Preparation of Disaster Management Plans for Electricity, Petroleum and Water Industries

Disaster Management Plan for National Water Supply and Drainage Board (NWSDB)

Final Report

December 2024

Acknowledgment

The Public Utilities Commission of Sri Lanka, as the regulator of electricity and designated regulator for Water and Petroleum, initiated the work on preparing the Disaster Management Plans, to enhance disaster preparedness within the electricity, petroleum, and water industries. As the Regulator PUCSL is responsible for protecting the consumer interest, ensuring uninterrupted utility services to the end consumer.

The plan was developed as provided in the Disaster Management Act No 13 of 2005 and as per guidelines issued by the Disaster Management Centre. It is appreciated the work done by the NWSDB for supporting the Consultant to develop the plan. In the NWSDB, General Manager, Additional General Managers, Deputy General Managers, Assistant General Managers, Regional Managers, Managers and all the staff in the Development division provide data, and comments at various stages of development of the Plan and support throughout the process.

Director General DMC for providing historical data on disasters in Sri Lanka, hazard profiles, Guidelines for the Development of the Institutional Disaster Management plan, National Disaster Management plan 2022-2030 and comments on the report,

Director General, National Building Research Organization and Director General, Irrigation Department for providing hazard profiles related to Landslides and Floods respectively,

Technical Evaluation Committee for providing technical inputs for the development of technical documents, and evaluation proposals and submitting their comments on reports submitted by consultants,

Executive Summery

NWSDB is entrusted with the provision of pipe-borne drinking water and is planning to increase provincial service coverage. Increasing trend in hazards is a major challenge to achieve planned coverage and maintain uninterrupted supply to consumers. NWSDB was established as a public authority as provided in National water Supply and Drainage Board Act. No 2 of 1974. Board headed by the Chairman and the Board of Directors take policy decisions. General Manager, appointed by the Board, leads a multi-disciplinary workforce made of professionals, non-professional categories.

Water Safety Plan advocated by WHO, safeguards quality of water and NWSDB has completed WSP for 289 out of 342 schemes by the end of 2023. NWSDDB has also prepared a structure to respond to disasters to ensure the safety of water provided at all circumstances.

Public Utilities Commission Sri Lanka (PUCSL) as designated regulator for water services, promote the interest of consumers, support the NWSDB to develop an Institutional Disaster Management Plan as provided in the Disaster Management Act No 13 of 2005 to respond to any impending disasters and ensure uninterrupted water supply during emergencies.

Conducting a risk assessment of water supply schemes is a basic requirement to identify risk levels of infrastructures against four selected hazards and develop mitigation, preparedness, response and recovery plans. Initially, 15 hazards were ranked high to low impacts, 6 were identified mostly affecting the water supply sector. PUCSL in consultation with NWSDB selected four hazards, floods, drought, landslides and chemical hazards for further analysis. Profiles of four hazards were evaluated based on 8 characteristics and flood ranked highest, followed by drought, chemical hazards and Landslide.

NWSDB agreed that Water sources, treatment plants, and main supply lines are critical infrastructure of water supply schemes, and considered for exposure, vulnerability and risk assessment. Hazard profiles developed by Disaster Management Center (DMC), Irrigation Department (ID), the Meteorological Department (MD) and the National Building Research Organization (NBRO) for Flood, drought, and landslides were collected with the assistance of PUCSL. Coordinates of identified element at risk provided by NWSDB were overlaid with the hazard layers respectively and the exposure level of the critical infrastructure (element at risk) were identified. Exposure level of infrastructure against floods, drought, chemical hazards and landslides listed and given in Table 2.13-2.20. Exposure level of the proposed water supply schemes were given separately for NWSDB for reconsidering the location before taking the final decision.

The vulnerability assessment provides a framework for developing risk reduction options and associated costs. In the absence of vulnerability data of infrastructure, exposure, resistance and resilience of the infrastructure to different hazards, used to develop indicators to assess vulnerability. Availability of early warning system, and water safety plans are indicators for the resistance and recovery framework and financial preparedness for recovery to develop resilience indicators. Details of vulnerability assessment given in the Table 2.21-2.29.

Due to lack of data, qualitative risk assessment was conducted using the output of hazard, exposure, vulnerability assessments of water treatment plants, Intakes, Chemical Buildings, Pump houses. Detail risk assessment for floods, landslides, Drought and Chemical Hazard provided in Tables 2.30- 2.33. Based on the above analysis, Districts/Divisions / Water Intakes were evaluated for the risk matrix as low risk, moderate risk, high risk, and very high risk for floods, landslides, drought and chemical hazards.

Hazards are present in all potable water systems, in varying degrees. Disaster mitigation is essential even when floods, droughts, landslides, and chemical hazards do not directly threaten, as accidents and pipeline breaches can contaminate water and significantly impact service. Mitigation plan proposed encompasses risk management related best practices in design, construction and maintenance measures to optimize their utilization. NWSDB used different standards for the design of all structures in water supply sector. In order to ensure resilience of the structure to disasters, NWSDB has to review design standards used at present and incorporate Disaster Risk Reduction concepts into design standards. Hazards, issues and impacts and possible mitigation measures related to the critical infrastructure of water supply system are given in table 3.1-3.6.

The Emergency Response Plan (ERP) is primarily composed of procedures and protocols that must be activated to respond to a variety of hazards, including localized to large-scale floods, droughts, landslides, and chemical hazards, as well as system contamination.

Data and information of the water supply schemes are required to prepare a plan to address major issues to achieve objectives promptly. Table 4.1-4.40 indicates the data required to be collected at WSS level to prepare response plan for each scheme where Water Safety Plan is available. Officer responsible and Standard Operation Procedure to implement risk reduction activity relate to 4 hazards is given as sample. Detail damage and loss assessment process and format for collection of data required to as pre- and post-disaster activity given in table 4.41-4.48.

A disaster recovery plan (DRP) is a formalized, structured approach that specifies how an organization can restart operations efficiently following a disaster. caused by natural or human intervention. Several steps for the preparation of the recovery. Recovery plan will be completed in two stages. Data required to conduct loss and damage assessment could be collected before disaster strikes and disaster loss and damage assessment as pot disaster activity. Damage and loss data will be used to complete the need assessment and budgetary requirement for rehabilitation of affected infrastructure.

Five training Modules proposed in the Training Plan for Water Supply Sector related to Disaster Risk Management to improve the capacity of officers engaged in DRR activitie.

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Abbreviations

AGM	Assistant General Manger
AMR	Anti-Microbial resistance
BBB	Building Back Better
BCP	Business Continuity Plan
CBO	Community Based Organizations
CBS	Central Bank of Sri Lanka
CEA	Central Environmental Authority
CEB	Ceylon Electricity Board
CERF	Central Emergency Response Fund
DAD	Department of Agrarian Development
DAD	Department of Agrarian Development
DGM	Deputy General Manager
DMC	Disaster Management Centre
DNCWS	Department of National Community Water Supply
DoM	Department of Metrology
DPRD	Disaster Preparedness and Response Division
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
DS	Divisional Secretary
EC	Electric; Conductor
EOC	Emergency Operation Centre
EPA	Emergency Response Plan
ERP	Emergency Response Plan
EU	European Union
EWS	Early Warning System
FGD	Focus Group Discussion
GDP	Gross Domestic Product
GFDRR	Global Fund for Disaster Risk Reduction

GND	Grama Niladhari division
GoSL	Government of Sri Lanka
GW	Ground Water
ID	Irrigation Department
ID	Irrigation Department
IDMP	Institutional Disaster Management Plan
IUCN	International Union on Conservation of Nature
KPI	Key Performance Indicator
LKR	Sri Lankan Rupee
MASL	Mahaweli Authority of Sri Lanka
MDM	Ministry of Disaster Management
MoH	Ministry of Health, Nutrition and Indigenous Medicine
MSD	Medical Supplies Division
NBRO	National Building Research Organization
NCCAS	National Climate Change Adaptation Strategy
NCCP	National Climate Change Policy
NCDM	National Council for Disaster Management
NCP	North Central province
NDMCC	National Disaster Management Coordination Committee
NDRSC	National Disaster Relief Service Centre
NGO	Non-Governmental organization
NP	Northern Province
NWP	North Western Province
NWSDB	National Water Supply & Drainage Board
OIC	Officer in Charge
PDNA	Post-Disaster Needs Assessment
PHDT	Plantation Human Development Trust
Po-DRP	Post Disaster Recovery Plan
Pr-DRP	Pre disaster Recovery Plan
PUCSL	Public Utility Commission of Sri Lanka

RE	Regional Engineer
RWS	Rural Water Supply
SDGs	Sustainable Development Goals
SLR	Sri Lanka Railways
SOP	Standard Operation Procedure
SW	Surface Water
TDS	Total Dissolved Solids
UDA	Urban Development Authority
UNDP	United Nations Development Programme
UNOPS	United Nations Office for Project Services
WB	World Bank
WFP	World Food Programme
WHO	World Health Organization
WRB	Water Resources Board
WSP	Water Safety Plan
WSS	Water Supply Scheme
WTP	Water Treatment Plant

CHAPTER 1- INTRODUCTION

1.1 Profile of National Water Supply Drainage Board (NWSDB)

Sri Lanka is a country in the Indian Ocean located between 5° 55' & 9° 50' North Latitude and 79° 31' & 81° 53' East Longitude. It has a total land area of 65,610 sq. km with 2,905 sq.km of inland waters. The temperature varies in the country from 18.4 to 31.7 Deg. C. The country is an island of 226 to 433 km extents with 2,525m central hills. Due to the location and the nature of the terrain the country is abundant of water experiencing annual rainfall of 2000 to 2500 mm. Although the values of rainfall are relatively high the spatial distribution of rainfall is not uniform. The country has got three climatic zones namely wet, intermediate and dry. These climatic conditions have prompted the country to have floods, droughts and landslides as main natural hazards.

The country's drinking water availability situation is generally satisfactory. However, there are water scarcities due to uneven distribution of rainfall and the effects of climatic zones. The country's population stands at 22.2 million with a population density of 354 per square kilometer. Sri Lanka's access to safe drinking water stands at 96% with access to pipe borne water 60.4% (Central Bank, 2022) of where about 46% is supplied by NWSDB (KPI NWSDB, 2021). The National Water Supply and Drainage Board has got 342 water supply schemes and 2,752,000 water connections (KPI NWSDB, 2021).

Community water supply schemes cover about 14% of population. Other than community water supply projects, dug wells, rain water harvesting facilities and point sources such as tube wells cover about 40% of the population.
National Water Supply and Drainage Board (NWSDB) entrusted with provision of pipe borne drinking water in Sri Lanka. There are around 4,000community managed piped water suppliers in Sri Lanka managed by Department of National Community Supply Department under the Ministry of Water Supply and Estate Infrastructure Development which receives technical support from NWSDB.

Groundwater resources have been extensively used since ancient times for domestic purposes using shallow open wells in almost all parts of the country. Sri Lanka's largest aquifer extends over 200 km in the northwestern and northern coastal areas. There are about 4,238 rural water supply schemes in Sri Lanka with about 2,429 ground water intakes and about 80 NWSDB water schemes use ground water intakes. Table 1.1 additionally, there are about 3894 tube wells with individual usage maintained by NWSDB and DNCWS. This adds on to total ground water wells in use as individuals and schemes to around 6,394. (Source; NWSDB, https://dashboard.rwss.lk/realtime/0_1_real_time_cbo_count/index.html)

Table 1.1: Ground water Sources used for the WSS maintained by NWSDB
Ref: NWSDB (2020), Guideline for Management of Groundwater Sources for piped water supply schemes

Groundwater sources used for the WSS maintained by NWSDB and CBOs

Province	Number of WSSs maintained by NWSDB		Number of WSS maintained by CBOs (Source:www.rwss.lk, 2020)	
	No of WSSs with groundwater intakes	No of wells/ groundwater sources	No of WSSs with groundwater intakes(A)	No of wells/ groundwater sources(B)
Central	10	24	291	414
Sabaragamuwa	2	3	293	430
Southern	10	20	351	483
Uva	7	13	455	611
North	20	84	71	75
Western	6	21	265	415
North Central	14	63	236	387
North Western	8	25	429	761
East	3	19	38	46
Total	80	272	2,429	3,622

According to Department of Agrarian Development only 14,421 active tanks, and 1,661 cascades are estimated to remain by 2018[1].

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[1] Sampath Pethikada, Department of Agrarian Development 2018.

Table 1.2 Proposed Provincial wise water supply coverage by 2025

No.	Province	% of supply against total population
01	Western	91.8
02	North western	65.8
03	North Central	80.6
04	Northern	99.6
05	Central	75.7
06	Southern	86.6
07	Sabaragamuwa	64.2
08	Uva	74.8
09	Eastern	81.4

NWSDB has planned to achieve provincial service coverage from 60% to 100% by 2025 Table 1.2 (NWSDB Corporate Plan, 2020-2025). Significant decrease of availability of surface water due to increasing trend in drought hazard and salinity intrusion into fresh water bodies including rivers will be a major challenge to maintain a continuous supply to consumers.

1.2. Institutional and legal framework of NWSDB

National Water Supply and Drainage Board (NWSDB) was established as a public authority, as provided by the National Water Supply & Drainage Board Law no 2 1974, with a mandate to develop, provide, operate and coordinating an efficient water supply and sewerage system, distribution of water to public, domestic and industrial purposes. The act also provides for the establishment of a Board headed by a Chairman and Board of Directors. General Manager, appointed by the Board, head a multi-disciplinary workforce made of professional and non-professional categories. Financial authority and implementation are decentralized into several provincial units and headed by an Addl. GM; Provincial offices are headed by a DGM supported by AGMs at regional level. The organizational structure is shown in appendix 1.1
The Corporate plan 2020-2025 developed by NWSDB has identified the drought and saline intrusion as challenges to ensure uninterrupted supply of drinking water. Under the plan few projects identified to improve the water sources in Northern Province.

1.3. Water Safety Security and Disaster Management

The Water Safety Plan (WSP) Advocated by the WHO is a strategic tool of management of water quality and quantity since 2004. Also, the WSP complies as a tool to achieve SDG Goal 6 for Clean Water and Sanitation. WSP was implemented in more than 90 countries by 2017 including Sri Lanka (Setty, K. and Ferrero, G, 2021). As present WSP has evolved to safeguard water quality and quantity available to consumers of Sri Lanka. WSP is considered as most effective strategic tool to ensure safe access to drinking water to the communities. WSP has got 10 modules of actions under its urban version and 6 modules of action under its rural version. Emergency response plans categorized under its module 8, management procedures. Therefore, WSP has got a component for consideration of disaster management.

In Sri Lanka WSP was implemented by NWSDB since 2013. By 2020 December, 289 urban water supply schemes had completed or commenced WSPs out of 342 water supply schemes which is a progress of 85% in seven-year period. (NWSDB Annual Report 2021).

WSP implementation is continuing to be a mandatory requirement for water supply schemes under National Water Supply and Drainage Board, where an Emergency Response Plan is a part of it. This is the link to the Disaster management under WSP. Ministry of Water Supply & Estate Infrastructure Development has initiated development of "Water Safety Plan Policy" for Sri Lanka for stronger streamlining of the WSP implementation process in addition to the revision of National Water Policy in 2023.

Since 1996, the Sri Lankan government has been in the process of developing an institutionalized disaster management framework, but that plan proved incompatible to the challenge posed by the tsunami 2004. Therefore, disaster management reform has become a high priority in Sri Lanka. National Council for Disaster Management Chaired by the President of Sri Lanka, is the supreme body providing policy directives on management of all types of disasters. Ministry of Water Supply is a member of the council. (Figure 1.1).

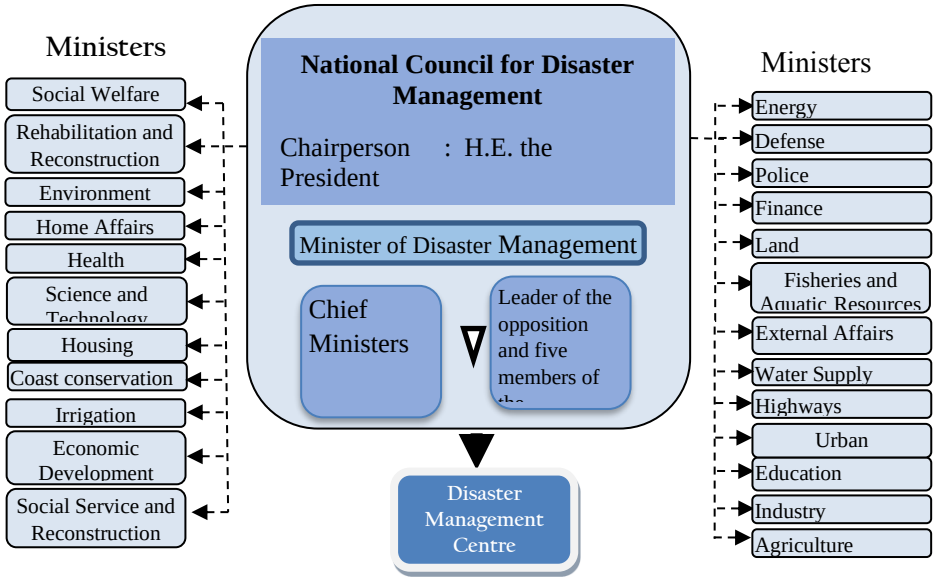

Figure 1.1 Composition of the National Council for Disaster Management

Source: National Disaster Managemnt Plan 2022-2030

Subsequently Sri Lanka has enhanced the disaster management process in Sri Lanka with a Disaster Management Policy (2010) and a National Disaster Management Plan (2013-2017). DMC is in the process of developing the National Disaster Management Plan 2022-2030.
Disaster Management Act no 13 of 2005 provide for the development of Institutional Disaster Management Plan. DMC has issued a guideline for the development of IDMP and based on the guideline Institutional Disaster Management plan for NWSDB will be developed.

NWSDB continued following Sri Lanka's Disaster Management Efforts with the Disaster Management Center. Often the activities which have been of localized nature were handled at the Divisional Secretariat Level which is the focal action point during major disasters such as floods, droughts and landslides.

Under specific issues of interest, the dry zone of Sri Lanka is affected by Chronic Kidney Disease of unknown etiology (CKDu) which is being addressed by provision of pure water through localized reverse osmosis water purification units. This was initiated under the technical assistance of NWSDB.

1.4. Arrangements in place to address an Emergency Situation

In the event of a disaster, procedure specified in the water safety plan will be effective in managing such disasters. This mechanism has got different levels of activation based on the nature of disaster and its magnitude. There could be scheme specific arrangements for management of localized disasters.
Organisation structure and management procedure as provided in WSP guidelines to ensure the safety of water provided to consumers is shown as a flow chart in the appendix 1.2
The emergency response is practiced at four levels.

- **Level 1:** Officer in Charge of the local water supply scheme is the Incident Commander.
- **Level 2:** Area Engineer/ Manager (O&M) responsible to prepare Contingency plans and coordinate the response activities of several schemes impacted in the area
- **Level 3:** Assistant General Manager / Deputy General Manager is the Team Leader responsible for prepare Contingency Plans and coordinating the response activities performed by various divisions in the impacted region
- **Level 4:** Emergency Response Unit established at the national level, coordinates with regional and national level agencies.

The WSP tool, already institutionalized with NWSDB, is applicable to each individual water supply scheme with individual emergency response plan. The consultancy team identifies following main differences the Institutional Disaster Management Plan (IDMP) and localized WSP Emergency Response plans

Table 1.3. Major difference identified in response procedures of WSP and IDMP

Item	Water Safety Plan	IDMP
1	Main objective is to ensure the safety of water provided to consumers by NW	Main aim is to reduce the disaster risk and ensure uninterrupted water supply service.
2	Response trigger by consumer complaint or incident reported	Response trigger by Early warning formulated and issued by technical agencies for flood, drought, landslides and chemical hazards
3.	Flow chart indicate coordination at national level	Coordination at all levels. Local, provincial, District, Divisional, Grama niladhari and Community level

4	Responsibility of collecting data not clear	Data collection at local level and transmission to national level given.

It is expected that the Institutional Disaster Management Plan of NWSDB (IDMP) will address major difference identified. IDMP only provide a guideline and each WSS has to develop a disaster management and response plan considering the hazards specific to the area and the resources available based on IDMP

1.5. Economic Risk

The United Nations General Assembly by resolution adopted on 28th July 2010, recognized the "right to safe and clean drinking water and sanitation as a human right". Government of Sri Lanka has pledged its commitment to achieve 17 Sustainable Development Goals (SDG). Towards this, the government has enacted SDG Act No19 of 2017 to supervise the development of policies and strategies on SDG and facilitate all agencies to follow-up and monitor the implementation of 17 goals and 169 Targets of Sustainable Development. Accordingly, NWSDB has the responsibility to achieve Goal 6 of SDG with a target to provide clean water to all by 2030.

However, increasing trend in water related disasters such as floods, drought, cyclones and landslides during the last decade caused significant damages to infrastructure and substantial losses to agriculture, industry and commercial establishment. Development funds are frequently transferred to reconstruct damage infrastructure, relief recovery operations. Further the Climate change impacts have intensified the hydro meteorological hazards causing frequent severe cyclonic condition associated with flood and landslides disrupting plans and programmes of NWSDB to active targets by 2030. Therefore, it is critical to mainstream disaster risk reduction concepts as outlined in Sendai Framework for Disaster Risk Reduction into development planning process of NWSDB to ensure the water supply sector is resilient to disaster impacts and achieve SDG target by 2030.

National Planning Department has prepared a new format for the formulation of project proposals and had informed all state sector agencies, expecting funds for sector development, to align the project objective/s with the relevant SDGs and mainstream the Disaster Risk Reduction in to all components of the project management cycle.

Disaster risk reduction is considered as the core of sustainable development and economic risk could be minimized by mainstreaming DRR in to all sector development projects and programmes.

1.6 Objectives of the proposed IDMP.

1. To bridge the gap between the National Disaster Management Plan and Emergency Response Plans of individual water supply schemes.
2. Institutionalize the Stakeholder involvement for action.
3. Enhancement of intuitional level preparedness such as shared facilities
4. Propose a customized framework of Disaster Management actions under the concept of risk assessment and risk minimization.
5. Institutionalization of PDNA.
6. Streamline the funding requirements
7. Enhanced Training and Awareness across the stakeholders.

Chapter 2. Hazard, Exposure, Vulnerability and Risk Assessment

2.1. Introduction

The drinking water supply industry is essential for the sustained growth of life on Earth. However, the supply of water to rural and urban regions should not be taken for granted, as the infrastructure is sensitive to a variety of natural and anthropogenic threats that might disrupt drinking water supplies. Events that endanger the continuity of the drinking water supply are numerous, both regionally and temporally. Some locations may be vulnerable to drought and others to flood. Shortage of drinking water required for survival could be faced at both instances. The population is reliant on the provision of drinking water, and if it cannot be fulfilled an emergency or crisis occurs. A range of factors can jeopardize the system's functionality and the provision of drinking water. Natural forces have influenced the technology infrastructure since its inception. Natural risks mostly include water movements, runoff, and landslides. They will undoubtedly become more intense and frequent as a result of climate change. For these reasons, the subject of water has become a heated topic.
To control or minimize impact of natural hazards, it is essential to know the characteristics of common adverse natural phenomena and how they impact. Studying and properly managing such risk using scientific knowledge and technological capabilities is also a prerequisite for developing operational, planning, training, and simulation programs.

There are five basic objectives for risk assessment:

- Identification and quantification of hazards that can affect the water supply system, whether they are natural or derive from human activity or combination of both;
- Estimation of the susceptibility to damage of components that are considered essential (critical Infrastructure) to provide water in case of disaster and climate change event;
- Definition of measures to be included in the mitigation plan, such as: retrofitting projects, improvement of watersheds, and evaluation of foundations and structures including measures to recover the damages;
- These measures aim to decrease the physical vulnerability of a system’s components;
- Identification of measures and procedures for developing an emergency response and operation plan. This will assist the NWSDB to supplement services in emergencies;
- Evaluation of the effectiveness of the mitigation and emergency plans, and implementation of training activities, such as simulations, seminars, and workshops.

2.2. Hazard Identification

Hazards may occur or be introduced throughout the water supply system, from catchment to consumers. Effective risk management, therefore, requires identification of all potential hazards, their sources, possible hazardous events and an assessment of the risk presented by each.

Depending on their origin, hazards can be of two types:

a) Those related to natural events, i.e., physical phenomena arising in nature;
b) Those caused by human activities

This classification cannot be employed rigidly, since we often find interactions between natural phenomena and human actions. For instance, a landslide may be caused by erosion as a result of deforestation, by failures in channeling runoff or wastewater, or by establishing settlements in unstable areas.

Another method of classifying hazards is based on their mode of occurrence.

a) Sudden onset, as in the case of earthquakes;
b) Gradual (Slow) onset, as in the case of drought or combination of both.

The various types of hazards manifest themselves as events that can have adverse effects and can potentially lead to an emergency or even reach the level of a disaster. However, it is common for the classifications above to be applied to disasters.

2.2.1. Hazard Prioritization

Hazard prioritization is the process of identifying all hazards that impact to the industry and determining which ones are the most severe so that they can be addressed first. Prioritization should be determined based on the likelihood or frequency of a hazard as well as the possible damage or consequence it poses to the industry.
The Hazard prioritization identifies the hazards and examines the risks that pose a threat to the people, property, environment and economy of the country particularly focusing the water supply sector. This assessment is a critical part of the preparation of disaster preparedness plans for the water supply sector of the country. Identified hazards should be used in mitigation strategies, preparedness programs, emergency response plan exercises, and training and awareness programs in the water supply industry to ensure the resilience of the sector.

2.2.2. Objectives of Hazard Prioritization

The prime objective of 'hazard prioritization is to evaluate hazards, then remove that hazard or minimize the level of its risk by adding control measures, as necessary.

The major objective will be accomplished through the following sub-objectives as follows:

- To identify six high impacts hazards to the water supply industry of the country.
- To select four hazards for in-depth risk assessment and to formulate mitigation strategies, preparedness programs, emergency response plan exercises, and training and awareness programs related to disaster risk management in the water supply industry.

2.2.3. Data Used for the Hazard Prioritization

The hazard prioritization utilized data and information from the following sources;

- Desinventra Database of Disaster Management Center,
- The data and information provided by National Water Supply Drainage Board,
- Damage and Loss Assessment Report 2010 Flood, Post Disaster Need Assessment Reports of 2016 and 2017 flood and landslides,
- Damage and Loss Assessment reports of Disaster Management Center,
- Disaster study reports published by UN Agencies such as IUCN, UNDP, WFP, etc.

During the analysis approximation and assumptions were made as the existing data set was associated with numerous limitations;

2.2.4. Limitations

- Following the return periods of the particular hazards, the frequency of hazards has not been documented.
- Terminologies of the Desinventra database have not been customized based on the country context.
- Data on damages and losses are not recorded in any database

2.2.5. Assumption

- Assume the impacted population is proportional to the affected Consumers of NWSDB in urban areas.
- Assume a positive correlation between the data on destroyed houses (Fully Damaged) and damaged infrastructure of NWSDB.
- Data was grouped assuming the different disaggregation recorded in Desinventra (Eg. Data recorded under; Flood, Rain, Storm were grouped as flood).
- The frequency of hazards was calculated based on the number of data cards recorded during the last 30 years in the Desinventra database.

2.2.6. Hazard Prioritization Methodology

For the ranking of hazards, the following criteria were applied:

- Frequency/ probability of occurrence: based on historical observation, how often the type or level of hazard will occur.
- Impact on the Public: based on historical observation and demographic information and study, how the type or level of hazard would affect the general public and their daily lives (no. of people affected/ no. of Housing damage) Impact on Responder to save lives and minimize property damages, based on historical observation and study, how the type or level of hazard would affect responders 'ability to save lives, protect property.
- Impact on continuity of operations / program operations: based on historical observation and study, how the type or level of hazard would affect the operation of facilities and execution of services in support of disaster and daily operations.
- Impact on property, facilities, and infrastructure: based on historical observation, study, how the type or level of hazard would affect county facilities, critical infrastructure, and other structures.
- Impact on delivery of services: based on historical observation and study, how the type or level of hazard would affect the public or private delivery of essential services to the affected or neighboring population.
- Impact on the environment: based on historical observation, and study, how the type or level of hazard would affect the environment, and associated effects
- Impact on the economic condition: based on historical observation, study, how the type or level of hazard would affect the economic success and viability of local, state, and national enterprises, and longer-term impacts to supply chain or commodity requirements.

This hazard prioritization also looked at current hazards through the lens of climate change. In anticipation of the impact of climate change in the country, this analysis also projected which hazards could occur more frequently or become more extreme in the future.

The hazard prioritization is to determine which criteria to use to rank the hazards. Criteria may include factors such as the probability of an emergency, the level of vulnerability of people or property, or both, the degree of manageability, and whether the hazard may worsen and how quickly. In this study, these indicators were asses using proxies developed based on the assumptions such as;

- No. of Affected population having a direct relationship with the impact on the consumers of the water sector.
- No. of housing, damage is directly related to the damage to water supply infrastructures.

All the hazards mentioned in the Sri Lanka Disaster Management Act., were considered for the analysis. But, the availability of data for each hazards vary dramatically but data was standardized to ensure the accuracy of the analysis.

To determine the relative weight assigned to each hazard, two approaches were used.

First, data and information recorded in the; DesInventar database of DMC were used to evaluate the frequency of occurrence and severity adopting the assumption explained above to overcome the limitations of the paucity and quality of historical recorded data.

Since, data fields recorded in Desinventra database having different definitions. (Eg. Landslide, Slope Failures, Slips, Soil Collapse etc.) Data and information recoded under following terms were grouped as summarized in below table 2.1.

Table 2.1: Summery of Disaster Groups

Terms	**Group Terms**
Landslides, Slope Failures, Slips, Soil Collapse, Cutting Failure	Landslide
Floods, Heavy Rains, Flash Floods, Urban Floods	Flood
Storm surge, Coastal Erosion, Sea Level Rise,	Coastal Hazards
Natural Drought, Agricultural Drought	Drought
Cyclone, Strong Winds, Gale, Storm, Tornado	Cyclone

The second option would be to conduct an expert elicitation exercise using techniques such as the Delphi method. Depending on the availabilitry of data, Consultant will use combination of the two mathods.

The prioritization process in this assessment comprises the following steps:

- Step 1. Identification of the hazard
- Step 2. Identification and definition of the criteria by which each selected hazard/ will be quantified.
- Step 3. Assignment of criterion-based values to the hazard

- Step 4. Normalization of these values to make them comparable between criteria.
- Step 5. The weighting of the criteria reflects their relative importance.
- Step 6. Combining the weighted normalized values for each hazard to produce a score and ranking of the scores to obtain the order of priority.
- Step 7. Reporting

2.3. Analysis and Results of Hazard Prioritization

After identifying the frequency and the consequence of particular hazards all the data was standardized and categorized as illustrated in the following table 2.2.

Table 2.2: Frequency and Consequence Ranking

Scale of Severity or the consequence	**Category**	**Scale of Frequency or likelihood**	**Category**
<1	Insignificant	<1	Very Unlikely
1-2	Minor	1-2	Unlikely
3-5	Moderate	3-5	Possible
6-8	Major	6-8	Likely
>8	Catastrophic	>8	Very Likely

Using the above matrix risk or the impact of each hazard were identified and categorized qualitatively as given in the table 2.3.

Table 2.3: Risk Ranking

Scale of Risk (Frequency X Consequence)	**Category**
<1	Low
1-4	Low- Medium
9-25	Medium
36-64	Medium- High
>64	High

All the hazards were plotted frequency against the consequences and the results are illustrated in Table 2.4.

Table 2.4: Hazard Ranking

Impact or Severity						
		Insignificant(1) *(<1)*	*Minor(2)* *(1-2)*	*Moderate(3)* *(3-5)*	*Major (4)* *(6-8)*	*Catastrophic(5)* *(>8)*
Probability or Likelihood	*Very Likely* *(>8)*	Low-Medium	Medium	Medium-High **Drought**	High **Coastal Hazards**	High **Flood**
	Likely *(6-8)*	Low-Medium **Fire**	Low-Medium	Medium	Medium-High	High **Landslide**
	Possible *(3-5)*	Low **maritime hazard; Lightening**	Low-Medium	Medium **Pollution** **Industrial Hazard** **Chemical Hazards**	Medium-High	Medium-High **High wind/Cyclone**
	Unlikely *(1-2)*	Low **, Air Hazard**	Low-Medium **nuclear disaster, radiological emergency**	Low-Medium	Medium	Medium-High **Tsunami**
	Very Unlikely *(<1)*	Low **Epidemic / Air raids**	Low	Low-Medium	Medium	Medium **Earthquake** **Explosion**

The hazard prioritization summary provides a list of the hazards ranked into five categories of risk as given in table 2.5.

Table 2.5: The hazard prioritization summary

Category	**Types of Hazards**
High	Flood, Landslide, Coastal Hazard
Medium-High	Drought, High wind, /Cyclone, Tsunami
Medium	Pollution, Industrial Hazard, chemical Hazards, Earthquake, Explosion
Low -Medium	Nuclear Disasters, Radiological Emergency
Low	Epidemic, Air Raids

Based on the above analysis following six hazards were selected for discussion with the official of NWSDB;

1. Flood,
2. Landslide,
3. Coastal Hazard
4. Drought,
5. High wind, /Cyclone,
6. Tsunami

Limitations

The analysis report having following limitations;

- The report is purely based on secondary data.
- The historical data for certain hazards covers limited duration.
- The report also doesn't take into consideration wider economic and social impacts of these hazards.

2.4. Prioritized Hazards

It is expected that the hazard ranking report will serve as a base document for in depth risk analysis required to be done for this study. Based on the available data, the result of final raking is Flood, Landslide, Coastal Hazard, Drought, High wind, /Cyclone and Tsunami.

However, in consultation with NWSDB, experience on responding to disasters in the past, qualitative data, mitigation actions taken to minimize the impacts of some of the hazards and information provided by both NWSDB and PUCSL, "Floods, droughts, landslides, and chemical hazards," are proposed for detail hazard exposure, vulnerability and risk analysis.

2.5. Hazard Assessment

Sources and the details of data used for the Hazard Assessment are given below table 2.6:

Table 2.6: Details of Hazard Layers

Hazard	Sources	Scale	Area Covered	Remarks
Flood	Disaster Management Centre, Irrigation Department	1:50,000	Island wide but there are some gaps	Data has been extracted timely in flood events. No clear information in the annual or return period
Landslide	National Building Research Organization	1:50,000	All landslide prone areas	Map depicts landslide susceptibility areas
Drought	Disaster Management Centre	1:50,000	Island wide	Maps prepared based on the Agro-Ecological Zones and categorized as high, moderate and low
Chemical	CEA (for industrial types and locations) NWSDB (for Gas Chlorine)			No particular responsible authority to obtain the data/information. Some of the data on river pollution caused by some factories along Kalani River provided by NWSDB.

2.5.1. Floods

Floods are caused by extreme rainfall, unusually high sea levels, or the failure of dams and dikes. Floods are becoming increasingly common as a result of human activity that causes environmental deterioration, deforestation, and unsuitable land use. However, certain floods are caused by the geomorphology and climatology of water catchment areas. The extent of flood effects is determined by the water's level, pace, and geographical region covered. Other important considerations include the design quality of the installations and the type of soil on which they are erected.

The main effects of floods on water supply systems are the following:

- Total or partial destruction of river water intakes;
- Damage to pumping stations close to flooding waterways;
- Blockage of components due to excessive sedimentation;
- Loss of intake due to changes in the course of rivers and streams;
- Rupture of exposed pipes across and along rivers and streams;
- Contamination in water catchment areas;
- Power cuts, road blockages, and disruption of communications;
- Intrusion of salt water into continental aquifers, contaminating or reducing the availability of groundwater.
- Water quality deterioration during flooding including disease causing micro-organisms.
- Accessibility to the intake
- Failure of water infrastructure Power outage
- Water supply to the displaced people

The spatial distribution of the maximum experienced flood in the country is given in figure 2.1

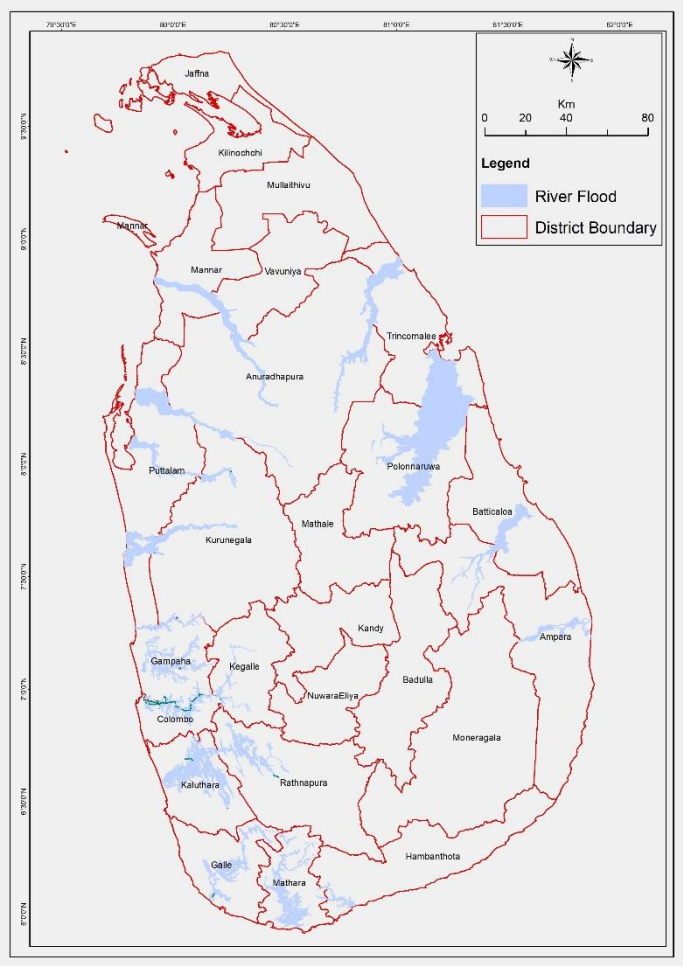

Figure 2.1: Spatial Distribution of Flood in Sri Lanka (Data from DMC and Dept. of Irrigation)

2.5.2. Landslides

Landslides occur when the composition, structure, hydrology, or vegetation of a sloping terrain changes abruptly or gradually. They are frequently linked to major dangers such as earthquakes and water saturation induced by storms or heavy rains. In cities, they are also related with human actions such as delivering drinking water to residents on unstable soil slopes. Leaks in these systems cause excessive moisture in the soil, which can lead to landslides. When drinking water is supplied without sufficient sewage, the situation can deteriorate quickly. The magnitude of a landslide's impact is determined by the volume and speed of the mass in motion, as well as the extension of the unstable zone and the mass's fragmentation. Landslides are generally predictable since they are preceded by fissures and undulations in the terrain.

Changes in the physical or chemical characteristics of intake water, which will affect treatment;

- Total or partial destruction of the works, particularly intake and transmission components in the path of active landslides;
- Contamination of the water at surface intakes located in mountainous areas;
- Indirect impacts due to the blocking of roads and the disruption of power and communications;
- Blockage of sewage systems due to buildup of mud and stones.

As shown in the Figure 2. Kandy, Mat ale, Kigali, Rathnapura, Galle, Matara, Hambanthota, Kalutara, Badulla, NuwaraEliya, Badulla, Moneragala, Gampaha and Colombo have been identified as possible district for landslides and slope failures but details of the probability for occurrence of landslide or slope failures not available.

Landslide susceptibility map (Figure 2.2) depicts in the figure and the hazard zonation were categorized as; Not likely, Modest, Expected and Most likely following qualitative assessment by national Building research Organization (NBRO).

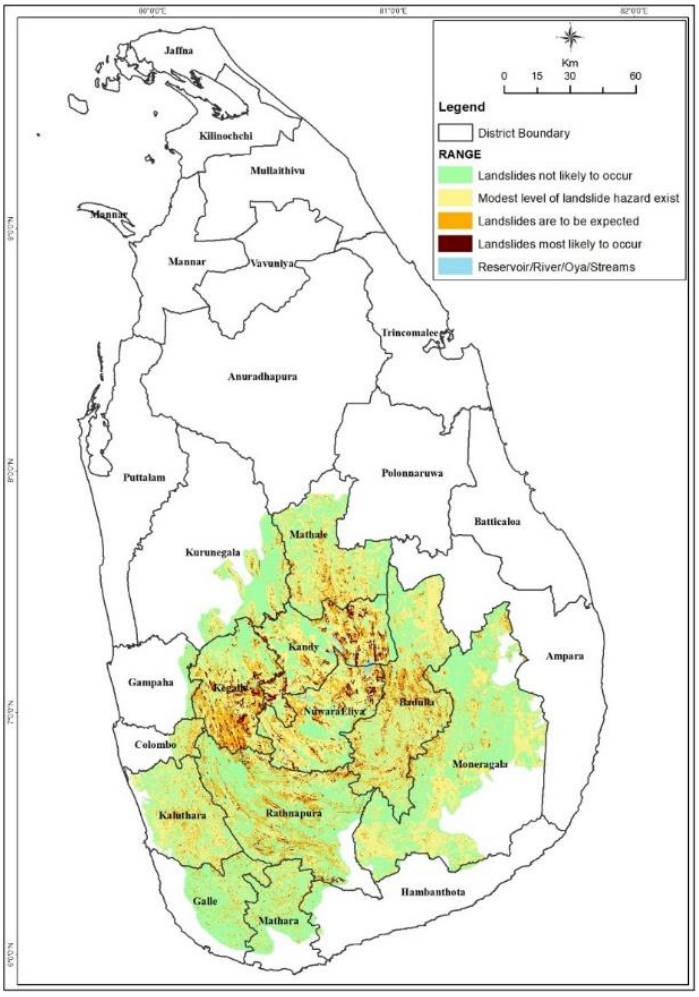

Figure 2.2. Landslide Susceptible Map of Sri Lanka (Data Source: NBRO)

Moreover, landslide inundation area should consist with flow path of the landslides as well. But it has been noticed that landslide flow path area is not available in either DMC or NBRO. However, the landslide map used for the analysis is on the landslide susceptibility, it is assumed that flow path also included in the susceptible area.

2.5.3. Drought

Droughts are long, dry periods that occur during natural climatic cycles and are caused by a complex set of hydro meteorological variables that affect both the soil and the atmosphere. They do not necessarily start when it stops raining, because enough water may have been stored in reservoirs or in the ground to maintain hydric equilibrium for a while.

The potential impact of drought on water supply and sewerage systems includes the following effects:

- Loss or reduction of surface- and groundwater sources and deterioration of water quality;
- A decline in water levels at intake points and in storage facilities;
- The need to distribute water with water trucks, affecting quality and increasing costs;
- Damage to the system due to lack of use;
- Accumulation of solid matter in water supply systems
- Saline intrusion in river intake near coastal zones
- Increase in drinking water demand (Consumers / Community)
- Increase in water demand from other water users

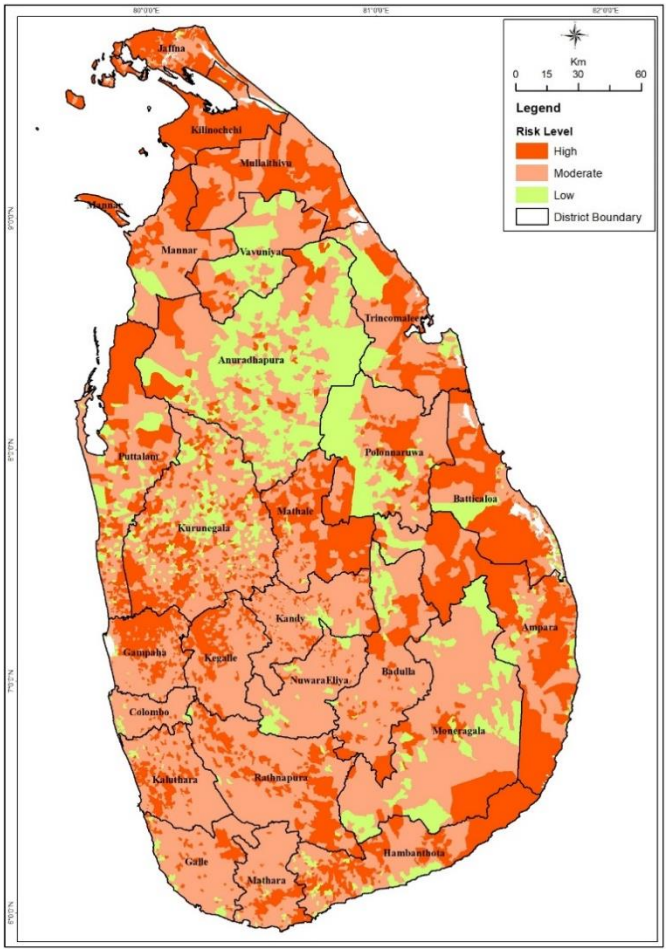

Figure 2.3: Spatial distribution of drought showing there zones high, moderate and low (Data Source: DMC).

The Spatial distribution of drought which has developed based on the Agro Ecological zones of the country is couple with the drought risk index map developed by the DMC in 2019 and shown in figure 2.3 with three zones as high, moderate and low

2.5.4. Chemical Hazards

A chemical hazard can be considered as any chemical agent that may compromise water safety or suitability, as shown in Table 2.7.

Table 2.7: List of chemicals that could affect water supply system

Chemicals from watershed/ catchment	Chemicals from reservoir storage	Chemicals from water treatment processes	Chemicals from distribution
Nitrate Arsenic Fluoride Pesticides Other heavy metals Organic toxicants Herbicides Rodenticides micro-plastic, pharmaceutical waste, Iron, Manganese	Algal toxins Cleaners Liner chemicals Lubricants Pesticides Herbicides	Flocculants pH adjusters Disinfection by products Impurities in treatment chemicals gas chlorine	Copper Lead Cleaners Petroleum products Liner chemicals

Possible effects of Chemical hazards in water supply sector could be identified as per table 2.8 given below.

Table 2.8: Possible impact of chemicals on water supply system

Chemical Substance	Possible effect
Chlorine (gas)	A very strong oxidizer and disinfectant. It is a toxic and corrosive gas that causes irritation of the eyes and the respiratory tract even at low concentrations. Also, it causes skin irritation. Inhalation could be fatal. WHO guideline value is 5 mg/L maximum concentration in water. Chlorine may cause fire or intensify fire as it's a strong oxidizer.
Hydrofluoric acid	A very strong acid that is used in water fluoridation. However, Fluoridation is not practiced in Sri Lanka.
Sodium hypochlorite	It is used as a solution. The substance is toxic and corrosive, in particular of the respiratory tract; causes burns and irritation to eyes and skin
Calcium hypochlorite	The substance is corrosive and very destructive of mucous tissues; may cause chemical pneumonia and lung edema
Ozone	Ozone is an oxidizing and an irritant gas; when inhaled, it may cause breathing difficulties, headaches, fatigue, eye irritation, tears and conjunctivitis. However, the effects will be limited to the leakages at the point of use within the exposed environment. There will be no long-term effect in drinking water systems as Ozone is an unstable gas.

Chemical Substance	Possible effect
Chlorine dioxide	Chlorine dioxide is a very corrosive gas that causes strong irritation of the respiratory tract and the eyes.
Exposure to coagulants (such as aluminum sulfate residues, monomers etc.):	These substances assist precipitation of suspended matter in the water. However, residue traces of coagulants in drinking water may create chronic health issues at consumer side. WHO has defined residual Aluminum in drinking water as 0.2 mg/L. Excessive exposure to Aluminum in drinking water can lead to Alzheimer disease? Generally, polymer dose is limited to 1 mg/L in water treatment, at a monomer content of 0.05% as per NSF guidelines. (Ref WHO). The health-based guideline value for Acrylamide monomer in drinking water is set to be 0.5 μg/L by WHO.
Impurities in treatment of chemicals	The effects would affect the efficiency of water treatment and residues may affect consumers if present above the health-based guideline values given by WHO.
Disinfection by products	Disinfection used to kill pathogenic organisms (e.g. bacteria and its spores, viruses, protozoa and their cysts, worms, and larvae) present in water. However disinfecting process may add several kinds of disinfected by products such as Trihalomethene (THM), Haloactitic acid (HAA) which are detrimental to human being. EPA guidelines are set as Total THM to be less than 80 ppb and HAA to be less than 60 ppb. This is controlled by adopting maximum dose value of 5 ppm Chlorine in drinking water.
Heavy metals	Heavy metals can bind with organic groups, resulting in the formation of detrimental chemicals that can induce damaging effects on our cells. WHO, EPA and SLS have defined health-based guideline values for heavy metals in drinking water?
pharmaceutical /Antibiotic Resistance	Anti-Microbial Resistance (AMR) occurs when microorganisms such as bacteria, viruses, parasites or fungi become resistant to antimicrobial treatments to which they were previously susceptible. Recommended solution is the implementation of best practices of wastewater and solid waste management in production and the use of antibiotics.
Algal toxins	Not all algae (or cyanobacteria) produce algal toxins. Some algae produce algal toxins such as Antitoxin-a (3 μg/L), Cylindrospermopsin (1 μg/L), Microcystin (1 μg/L), Saxitoxin (1 μg/L) ;(Drinking water guideline value used by Oregon Health Authority). In Sri Lanka only Microcystin is found to be applicable. Microcystin-LR can produce abdominal pain, headache, sore throat, vomiting and nausea, dry cough, diarrhea, blistering around the mouth, and pneumonia in humans.
Petroleum products	No health-based values defined by WHO as Petroleum products may cause taste and odor issues at low concentrations under short term exposure.
High turbidity	High Turbidity is an indication of a poor source. It is caused by suspended particles. Instruments are required to detect turbidity below 4 NTU. Turbidity is a parameter related to acceptability of drinking water, hence no health-based values defined by WHO.
High Electrical Conductivity (EC) content	High EC is associated with high Total Dissolved solids. TDS is not defined by WHO by giving a health-based guideline value. However, to control palatability issues TDS value should not exceed 600 mg/L. (WHO, 2017)

NWSDB has collected information on several chemical hazards that effect water supply industry and the impacts are summarized in Table 2.9.

Table 2.9: Chemical hazards reported since 2016

Chemical Hazard	Year	Name of water supply scheme	Impact Area		Effect to the Water Supply Sector	Economic estimation of effects and Impact
			District	Divisional Secretary		
Oil leak to Kelani River from Coca Cola factory	2017	Amabatale WTP / Biyagama WTP	Gampaha	Biyagama Kaduwela	River polluted, supply from both plants interrupted for few hours. Distribution lines flushed	Rs. 120 million claimed from Coca Cola as damage
Oil leak to Kelani River from Sapugasgande oil refinery during heavy rain	2021	Amabatale WTP / Biyagama WTP	Gampaha	Biyagama Kaduwela	MEPA, DMC & NWSDB CPC acted to prevent the pollutant entering the river by installing floating booms to Pattiwila ally, removing the floating oil by gully bowsers, Kelani River water quality monitored for 9 days continually for oil/ grease.	Estimated details not available
Accidental factory discharges to Kelani River	2021	Biyagama WTP	Gampaha	Biyagama	River pollution, unable to maintain Residual chlorine, supply interrupted for few hours	Estimated details not available
Accidental factory discharges to Kelani River	2017	Amabatale WTP	Colombo	Kaduwela	River pollution, unable to maintain Residual chlorine, supply interrupted for few hours	Estimated details not available
Accidental factory discharges to Kelani River	2016	Amabatale WTP	Colombo	Kaduwela	River pollution, unable to maintain Residual chlorine, supply interrupted for few hours	Estimated details not available
Tanker with petrol fuel overturn	2016	Kandana WTP	Ratnapura/Kalutara	Idangoda, Ingiriya, Horana	Petrol mixing with river water	Estimated details not available
Accidental chemical spill from a factory at Horana EPZ	2022	Kandana WTP	Kalutara	Ingiriya, Horana		Estimated details not available
Accidental agro chemical spill from Road accidents during transport	Reports on accidents involving agro chemicals not available with any of the agencies.				Water sample taken from Mahaweli river and few other reported contamination with phosphates, propanol, propachlor, clomazon , and endosulfan .	Cost of cleaning not available

2.6. Hazard Profile

Last 20 years' data obtained from the Desinventra Database of DMC were analyzed based on hazard characteristics (Magnitude, Frequency, Duration, Onset Speed, Spatial Extended, Predictability) and plotted against the scale 1-10 in order to prepare the hazard profile to understand and compare the considered hazards. Result of the analysis is given in Table 2.10 and Figure 2.4.

Table 2.10: Hazard Profile evaluation based on the Characteristics of Hazards

	Flood	Landslide	Drought	Chemical Hazard
Magnitude	8	3	8	9
Frequency	8	3	5	1
Duration	5	6	9	9
Onset Speed	7	9	1	8
Spatial Extended	6	1	9	1
Predictability	8	7	9	4
Total	**42**	**29**	**41**	**32**

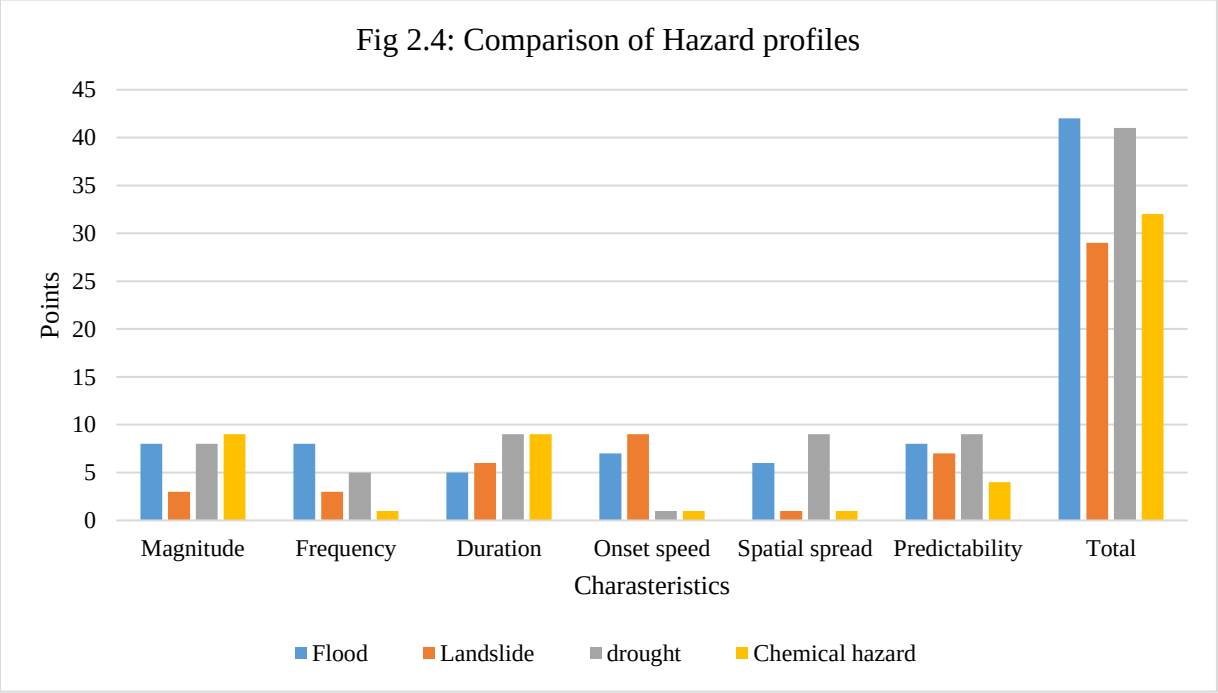

Figure 2.4. Hazard Profile

The analysis depicts the most impacted hazards for water supply sector in the country are Flood, Drought, Chemical hazards and landslide in the order of priority.

2.7. Elements at Risk

All objects, people, activities, and processes that may be adversely affected by hazardous phenomena in a specific area, whether directly or indirectly, are considered elements at risk in the disaster risk assessment. This includes structures, facilities, human resources, equipment, economic operations, public services, and the

environment. The element at risk can be detailed based on the level of risk assessment. For example, if a project-specific risk assessment is necessary, more data about the element at risk must be considered because they raise the certainty of the risk assessment and allow for more accurate risk-based decisions. Easily it would be accomplished using the assert management registry of particular entity.

There are numerous sorts of elements at risk, as well as numerous classification schemes. The table 2.11 is an example of such a classification.

Table 2.11. Example of Clarification of element at risk

Element at risk	**Required Details**
Building	construction types, building height, building age, total floor space, replacement costs
Human Resources	No of human resources Staff and customers approximately, distribution in space, distribution in time, age distribution, gender distribution, handicapped
Essential Facilities	Transport, Equipment, Stores, water Sources, etc.
Databases	Technical, Financial, Customer details etc.
Environment of the location	Water catchment characteristic's (Highly urbanized, Industrialized etc.)

A survey of elements at risk is always incomplete, and therefore a risk assessment study nearly always focuses on specific groups of elements at risk. Since this study focus on the national level assessment with respect to the availability of data followings are considered as element at risk; Water Sources (Water Catchment), Treatment plant (Intake, Distribution Chamber, Flocculation & Sedimentation, Sand Filter, Clear Water Reservoir, Chemical storage Building, Pump House, Clear Water Transmission), main distribution lines.

The summery of the element at risk considered for the study is given in Table 2.12. Details of risk elements ie. Name, location types etc. are given in the appendix No 2.3

Table 2.12: Summery of number of Risk elements considered in the study.

Operational Regions	District	Water Sources		Treatment plants		Number of Main distribution lines
		No. Catchments	No. Tube wells	No. Intakes	No. pump houses	
Central	Kandy	3	14	19	2	27
	Matale	2	5	7	1	8
	Nuwaraeliya	2	1	13	2	11
Eastern	Trncomale	3	5	4	2	15
	Batticalloa	1		2	1	4
	Ampara	5	3	9	4	32
NCP	Anuradhapura	5	55	11	1	17
	Polonnaruwa					
NWP	Kurunegala	3	12	17	4	17
	Puttalum	8	38	16	2	7
NP	Jaffna	5	13	22		16
	Mulathivu	2	13	13	1	4
	Killinochchi	2	8	4	1	1
	Vavunia	2	10	3	1	3
	Mannar	4	16	26		11
Sabaragamuwa	Kegalle	3	2	4		4
	Rathnapura	2	2	17		24
Southern	Galle	1	3	3	1	16
	Matara	3	12	11	1	10
	Hambanthota	5		14	3	16
Uva	Badulla	3		18		23
	Moneragala	6	14	26	1	22
Western	Gampaha	3	19	7	3	25
	Colombo	1		3	1	28
	Kalutara	2		3	1	10

2.8. Exposure Assessment

Exposure assessment is used to determine the contact of element at risk with a potentially hazardous event and, if so, level of exposure (Based on the Location) and the duration of exposure (Based on the length of hazard event).

In order to develop disaster risk reduction plan, at first the systems/elements that are expose should be identified. Coordinates of identified element at risk provided by NWSDB were overlaid with the hazard layers respectively and exposure level of the critical infrastructure (element at risk) were identified.

It was not possible to assess the temporal exposure as historical details of the impacts have not been available.

2.8.1. Flood Exposure

Flood maps provided by Irrigation Department and DMC were merged with respect to the attribute data of the shape files. Since data on the severity of flood or the return periods are not available flood exposure of the element at risk was assessed following the inundation areas. Hence catchments exposure was based on the spatial extend of inundation and other elements at risk exposure was assessed based on the following indicator ***"Element at risk is located in inundation area Yes/No" and*** the numbers of elements are summarized in the following table 2.13. Details of percentages of catchment areas and elements exposed to floods given in Appendix No2.4.

Table 2.13: Summery of number of catchment areas and elements exposed to floods

Operational Regions	District	Water Sources			Treatment Plants					
		No of Catchment areas	Tube wells		Chemical Building/treatment		Pump House			
			Exposed	Not Exposed	Not Exposed	Exposed	Not Exposed	Exposed	Not Exposed	Exposed
Central	Kandy	4	0	13	19	0	2	1	29	No
	Mathale	5	0	6	7	0	1	1	10	
	Nuwaraeliya	4	0	1	3	0	0	1	15	
Eastern	Trincomale	11	5	0	4	0	1	9	10	
	Baticaloa	17	0	0	2	0	0	0	1	
	Ampara	21	0	4	9	0	3	0	14	
North Central	Polonnaruwa	7	2	7	10	0	1	3	13	
	Anuradapura	15	1	38	9	0	1	3	46	
North Western	Kurunegala	9	1	12	14	1	2	6	17	
	Puttlam	11	9	30	9	0	1	12	31	
Northern	Jaffna	4	10	12	18	0	0	10	12	
	Multhiuv	20	1	12	10	0	0	1	12	
	Kilinochchi	8	1	6	0	1	0	2	6	
	Vavuniya	9	0	9	3	0	1	0	10	
	Mannar	7	11	5	25	0	0	11	5	
Sabaragamuwa	Kegalle	5	2	0	3	1	0	7	7	
	Rathnapura	7	2	0	18	0	0	4	10	
Southern	Galle	9	1	0	3	2	1	4	0	
	Matara	6	3	1	9	1	0	9	2	
	Hambantota	20	0	0	11	1	1	1	11	
Uva	Badulla	7	0	0	20	0	1	0	27	
	Moneragala	18	0	14	22	0	2	0	21	
Western-Northern	Gampaha	3	11	10	8	3	0	19	10	
Western-Central	Colombo	5	0	0	2	2	0	6	6	
Western-South	Kalutara	5	0	0	2	1	0	3	1	

2.8.2. Water Sources Exposure to Flood hazard

Details of water sources exposed to flood hazard are given in the following table 2.14.

Table 2.14: Summarized details of water Intakes exposed to floods

Operational Regions	District	Divisional Secretariat	Water Sources
Central	Kandy	Udapalatha	Mahaweli river
	Matale	Pallepola	Nalanda Tank
	Nuwara Eliya	Ambagamuwa	Kelani River
Eastern	Trincomalee	Kuchchaveli	Lalikadu Kulam
		Kuchchaveli	Ground Water - Thandamuripu
		Kuchchaveli	Ground Water - Yan Oya
		Kantalae	Mahaweli River
		Muttur	Mahaweli River
		Kantalae	Kanthale Wewa
North Central	Anuradhapura	Padaviya	Ground Water
		Mahavilachchiya	Malwathuoya
		Thalawa	Koonwewa Tank
	Polonnaruwa	Lankapura	Ground Water - WRB new BH 1
		Lankapura	Ground Water - WRB new BH 2
		Thamankaduwa	Mahaweli River
North West	Kurunegala	Galgamuwa	Close to "Mee" oya
		Ambanpola	MeeOya
		Narammala	Maha Oya
		Pannala	Maha Oya
		Wariyapola	Maguru Oya
			Deduru Oya reservoir
	Puttalam	Chilaw	Ground Water - In side T/Plant
			Ground Water - Munneswaram
			Ground Water - Munneswaram (temple)
			Ground Water - Outside T/Plant
			Ground Water - TWS - Thiththakade
		Nattandiya	Ground Water -Kokkalamulla
		Dankotuwa	Maha Oya
		Mahawewa	Kadupiti Oya
		Pallama	Deduru Oya
Northern	Jaffna	Delft	Ground Water Delft
		Vadamaradchy North	Ground Water Manalkadu
		Vadamaradchy North	Ground WaterWallipuram
		Velanai	Ground Water Velanai
		Velanai	Ground Water Mandaithivu 32
	Kilinochchi	Karachchi	Ground Water Kilinochchi
		Karachchi	Kilinochchi dry Aru
	Mannar	Manthai West	Ground Water Periamadu
	Mannar	Nanaddan	Ground Water - Murunkan well field
	Mullaitivu	Maritimepattu	Ground Water - Wattappalai

Table 2.14: Summarized details of water Intakes exposed to floods ……Cont

Operational Regions	District	Divisional Secretariat	Water Sources
Sabaragamuwa	Kegalle	Dehiovita	Ground Water Gonagala
		Ruwanwella	Ground Water Gonagala
		Bulathkohupitiya	Endurapotha Ela
		Dehiovita	Maha Oya/Kahanawita Ela
		Kegalle	Gurugoda Oya
		Ruwanwella	Kelani River
		Yatiyanthota	Wee Oya
	Ratnapura	Kiriella	Ground Water - Kiriella
		Nivithigala	Ground Water - Nivithigala
		Ratnapura	Kalu Ganga
Sourthern	Galle	Nagoda	Ground Water Kabeel watta
		Baddegama	Gin Ganga
		Bope-Poddala	Gin Ganga
	Hambantota	Tangalle	Kirama Oya
	Matara	Pitabeddara	Ground Water - Nariyawatta
		Pitabeddara	Ground Water - Town Pitabaddara
		Athuraliya	Nilwala River
		Kamburupitiya	Nilwala River
		Kotapola	Gin Ganga
		Pasgoda	Katuwana Nembili stream
		Thihagoda	Nilwala River
West South	Kalutara	Ingiriya	Ingiriya Nachchimale Ela
		Madurawala	Kalu Gaga
		Dodangoda	Kalu Gaga
West Central	Colombo	Kaduwela	Kelani River
		Seethawaka	Seethawaka ganga
		Padukka	Kalatuwawa Tank
		Padukka	labugama Tank
West North	Gampaha	Divulapitiya	Ground Water iulapitiya WSS - ii, Thekkawatta
		Divulapitiya	Ground Water Diulapitiya WSS – Thekkawatta
		Divulapitiya	Ground Water Kotadeniyawa, Welihinda, Thekkawatta
		Gampaha	Ground Water Attanagalu Oya Bank
		Gampaha	Ground WaterAttanagalu Oya bank
		Gampaha	Ground Water Vidiyawatta
		Gampaha	Ground Water Yakkala Treatment plant
		Minuwangoda	Ground Water Ambagahawatta Pump House
		Minuwangoda	Ground Water Industrial Zone (BOI) - ii
		Minuwangoda	Ground Water Kotugoda Road, Near Temple
		Minuwangoda	Ground Water Wegowa Pump House
		Attanagalla	Attanagalu Oya
		Biyagama	Kelani River
		Divulapitiya	Maha Oya
		Dompe	Kelani River
		Katana	Maha Oya
		Minuwangoda	Attanagalu Oya (Dandugam Oya)

2.8.3. Exposure of Proposed Water Sources and Water Intakes to Flood Hazard

Locations of the proposed water intakes at the respective water sources were overlaid with the flood hazard layers and the following table 2.15 given the exposure of the proposed locations for flood hazard. Among the 238 of proposed water sources and the proposed intake locations 90 numbers of locations are exposed to flood. Summery of number of proposed water intakes and treatnment plants exposed to floods given in Table 2.15. Details of proposed water intakes and WTP exposed to floods given in Appendix 2.5

Table 2.15: Exposure of Proposed Water Intakes and treatment plants to Flood Hazard

Operational Regions	District	Number of Proposed Project	Water Sources	Treatment Plants	
			Catchment	Intakes	
				Exposed	Not Exposed
Central	Kandy	12	13		13
	Mathale	2	2	2	
	Nuwaraeliya	3	3		3
Eastern	Trincomale	**16**	8	11	5
	Baticaloa	8	8	4	4
	Ampara	7	7	2	5
North Central	Polonnaruwa	5	5	1	4
	Anuradapura	17	17		17
North Western	Kurunegala	9	6	2	7
	Puttlam	9	5	6	3
Northern	Jaffna	11	10	5	6
	Multhiuv	5	5		5
	Kilinochchi	8	6	5	3
	Vavuniya	7	7	1	6
	Mannar	9	9	2	7
Sabaragamuwa	Kegalle	14	6	5	9
	Rathnapura	15	11	5	10
Southern	Galle	7	3	5	2
	Matara	7	4	6	1
	Hambantota	16	12	2	14
Uva	Badulla	12	11	2	10
	Moneragala	12	11		12
Western-Northern	Gampaha	18	5	16	2
Western-Central	Colombo	4	2	4	
Western-South	Kalutara	4	2	3	1

2.8.4. Exposure of Water Treatment Plants to Flood Hazard

Location map of the water treatment plants was overlaid with the flood hazard map and the exposed water intakes were identified for further assessment and the details are given table 2.16.

Table 2.16: Details of Water Treatment Plants Exposed to Flood

Operational Regions	District	Divisional Secretariat	Name of Water Treatment Plant	Source	Area Covered
North West	Kurunegala	Ambanpola	Galgamuwa - Mee Oya	Mee oya, 2 BH (used in dry season)	Galgamuwa
		Bingiriya	Vilaththawa/ Chilaw	Deduru Oya	Chilaw
		Pannala	Pannala	Ma Oya	Pannala
Northern	Jaffna	Vadamaradchy North	Karaveddy -Dug well	Karaveddy -Dug well	Karaveddy, Point-Pedro, Valvettithurai
		Vadamaradchy North	Vallipuram, Point Pedro		
		Vadamaradchy North	Karaveddy -Dug well	Vallipuram Intake - Tube wells 1-6	Karaveddy, Point-Pedro, Valvettithurai
		Vadamaradchy North	Vallipuram Intake - Dug wells 1,2,3, &4, Tube wells 1-6 Vallipuram, Point Pedro		
		Vadamaradchy North	Vallipuram Intake - Dug wells 1,2,3, &4, Tube wells 1-6 Vallipuram, Point Pedro	Vallipuram Intake - Dug wells 1,2,3, &4	Karaveddy, Point-Pedro, Valvettithurai
		Velanai	Tube wells 1 Water supply lane, Velanai	Tube wells 1	Velanai
	Kilinochchi	Karachchi	Karadipokku 01 dug well, 01 tube well Wilson Roa*	Karadipokku 01 dug well, o1 tube well	Killinochchi
		Karachchi	Surface Water (Dry Aru), Wilson Road, Kilinochchi	Surface Water (Dry Aru)	Killinochchi
	Mannar	Manthai West	Periyamadu	Periyamadu	Periyamadu
Sabaragamuwa	Kegalle	Dehiovita	Kotabodawatta	Kelani Ganga	Awissawella
		Deraniyagala	Weliharanawa	Walawe Ganga	Balangoda
	Ratnapura	Nivithigala	Muwagama	Kalu Ganga	Rathnapura
Sourthern	Galle	Baddegama	Baddegama	Gingaga	Baddegama, Balapitiya, Batapola, Elpitiya, Ambalangoda, Hikkaduwa
		Bope-Poddala	Wakwella	Gingaga	Wakwella, Galle
	Hambantota	Ambalantota	Kirindioya	Lunugamvehera	Kirinda
		Tangalle	Muruthawela	Murutawela reservoir	Muruthawela, Walasmulla
		Walasmulla	Kataragama	Mankganga	Kataragama
	Matara	Thihagoda	Thihagoda	BH2	Thihagoda
		Malimbada	Malimbada / Nadugala	Nilwala Ganga	Matara, Malimbada, Devinuwara, Dikwella, Gandara, Kottagoda, Kudawella

		Kamburupitiya	Karagoda Uyangoda	(blank)	Karagoda - Uyangoda
Operational Regions	**District**	**Divisional Secretariat**	**Name of Water Treatment Plant**	**Source**	**Area Covered**
West Central	Colombo	Kolonnawa	Ambatale	Kelani Ganga	Slave-Island, Hultsdroft, Thimbirigasyaya, Pamankada, Mattakuliya, Kotahena, Maligawatta, Borella, Battaramulla - Hokandara, Kotte, Kolonnawa-Kotikawatta- Mulleriyawa, Dehiwala
	Colombo	Seethawaka	Kosgama/ Akarawita	Kelani Ganga	Kosgama
	Colombo	Seethawaka	Penrithwatta	Kelani Ganga	Awissawella
West North	Gampaha	Biyagama	Pattiwila	Kalani Ganga	Kelaniya, Welisara, Biyagama - Dompe, Mahara, Ragama, Ja-Ela, Katunayake
	Gampaha	Dompe	Chico	Kalani Ganga	Athurugiriya
	Gampaha	Dompe	Pugoda	Kelani Ganga	Pugoda
	Gampaha	Dompe	Ranpokunawatta	Kelani Ganga	Kirindiwela, Ranpokunugama, Urapola Attanagalla
	Gampaha	Gampaha	Gampaha/ Yakkala	Attanagallu Oya	Gampaha, Yakkala
	Gampaha	Katana	Bambukuliya	Ma Oya	Negambo
	Gampaha		Raddolugama	Dhandugam oya	Raddolugama
West-South	Kalutara	Madurawala	Kandana	Kalu Ganga	Miriswatta, Piliyandala, Wadduwa, Moratuwa, Horana, Bandaragama, Kumbuka, Panadura

2.8.5. Exposure to Landslide Hazard

1; 50,000 scale landslide susceptible map provided by the National Building Research Organization (NBRO) was used to understand the level of exposure of the element at risk (Water Sources and the Water Treatment plants/intakes). Landslides maps has categorized level of susceptibility to occur landslide in geographical area as Not Likely, Modest Level, Expected and Most Likely. But the maps have not been validated based on the actual historical record on landslide and the landslide flow part s have not been identified. Hence the degree of certainty of maps is questionable.

Summary of the element at risk exposed to landslide is given in table 2.17.

Table 2.17: Summary of the element at risk exposed to landslide

Operational Regions	Districts	Water Sources					Treatment Plants											
		Catchments (Area as %)	Tube wells				Intakes				Chemical Building/Treatment				Pump House			
			Not Likely	Modest	Expected	Most Likely	Not Likely	Modest	Expected	Most Likely	Not Likely	Modest	Expected	Most Likely	Not Likely	Modest	Expected	Most Likely
Central	Kandy	Kelani River (0.2), Mahaweli River (89.11), Maha Oya (7.97), Deduru Oya (2.72)	7	6	0	0	9	13	2	3	0	1	1	0	6	11	1	1
	Mathale	Mahaweli River (71.1), Yan Oya (1.99), Malwathu Oya (0.41), Kala Oya (25.0), Deduru Oya (1.5)	0	5	1	0	2	7	1	0	0	1	0	0	1	3	1	0
	Nuwaraeliya	Kelani River (24.17), Walawe River (1.21), Kalu River (0.1), Mahaweli River (74.52)	0	1	0	0	4	8	2	2					2	9	1	0
North Western	Kurunegala	Karambalan Oya (12.21), Ratmal Oya (3.48), Maha Oya (9.11), Mahaweli Ganga (0.01), Kala Oya (8.21), Mi Oya (14.91), Kalagama Oya (0.01), Rathambala Oya (2.03), Deduru Oya (50.0)	3	0	0	0	6	0	0	0					6	1	0	0
Sabaragamuwa	Kegalle	Kelani Ganga (61.93), Maha Oya (33.09), Attanagalu Oya (4.43), Kalu Ganga (0.28), Deduru Oya (0.34)	1	2	0	0	8	3	2	1	2	0	1	0	3	2	0	1
	Rathnapura	Kelani Ganga (2.3), Nilwala Ganga (0.27), Urubokka Oya (0.25), Kachigala (0.52), Walawe Ganga (40.63), Kalu Ganga (54.62), Gin Ganga (1.39)	2	0	0	0	5	3	3	0					8	5	5	0
Southern	Galle	Koggala Lake (3.39), Polwatta Ganga (9.28), Nilwala Ganga (2.9), Kalu Ganga (0.46), Benthota Ganga (19.16), Madu Ganga (4.52), Madampe Lake (5.88), Telwatta Ganga (3.28), Ratgama Lake (0.98), Gin Ganga (46.4)	1	0	0	0	1	0	0	0					0	1	1	0
	Matara	Polwatta Ganga (6.8), Nilwala Ganga (70.38), Seenimodara Oya (0.51), Kirama Oya (3.82), Urubokka Oya (1.48), Gin Ganga (9.38)	3	0	0	0	6	0	0	0					5	3	0	0
	Hambantota	Nilwala Ganga (1.79), Seenimodara Oya (1.62), Kirama Oya (6.05), Rekawa Oya (3.53), Urubokka Oya (12.2), Kachigala (7.95), Walawe Ganga (12.6), Karagan Oya (3.26), Malala Oya (11.74), Embilikala Oya (2.68), Kirindi Oya 11.3), Bambawe Aru (3.2), Mahasiliwa Oya (0.71), Butawa Oya (2.0), Menik Ganga (3.63), Katupila Aru (2.99), Kuranda Aru (3.86), Nabadagas Aru (2.65), Karambe Aru (2.0), Kumbukkan Oya (0.94)	0	0	0	0	1	0	0	0					0	1	0	0
Uva	Badulla	Walawe Ganga (8.5), Kirindi Oya (9.47), Menik Ganga (1.58), Kumbukkan Oya (3.42), Gal Oya (0.56), Maduru Oya (9.69), Mahaweli Ganga (66.77)	0	0	0	0	5	17	2	1					4	9	3	1
	Moneragala	Walawe Ganga (10.53), Malala Oya (2.0), Kirindi Oya (10.56), Menik Ganga (19.76), Katupila Aru (0.38), Kuranda Aru (0.82), Nabadagas Aru (0.46), Kumbukkan Oya (17.37), Baguru Oya (0.48), Wila Oya (4.35), Heda Oya (7.55), Karanda Oya (2.12), Pannel Oya (0.2), Gal Oya (18.38), Magalavatavan Aru (1.14), Mundeni Aru (2.72), Maduru Oya (0.66), Mahaweli Ganga (0.38)	10	2	1	0	11	5	1	0	1	0	0	0	8	4	1	0

Table 2.17: Summary of the element at risk exposed to landslide Cont…..

			Water source								Water Treatment Plant											
Operational Regions	**District**	**Catchment area as a % of total**	**Tube wells**				**Intakes**				**Chemical Building/Treatment**				**Pump House**				**Distribution Lines**			
		Area covered by WSS as a % of total catchment	**Not Likely**	**Modest**	**Expected**	**Most Likely**	**Not Likely**	**Modest**	**Expected**	**Most Likely**	**Not Likely**	**Modest**	**Expected**	**Most Likely**	**Not Likely**	**Modest**	**Expected**	**Most Likely**	**Not Likely**	**Modest**	**Expected**	**Most Likely**
Western-Northern	Gampaha	Kelani Ganga (23.77), Attanagalu Oya (57.48), Maha Oya (18.75)	0	0	0	0									1	0	0	0				
Western-Central	Colombo	Kelani Ganga (65.35), Bolgoda Ganga (27.6), Kalu River (2.45), Beire Lake (1.88), Kirulapana (2.71)	0	0	0	0	0	3	1	0	1	0	0	0	1	0	1	0				
Western-South	Kalutara	Kelani River (0.65), Bolgioda Ganga (14.84), Benthota Ganga (25.47), Kalu Ganga (58.13), Gin Ganga (0.37)	0	0	0	0	0	1	1	0					2	0	0	0				

2.8.6. Exposure of Water Sources to Landslide hazard

Summer of Number of water sources exposed to landslide hazard under different esposure levels are given in the following table 2.18. Details names of water resources exposed to Landslides given in Appendix 2.6

Table 2.18: Summery of number of waters resources exposed to Landslides

Operational Regions	District	Divisional Secretariate	Landslide Susceptibility Level			
			Not Likely	Modest Level	Expected	Most Likely
Central	Kandy	17	15	17	4	3
	Matale	4	2	5	1	
	Nuwara Eliya	5	4	7	2	2
Sabaragamuwa	Kegalle	9	8	3	2	1
					Yes	
	Ratnapura	8	4	3	3	
Southern	Galle	1	1			
	Hambantota	1	1			
	Matara	4	5			
Uva	Badulla	8	8	14	2	1
	Moneragala	4	4	3	2	
West Central	Colombo	3		2	1	
West South	Kalutra	4	1	1	2	

2.8.7. Exposure of Water Treatment Plants to Landslide Hazard

Exposure of all Water Treatment Plants were estimated based on the landslide susceptibility map and the levels of the exposure are given in Table 2.19

Table 2.19: Exposure of Water Treatment Plants to Landslide Hazard

Operational Regions	District	Divisional Secretariat	WTP Name	Capacity (m^3)	Landslide Susceptibility Level			
					Not Likely	Modest	Expected	Most Likely
Central	Kandy	Doluwa	Doluwa	375		Yes		
		Doluwa	Gampolawatta	900		Yes		
		Doluwa	Nilambe	10500	Yes			
		Ganga Ihala Korale	Ulapane	8000				Yes
		Harispattuwa	Greater Kandy	56000		Yes		
		Kandy Four Gravets & Gangawata Korale	Hantana Housing Scheme	650		Yes		
		Kandy Four Gravets & Gangawata Korale	Haragama	3750		Yes		
		Kundasale	Balagolla	8000	Yes			
		Medadumbara	Rangala (Meda Dumbara)	3000		Yes		
		Panvila	Araththana	12000		Yes		
		Pasbage Korale	Nawalapitiya	4500	Yes			
		Pathadumbara	Polgolla	10000	Yes			
		Pathahewaheta	Marassana	3500		Yes		
		Pujapitiya	Ankumbura (Ihalamulla B/H)	200	Yes			
		Thumpane	Galagedara	600	Yes			
		Udapalatha	Datry	120		Yes		
			Elpitiya	5000		Yes		
			Para Deka	5200		Yes		
		Udunuwara	Meewathura (K/S TP)	32000			Yes	
	Matale	Ambanganga Korale	Pussella	300			Yes	
		Matale	Matale	15000		Yes		
		Pallepola	Naula	1500	Yes			
		Rattota	Udatenna	5000		Yes		
		Ukuwela	Ukuwela	900		Yes		
	Nuwaraelliya	Ambagamuwa	Ginigathena	1200		Yes		
			Hatton High Lift - Dukenose	2000		Yes		
			Hatton Low Lift - Invary	2000		Yes		
			Maskeliya	750		Yes		
			Sinhapura	3000		Yes		
		Hanguranketha	Rikillagaskada	3000			Yes	
		Kothmale	Pundaluoya	600		Yes		
			Pussellawa	900		Yes		
		Nuwara Eliya	Kotagala	700	Yes			

Operational Regions	District	Divisional Secretariat	WTP Name	Capacity (m^3)	Landslide Susceptibility Level			
					Not Likely	Modest	Expected	Most Likely
		Nuwaraeliy	Talawakale	1000	Yes			
		Walapane	Ragala	750		Yes		
			Walapane	900		Yes		
North Western	Kurunegala	Alawwa	Alawwa	1000	Yes			
		Mawathagama	Buluwala	350	Yes			
			Mawathagama	500	Yes			
		Narammala	Narammala	2000	Yes			
		Polgahawela	Polgahawela - Karandana	3000		Yes		
		Rideegama	Dodangaslanda	1500	Yes			
			Hettipola	500	Yes			
			Ogodapola	500	Yes			
Sabaragamuwa	Kegalle	Bulathkohupitiya	Bulathkohupitiya	180				Yes
		Dehiovita	Kotabodawatta	3000	Yes			
		Deraniyagala	Benkiyawatta	3000		Yes		
			Weliharanawa	7000		Yes		
		Aranayaka	Aranayaka TP	900		Yes		
			Mediliya TP	1500		Yes		
			Hiriwadunna TP	8500			Yes	
		Mawanella	Mawanella TP	15000		Yes		
		Ruwanwella	Rathkarawwa	9000	Yes			
	Ratnapura	Eheliyagoda	Ingiriya/Nachchamale	300		Yes		
			Kalatuwawa	98000	Yes			
			Kolonna	7000		Yes		
			Mas Embula	4500			Yes	
			Nimalagama	160			Yes	
		Godakawela	Kohiladeniya/ Eheliyagoda	1450	Yes			
		Imbulpe	Nallattanniya	30		Yes		
		Kahawatta	Idangoda	600	Yes			
		Kuruvita	Nisala Uyana - Kahawatta	4500			Yes	
			Sinhapura	3000			Yes	
			Watapotha	900	Yes			
		Nivithigala	Muwagama	6000			Yes	
			Pompakale	13500	Yes			
		Ratnapura	Watapotha	900	Yes			
			Sri padaya	500	Yes			
		Weligepola	Dehiowita TP	1500	Yes			
			Yatiyanthota TP	950		Yes		
Southern	Galle	Nagoda	Udugama	1200		Yes		
		Niyagama	Pitigala	190			Yes	
	Hambantota	Walasmulla	Sapugahadola & water from Muruthawela	200		Yes		
	Matara	Akuressa	Akuressa	3000	Yes			
		Hakmana	Hakmana	1000		Yes		
		Kotapola	Deniyaya	550	Yes			

Operational Regions	District	Divisional Secretariat	WTP Name	Capacity (m^3)	Landslide Susceptibility Level			
					Not Likely	Modest	Expected	Most Likely
		Mulatiyana	Makandura	1750	Yes			
		Pasgoda	Athdolakanda, Beerideniya & Nebilidola	800	Yes			
		Pasgoda	Urubokka	275		Yes		
		Pitabeddara	Pitabeddara	300		Yes		
		Welipitiya	Hallala	8000	Yes			
Uva	Badulla	Badulla	Badulla	10000		Yes		
		Bandarawela	Bandarawela	3000				Yes
			Makulella	500	Yes			
		Ella	Mullepihilla	130	Yes			
		Hali-Ela	Demodara	15000		Yes		
			Hali Ela	2000		Yes		
		Haputale	Diyathalawa	6000		Yes		
		Uva Paranagama	Ambagasdowa	3000	Yes			
			Medawala	650		Yes		
		Welimada	Bogahakubura	600	Yes			
			Boralanda	3000		Yes		
			Keppetipola	3000			Yes	
			Welimada	2000			Yes	
		Bibile	Bibila	800		Yes		
			Medagama	800	Yes			
		Buttala	Buttala	3500	Yes			
			Poojapiyita (Bokkawala B/Hs)	250	Yes			
		Moneragala	Monaragala - Partial (RSF, SSF, Cl)	3000	Yes			
			Okkampitiya	1400	Yes			
		Wellawaya	Harispaththuwa (Rajapihilla B/H)	1700		Yes		
			Ice Pilla - Partial (SSF)	2000	Yes			
			Minigamuwa	35	Yes			
			Poojapiyita (Bolagala Well field)	220	Yes			
			Yalabowa -Full	7250		Yes		
			Penrithwatta	3000	Yes			
West North	Gampaha	Mirigama	Bataleeya	350	Yes			
	Kalutara	Mathugama	Wettewa	280	Yes			
		Palindanuwara	Idangoda	600	Yes			

2.8.8. Exposure of Proposed Water sources/Intakes to Landslide Hazard

NWSDB has proposed 238 new intakes at surface water sources to expand the water supply network of the country to fulfill the drinking water demand of the public. Location map of the proposed intakes overlaid with landslide hazard profile and the level of exposure under each category of the landslide susceptibility is given in Table 2.20. Details given in Annex2.7

Table 2.20: Proposed Water sources and Intakes Exposed to Landslides

Operational Regions	District	Total Number of Proposed Intakes	Water sources Number of catchments	Treatment Plants/ Intakes			
				Level of exposure			
				Not Likely	Modest	Expected	Most Likely
Central	Kandy	11	2	4	2	3	2
	Mathale	1	1	1	0	0	0
	Nuwaraeliya	5	1	1	3	1	0
North Western	Kurunegala	5	2	5	0	0	0
Sabaragamuwa	Rathnapura	12	2	7	2	2	1
	Kegalle	18	2	10	3	3	2
Southern	Hambantota	1	1	1	0	0	0
	Galle	2	2	2	0	0	0
	Matara	7	3	7	0	0	0
Uva	Badulla	11	2	3	7	0	1
	Moneragala	8	5	5	2	1	0
Western-Northern	Gampaha	2	1	0	2	0	0
Western-Central	Colombo	2	1	1	1	0	0
Western-South	Kalutara	1	1	0	1	0	0

Meantime, the analysis indicated that 6 of the proposed intakes are placed in the landslides most likely area while 10 intakes of the proposed sites in 6 districts are located in landslide-expected areas.

2.8.9. Exposure to Drought Hazard

Since the water scarcity is the issue associated with drought, water sources and the water intakes were analyzed against the high, moderate and low categories of drought hazard map published by the DMC and the analysis result has been summarized in Table 2.21. Detail of exposure of water sources to drought given in Appendix 2.8

Table 2.21: Summery of level of exposure of water sources to drought

Operational Regions	District	Divisional Secretariate	Water Sources					
			Catchments			Tube wells		
			High	Moderate	Low	High	Moderate	Low
Central	Kandy	15	1	14	2		8	
	Mathale	5		17	3	2	4	
	Nuwaraeliya	5	1	4	1		1	
Eastern	Trincomale	4	2	1	1		5	
	Baticaloa	1	1					
	Ampara	7	3	4	3	2	2	
North Central	Polonnaruwa	6	1	3	3	2	6	1
	Anuradapura	15		1	9		24	15
North Western	Kurunegala	10	3	10	7	7	27	18
	Puttalam	10	1	3		19	20	17
Northern	Jaffna	10				20	2	
	Multhiuv	4				5	8	
	Kilinochchi	2	1			2	5	
	Vavuniya	1			1		7	2
	Mannar	2				16		
Sabaragamuwa	Kegalle	9	5	8			2	
	Rathnapura	9	3	9			2	
Southern	Hambantota	6	4	6	2			
	Galle	3		3			1	
	Matara	8	1	6		1	3	
Uva	Badulla	9	4	21	2			
	Moneragala	11	1	4	2		14	
Western-Northern	Gampaha	8	3	5		12	9	
Western-Central	Colombo	4		4	2			
Western-South	Kalutara	4	1	3				

Details of Exposure to Water Treatment Plants / Intakes to Drought

Drought exposure data indicates that 102 water intakes in 21 districts are highly exposed to drought and 255 intakes in 22 districts are moderately exposed**.** Summery of number of WTP/Intakes exposed to floods given in table 2.22 below. Details of treatment plants exposed to drought are given in Appendix 9

Table 2.22: Summary of number of Water Treatment Plants / Intakes exposed to drought

Operational Regions	District	Divisional Secretariate	No of Water Treatment plants / Intakes Expose to Drought Hazard			
			High	Moderate	Low	Grand Total
Central	Kandy	14	2	15	2	19
	Matale	7	2	4	1	7
	Nuwara Eliya	5	2	9	1	12
Eastern	Ampara	6	6	1	2	9
	Batticaloa	2	1	1	1	6
	Trincomalee	4		2	1	1
Northern	Jaffna	8	22			22
	Kilinochchi	1	2			2
	Mannar	3	7	19		26
	Mullaitivu	3	9	1		10
	Vavuniya	2		2	1	3
North Central	Anuradhapura	8		3	6	9
	Polonnaruwa	6	2	5	3	`0
North Western	Kurunegala	12	1	14	2	17
	Puttalam	7	1	8		9
Sabaragamuwa	Kegalle	4		5		5
	Ratnapura	**10**	6	13	1	20
Sourthern	Galle	4	1	5		5
	Hambantota	8	5	7		14
	Matara	11	4	8		12
Uva	Moneragala	8	5	13	2	21
	Badulla	9	3	16	1	20
West Central	Colombo	4		5		5
West North	Gampaha	8	3	12		15
West South	Kalutara	3	1	2		3

2.8.10. Exposure of Proposed Water sources/Intakes to Drought Hazard

Exposure of water sources and intakes were also analyzed using map over laying method and the results summarized as given in the following table 2.23. For details refer to Appendix 8. Out of 217 proposed projects 52 catchments, 5 Tube wells and 42 intakes are located in high exposed drought zones. Details in Appendix 10.

Table 2.23: Summary of proposed projects exposed to Drought

Operational Regions	District	Number of Proposed Projects	Water Sources						Treatment Plants/ Intakes		
			Catchment			Tube wells			Level of exposure		
			High	Moderate	Low	High	Moderate	Low	High	Moderate	Low
Central	Kandy	12	0	11	1					11	1
	Mathale	2	0	1	1					1	
	Nuwaraeliya	3	0	3						3	
Eastern	Trincomalee	12	4	5	3				5	9	2
	Baticaloa	8	**3**	4	**1**				3	3	1
	Ampara	7	**3**	**3**	1				3	3	1
North Central	Polonnaruwa	5	2	**2**	**1**				2	2	1
	Anuradapura	14	**0**	**5**	10					6	10
North Western	Kurunegala	10	2	**3**	**5**				2	5	3
	Puttlam	9	**4**	5					4	5	
Northern	Jaffna	8	7	0		2			10	0	
	Multhiuv	5	**2**	2			**1**		2	3	
	Kilinochchi	5	2	0		1	1		2	2	
	Vavuniya	4	1	2	1		2		0	6	1
	Mannar	5	1	1		2	1		3	6	1
Sabaragamuwa	Kegalle	14	7	7					7	7	
	Rathnapura	14	3	11					3	12	3
Southern	Hambantota	16	4	9	3				4	9	1
	Galle	7	0	7					0	7	
	Matara	7	1	5					1	5	
Uva	Badulla	12	1	8	3				0	7	
	Moneragala	13	1	11	1				0	9	1
Western-Northern	Gampaha	18	4	14					4	14	
Western-Central	Colombo	4	0	4					0	4	
Western-South	Kalutara	3	0	3					0	4	
Total		217	52	126		5	5		42	143	

2.8.11. Exposure to Chemical Hazards

Since different kinds of chemicals are used for the water treatments, all the water treatment plants could be susceptible to chemical hazards. Due to a lack of data, it was assumed that surface water sources and intakes associated with urban centers, Industrial zones, and hospitals are exposed to chemical hazards.

Even though the surface water bodies are exposed to chemicals such as pesticides, herbicides, etc. it has not been considered due to lack of data. Urban centers are considered as one of the sources chemical pollutions.

Table 2.24: Exposure of Catchments and treatment plants to Chemical Hazards

Operational Regions	District	Water Sources		Treatment Plants		Main Distribution Lines
		Catchments	Tube wells within 500m	Chemical Building	Pump House	
Central	Kandy	Mahaweli River, Maha Oya, Deduru Oya	0	Do	Do	Kandy South, Udu/Yatinuwara, Akurana, Alawathugoda, Pathadumbara, Ankumbura, Poojapitiya, Hedeniya, KMC
	Mathale	Mahaweli River, Kala Oya	0			Matale
	Nuwaraeliya	Kelani River, Mahaweli River	0			No
Eastern	Trincomale	Verugal Aru, Mahaweli River, Yan Oya	0			Andankulam, Daniyagama, Wellaimanal, Kantale, Kappalthurai, Mahamar, Sampalthivu, Thampalagamam, Varothayangar, wanela
	Baticaloa	Magalavatavan Aru	0			Batticaloa
	Ampara	Heda Oya, Pannel Oya, Gal Oya, Mundeni Aru, Mahaweli River	0			Thirukkovil, Addalachchenai, Akkaraipattu, Oluvil-palamunai, Ampara, Damana, Hingurana, Irakkamam, Kalmunai, Karaithivu, Madana, Maruthamunai, Ninthavur, Sainthanaruthu, Thottama, Kallar
North Central	Polonnaruwa	Mahaweli River	0			Sammanthurai
	Anuradapura	Kala Oya, Malwathu Oya, Moderagama Aru, Yan Oya, Ma Oya	0			Anuradhapura-North (Jaffna-Junction), Anuradhapura-New-Town, Mihintale
North Western	Kurunegala	Maha Oya, Deduru Oya, Mi Oya	0			GKWSSP (Zone 3), KMC, Chilaw, Mahawa, Nikaweratiya
	Puttlam	Maha Oya, Ratmal Oya, Karambalan Oya, Deduru Oya, Mi Oya, Tiladiaya, Moongil Aru, Kala Oya	0			Puttlam
Northern	Jaffna	Delf, Mandaithive, Kayts, Jaffna, Karainagar	0			No
	Multhiuv	Pali Aru, Per Aru	0			No
	Kilinochchi	Palllavarayankuddu, Kanakarayan Aru	**2**			Killinochchi,
	Vavuniya	Malwathu Oya, Paranki Aru	0			Vavuniya
	Mannar	Giant's Tank, Nay Aru, Pali Aru, Palllavarayankuddu	0			No
Sabaragamuwa	Kegalle	Kelani Ganga, Attanagalu Oya, Maha Oya	0			Awissawella
	Rathnapura	Walawe Ganga, Kalu Ganga	0			No

Table 2.24: Exposure of Catchments and treatment plants to Chemical Hazards Cont……

Operational Regions	District	Water Sources		Treatment Plants		Main Distribution Lines
		Catchments	Tube wells within 500m	Main Distribution Lines	Main Distribution Lines	
Southern	Galle	Gin Ganga	0			Koggala, Ahangama, Akmeemana - Habaraduwa, Bope-Poddala, Hapugala, Wakwella, Galle, Baddegama, Balapitiya, Batapola, Elpitiya, Ambalangoda, Hikkaduwa
	Matara	Nilwala Ganga, Dikwella, Polwatta Ganga, Gin Ganga	0			Matara, Malimbada, Devinuwara, Dikwella, Gandara, Kottagoda, Kudawella
	Hambantota	Kirama Oya, Walawe Ganga, Urubokka Oya, Kachigala, Kirindi Oya, Nilwala Ganga	0			Muruthawela, Walasmulla, Ranna
Uva	Badulla	Walawe Ganga, Mahaweli Ganga, Kirindi Oya	0			Rambukkana
	Moneragala	Menik Ganga, Kirindi Oya, Kumbukkan Oya, Heda Oya, Gal Oya, Mundeni Aru	0			Hambanthota, Ruhunupura, Sooriyawewa, Okkampitiya, Madulla, Monaragala
Western-Northern	Gampaha	Kelani Ganga, Attanagalu Oya, Maha Oya	4			Kelaniya, Welisara, Biyagama - Dompe, Mahara, Ragama, Ja-Ela, Katunayake, Gampaha, Yakkala, Raddolugama
Western-Central	Colombo	Kelani Ganga	0			Slave-Island, Hultsdroft, Thimbirigasyaya, Pamankada, Mattakuliya, Kotahena, Maligawatta, Borella, Battaramulla - Hokandara, Kotte, Kolonnawa- Kotikawatta-Mulleriyawa, Dehiwala, Awissawella
Western-South	Kalutara	Benthota Ganga, Kalu Ganga	0			Miriswatta, Piliyandala, Wadduwa, Moratuwa, Horana, Bandaragama, Kumbuka, Panadura

2.8.12. Exposure of Proposed Water sources/Intakes to Chemical Hazard

Four tube wells in Gampaha district and two tube wells in Killinochchi districts are within 500m radius of urban centers and could be polluted by urban waste.

Thirty-seven catchment areas of 217 proposed projects for the improvement of water supply system and two tube wells could be affected by chemical pollutions. Special attention needs to be paid at the planning and design stage to prevent impact of chemical pollution. Table 2.25 give details of exposed catchment areas and tube wells.

Table 2.25: Proposed Water sources and Intakes Exposed to Chemical Hazards

Operational Regions	District	Proposed Project Name	Water Sources	
			Catchment	Tube wells
Central	Kandy	Installation of 1500m3/day package TP for Medadumbara WSS & Pipe Laying	Yes	
		Kundasale Haragama WSP	Yes	
		Nawalapitiya Pallegama Water Supply Project	Yes	
	Ampara	Improvement of Dehiytakandiya & Lihiniyagama WSS	Yes	
North Central	Anuradapura	Future Expansion for Anuradhapura City - North Area	Yes	
		Greater Anuradhapura North & Greater Trincomalee Integrated Water Supply Project	Yes	
		Palugaswewa water supply project (Restructured for immediate need)	Yes	
North Western	Kurunegala	Bingirya - Udubaddawa & Makadura-Pannala- Kuliyapitiya Integrated WSP - Phase I (02 Nos. 20000m3/d WTP)	Yes	
	Puttlam	Kakkapalliya Water Supply Project	Yes	
		Kalpitiya WSP	Yes	
		Puttalam Water Supply Project - Stage II	Yes	
Northern	Jaffna	Chunnakam WSP		
		Improvement of WTP in Thottaveli, Murunkan & Point Pedro		Yes
	Mannar	Greater Jaffna WSP	Yes	
		Rehabilitation of Thalai Mannar WSS		Yes
Sabaragamuwa	Kegalle	Improvements of the Intake weir of Yatiyanthota Water Treatment Plant	Yes	
		Integration of Kegalle WSS	Yes	
		Rambukkana Water Supply Project - 16,000m3/day capacity	Yes	
		WASSIP	Yes	
	Rathnapura	Kuruvita Water Supply Project- Capacity 5000 m3/day	Yes	
		Upgrading Pelmadulla WTP & Distribution Improvements	Yes	
Southern	Galle	Baddegagama IWSP-Stage II	Yes	
		Baddegama IWSP-Stage I	Yes	
		Capacity improvement and distribution expansion project of Udugama WSS	Yes	
		Greater Galle stage III WSP	Yes	
		Imaduwa WSP	Yes	
	Matara	Augmentation of Hallala WSS	Yes	
		Deniyaya WSP	Yes	
		Deyyandara-Mulatiyana WSP	Yes	
Uva	Moneragala	Bibila Medagama Phase ll	Yes	
		Thanamalvila Sevanagala Integrated WSP	Yes	
Western-Northern	Gampaha	Augmentation of Divulapitiya WTP	Yes	
		Augmentation of Gampaha WTP	Yes	
		Augmentation of Nittambuwa WSS	Yes	
		Augmentation of Ranpokunawatta WTP	Yes	
		Augmentation of Veyangoda WSS	Yes	
		Augmentation of Yakkala WSS	Yes	
		Divulapitiya Water Supply Project - Stage I	Yes	
		Divulapitiya Water Supply Scheme ΓÇô Stage II	Yes	
		Extension of Intake Structure at Pugoda	Yes	

2.9. Vulnerability Assessment

Vulnerability is defined as a property associated with a component, a subsystem, or the overall water supply system to represent the possibility of being influenced by hazards/threats with given likelihoods and severities. The vulnerability assessment provides a framework for developing risk reduction options and associated costs.

Water systems should review their vulnerability assessments periodically to account for variations in hazard severity or additions to the system to ensure that resilience is being met. Calculating risk in this manner not only allows for a comparison of different hazards based upon their risk score but also provides a basis for evaluating countermeasures that would be considered for reducing risk. Risk reduction can be achieved by lowering either the probability of the event happening or the severity of the event, or both. The components of water sources systems should be identified and their vulnerability to natural hazards and threats should be determined. Water supply systems that are highly exposed, sensitive, and less adaptable, are highly vulnerable to disasters.

Hence for this study vulnerability was evaluated based on the following relationship.

Vulnerability = (Exposure) + (Resistance) + Resilience

Indicators were developed to measure each component of vulnerability as follows;

Component	**Measurable Indicator**
Exposure- Consider only the spatial component of exposure	Level of Exposure to different hazards
Resistance Measures taken to prevent, avoid or reduce loss	**Availability of Water Safety Plan** **Availability of Early Warning System** Level of preparedness for response and disaster response procedures are clearly defined Orientation and training for disaster response plan and procedures undertaken Special skills required during emergency operations are imparted to the officials and staff Procedures established for the emergency distribution of water if the existing supply is disrupted Sources of materials needed for response operation have been identified An officer has been designated as Emergency Officer for Disaster Management 1 **Due to a lack of data (only the Availability of the Water Safety Plan and Availability of the Early Warning System were used for the analysis)**
Resilience- Ability to recover within a short period	Recovery Framework established Financial Preparedness for Recovery

NWSDB was requested to provide data on vulnerability indicators for highly and moderately exposed elements of critical infrastructure. All provided data is not usable as the inconsistency and gaps of data. Hence analysis was accomplished using the complete data sets, to understand the vulnerability of water treatment plants/intakes.

Table 2.26: Flood Vulnerability Assessment of Water Treatment Plants

Water Treatment Plant	Region	District	Divisional Secretariat	Exposure	Resistance			Resilience		Total Vulnerability
				Exposure (Yes-1/No-0)	Availability of Water Safety Plan (Yes-1, No-2)	Availability of Early Warning receiving System (yes-1, No-2)	Availability of Early Warning disseminating System (yes-1 No-2)	Recovery Framework established (yes-1, No-2)	Financial Preparedness for recovery (yes-1, No-2)	
Galgamuwa - Mee Oya	North West	Kurunegala	Ambanpola	1	1	2	2	2	2	10
Vilaththawa/ Chilaw			Bingiriya	1	1	2	2	2	2	10
Pannala			Pannala	1	1	2	2	2	2	10
Karaveddy -Dug well	Northern	Jaffna	Vadamaradchy North	1	1	2	2	2	2	10
Vallipuram, Point Pedro			Vadamaradchy North	1	1	2	2	2	2	10
Karaveddy -Dug well			Vadamaradchy North	1	1	2	2	2	2	10
Vallipuram Intake - Dug wells 1,2,3, &4, Tube wells 1-6 Vallipuram, Point Pedro			Vadamaradchy North	1	1	2	2	2	2	10
Vallipuram Intake - Dug wells 1,2,3, &4, Tube wells 1-6 Vallipuram, Point Pedro			Vadamaradchy North	1	1	2	2	2	2	10
Tube wells 1 Water supply lane, Velanai			Velanai	1	1	2	2	2	2	10
Karadipokku 01 dug well, 01 tube well Wilson Roa*		Kilinochchi	Karachchi	1	1	2	2	2	2	10
Surface Water (Dry Aru), Wilson Road, Kilinochchi			Karachchi	1	1	2	2	2	2	10
Periyamadu		Mannar	Manthai West	1	1	2	2	2	2	10
Kotabodawatta	Sabaragamuwa	Kegalle	Dehiovita	1	1	2	2	2	2	10
Weliharanawa			Deraniyagala	1	1	2	2	2	2	10

Table 2.26: Flood Vulnerability Assessment of Water Treatment Plants Cont…..

Water Treatment Plant	Region	District	Divisional Secretariate	Exposure	Resistance			Resilience		Resistance
				Exposure (Yes-1/No-0)	Availability of Water Safety Plan (Yes-1, No-2)	Availability of Early Warning receiving System (yes-1, No-2)	Availability of Early Warning disseminating System (yes-1 No-2)	Recovery Framework established (yes-1, No-2)	Financial Preparedness for recovery (yes-1, No-2)	
Muwagama	Sabaragamuwa	Ratnapura	Nivithigala	1	1	2	2	2	2	10
Baddegama	Southern	Galle	Baddegama	1	1	2	2	2	2	10
Wakwella			Bope-Poddala	1	1	2	2	2	2	10
Kirindioya		Hambantota	Ambalantota	1	1	2	2	2	2	10
Muruthawela			Tangalle	1	1	2	2	2	2	10
Kataragama			Walasmulla	1	1	2	2	2	2	10
Thihagoda		Matara	Thihagoda	1	2	2	2	2	2	11
Malimbada / Nadugala			Malimbada	1	1	2	2	2	2	10
Karagoda Uyangoda			Kamburupitiya	1	1	2	2	2	2	10
Ambatale	West Central	Colombo	Kolonnawa	1	1	2	2	2	2	10
Kosgama/ Akarawita			Seethawaka	1	1	2	2	2	2	10
Penrithwatta			Seethawaka	1	1	2	2	2	2	10
Pattiwila	West North	Gampaha	Biyagama	1	1	2	2	2	2	10
Chico			Dompe	1	1	2	2	2	2	10
Pugoda			Dompe	1	1	2	2	2	2	10
Ranpokunawatta			Dompe	1	1	2	2	2	2	10
Gampaha/ Yakkala			Gampaha	1	1	2	2	2	2	10
Bambukuliya			Katana	1	2	2	2	2	2	11
Raddolugama				1	1	2	2	2	2	10
Kandana	West-South	Kalutara	Madurawala	1	1	2	2	2	2	10

Table 2.27: Landslide Vulnerability Assessment of Water Treatment Plants

Water Treatment Plant	Region	District	Divisional Secretariat	Exposure	Resistance			Resilience		Total Vulnerability
				Exposure (Not Likely-1, Modest-2, Expected -3, Most Likely-4)	Availability of Water Safety Plan (Yes-1, No-2)	Availability of Early Warning receiving System (yes-1, No-2)	Availability of Early Warning disseminating System (yes-1, No-2)	Recovery Framework established (yes-1, No-2)	Financial Preparedness for recovery (yes-1, No-2)	
Doluwa	Central	Kandy	Doluwa	2	1	2	2	2	2	11
Gampolawatta			Doluwa	2	1	2	2	2	2	11
Nilambe			Doluwa	1	1	2	2	2	2	10
Ulapane			Ganga Ihala Korale	4	1	2	2	2	2	13
Greater Kandy			Harispattuwa	2	1	2	2	2	2	11
Hantana Housing Scheme			Kandy Four Gravets & Gangawata Korale	2	1	2	2	2	2	11
Haragama			Kandy Four Gravets & Gangawata Korale	2	1	2	2	2	2	11
Balagolla			Kundasale	1	1	2	2	2	2	10
Rangala (Meda Dumbara)			Medadumbara	2	1	2	2	2	2	11
Araththana			Panvila	2	1	2	2	2	2	11
Nawalapitiya			Pasbage Korale	1	1	2	2	2	2	10
Polgolla			Pathadumbara	1	1	2	2	2	2	10
Marassana			Pathahewaheta	2	1	2	2	2	2	11
Ankumbura (Ihalamulla B/H)			Pujapitiya	1	1	2	2	2	2	10
Galagedara			Thumpane	1	1	2	2	2	2	10
Datry			Udapalatha	2	1	2	2	2	2	11
Elpitiya				2	1	2	2	2	2	11

Table 2.27: Landslide Vulnerability Assessment of Water Treatment Plants Cont…..

Water Treatment Plant	Region	District	Divisional Secretariat	Exposure	Resistance				Resilience	Total Vulnerability
				Availability of Water Safety Plan (Yes-1, No-2)	Availability of Early Warning receiving System (yes-1, No-2)	Availability of Early Warning disseminating System (yes-1 No-2)	Recovery Framework established (yes-1, No-2)	Financial Preparedness for recovery (yes-1, No-2)		
Para Deka				2	1	2	2	2	2	11
Meewathura (K/S TP)			Udunuwara	3	1	2	2	2	2	12
Pussella		Matale	Ambanganga Korale	3	1	2	2	2	2	12
Matale			Matale	2	1	2	2	2	2	11
Naula			Pallepola	1	1	2	2	2	2	11
Udatenna			Rattota	2	1	2	2	2	2	11
Ukuwela			Ukuwela	2	1	2	2	2	2	11
Ginigathena		NuwaraElliya	Ambagamuwa	2	1	2	2	2	2	11
Hatton High Lift - Dukenose				2	1	2	2	2	2	11
Hatton Low Lift - Invary				2	1	2	2	2	2	11
Maskeliya				2	1	2	2	2	2	11
Sinhapura				2	1	2	2	2	2	11
Rikillagaskada			Hanguranketha	3	1	2	2	2	2	12
Pundaluoya			Kothmale	2	1	2	2	2	2	11
Pussellawa				2	1	2	2	2	2	11
Kotagala			Nuwara Eliya	1	1	2	2	2	2	10
Talawakale				1	1	2	2	2	2	10
Ragala			Walapane	2	1	2	2	2	2	11
Walapane				2	1	2	2	2	2	11

Table 2.27: Landslide Vulnerability Assessment of Water Treatment Plants Cont…..

Water Treatment Plant	Region	District	Divisional Secretariat	Exposure	Resistance			Resilience		Total Vulnerability
				Exposure (Not Likely-1, Modest-2, Expected -3, Most Likely-4)	Availability of Water Safety Plan (Yes-1, No-2)	Availability of Early Warning receiving System (yes-1, No-2)	Availability of Early Warning disseminating System (yes-1 No-2)	Recovery Framework established (yes-1, No-2)	Financial Preparedness for recovery (yes-1, No-2)	
Alawwa	North Western	Kurunegala	Alawwa	1	1	2	2	2	2	10
Buluwala			Mawathagama	1	1	2	2	2	2	10
Mawathagama				1	1	2	2	2	2	10
Narammala			Narammala	1	1	2	2	2	2	10
Polgahawela - Karandana			Polgahawela	2	1	2	2	2	2	12
Dodangaslanda			Rideegama	1	1	2	2	2	2	10
Hettipola				1	1	2	2	2	2	10
Ogodapola				1	1	2	2	2	2	10
Bulathkohupitiya	Sabaragamuwa	Kegalle	Bulathkohupitiya	4	1	2	2	2	2	14
Kotabodawatta			Dehiovita	1	1	2	2	2	2	10
Benkiyawatta			Deraniyagala	2	1	2	2	2	2	11
Weliharanawa				2	1	2	2	2	2	11
Aranayaka TP			Aranayaka	2	1	2	2	2	2	11
Mediliya TP				2	1	2	2	2	2	11
Hiriwadunna TP				3	1	2	2	2	2	12
Mawanella TP			Mawanella	2	1	2	2	2	2	11
Rathkarawwa			Ruwanwella	1	1	2	2	2	2	11
Ingiriya/Nachchamale		Ratnapura	Eheliyagoda	2	1	2	2	2	2	12
Kalatuwawa				1	1	2	2	2	2	11
Kolonna				2	1	2	2	2	2	12
Mas Embula				3	1	2	2	2	2	13

Table 2.27: Landslide Vulnerability Assessment of Water Treatment Plants Cont…..

Water Treatment Plant	Region			Exposure	Resistance			Resilience		Total Vulnerability
		District	Divisional Secretariat	Exposure (Not Likely-1, Modest-2, Expected -3, Most Likely-4)	Availability of Water Safety Plan (Yes-1, No-2)	Availability of Early Warning receiving System (yes-1, No-2)	Availability of Early Warning disseminating System (yes-1 No-2)	Recovery Framework established (yes-1, No-2)	Financial Preparedness for recovery (yes-1, No-2)	
Nimalagama	Sabaragamuwa	Rathnapura		3	1	2	2	2	2	12
Kohiladeniya/ Eheliyagoda			Godakawela	1	1	2	2	2	2	10
Nallattanniya			Imbulpe	2	1	2	2	2	2	11
Idangoda			Kahawatta	1	1	2	2	2	2	10
Nisala Uyana - Kahawatta			Kuruvita	3	1	2	2	2	2	12
Sinhapura				3	1	2	2	2	2	12
Watapotha				1	1	2	2	2	2	10
Muwagama			Nivithigala	3	1	2	2	2	2	12
Pompakale				1	1	2	2	2	2	10
Watapotha			Ratnapura	1	1	2	2	2	2	10
Sri padaya				1	1	2	2	2	2	10
Dehiowita TP			Weligepola	1	1	2	2	2	2	10
Yatiyanthota TP				2	1	2	2	2	2	11
Udugama	Southern	Galle	Nagoda	2	1	2	2	2	2	11
Pitigala			Niyagama	3	1	2	2	2	2	12
Sapugahadola & water from Muruthawela		Hambantota	Walasmulla	2	1	2	2	2	2	11
Akuressa		Matara	Akuressa	1	1	2	2	2	2	11
Hakmana			Hakmana	2	1	2	2	2	2	11
Deniyaya			Kotapola	1	1	2	2	2	2	10

Table 2.27: Landslide Vulnerability Assessment of Water Treatment Plants Cont…..

Water Treatment Plant	Region	District	District	Exposure	Resistance			Resilience		Total Vulnerability
				Exposure (Not Likely-1, Modest-2, Expected -3, Most Likely-4)	Availability of Water Safety Plan (Yes-1, No-2)	Availability of Early Warning receiving System (yes-1, No-2)	Availability of Early Warning disseminating System (yes-1 No-2)	Recovery Framework established (yes-1, No-2)	Financial Preparedness for recovery (yes-1, No-2)	
Makandura	Southern	Matara	Mulatiyana	1	1	2	2	2	2	10
Athdolakanda, Beerideniya & Nebilidola			Pasgoda	2	1	2	2	2	2	11
Urubokka			Pasgoda	2	1	2	2	2	2	11
Pitabeddara			Pitabeddara	2	1	2	2	2	2	11
Hallala			Welipitiya	1	1	2	2	2	2	10
Badulla	Uva	Badulla	Badulla	2	1	2	2	2	2	11
Bandarawela			Bandarawela	4	1	2	2	2	2	13
Makulella				1	1	2	2	2	2	10
Mullepihilla			Ella	1	1	2	2	2	2	10
Demodara			Hali-Ela	2	1	2	2	2	2	11
Hali Ela				2	1	2	2	2	2	11
Diyathalawa			Haputale	2	1	2	2	2	2	11
Ambagasdowa			Uva Paranagama	1	1	2	2	2	2	10
Medawala				2	1	2	2	2	2	11
Bogahakubura			Welimada	1	1	2	2	2	2	10
Boralanda				2	1	2	2	2	2	11
Keppetipola				3	1	2	2	2	2	12
Welimada				3	1	2	2	2	2	12
Bibila		Moneragala	Bibile	2	1	2	2	2	2	11
Medagama				1	1	2	2	2	2	10

Table 2.27: Landslide Vulnerability Assessment of Water Treatment Plants Cont…..

Water Treatment Plant	Region	District	District	Exposure	Resistance			Resilience		Total Vulnerability
				Exposure (Not Likely-1, Modest-2, Expected -3, Most Likely-4)	Availability of Water Safety Plan (Yes-1, No-2)	Availability of Early Warning receiving System (yes-1, No-2)	Availability of Early Warning disseminating System (yes-1 No-2)	Recovery Framework established (yes-1, No-2)	Financial Preparedness for recovery (yes-1, No-2)	
Buttala	Uva	Moneragala	Buttala	1	1	2	2	2	2	10
Poojapiyita (Bokkawala B/Hs)				1	1	2	2	2	2	10
Monaragala - Partial (RSF, SSF, Cl)			Moneragala	1	1	2	2	2	2	10
Okkampitiya				1	1	2	2	2	2	10
Harispaththuwa (Rajapihilla B/H)			Wellawaya	2	1	2	2	2	2	11
Ice Pilla - Partial (SSF)				1	1	2	2	2	2	10
Minigamuwa				1	1	2	2	2	2	10
Poojapiyita (Bolagala Well field)				1	1	2	2	2	2	10
Yalabowa -Full				2	1	2	2	2	2	11
Penrithwatta				1	1	2	2	2	2	10
Bataleeya	West North	Gampaha	Mirigama	1	1	2	2	2	2	10
Wettewa		Kalutara	Mathugama	1	1	2	2	2	2	10
Idangoda			Palindanuwara	1	1	2	2	2	2	10

Table 2.28: Drought Vulnerability Assessment of Water Treatment Plants

Water Treatment Plant	Region	District	Divisional Secretariat	Exposure	Resistance			Resilience		Total Vulnerability
				Exposure (Low - 1, Moderate - 2, High - 3)	Availability of Water Safety Plan (Yes-1, No-2)	Availability of Early Warning receiving System (yes-1, No-2)	Availability of Early Warning disseminating System (yes-1 No-2)	Recovery Framework established (yes-1, No-2)	Financial Preparedness for recovery (yes-1, No-2)	
Gampolawatta	Central	Kandy	Doluwa	3	1	2	2	2	2	12
Doluwa			Doluwa	2	1	2	2	2	2	11
Nilambe			Doluwa	2	1	2	2	2	2	11
Ulapane			Ganga Ihala Korale	2	1	2	2	2	2	11
Greater Kandy			Harispattuwa	2	1	2	2	2	2	11
Haragama			Kandy Four Gravets & Gangawata Korale	1	1	2	2	2	2	10
Hantana Housing Scheme			Kandy Four Gravets & Gangawata Korale	2	1	2	2	2	2	11
Balagolla			Kundasale	1	1	2	2	2	2	10
Rangala (Meda Dumbara)			Medadumbara	3	1	2	2	2	2	12
Araththana			Panvila	2	1	2	2	2	2	11
Nawalapitiya			Pasbage Korale	2	1	2	2	2	2	11
Polgolla			Pathadumbara	2	1	2	2	2	2	11
Marassana			Pathahewaheta	2	1	2	2	2	2	11
Ankumbura (Ihalamulla B/H)			Pujapitiya	2	1	2	2	2	2	11
Galagedara			Thumpane	2	1	2	2	2	2	11
Para Deka			Udapalatha	2	1	2	2	2	2	11
Datry			Udapalatha	2	1	2	2	2	2	11
Elpitiya			Udapalatha	2	1	2	2	2	2	11
Meewathura (K/S TP)			Udunuwara	2	1	2	2	2	2	11
Ukuwela		Matale	Ukuwela	2	1	2	2	2	2	11
Udatenna			Rattota	2	1	2	2	2	2	11

Table 2.28: Drought Vulnerability Assessment of Water Treatment Plants Cont……

Water Treatment Plant	Region	District	Divisional Secretariat	Exposure	Resistance			Resilience		Total Vulnerability
				Exposure (Low - 1, Moderate - 2, High - 3)	Availability of Water Safety Plan (Yes-1, No-2)	Availability of Early Warning receiving System (yes-1, No-2)	Availability of Early Warning disseminating System (yes-1 No-2)	Recovery Framework established (yes-1, No-2)	Financial Preparedness for recovery (yes-1, No-2)	
Matale			Matale	2	1	2	2	2	2	11
Pussella			Ambanganga Korale	2	1	2	2	2	2	11
Wilgamuwa			Wilgamuwa	3	1	2	2	2	2	12
Naula			Pallepola	1	1	2	2	2	2	10
Dambulla New & Dambulla Old			Dambulla	3	1	2	2	2	2	12
Sinhapura		Nuwara Eliya	Ambagamuwa	1	1	2	2	2	2	10
Maskeliya			Ambagamuwa	2	1	2	2	2	2	11
Hatton High Lift - Dukenose			Ambagamuwa	2	1	2	2	2	2	11
Hatton Low Lift - Invary			Ambagamuwa	2	1	2	2	2	2	11
Tawalkale			Nuwara Eliya	2	1	2	2	2	2	11
Kotagala			Nuwara Eliya	2	1	2	2	2	2	11
Ginigathena			Ambagamuwa	2	1	2	2	2	2	11
Ragala			Walapane	2	1	2	2	2	2	11
Pundaluoya			Kothmale	2	1	2	2	2	2	11
Walapane			Walapane	2	1	2	2	2	2	11
Pussellawa			Kothmale	3	1	2	2	2	2	12
Rikillagaskada			Hanguranketha	3	1	2	2	2	2	12
Sagamam	Eatern	Ampara	Thirukkovil	3	1	2	2	2	2	12
Kondavatuwana			Ampara	1	1	2	2	2	2	10
Himuthdawa			Uhana	3	1	2	2	2	2	12
Padiyathalawa			Padiyathalawa	3	1	2	2	2	2	12
Mahaoya			Mahaoya	3	1	2	2	2	2	12
Sandunpura			Dehiattakandiya	3	1	2	2	2	2	12

Table 2.28: Drought Vulnerability Assessment of Water Treatment Plants Cont……

Water Treatment Plant	Region	District	Divisional Secretariat	Exposure	Resistance			Resilience		Total Vulnerability
				Exposure (Low - 1, Moderate - 2, High - 3)	Availability of Water Safety Plan (Yes-1, No-2)	Availability of Early Warning receiving System (yes-1, No-2)	Availability of Early Warning disseminating System (yes-1 No-2)	Recovery Framework established (yes-1, No-2)	Financial Preparedness for recovery (yes-1, No-2)	
Lihiniyagama		Ampara	Dehiattakandiya	3	1	2	2	2	2	12
Dehiattakandiya			Dehiattakandiya	1	1	2	2	2	2	10
Mawanagama			Dehiattakandiya	2	1	2	2	2	2	11
Vavunathivu		Batticaloa	Manmunai West	3	1	2	2	2	2	12
Ihalagama WTP			Koralai Pattu North (Vaharai)	2	1	2	2	2	2	11
Eachchalampatthu		Trincomalee	Verugal Eachchilampattu	3	1	2	2	2	2	12
Kantale			Kanthalai	1	1	2	2	2	2	10
Muthur			Muttur	2	1	2	2	2	2	11
Pulmoddai			Kuchchaveli	2	1	2	2	2	2	11
RO plant, Alankulam road, Nainathivu	Northern	Jaffna	Island South (Velanai)	3	1	2	2	2	2	12
Well 5			Island South (Velanai)	3	1	2	2	2	2	12
Well 4			Island South (Velanai)	3	1	2	2	2	2	12
Well 2			Island South (Velanai)	3	1	2	2	2	2	12
Well 6			Island South (Velanai)	3	1	2	2	2	2	12
Well 3			Island South (Velanai)	3	1	2	2	2	2	12
Well 1			Island South (Velanai)	3	1	2	2	2	2	12
Tube wells 1 Water supply lane, Velanai			Island South (Velanai)	3	1	2	2	2	2	12
Dug well Ward no 4, Analaithivu			Island North (Kayts)	3	1	2	2	2	2	12

Table 2.28: Drought Vulnerability Assessment of Water Treatment Plants Cont……

Water Treatment Plant	Region	District	Divisional Secretariat	Exposure	Resistance			Resilience		Total Vulnerability
				Exposure (Low - 1, Moderate - 2, High - 3)	Availability of Water Safety Plan (Yes-1, No-2)	Availability of Early Warning receiving System (yes-1, No-2)	Availability of Early Warning disseminating System (yes-1 No-2)	Recovery Framework established (yes-1, No-2)	Financial Preparedness for recovery (yes-1, No-2)	
Tube wells 2 Vempirai			Thenmaradchy (Chavakachcheri)	3	1	2	2	2	2	12
Dug well Kaithdady south			Thenmaradchy (Chavakachcheri)	3	1	2	2	2	2	12
Tube wells 1 Vempirai			Thenmaradchy (Chavakachcheri)	3	1	2	2	2	2	12
Dug well 1&2, Araly south			Valikamam West (Chankanai)	3	1	2	2	2	2	12
Dug wells 2 Vaddukkoddai			Valikamam West (Chankanai)	3	1	2	2	2	2	12
Dug wells 1 Vaddukkoddai			Valikamam West (Chankanai)	3	1	2	2	2	2	12
Chunnakkam Dug well Pokkanai, Urelu			Valikamam East (Kopay)	3	1	2	2	2	2	12
Pokkanai Tube well 1,2, &3, 2 New tube well Pokkanai, Urelu			Valikamam South (Uduvil)	3	1	2	2	2	2	12
Dug well 1,2, &3 Sampalodai road, Karainagar			Karainagar	3	2	2	2	2	2	13
Nilaweray Tube welll 1, 2 &3 Nilavarai junction			Karainagar	3	2	2	2	2	2	13
Karaveddy -Dug well Vallipuram, Point Pedro			Vadamaradchy North (Point Pedro)	3	1	2	2	2	2	12

Table 2.28: Drought Vulnerability Assessment of Water Treatment Plants Cont……

Water Treatment Plant	Region	District	Divisional Secretariate	Exposure	Resistance			Resilience		Total Vulnerability
				Exposure (Low - 1, Moderate - 2, High - 3)	Availability of Water Safety Plan (Yes-1, No-2)	Availability of Early Warning receiving System (yes-1, No-2)	Availability of Early Warning disseminating System (yes-1 No-2)	Recovery Framework established (yes-1, No-2)	Financial Preparedness for recovery (yes-1, No-2)	
Vallipuram Intake - Dug wells 1,2,3, &4, Tube wells 1-6 Vallipuram, Point Pedro			Vadamaradchy North (Point Pedro)	3	1	2	2	2	2	12
Karaveddy -Dug well Vallipuram Intake - Dug wells 1,2,3, &4, Tube wells 1-6 Vallipuram, Point Pedro			Vadamaradchy North (Point Pedro)	3	1	2	2	2	2	12
Surface Water (Dry Aru), Wilson Road, Kilinochchi		Kilinochchi	Karachchi	3	1	2	2	2	2	12
Karadipokku 01 dug well, 01 tube well Wilson Roa*			Karachchi	3	1	2	2	2	2	12
Madu Dug well No:05		Mannar	Madhu	2	1	2	2	2	2	11
Madu Bore Hole No:03			Madhu	2	1	2	2	2	2	11
Madu Dug well No:04			Madhu	2	1	2	2	2	2	11
Madu Dug well No:03			Madhu	2	1	2	2	2	2	11
Madu Bore Hole No:02			Madhu	2	1	2	2	2	2	11
Madu Dug well No:02			Madhu	2	1	2	2	2	2	11
Madu Bore Hole No:01			Madhu	2	1	2	2	2	2	11
Madu Dug well No:01			Madhu	2	1	2	2	2	2	11
Murunkan Bore Hole No:01			Mannar Town	2	1	2	2	2	2	11
Murunkan Bore Hole No:02			Mannar Town	2	1	2	2	2	2	11

Table 2.28: Drought Vulnerability Assessment of Water Treatment Plants Cont……

Water Treatment Plant	Region	District	Divisional Secretariat	Exposure	Resistance			Resilience		Total Vulnerability
				Exposure (Low - 1, Moderate - 2, High - 3)	Availability of Water Safety Plan (Yes-1, No-2)	Availability of Early Warning receiving System (yes-1, No-2)	Availability of Early Warning disseminating System (yes-1 No-2)	Recovery Framework established (yes-1, No-2)	Financial Preparedness for recovery (yes-1, No-2)	
Murunkan Bore Hole No:03			Mannar Town	2	1	2	2	2	2	11
Murunkan Bore Hole No:04			Mannar Town	2	1	2	2	2	2	11
Murunkan Bore Hole No:05			Mannar Town	2	1	2	2	2	2	11
Murunkan Bore Hole No:06			Mannar Town	2	1	2	2	2	2	11
Murunkan Bore Hole No:07			Mannar Town	2	1	2	2	2	2	11
Murunkan Bore Hole No:08			Mannar Town	2	1	2	2	2	2	11
Murunkan Bore Hole No:09			Mannar Town	2	1	2	2	2	2	11
Murunkan Bore Hole No:10			Mannar Town	2	1	2	2	2	2	11
Murunkan Bore Hole No:11			Mannar Town	2	1	2	2	2	2	11
Periyamadu Pump House - L03			Manthai West	3	1	2	2	2	2	12
Periyamadu			Manthai West	3	1	2	2	2	2	12
Periyamadu Pump House - L02			Manthai West	3	1	2	2	2	2	12
Periyamadu Pump House - L04			Manthai West	3	1	2	2	2	2	12
Thevanpiddy Pump house - 137			Manthai West	3	1	2	2	2	2	12
Thevanpiddy Pump house - 136			Manthai West	3	1	2	2	2	2	12

Table 2.28: Drought Vulnerability Assessment of Water Treatment Plants Cont……

Water Treatment Plant	Region	District	Divisional Secretariate	Exposure	Resistance			Resilience		Total Vulnerability
				Exposure (Low - 1, Moderate - 2, High - 3)	Availability of Water Safety Plan (Yes-1, No-2)	Availability of Early Warning receiving System (yes-1, No-2)	Availability of Early Warning disseminating System (yes-1 No-2)	Recovery Framework established (yes-1, No-2)	Financial Preparedness for recovery (yes-1, No-2)	
Thevanpiddy Pump house - 135			Manthai West	3	1	2	2	2	2	12
Tube wells 1,2 Thunukkai pandiyankulam road, pandiyankulam			Manthai East	3	1	2	2	2	2	12
Tube well 3 Thunukkai pandiyankulam road, pandiyankulam			Manthai East	3	1	2	2	2	2	12
Tube wells 1 Mankulam thunukkai road, mallavi			Manthai East	2	1	2	2	2	2	11
Tube wells 3 Mankulam thunukkai road, mallavi			Thunukkai	3	1	2	2	2	2	12
Tube wells 4 Mankulam thunukkai road, mallavi		Mullaitivu	Thunukkai	3	1	2	2	2	2	12
Tube wells 5 Mankulam thunukkai road, mallavi			Thunukkai	3	1	2	2	2	2	12
Tube wells 2 Mankulam thunukkai road, mallavi			Thunukkai	3	1	2	2	2	2	12
Dug well 1 Mankulam thunukkai road, mallavi			Thunukkai	3	1	2	2	2	2	12
Nedunkerney -Tube well 1, Oddusudan, nedunkerny			Oddusuddan	3	1	2	2	2	2	12
Nedunkerney - Dug well 1, Oddusudan, nedunkerny			Oddusuddan	3	1	2	2	2	2	12
Vavuniya		Vavuniya	Vavuniya	1	1	2	2	2	2	10

Table 2.28: Drought Vulnerability Assessment of Water Treatment Plants Cont……

Water Treatment Plant	Region	District	Divisional Secretariat	Exposure	Resistance			Resilience		Total Vulnerability
				Exposure (Low - 1, Moderate - 2, High - 3)	Availability of Water Safety Plan (Yes-1, No-2)	Availability of Early Warning receiving System (yes-1, No-2)	Availability of Early Warning disseminating System (yes-1 No-2)	Recovery Framework established (yes-1, No-2)	Financial Preparedness for recovery (yes-1, No-2)	
Oddusuddan - Tube well 1, Oddusudan, nedunkerny			Vavuniya North	2	1	2	2	2	2	11
Oddusuddan - Tube well 2, Oddusudan, nedunkerny			Vavuniya North	2	1	2	2	2	2	11
Galnewa WTP	North Central	Anuradhapura	Galnewa	1	1	2	2	2	2	10
Eppawala WTP			Thalawa	1	1	2	2	2	2	10
Nallachchiya WTP / Thambuththegama			Thambuttegama	1	1	2	2	2	2	10
Thuruwila WTP			Nachchaduwa	1	1	2	2	2	2	10
Nuwarawewa WTP			Nuwaragam Palatha East	1	1	2	2	2	2	10
Thissawewa (Sacred City) WTP			Nuwaragam Palatha Central	1	1	2	2	2	2	10
Oyamaduwa WTP			Mahawilachchiya	2	1	2	2	2	2	11
Medawachchiya WTP			Medawachchiya	2	1	2	2	2	2	11
Thanthirimale WTP			Mahawilachchiya	2	1	2	2	2	2	11
Wadinagala		Polonnaruwa	Elahera	3	1	2	2	2	2	11
Bakamoona			Elahera	2	1	2	2	2	2	11
Aralaganwila			Dimbulagala	3	1	2	2	2	2	12
Dimbulagala			Dimbulagala	1	1	2	2	2	2	11
Manampitiya			Dimbulagala	2	1	2	2	2	2	12
Gallella			Thamankaduwa	2	1	2	2	2	2	12
Sammanthurai			Welikanda	1	1	2	2	2	2	11
Polonnaruwa			Thamankaduwa	1	1	2	2	2	2	11
Minneriya			Hingurakgoda	2	1	2	2	2	2	12
Medirigiriya			Medirigiriya	2	1	2	2	2	2	12
Alawwa	North Western	Kurunegala	Alawwa	2	1	2	2	2	2	12

Table 2.28: Drought Vulnerability Assessment of Water Treatment Plants Cont……

Water Treatment Plant	Region	District	Divisional Secretariat	Exposure	Resistance			Resilience		Total Vulnerability
				Exposure (Low - 1, Moderate -2, High - 3)	Availability of Water Safety Plan (Yes-1, No-2)	Availability of Early Warning receiving System (yes-1, No-2)	Availability of Early Warning disseminating System (yes-1 No-2)	Recovery Framework established (yes-1, No-2)	Financial Preparedness for recovery (yes-1, No-2)	
Pannala			Pannala	3	1	2	2	2	2	12
Polgahawela - Karandana			Polgahawela	2	1	2	2	2	2	11
Giriulla			Pannala	2	1	2	2	2	2	11
Narammala			Narammala	2	1	2	2	2	2	11
Mawathagama			Mawathagama	2	1	2	2	2	2	11
Buluwala			Mawathagama	2	1	2	2	2	2	11
Ogodapola			Ridigama	2	1	2	2	2	2	11
Hettipola			Ridigama	2	1	2	2	2	2	11
Kurunegala			Kurunegala	2	1	2	2	2	2	11
Gokerella			Ibbagamuwa	2	1	2	2	2	2	11
Dodangaslanda			Ridigama	2	1	2	2	2	2	11
Vilaththawa/ Chilaw			Bingiriya	2	1	2	2	2	2	11
Wariyapola - Mudannapola Watta			Wariyapola	2	1	2	2	2	2	11
Nikaweratiya - Magallegama			Nikaweratiya	1	1	2	2	2	2	10
Abanpola			Ambanpola	2	1	2	2	2	2	11
Galgamuwa - Mee Oya			Ambanpola	1	1	2	2	2	2	10
Dankotuwa - Metikotuwa		Puttalam	Dankotuwa	2	1	2	2	2	2	11
Wennapuwa			Wennappuwa	2	1	2	2	2	2	11
Andigama BH 2			Nattandiya	2	1	2	2	2	2	11
Andigama BH 3			Nattandiya	2	1	2	2	2	2	11
Nattandiya			Nattandiya	2	1	2	2	2	2	11
Nelumpokuna / Kakkapalliya			Madampe	2	1	2	2	2	2	11
Andigama BH 1			Pallama	2	1	2	2	2	2	11

Table 2.28: Drought Vulnerability Assessment of Water Treatment Plants Cont……

Water Treatment Plant	Region	District	Divisional Secretariate	Exposure	Resistance			Resilience		Total Vulnerability
				Exposure (Low - 1, Moderate - 2, High - 3)	Availability of Water Safety Plan (Yes-1, No-2)	Availability of Early Warning receiving System (yes-1, No-2)	Availability of Early Warning disseminating System (yes-1 No-2)	Recovery Framework established (yes-1, No-2)	Financial Preparedness for recovery (yes-1, No-2)	
Anamaduwa			Anamaduwa	2	1	2	2	2	2	11
Eluwankulama / Puttalm			Wanathavilluwa	3	1	2	2	2	2	12
Benkiyawatta	Sabaragamuwa	Kegalle	Deraniyagala	2	1	2	2	2	2	11
Weliharanawa			Deraniyagala	2	1	2	2	2	2	11
Kotabodawatta			Dehiovita	2	1	2	2	2	2	11
Rathkarawwa			Ruwanwella	2	1	2	2	2	2	11
Bulathkohupitiya			Bulathkohupitiya	2	2	2	2	2	2	12
Sewanagala		Ratnapura	Embilipitiya	3	1	2	2	2	2	11
Ruwawella TP			Embilipitiya	3	1	2	2	2	2	11
Idangoda			Kahawatta	2	1	2	2	2	2	11
Dehiowita TP			Weligepola	2	1	2	2	2	2	11
Kohiladeniya/ Eheliyagoda			Godakawela	2	1	2	2	2	2	11
Yatiyanthota TP			Weligepola	3	1	2	2	2	2	12
Bulathkohupitiya			Balangoda	2	1	2	2	2	2	11
Muwagama			Nivithigala	3	2	2	2	2	2	12
Pompakale			Nivithigala	2	2	2	2	2	2	11
Sri padaya			Ratnapura	2	1	2	2	2	2	11
Watapotha			Kuruvita	3	1	2	2	2	2	12
Watapotha			Ratnapura	2	1	2	2	2	2	11
Nallattanniya			Imbulpe	2	1	2	2	2	2	11
Ingiriya/Nachchamale			Eheliyagoda	2	1	2	2	2	2	11
Sinhapura			Kuruvita	2	1	2	2	2	2	11
Nimalagama			Eheliyagoda	2	1	2	2	2	2	11
Nisala Uyana - Kahawatta			Kuruvita	2	1	2	2	2	2	11
Kalatuwawa			Eheliyagoda	1	1	2	2	2	2	11
Mas Embula			Eheliyagoda	3	1	2	2	2	2	12

Table 2.28: Drought Vulnerability Assessment of Water Treatment Plants Cont……

Water Treatment Plant	Region	District	Divisional Secretariat	Exposure	Resistance			Resilience		Total Vulnerability
				Exposure (Low - 1, Moderate - 2, High - 3)	Availability of Water Safety Plan (Yes-1, No-2)	Availability of Early Warning receiving System (yes-1, No-2)	Availability of Early Warning disseminating System (yes-1 No-2)	Recovery Framework established (yes-1, No-2)	Financial Preparedness for recovery (yes-1, No-2)	
Kolonna			Eheliyagoda	2	1	2	2	2	2	11
Hapugala	Southern	Galle	Bope-Poddala	2	1	2	2	2	2	11
Wakwella			Bope-Poddala	2	1	2	2	2	2	11
Baddegama			Baddegama	2	1	2	2	2	2	11
Udugama			Nagoda	2	1	2	2	2	2	11
Pitigala			Niyagama	2	1	2	2	2	2	11
Kudaheella		Hambantota	Beliatta	2	1	2	2	2	2	11
Muruthawela			Tangalle	3	1	2	2	2	2	11
Kattakaduwa			Tangalle	2	1	2	2	2	2	11
Debarawewa(Tiissa)			Ambalantota	2	1	2	2	2	2	11
Kirindioya			Ambalantota	2	1	2	2	2	2	11
Wakamulla			Angunakolapelessa	2	1	2	2	2	2	11
Ridiyagama			Ambalantota	3	1	2	2	2	2	12
Kataragama			Walasmulla	1	1	2	2	2	2	11
Sapugahadola & water from Muruthawela			Walasmulla	2	1	2	2	2	2	11
Bundala			Tissamaharama	3	1	2	2	2	2	12
Ambalantota			Sooriyawewa	2	1	2	2	2	2	11
Welipothewala, Weligampathuwa Tube Well			Tissamaharama	3	1	2	2	2	2	12
Eraminiyaya (Agunokolapallasa)			Tissamaharama	3	1	2	2	2	2	12
Nalagama			Lunugamvehera	2	1	2	2	2	2	11
Radampala		Matara	Dickwella	3	1	2	2	2	2	13
Hallala			Welipitiya	2	1	2	2	2	2	11
Malimbada / Nadugala			Malimbada	3	1	2	2	2	2	12
Thihagoda			Thihagoda	2	1	2	2	2	2	11

Table 2.28: Drought Vulnerability Assessment of Water Treatment Plants Cont……

Water Treatment Plant	Region	District	Divisional Secretariat	Exposure	Resistance			Resilience		Total Vulnerability
				Exposure (Low - 1, Moderate - 2, High - 3)	Availability of Water Safety Plan (Yes-1, No-2)	Availability of Early Warning receiving System (yes-1, No-2)	Availability of Early Warning disseminating System (yes-1 No-2)	Recovery Framework established (yes-1, No-2)	Financial Preparedness for recovery (yes-1, No-2)	
Karagoda Uyangoda	Sourthern	Matara	Kamburupitiya	3	1	2	2	2	2	12
Hakmana			Hakmana	3	1	2	2	2	2	12
Akuressa			Akuressa	2	1	2	2	2	2	11
Makandura			Mulatiyana	2	1	2	2	2	2	11
Pitabeddara			Pitabeddara	2	1	2	2	2	2	11
Urubokka			Pasgoda	2	1	2	2	2	2	11
Athdolakanda, Beerideniya & Nebilidola			Pasgoda	2	1	2	2	2	2	11
Deniyaya			Kotapola	2	1	2	2	2	2	11
Ruhunupura	Uva	Moneragala	Katharagama	3	1	2	2	2	2	12
Gonagaldeniya			Thanamalvila	2	1	2	2	2	2	11
Warakapola TP			Thanamalvila	2	1	2	2	2	2	11
Thanamalwila			Thanamalvila	1	1	2	2	2	2	10
Moronthota TP			Thanamalvila	2	1	2	2	2	2	11
Yalabowa -Full			Wellawaya	2	1	2	2	2	2	11
Ice Pilla - Partial (SSF)			Wellawaya	2	1	2	2	2	2	11
Minigamuwa			Wellawaya	3	1	2	2	2	2	12
Buttala			Buttala	2	1	2	2	2	2	11
Poojapiyita (Bolagala Well field)			Wellawaya	2	1	2	2	2	2	11
Poojapiyita (Bokkawala B/Hs)			Buttala	2	1	2	2	2	2	11
Okkampitiya			Moneragala	3	1	2	2	2	2	12
Monaragala - Partial (RSF, SSF, Cl)			Moneragala	3	1	2	2	2	2	12
Alawathugoda - Vilana BH			Badalkumbura	2	1	2	2	2	2	11

Table 2.28: Drought Vulnerability Assessment of Water Treatment Plants Cont……

Water Treatment Plant	Region	District	Divisional Secretariat	Exposure	Resistance			Resilience		Total Vulnerability
				Exposure (Low - 1, Moderate -2, High - 3)	Availability of Water Safety Plan (Yes-1, No-2)	Availability of Early Warning receiving System (yes-1, No-2)	Availability of Early Warning disseminating System (yes-1 No-2)	Recovery Framework established (yes-1, No-2)	Financial Preparedness for recovery (yes-1, No-2)	
Harispaththuwa (Rajapihilla B/H)	UVA	Moneragala	Wellawaya	3	1	2	2	2	2	12
Alawathugoda - Ovissa BH			Badalkumbura	2	1	2	2	2	2	11
Pottuvil-Ulle			Siyambalanduwa	1	1	2	2	2	2	10
Siyabalanduwa			Siyambalanduwa	2	1	2	2	2	2	11
Muthukandiya WTP			Siyambalanduwa	1	1	2	2	2	2	10
Bibila			Bibile	2	1	2	2	2	2	11
Medagama			Bibile	2	1	2	2	2	2	11
Hriwadunna TP		Badulla	Haldummulla	3	1	2	2	2	2	12
Mawanella TP			Haldummulla	3	1	2	2	2	2	12
Aranayaka TP			Haldummulla	2	1	2	2	2	2	11
Mediliya TP			Haldummulla	2	1	2	2	2	2	11
Diyathalawa			Haputale	2	1	2	2	2	2	11
Boralanda			Welimada	2	1	2	2	2	2	11
Bandarawela			Bandarawela	2	1	2	2	2	2	11
Makulella			Bandarawela	2	1	2	2	2	2	11
Bogahakubura			Welimada	2	1	2	2	2	2	11
Mullepihilla			Ella	2	1	2	2	2	2	11
Keppetipola			Welimada	2	1	2	2	2	2	11
Welimada			Welimada	2	1	2	2	2	2	11
Demodara			Hali-Ela	2	1	2	2	2	2	11
Hali Ela			Hali-Ela	2	1	2	2	2	2	11
Medawala			Uva Paranagama	2	1	2	2	2	2	11
Ambagasdowa			Uva Paranagama	2	1	2	2	2	2	11
Badulla			Badulla	2	1	2	2	2	2	11
Mahiyanganaya			Mahiyanganaya	2	1	2	2	2	2	11
Giradurukotte			Mahiyanganaya	1	1	2	2	2	2	11
Rathkinda			Mahiyanganaya	2	2	2	2	2	2	12

Table 2.28: Drought Vulnerability Assessment of Water Treatment Plants Cont……

Water Treatment Plant	Region	District	Divisional Secretariat	Exposure	Resistance			Resilience		Total Vulnerability
				Exposure (Low - 1, Moderate - 2, High - 3)	Availability of Water Safety Plan (Yes-1, No-2)	Availability of Early Warning receiving System (yes-1, No-2)	Availability of Early Warning disseminating System (yes-1 No-2)	Recovery Framework established (yes-1, No-2)	Financial Preparedness for recovery (yes-1, No-2)	
Labugama	West Central	Colombo	Padukka	1	1	2	2	2	2	10
Kethhena			Homagama	2	1	2	2	2	2	11
Ambatale			Kolonnawa	2	1	2	2	2	2	11
Kosgama/ Akarawita			Seethawaka	2	1	2	2	2	2	11
Penrithwatta			Seethawaka	2	1	2	2	2	2	11
CHICO	West North	Gampaha	Dompe	2	1	2	2	2	2	11
Pattiwila			Biyagama	2	1	2	2	2	2	11
Pugoda			Dompe	2	1	2	2	2	2	11
Ranpokunawatta			Dompe	2	1	2	2	2	2	11
Embilipitiya New Town			Attanagalla	2	1	2	2	2	2	11
Gampaha/ Yakkala			Gampaha	2	1	2	2	2	2	11
Udugampola			Minuwangoda	2	1	2	2	2	2	11
Kalagedihene			Attanagalla	2	1	2	2	2	2	11
Raddolugama			Katana	2	1	2	2	2	2	11
Veyangoda			Attanagalla	2	1	2	2	2	2	11
Minuwangoda			Minuwangoda	3	1	2	2	2	2	13
Bataleeya			Mirigama	2	1	2	2	2	2	11
Meerigama			Mirigama	2	1	2	2	2	2	11
Divulapitiya			Divulapitiya	3	1	2	2	2	2	12
Bambukuliya			Katana	3	1	2	2	2	2	12
Idangoda	West South	Kalutara	Palindanuwara	2	1	2	2	2	2	11
Wettewa			Mathugama	3	1	2	2	2	2	12
Kandana			Madurawala	2	1	2	2	2	2	11

Table 2.28: Drought Vulnerability Assessment of Water Treatment Plants Cont……

Water Treatment Plant	Region	District	Divisional Secretariat	Exposure	Resistance			Resilience		Total Vulnerability
				Exposure (Low - 1, Moderate - 2, High - 3)	Availability of Water Safety Plan (Yes-1, No-2)	Availability of Early Warning receiving System (yes-1, No-2)	Availability of Early Warning disseminating System (yes-1 No-2)	Recovery Framework established (yes-1, No-2)	Financial Preparedness for recovery (yes-1, No-2)	
Kalagedihene		Gampaha	Attanagalla	2	1	2	2	2	2	11
Raddolugama			Katana	2	2	2	2	2	2	12
Veyangoda			Attanagalla	2	1	2	2	2	2	11
Minuwangoda			Minuwangoda	3	2	2	2	2	2	13
Bataleeya			Mirigama	2	2	2	2	2	2	12
Meerigama			Mirigama	2	2	2	2	2	2	12
Divulapitiya			Divulapitiya	3	2	2	2	2	2	13
Bambukuliya			Katana	3	2	2	2	2	2	13
Idangoda	West South	Kalutara	Palindanuwara	2	1	2	2	2	2	12
Wettewa			Mathugama	3	1	2	2	2	2	12
Kandana			Madurawala	2	1	2	2	2	2	12

Table 2.29: Chemical Hazard Vulnerability Assessment of Water Treatment Plants

Water Treatment Plant	Region	District	Divisional Secretariate	Exposure	Resistance			Resilience		Total Vulnerability
				Exposure (Low-1, Moderate - 2, High - 3)	Availability of Water Safety Plan (yes - 1, No - 2)	Availability of Early Warning Receiving System (yes - 1, No - 2)	Availability of Early Warning disseminating System (yes - 1, No - 2)	Recovery Framework established (yes - 1, No - 2)	Financial Preparedness for recovery (yes - 1, No - 2)	
Meewathura (K/S TP)	Central	Kandy	Udunuwara	Data Not available to determine exposure leve	1	2	2	2	2	09
Rangala (Meda Dumbara)			Medadumbara		1	2	2	2	2	09
Matale		Matale	Ambanganga		1	2	2	2	2	09
Maskeliya		Nuwara Eliya	Ambagamuwa		1	2	2	2	2	09
Ginigathena			Ambagamuwa		1	2	2	2	2	09
Rikillagaskada			Hanguranketa		1	2	2	2	2	09
Mahaoya	Eastern	Ampara	Mahaoya		1	2	2	2	2	09
Mawanagama			Dehiattakandiya		1	2	2	2	2	09
Chunnakkam Dug well Pokkanai, Urelu	Northern	Jaffna	Valikamam East (Kopay)		1	2	2	2	2	09
Madu Dug well No:04		Mannar	Madhu		1	2	2	2	2	09
Madu Bore Hole No:02			Madhu		1	2	2	2	2	09
Madu Dug well No:02			Madhu		1	2	2	2	2	09
Madu Bore Hole No:01			Madhu		1	2	2	2	2	09
Madu Dug well No:01			Madhu		1	2	2	2	2	09
Murunkan Bore Hole No:01			Mannar Town		1	2	2	2	2	09
Murunkan Bore Hole No:02			Mannar Town		1	2	2	2	2	09
Murunkan Bore Hole No:03			Mannar Town		1	2	2	2	2	09
Murunkan Bore Hole No:04			Mannar Town		1	2	2	2	2	09
Murunkan Bore Hole No:05			Mannar Town		1	2	2	2	2	09
Murunkan Bore Hole No:06			Mannar Town		1	2	2	2	2	09
Murunkan Bore Hole No:07			Mannar Town		1	2	2	2	2	09
Murunkan Bore Hole No:08			Mannar Town		1	2	2	2	2	09
Murunkan Bore Hole No:09			Mannar Town		1	2	2	2	2	09
Murunkan Bore Hole No:10			Mannar Town		1	2	2	2	2	09

Table 2.29: Chemical Hazard Vulnerability Assessment of Water Treatment Plants Cont……

Water Treatment Plant	Region	District	Divisional Secretariat	Exposure	Resistance			Resilience		Total Vulnerability
				Exposure (Low-1, Moderate - 2, High - 3)	Availability of Water Safety Plan (yes - 1, No - 2)	Availability of Early Warning Receiving System (yes - 1, No - 2)	Availability of Early Warning disseminating System (yes - 1, No - 2)	Recovery Framework established (yes - 1, No - 2)	Financial Preparedness for recovery (yes - 1, No - 2)	
Nedunkerney -Tube well 1, Oddusudan, nedunkerny		Mullaitivu	Oddusuddan	Data Not available to determine exposure leve	1	2	2	2	2	09
Nedunkerney - Dug well 1, Oddusudan, nedunkerny			Oddusuddan		1	2	2	2	2	09
Vavuniya		Vavuniya	Vavuniya		1	1	2	2	2	09
Oddusuddan - Tube well 2, Oddusudan, nedunkerny			Vavuniya North		1	1	2	2	2	09
Eppawala WTP	North Central	Anuradhapura	Thalawa		1	1	2	2	2	09
Thanthirimale WTP			Mahawilachchiya		1	1	2	2	2	09
Gallella		Polonnaruwa	Thamankaduwa		1	1	2	2	2	09
Hettipola	North Western	Kurunegala	Rideegama		1	1	2	2	2	09
Kurunegala			Kurunegala		1	1	2	2	2	09
Dankotuwa - Metikotuwa		Puttalam	Dankotuwa		1	1	2	2	2	09
Wennapuwa			Wennappuwa		1	2	2	2	2	09
Benkiyawatta	Sabaragamuwa	Kegalle	Deraniyagala		1	2	2	2	2	09
Muwagama		Ratnapura	Nivithigala		2	2	2	2	2	10
Pompakale			Nivithigala		2	2	2	2	2	10
Wakwella	Southern	Galle	Bope-Poddala		1	2	2	2	2	09
Pitigala			Niyagama		1	2	2	2	2	09
Debarawewa(Tiissa)		Hambantota	Ambalantota		1	2	2	2	2	09
Sapugahadola & water from Muruthawela			Walasmulla		1	2	2	2	2	09
Welipothewala, Weligampathuwa Tube Well			Thissamaharama		1	2	2	2	2	09
Eraminiyaya (Agunokolapallasa)			Thissamaharama		1	2	2	2	2	09

Table 2.29: Chemical Hazard Vulnerability Assessment of Water Treatment Plants Cont……

Water Treatment Plant	Region	District	Divisional Secretariat	Exposure	Resistance			Resilience		Total Vulnerability
				Exposure (Low-1, Moderate - 2, High - 3)	Availability of Water Safety Plan (yes - 1, No - 2)	Availability of Early Warning Receiving System (yes - 1, No - 2)	Availability of Early Warning disseminating System (yes - 1, No - 2)	Recovery Framework established (yes - 1, No - 2)	Financial Preparedness for recovery (yes - 1, No - 2)	
Hallala		Matara	Welipitiya		1	2	2	2	2	09
Karagoda Uyangoda			Kaburupitiya		1	2	2	2	2	09
Pitabeddara			Pitabaddara		1	2	2	2	2	09
Deniyaya			Kotapola		1	2	2	2	2	09
Okkampitiya	Uva	Moneragala	Monaragala		1	2	2	2	2	09
Monaragala - Partial (RSF, SSF, Cl)			Monaragala		1	2	2	2	2	09
Bibila			Bibile		1	2	2	2	2	09
Aranayaka TP		Badulla	Haldummulla		1	2	2	2	2	09
Diyathalawa			Haputale		1	2	2	2	2	09
Bandarawela			Bandarawela		1	2	2	2	2	09
Keppetipola			Welimada		1	2	2	2	2	09
Badulla			Badulla		1	2	2	2	2	09
Mahiyanganaya			Mahiyanganaya		1	2	2	2	2	09
Kethhena	West Central	Colombo	Homagama		1	2	2	2	2	09
Kosgama/ Akarawita			Seethawaka		1	2	2	2	2	09
Penrithwatta			Seethawaka		1	2	2	2	2	09
CHICO	West North	Gampaha	Dompe		1	2	2	2	2	09
Pugoda			Dompe		1	2	2	2	2	09
Gampaha/ Yakkala			Gampaha		2	2	2	2	2	10
Udugampola			Minuwangoda		2	2	2	2	2	10
Minuwangoda			Minuwangoda		2	2	2	2	2	10

2.10. Risk Assessment

Due to lack of data, it is not possible to conduct probabilistic risk assessment and hence qualitative risk assessment was conducted using the output of hazard, exposure, vulnerability assessments of water treatment plant (Intakes, Chemical Buildings, Pump house).

Table 2.30 Gives results of flood risk assessment
Table2 .31 – Provided details of landslide risk assessment
Table 2.32 –Provides deatials of drpought risk assessment
Table 2.33 – Provides details of Chemical hazard risk assessment
Based on the above analysis Districts/ Division / Water Intakes were evaluated for the risk matrix as low risk moderate risk, high risk and very high risk for floods, Landslide, droght and chemical hazards.

Table 2.30: Flood Risk Assessment

Water Treatment Plant	Region	District	Divisional Secretariat	Hazard	Vulnerability Assessment	Risk
				(Flood: No-1, Yes-2)		Hazard X Vulnerability
Galgamuwa - Mee Oya	North West	Kurunegala	Ambanpola	2	10	20
Vilaththawa/ Chilaw			Bingiriya	2	10	20
Pannala			Pannala	2	10	20
Karaveddy -Dug well	Northern	Jaffna	Vadamaradchy North	2	10	20
Vallipuram, Point Pedro			Vadamaradchy North	2	10	20
Karaveddy -Dug well			Vadamaradchy North	2	10	20
Vallipuram Intake - Dug wells 1,2,3, &4, Tube wells 1-6 Vallipuram, Point Pedro			Vadamaradchy North	2	10	20
Vallipuram Intake - Dug wells 1,2,3, &4, Tube wells 1-6 Vallipuram, Point Pedro			Vadamaradchy North	2	10	20
Tube wells 1 Water supply lane, Velanai			Velanai	2	10	20
Karadipokku 01 dug well, 01 tube well Wilson Roa*		Kilinochchi	Karachchi	2	10	20
Surface Water (Dry Aru), Wilson Road, Kilinochchi			Karachchi	2	10	20
Periyamadu		Mannar	Manthai West	2	10	20
Kotabodawatta	Sabaragamuwa	Kegalle	Dehiovita	2	10	20
Weliharanawa			Deraniyagala	2	10	20
Muwagama		Ratnapura	Nivithigala	2	10	20
Baddegama	Southern	Galle	Baddegama	2	10	20
Wakwella			Bope-Poddala	2	10	20
Kirindioya		Hambantota	Ambalantota	2	10	20
Muruthawela			Tangalle	2	10	20
Kataragama			Walasmulla	2	10	20

Table 2.30: Flood Risk Assessment Cont……..

Water Treatment Plant	Region	District	Divisional Secretariat	Hazard (Flood: No-1, Yes-2)	Vulnerability Assessmen	Risk Hazard X Vulnerability
Thihagoda	Southern	Matara	Thihagoda	2	10	20
Malimbada / Nadugala			Malimbada	2	10	20
Karagoda Uyangoda			Kamburupitiya	2	10	20
Ambatale	West Central	Colombo	Kolonnawa	2	10	20
Kosgama/ Akarawita			Seethawaka	2	10	20
Penrithwatta			Seethawaka	2	10	20
Pattiwila	West North	Gampaha	Biyagama	2	10	20
Chico			Dompe	2	10	20
Pugoda			Dompe	2	10	20
Ranpokunawatta			Dompe	2	10	20
Gampaha/ Yakkala			Gampaha	2	10	20
Bambukuliya			Katana	2	10	20
Raddolugama				2	10	20
Kandana	West-South	Kalutara	Madurawala	2	10	20

Based on the above analysis Districts/ Division / Water Treatment Plants were evaluated for the risk matrix as low risk moderate risk, high risk and very high risk for flood hazard.

Table 2.31: Landslide Risk Assessment

Water Treatment Plant	Region	District	Divisional Secretariat	Hazard	Vulnerability Assessment	Risk
				Exposure (Not Likely-1, Modest-2, Expected - 3, Most Likely-4)		Hazard X Vulnerability
Doluwa	Central	Kandy	Doluwa	2	11	22
Gampolawatta			Doluwa	2	11	22
Nilambe			Doluwa	1	10	10
Ulapane			Ganga Ihala Korale	4	13	52
Greater Kandy			Harispattuwa	2	11	22
Hantana Housing Scheme			Kandy Four Gravets & Gangawata Korale	2	11	22
Haragama			Kandy Four Gravets & Gangawata Korale	2	11	22
Balagolla			Kundasale	1	10	10
Rangala (Meda Dumbara)			Medadumbara	2	11	22
Araththana			Panvila	2	11	22
Nawalapitiya			Pasbage Korale	1	10	10
Polgolla			Pathadumbara	1	10	10
Marassana			Pathahewaheta	2	11	22
Ankumbura (Ihalamulla B/H)			Pujapitiya	1	10	10
Galagedara			Thumpane	1	10	10
Datry			Udapalatha	2	11	22
Elpitiya				2	11	22
Para Deka				2	11	22
Meewathura (K/S TP)			Udunuwara	3	11	33
Pussella		Matale	Ambanganga Korale	3	10	30
Matale			Matale	2	13	26
Naula			Pallepola	1	11	11
Udatenna			Rattota	2	11	22
Ukuwela			Ukuwela	2	11	22
Ginigathena		Nuwaraelliya	Ambagamuwa	2	10	20
Hatton High Lift - Dukenose				2	11	22
Hatton Low Lift - Invary				2	11	22
Maskeliya				2	10	20
Sinhapura				2	10	20
Rikillagaskada			Hanguranketha	3	11	33
Pundaluoya			Kothmale	2	10	20
Pussellawa				2	10	20
Kotagala			Nuwara Eliya	1	11	11
Talawakale				1	11	11
Ragala			Walapane	2	10	20
Walapane				2	13	26

Table 2.31: Landslide Risk Assessment Cont…..

Water Treatment Plant	Region	District	Divisional Secretariat	Hazard	Vulnerability Assessment	Risk Assessment
				Exposure (Not Likely-1, Modest-2, Expected - 3, Most Likely-4)		Hazard X Vulnerability
Alawwa	North Western	Kurunegala	Alawwa	1	11	11
Buluwala			Mawathagama	1	11	11
Mawathagama				1	11	11
Narammala			Narammala	1	10	10
Polgahawela - Karandana			Polgahawela	2	11	22
Dodangaslanda			Rideegama	1	11	11
Hettipola				1	10	10
Ogodapola				1	10	10
Bulathkohupitiya	Sabaragamuwa	Kegalle	Bulathkohupitiya	4	11	44
Kotabodawatta			Dehiovita	1	10	10
Benkiyawatta			Deraniyagala	2	10	20
Weliharanawa				2	11	22
Aranayaka TP			Aranayaka	2	11\	22
Mediliya TP				2	11	22
Hiriwadunna TP				3	11	33
Mawanella TP			Mawanella	2	10	22
Rathkarawwa			Ruwanwella	1	13	13
Ingiriya/Nachchamale		Ratnapura	Eheliyagoda	2	11	22
Kalatuwawa				1	11	11
Kolonna				2	11	22
Mas Embula				3	10	30
Nimalagama				3	11	30
Kohiladeniya/ Eheliyagoda			Godakawela	1	11	11
Nallattanniya			Imbulpe	2	10	20
Idangoda			Kahawatta	1	10	10
Nisala Uyana - Kahawatta			Kuruvita	3	11	33
Sinhapura				3	10	30
Watapotha				1	10	10
Muwagama			Nivithigala	3	11	33
Pompakale				1	11\	11
Watapotha			Ratnapura	1	11	11
Sri padaya				1	11	11
Dehiowita TP			Weligepola	1	10	10
Yatiyanthota TP				2	13	26
Udugama	Southern	Galle	Nagoda	2	11	22
Pitigala			Niyagama	3	11	33
Sapugahadola & water from Muruthawela		Hambantota	Walasmulla	2	11	22
Akuressa		Matara	Akuressa	1	10	10

Table 2.31: Landslide Risk Assessment Cont…..

Water Treatment Plant	Region	District	Divisional Secretariat	Hazard	Vulnerability Assessment	Risk Assessment
				Exposure (Not Likely-1, Modest-2, Expected - 3, Most Likely-4)		Hazard X Vulnerability
Hakmana			Hakmana	2	11	22
Deniyaya			Kotapola	1	12	12
Makandura			Mulatiyana	1	12	12
Athdolakanda, Beerideniya & Nebilidola			Pasgoda	2	11	22
Urubokka			Pasgoda	2	11	22
Pitabeddara			Pitabeddara	2	11	22
Hallala			Welipitiya	1	11	11
Badulla			Badulla	2	11	22
Bandarawela			Bandarawela	4	11	44
Makulella				1	11	11
Mullepihilla			Ella	1	11	11
Demodara			Hali-Ela	2	11	22
Hali Ela				2	12	22
Diyathalawa		Badulla	Haputale	2	11	22
Ambagasdowa			Uva Paranagama	1	11	11
Medawala				2	10	20
Bogahakubura			Welimada	1	10	10
Boralanda				2	11	22
Keppetipola				3	11	33
Welimada				3	11	33
Bibila			Bibile	2	12	24
Medagama				1	12	24
Buttala	Uva		Buttala	1	11	11
Poojapiyita (Bokkawala B/Hs)				1	11	11
Monaragala - Partial (RSF, SSF, Cl)			Moneragala	1	11	11
Okkampitiya				1	11	11
Harispaththuwa (Rajapihilla B/H)		Moneragala	Wellawaya	2	11	22
Ice Pilla - Partial (SSF)				1	11	11
Minigamuwa				1	11	11
Poojapiyita (Bolagala Well field)				1	11	11
Yalabowa -Full				2	11	22
Penrithwatta				1	12	12
Bataleeya	West North	Gampaha	Mirigama	1	11	11
Wettewa		Kalutara	Mathugama	1	11	11
Idangoda			Palindanuwara	1	10	10

Based on the above analysis Districts/ Division / Water Intakes were evaluated for the risk matrix as low risk moderate risk, high risk and very high risk for Landslide hazard.

Table 2.32: **Drought Risk Assessment**

Water Treatment Plant	Region	District	Divisional Secretariat	Hazard	Vulnerability Assessment	Risk Assessment
				Exposure (Low-1, Moderate-2, High-3)		Hazard X Vulnerability
Gampolawatta	Central	Kandy	Doluwa	3	12	36
Doluwa			Doluwa	2	11	22
Nilambe			Doluwa	2	11	22
Ulapane			Ganga Ihala Korale	2	11	22
Greater Kandy			Harispattuwa	2	11	22
Haragama			Kandy Four Gravets & Gangawata Korale	1	10	10
Hantana Housing Scheme			Kandy Four Gravets & Gangawata Korale	2	11	22
Balagolla			Kundasale	1	10	10
Rangala (Meda Dumbara)			Medadumbara	3	12	36
Araththana			Panvila	2	11	22
Nawalapitiya			Pasbage Korale	2	11	22
Polgolla			Pathadumbara	2	11	22
Marassana			Pathahewaheta	2	11	22
Ankumbura (Ihalamulla B/H)			Pujapitiya	2	11	22
Galagedara			Thumpane	2	11	22
Para Deka			Udapalatha	2	11	22
Datry			Udapalatha	2	11	22
Elpitiya			Udapalatha	2	11	22
Meewathura (K/S TP)			Udunuwara	2	11	22
Ukuwela		Matale	Ukuwela	2	12	24
Udatenna			Rattota	2	12	24
Matale			Matale	2	12	24
Pussella			Ambanganga Korale	2	12	24
Wilgamuwa			Wilgamuwa	3	13	39

Table 2.32: **Drought Risk Assessment Cont…….**

Water Treatment Plant	Region	District	Divisional Secretariat	Hazard	Vulnerability Assessment	Risk Assessment
				Exposure (Low-1, Moderate-2, High-3)	Assessment	Hazard X Vulnerability
Naula		Matale	Pallepola	1	11	11
Dambulla New & Dambulla Old			Dambulla	3	13	39
Sinhapura		Nuwara Eliya	Ambagamuwa	1	11	11
Maskeliya			Ambagamuwa	2	12	24
Hatton High Lift - Dukenose			Ambagamuwa	2	12	24
Hatton Low Lift - Invary			Ambagamuwa	2	12	24
Tawalkale			Nuwara Eliya	2	12	24
Kotagala			Nuwara Eliya	2	12	24
Ginigathena			Ambagamuwa	2	12	24
Ragala			Walapane	2	12	24
Pundaluoya			Kothmale	2	12	24
Walapane			Walapane	2	12	24
Pussellawa			Kothmale	3	13	39
Rikillagaskada			Hanguranketha	3	13	39
Sagamam	Eatern	Ampara	Thirukkovil	3	13	39
Kondavatuwana			Ampara	1	11	11
Himuthdawa			Uhana	3	13	39
Padiyathalawa			Padiyathalawa	3	13	39
Mahaoya			Mahaoya	3	13	39
Sandunpura			Dehiattakandiya	3	13	39
Lihiniyagama			Dehiattakandiya	3	11	33
Dehiattakandiya			Dehiattakandiya	1	12	12
Mawanagama			Dehiattakandiya	2	13	26
Vavunathivu		Batticaloa	Manmunai West	3	12	36
Ihalagama WTP			Koralai Pattu North (Vaharai)	2	13	26
Eachchalampatthu		Trincomalee	Verugal Eachchilampattu	3	11	33
Kantale			Kanthalai	1	12	12
Muthur			Muttur	2	12	22
Pulmoddai			Kuchchaveli	2	13	26
RO plant, Alankulam road, Nainathivu	Northern	Jaffna	Island South (Velanai)	3	13	39
Well 5			Island South (Velanai)	3	13	39
Well 4			Island South (Velanai)	3	13	39
Well 2			Island South (Velanai)	3	13	39
Well 6			Island South (Velanai)	3	13	39
Well 3			Island South (Velanai)	3	13	39
Well 1			Island South (Velanai)	3	13	39
Tube wells 1 Water supply lane, Velanai			Island South (Velanai)	3	13	39
Dug well Ward no 4, Analaithivu			Island North (Kayts)	3	13	39
Tube wells 2 Vempirai			Thenmaradchy (Chavakachcheri)	3	12	36

Table 2.32: **Drought Risk Assessment Cont…….**

Water Treatment Plant		District	Divisional Secretariat	Hazard	Vulnerability Assessment	Risk Assessment
				Exposure (Low-1, Moderate-2, High-3)	Assessment	Hazard X Vulnerability
Dug well Kaithdady south			Thenmaradchy (Chavakachcheri)	3	12	36
Tube wells 1 Vempirai			Thenmaradchy (Chavakachcheri)	3	12	36
Dug well 1&2, Araly south			Valikamam West (Chankanai)	3	12	36
Dug wells 2 Vaddukkoddai			Valikamam West (Chankanai)	3	12	36
Dug wells 1 Vaddukkoddai			Valikamam West (Chankanai)	3	12	36
Chunnakkam Dug well Pokkanai, Urelu			Valikamam East (Kopay)	3	12	36
Pokkanai Tube well 1,2, &3, 2 New tube well Pokkanai, Urelu			Valikamam South (Uduvil)	3	12	36
Dug well 1,2, &3 Sampalodai road, Karainagar			Karainagar	3	13	36
Nilaweray Tube welll 1, 2 &3 Nilavarai junction			Karainagar	3	13	36
Karaveddy -Dug well Vallipuram, Point Pedro			Vadamaradchy North (Point Pedro)	3	12	36
Vallipuram Intake - Dug wells 1,2,3, &4, Tube wells 1-6 Vallipuram, Point Pedro			Vadamaradchy North (Point Pedro)	3	12	36
Karaveddy -Dug well Vallipuram Intake - Dug wells 1,2,3, &4, Tube wells 1-6 Vallipuram, Point Pedro	**Region**		Vadamaradchy North (Point Pedro)	3	12	36
Surface Water (Dry Aru), Wilson Road, Kilinochchi		Kilinochchi	Karachchi	3	13	39
Karadipokku 01 dug well, 01 tube well Wilson Roa*			Karachchi	3	13	39
Madu Dug well No:05			Madhu	2	12	24
Madu Bore Hole No:03			Madhu	2	12	24
Madu Dug well No:04			Madhu	2	12	24
Madu Dug well No:03			Madhu	2	12	24
Madu Bore Hole No:02			Madhu	2	12	24
Madu Dug well No:02			Madhu	2	12	24
Madu Bore Hole No:01			Madhu	2	12	24
Madu Dug well No:01			Madhu	2	12	24
Murunkan Bore Hole No:01		Mannar	Mannar Town	2	12	24
Murunkan Bore Hole No:02			Mannar Town	2	12	24
Murunkan Bore Hole No:03			Mannar Town	2	12	24
Murunkan Bore Hole No:04			Mannar Town	2	12	24
Murunkan Bore Hole No:05			Mannar Town	2	12	24
Murunkan Bore Hole No:06			Mannar Town	2	12	24
Murunkan Bore Hole No:07			Mannar Town	2	12	24
Murunkan Bore Hole No:08			Mannar Town	2	12	24

Table 2.32: **Drought Risk Assessment Cont…….**

Water Treatment Plant	Region	District	Divisional Secretariat	Hazard Exposure (Low-1, Moderate-2, High-3)	Vulnerability Assessment	Risk Assessment Hazard X Vulnerability
Murunkan Bore Hole No:09			Mannar Town	2	12	24
Murunkan Bore Hole No:10			Mannar Town	2	12	24
Murunkan Bore Hole No:11			Mannar Town	2	12	24
Periyamadu Pump House -L03			Manthai West	3	13	39
Periyamadu			Manthai West	3	13	39
Periyamadu Pump House -L02			Manthai West	3	13	39
Periyamadu Pump House -L04			Manthai West	3	13	39
Thevanpiddy Pump house -137			Manthai West	3	13	39
Thevanpiddy Pump house -136			Manthai West	3	13	39
Thevanpiddy Pump house -135			Manthai West	3	13	39
Tube wells 1,2 Thunukkai pandiyankulam road, pandiyankulam			Manthai East	3	13	39
Tube well 3 Thunukkai pandiyankulam road, pandiyankulam			Manthai East	3	13	39
Tube wells 1 Mankulam thunukkai road, mallavi			Manthai East	2	12	24
Tube wells 3 Mankulam thunukkai road, mallavi			Thunukkai	3	13	39
Tube wells 4 Mankulam thunukkai road, mallavi		Mullaitivu	Thunukkai	3	13	39
Tube wells 5 Mankulam thunukkai road, mallavi			Thunukkai	3	13	39
Tube wells 2 Mankulam thunukkai road, mallavi			Thunukkai	3	13	39
Dug well 1 Mankulam thunukkai road, mallavi			Thunukkai	3	13	39
Nedunkerney -Tube well 1, Oddusudan, nedunkerny			Oddusuddan	3	13	39
Nedunkerney - Dug well 1, Oddusudan, nedunkerny			Oddusuddan	3	13	39
Vavuniya			Vavuniya	1	11	11
Oddusuddan - Tube well 1, Oddusudan, nedunkerny		Vavuniya	Vavuniya North	2	12	24
Oddusuddan - Tube well 2, Oddusudan, nedunkerny			Vavuniya North	2	12	24
Galnewa WTP			Galnewa	1	11	11
Eppawala WTP			Thalawa	1	11	11
Nallachchiya WTP / Thambuththegama			Thambuttegama	1	11	11
Thuruwila WTP			Nachchaduwa	1	11	11
Nuwarawewa WTP			Nuwaragam Palatha East	1	11	11
Thissawewa (Sacred City) WTP	North Central	Anuradhapura	Nuwaragam Palatha Central	1	11	11
Oyamaduwa WTP			Mahawilachchiya	2	12	24
Medawachchiya WTP			Medawachchiya	2	12	24
Thanthirimale WTP			Mahawilachchiya	2	12	24
Wadinagala		Polonnaruwa	Elahera	3	13	39
Bakamoona			Elahera	2	12	24

Table 2.32: **Drought Risk Assessment Cont…….**

Water Treatment Plant	Region	District	Divisional Secretariat	Hazard	Vulnerability Assessment	Risk Assessment
				Exposure (Low-1, Moderate-2, High-3)	Assessment	Hazard X Vulnerability
Aralaganwila			Dimbulagala	3	13	39
Dimbulagala			Dimbulagala	1	11	11
Manampitiya			Dimbulagala	2	12	24
Gallella			Thamankaduwa	2	12	24
Sammanthurai			Welikanda	1	11	11
Polonnaruwa			Thamankaduwa	1	11	11
Minneriya			Hingurakgoda	2	12	24
Medirigiriya			Medirigiriya	2	12	24
Alawwa	North Western	Kurunegala	Alawwa	2	12	24
Pannala			Pannala	3	13	39
Polgahawela - Karandana			Polgahawela	2	12	24
Giriulla			Pannala	2	12	24
Narammala			Narammala	2	12	24
Mawathagama			Mawathagama	2	12	24
Buluwala			Mawathagama	2	12	24
Ogodapola			Ridigama	2	12	24
Hettipola			Ridigama	2	12	24
Kurunegala			Kurunegala	2	12	24
Gokerella			Ibbagamuwa	2	12	24
Dodangaslanda			Ridigama	2	12	24
Vilaththawa/ Chilaw			Bingiriya	2	12	24
Wariyapola - Mudannapola Watta			Wariyapola	2	12	24
Nikaweratiya - Magallegama			Nikaweratiya	1	11	11
Abanpola			Ambanpola	2	12	24
Galgamuwa - Mee Oya			Ambanpola	1	11	11
Dankotuwa - Metikotuwa		Puttalam	Dankotuwa	2	12	24
Wennapuwa			Wennappuwa	2	12	24
Andigama BH 2			Nattandiya	2	12	24
Andigama BH 3			Nattandiya	2	12	24
Nattandiya			Nattandiya	2	12	24
Nelumpokuna / Kakkapalliya			Madampe	2	12	24
Andigama BH 1			Pallama	2	12	24
Anamaduwa			Anamaduwa	2	12	24
Eluwankulama / Puttalm			Wanathavilluwa	3	13	39
Benkiyawatta	Sabaragamuwa	Kegalle	Deraniyagala	2	12	24
Weliharanawa			Deraniyagala	2	12	24
Kotabodawatta			Dehiovita	2	12	24
Rathkarawwa			Ruwanwella	2	12	24
Bulathkohupitiya			Bulathkohupitiya	2	12	24
Sewanagala		Ratnapura	Embilipitiya	3	13	39
Ruwawella TP			Embilipitiya	3	13	39
Idangoda			Kahawatta	2	12	24
Dehiowita TP			Weligepola	2	12	24

Kohiladeniya/ Eheliyagoda			Godakawela	2	12	24
Yatiyanthota TP			Weligepola	3	13	39

Table 2.32: **Drought Risk Assessment Cont…….**

Water Treatment Plant	Region	District	Divisional Secretariat	Hazard	Vulnerability Assessment	Risk Assessment
				Exposure (Low-1, Moderate-2, High-3)	Assessment	Hazard X Vulnerability
Bulathkohupitiya			Balangoda	2	12	24
Muwagama			Nivithigala	3	13	39
Pompakale			Nivithigala	2	12	24
Sri padaya			Ratnapura	2	12	24
Watapotha			Kuruvita	3	13	39
Watapotha			Ratnapura	2	12	24
Nallattanniya			Imbulpe	2	12	24
Ingiriya/Nachchamale			Eheliyagoda	2	12	24
Sinhapura			Kuruvita	2	12	24
Nimalagama			Eheliyagoda	2	12	24
Nisala Uyana - Kahawatta			Kuruvita	2	12	24
Kalatuwawa			Eheliyagoda	1	11	11
Mas Embula			Eheliyagoda	3	13	39
Kolonna			Eheliyagoda	2	12	24
Hapugala	Southern	Galle	Bope-Poddala	2	12	24
Wakwella			Bope-Poddala	2	12	24
Baddegama			Baddegama	2	12	24
Udugama			Nagoda	2	12	24
Pitigala			Niyagama	2	12	24
Kudaheella		Hambantota	Beliatta	2	12	24
Muruthawela			Tangalle	3	13	39
Kattakaduwa			Tangalle	2	12	24
Debarawewa(Tiissa)			Ambalantota	2	12	24
Kirindioya			Ambalantota	2	12	24
Wakamulla			Angunakolapelessa	2	12	24
Ridiyagama			Ambalantota	3	13	39
Kataragama			Walasmulla	1	11	11
Sapugahadola & water from Muruthawela			Walasmulla	2	12	24
Bundala			Tissamaharama	3	13	39
Ambalantota			Sooriyawewa	2	12	24
Welipothewala, Weligampathuwa Tube Well			Tissamaharama	3	13	39
Eraminiyaya(Agunokolapallasa)			Tissamaharama	3	13	39
Nalagama			Lunugamvehera	2	12	24
Radampala		Matara	Dickwella	3	13	39
Hallala			Welipitiya	2	12	24
Malimbada / Nadugala			Malimbada	3	13	39
Thihagoda			Thihagoda	2	12	24
Karagoda Uyangoda			Kamburupitiya	3	13	39
Hakmana			Hakmana	3	13	39

Akuressa			Akuressa	2	12	24
Makandura			Mulatiyana	2	12	24
Pitabeddara			Pitabeddara	2	12	24
Urubokka			Pasgoda	2	12	24
Athdolakanda, Beerideniya & Nebilidola			Pasgoda	2	12	24
Deniyaya			Kotapola	2	12	24

Table 2.32: **Drought Risk Assessment Cont…….**

Water Treatment Plant	Region	District	Divisional Secretariat	Hazard	Vulnerability Assessment	Risk Assessment
				Exposure (Low-1, Moderate-2, High-3)	Assessment	Hazard X Vulnerability
Ruhunupura	Uva	Moneragala	Katharagama	3	13	39
Gonagaldeniya			Thanamalvila	2	12	24
Warakapola TP			Thanamalvila	2	12	24
Thanamalwila			Thanamalvila	1	11	11
Moronthota TP			Thanamalvila	2	12	24
Yalabowa -Full			Wellawaya	2	12	24
Ice Pilla - Partial (SSF)			Wellawaya	2	12	24
Minigamuwa			Wellawaya	3	13	39
Buttala			Buttala	2	12	24
Poojapiyita (Bolagala Well field)			Wellawaya	2	12	24
Poojapiyita (Bokkawala B/Hs)			Buttala	2	12	24
Okkampitiya			Moneragala	3	13	39
Monaragala - Partial (RSF, SSF, Cl)			Moneragala	3	13	39
Alawathugoda - Vilana BH			Badalkumbura	2	12	24
Harispaththuwa (Rajapihilla B/H)			Wellawaya	3	13	39
Alawathugoda - Ovissa BH			Badalkumbura	2	12	24
Pottuvil-Ulle			Siyambalanduwa	1	11	11
Siyabalanduwa			Siyambalanduwa	2	12	24
Muthukandiya WTP			Siyambalanduwa	1	11	11
Bibila			Bibile	2	12	24
Medagama			Bibile	2	12	24
Hriwadunna TP		Badulla	Haldummulla	3	13	39
Mawanella TP			Haldummulla	3	13	39
Aranayaka TP			Haldummulla	2	12	24
Mediliya TP			Haldummulla	2	12	24
Diyathalawa			Haputale	2	12	24
Boralanda			Welimada	2	12	24
Bandarawela			Bandarawela	2	12	24
Makulella			Bandarawela	2	12	24
Bogahakubura			Welimada	2	12	24
Mullepihilla			Ella	2	12	24
Keppetipola			Welimada	2	12	24
Welimada			Welimada	2	12	24

Demodara			Hali-Ela	2	12	24
Hali Ela			Hali-Ela	2	12	24
Medawala			Uva Paranagama	2	12	24
Ambagasdowa			Uva Paranagama	2	12	24
Badulla			Badulla	2	12	24
Mahiyanganaya			Mahiyanganaya	2	12	24
Giradurukotte			Mahiyanganaya	1	11	11
Rathkinda			Mahiyanganaya	2	12	24
Labugama	West Central	Colombo	Padukka	1	11	11
Kethhena			Homagama	2	12	24
Ambatale			Kolonnawa	2	12	24

Table 2.32: **Drought Risk Assessment Cont…….**

Water Treatment Plant	Region	District	Divisional Secretariat	Hazard	Vulnerability Assessment	Risk Assessment
				Exposure (Low-1, Moderate-2, High-3)	Assessment	Hazard X Vulnerability
Kosgama/ Akarawita			Seethawaka	2	12	24
Penrithwatta			Seethawaka	2	12	24
CHICO	West North	Gampaha	Dompe	2	12	24
Pattiwila			Biyagama	2	12	24
Pugoda			Dompe	2	12	24
Ranpokunawatta			Dompe	2	12	24
Embilipitiya New Town			Attanagalla	2	12	24
Gampaha/ Yakkala			Gampaha	2	12	24
Udugampola			Minuwangoda	2	12	24
Kalagedihene			Attanagalla	2	12	24
Raddolugama			Katana	2	12	24
Veyangoda			Attanagalla	2	12	24
Minuwangoda			Minuwangoda	3	13	39
Bataleeya			Mirigama	2	12	24
Meerigama			Mirigama	2	12	24
Divulapitiya			Divulapitiya	3	13	39
Bambukuliya			Katana	3	13	39
Idangoda	West South	Kalutara	Palindanuwara	2	12	24
Wettewa			Mathugama	3	13	39
Kandana			Madurawala	2	12	24

Based on the above analysis Districts/ Division / Water Intakes were evaluated for the risk matrix as low risk moderate risk, high risk and very high risk for Drought hazard.

Table 2.33: Chemical Hazard Assessment

Water Treatment Plant	Region	District	Divisional Secretariat	Hazard	Vulnerability	Risk
				Exposure (Lowt-1, Moderate-2, High-3)	Assessment	Hazard X Vulnerability
Meewathura (K/S TP)	Central	Kandy	Udunuwara		09	09
Rangala (Meda Dumbara)			Medadumbara		09	09
Matale		Matale	Ambanganga		09	09
Maskeliya		Nuwara Eliya	Ambagamuwa		09	09
Ginigathena			Ambagamuwa		09	09
Rikillagaskada			Hanguranketa		09	09
Mahaoya	Eastern	Ampara	Mahaoya		09	09
Mawanagama			Dehiattakandiya		09	09
Chunnakkam Dug well Pokkanai, Urelu	Northern	Jaffna	Valikamam East (Kopay)		09	09
Madu Dug well No:04		Mannar	Madhu		09	09
Madu Bore Hole No:02			Madhu		09	09
Madu Dug well No:02			Madhu		09	09
Madu Bore Hole No:01			Madhu		10	10
Madu Dug well No:01			Madhu		10	10
Murunkan Bore Hole No:01			Mannar Town		09	09
Murunkan Bore Hole No:02			Mannar Town		09	09
Murunkan Bore Hole No:03			Mannar Town		09	09
Murunkan Bore Hole No:04			Mannar Town		09	09
Murunkan Bore Hole No:05			Mannar Town		09	09
Murunkan Bore Hole No:06			Mannar Town		09	09
Murunkan Bore Hole No:07			Mannar Town		09	09
Murunkan Bore Hole No:08			Mannar Town		09	09
Murunkan Bore Hole No:09			Mannar Town		09	09
Murunkan Bore Hole No:10			Mannar Town		09	09
Nedunkerney -Tube well 1, Oddusudan, nedunkerny		Mullaitivu	Oddusuddan		09	09
Nedunkerney - Dug well 1, Oddusudan, nedunkerny			Oddusuddan		09	09
Vavuniya		Vavuniya	Vavuniya		09	09
Oddusuddan - Tube well 2, Oddusudan, nedunkerny			Vavuniya North		09	09
Eppawala WTP	North Central	Anuradhapura	Thalawa		09	09
Thanthirimale WTP			Mahawilachchiya		09	09
Gallella		Polonnaruwa	Thamankaduwa		09	09
Hettipola	North Western	Kurunegala	Rideegama		09	09
Kurunegala			Kurunegala		10	10
Dankotuwa - Metikotuwa		Puttalam	Dankotuwa		10	10
Wennapuwa			Wennappuwa		09	09
Benkiyawatta	Sabaragamuwa	Kegalle	Deraniyagala		09	09
Muwagama		Ratnapura	Nivithigala		09	09
Pompakale			Nivithigala		09	09
Wakwella	Southern	Galle	Bope-Poddala		09	09
Pitigala			Niyagama		09	09
Debarawewa(Tiissa)		Hambantota	Ambalantota		09	09
Sapugahadola & water from Muruthawela			Walasmulla		09	09

Welipothewala, Weligampathuwa Tube Well			Thissamaharama		09	09
Eraminiyaya (Agunokolapallasa)			Thissamaharama		09	09

Table 2.33: Chemical Hazard Assessment Cont……

Water Treatment Plant	Region	District	Divisional Secretariat	Hazard Exposure (Lowt-1, Moderate-2, High-3)	Vulnerability Assessment	Risk Hazard X Vulnerability
Shalala		Matera	Welipitiya		09	09
Karagoda Uyangoda			Kaburupitiya		09	09
Pitabeddara			Pitabaddara		09	09
Deniyaya			Kotapola		09	09
Okkampitiya		Moneragala	Monaragala		09	09
Monaragala - Partial (RSF, SSF, Cl)			Monaragala		09	09
Bibila			Bibile		09	09
Aranayaka TP	Uva	Badulla	Haldummulla		09	09
Diyathalawa			Haputale		09	09
Bandarawela			Bandarawela		09	09
Keppetipola			Welimada		09	09
Badulla			Badulla		09	09
Mahiyanganaya			Mahiyanganaya		09	09
Kethhena	West Central	Colombo	Homagama		09	09
Kosgama/ Akarawita			Seethawaka		09	09
Penrithwatta			Seethawaka		09	09
CHICO	West North	Gampaha	Dompe		09	09
Pugoda			Dompe		09	09
Gampaha/ Yakkala			Gampaha		10	10
Udugampola			Minuwangoda		10	10
Minuwangoda			Minuwangoda		10	10

Based on the above analysis Districts/ Division / Water Intakes were evaluated for the risk matrix as low risk moderate risk, high risk and very high risk for Chemical Hazard.

Further to that considering the hazard, exposure and vulnerability magnitude of the effect caused by each type of hazards were evaluated to investigate the level of risk is depicting in the below table.2.34.

Table 2.34: Magnitude of Effect Caused by Hazards

Effects on Water Supply System	**Flood**	**Landslide**	**Drought**	**Chemical Hazards**
Structural damage to system infrastructure				
Rupture of mains and pipes				
Obstructions in intake points, intake screens, treatment plants and transmission pipes				
Pathogenic contamination and chemical pollution of water supply				
Water shortages				
Disruption of power, communications and road system				
Shortage of personnel				
Lack of equipment, spare parts and materials				

	Symbols used:
Severe effect	
Moderate effect	
Minimal effect	

Chapter 3. Disaster Mitigation Plan for NWSDB

3.1. Introduction

Hazards are present in all potable water systems, in varying degrees. Disaster mitigation is essential even when floods, droughts, landslides, and chemical hazards do not directly threaten, as accidents and pipeline breaches can contaminate water and significantly impact service. Entities responsible for the operation and maintenance of these systems should implement strategies that are designed to mitigate the systems' vulnerability and implement the most effective measures to mitigate the current risks associated with water.

The mitigation plan should establish the requisite procedures to identify the threats or impact of potential disasters, thereby reducing the potential risk. Vulnerability analysis is instrumental in identifying the physical deficiencies of system components after the hazards specific to a specific zone have been identified.

The organization and management of the NWSDB are also subject to vulnerability analysis, in addition to the physical structure of the system. For instance, the analysis in the financing division of the NWSDB would ascertain whether there are adequate funds to implement mitigation measures or whether resources must be reallocated to guarantee the feasibility of mitigation plans. This chapter delineates the catastrophe mitigation planning process, including its content and the steps that are required to execute and maintain the program in order of priority.

The following recommendations are designed to facilitate the successful execution of potable water supply projects. They encompass not only risk management-related aspects but also best practices in design and construction, as they serve as a foundation for mitigating vulnerabilities. They have been categorized into design, construction, and maintenance measures to optimize their utilization. They are intended to serve as a reference and are utilized when appropriate for a specific undertaking. **NWSDB used different standards for the design of all structures in water supply sector. In order to ensure resilience of structure to disasters, NWSDB has to review design standards used at present and incorporate Disaster Risk Reduction concepts into design standards**. **Impacts of Sea Level rise due to climate change should also be considered in planning and designing river intakes close to coastal areas.**

The primary natural hazards that have an impact on potable water systems and the potential mitigation measures are given below:

3.2. Mitigating impacts of hazards on drinking water sector

Types of mitigation measures, identifying critical infrastructure in water supply system and level of exposure, identifying and conducting risk assessment for critical infrastructure and types of mitigation measures to minimize the impact of hazard are described in detail in Chapter 2 of risk assessment. Summary of water intakes and WTPs exposed to floods given in Table 2.15 and table 2.16

Hazards, issues and impacts and possible mitigation measures related to critical infrastructure of water supply system are given below;

Table 3.1: Possible mitigation measures at Intake points i.e., wells, Infiltration Galleries, Surface Water (Rivers, Lakes, Lagoons), and springs

Hazard	Issues and Impact	Possible mitigation measures
Floods	• Surface waters (polluted) go into the chamber. • Silting up of water wells with sediments and sand. Interruption in the pumping systems. • Destruction of the intake works in rivers by stones and debris transported by the flash flood that also weakens the structure. • Destruction of infiltration galleries. • Loss of the water source due to changes in the river course and severe river bank erosions.	**In the design phase, take into account:** • Carry out hydrological studies to estimate flood hazards and the resulting erosion and landslides. • In case of rivers, determine the erosion potential in the bed river to avoid damages to any structure, especially foundations, to be built. • Locate the water intake at an adequate depth to avoid penetration of floating materials. Incorporation of floating barriers to stop floating objects entering intakes. • Drainage ditches. • Change the location of the wet chamber. Build channeling structures. • Ensure the dam has a proper spillway size for peak floods. • The dam must include a constant sludge purge system (pipes installed in the bed of the dam or at the gates that evacuate the sludge). • There must be a gate facilitating the periodical and exceptional (after river floods) cleaning. • When the river bed is broad and has a large flow rate, it is advisable to deviate some amount of water required by a channel where the intake works are built. • Include an overflow structure to allow excess of water to return to the river. • In case a pump is used, it is advisable to raise the walls of the wet chamber. Appendix 12 provided details of Water treatment plants exposed to floods. • In case of flash floods occurring in the stream, its often better to use submerged screened pipes to catch the water rather than to build a dam that could be destroyed during the flash flood. This involves a concrete structure across the river bed build on gravel where the screened pipe is laid and then covered with river material. This pipe takes water to the wet chamber. • In addition to the submerged screened pipe, it is advisable to install silt trap to reduce the energy of the flow and remove coarse material. • Consider design high flood level in installation of pumps, control panels etc.

		In the construction phase, take into account: • In streams/river, build energy dissipaters upstream to decrease water velocity and transport of bed load. • Stone line the bed of the river before and after the dam to avoid erosion. • The foundations must be deep enough so that they are not affected by erosion. • Make the surface waterproof to avoid contamination by infiltration of polluted surface water. • Avoid as far as possible building any structure in the river bed that could dam its flow. **In the operational phase, consider:** • Draining of underground structures. • Rehabilitation of the system in case of collapse • Desilting inside the intake structures. • Back flushing or manual cleaning of intake screens. • Arrange means of access/supply lines for the system and operators of the intakes during floods.
Drought	• Drastic reduction in the supply of water from the Surface water sources/spring. • Pollution of surface waters due to the decrease in its purification capacity caused by the reduction of the water discharge. • Reduction of underground water sources due to the decrease of the water table level. • The volume of water taken in well is reduced and greater pumping depth are required. • Reduction of the water flow from surface intakes due to the reduction in rivers and springs discharge. Disappearance of the water source	**In the design phase, take into account:** • Determine the permeability of the soil. Identify alternative water sources. • Foresee measures to recharge the aquifer. • Plan tree plantations using native species. • Determine hydraulic characteristics of the underground aquifers that feed water springs in the area. • Identify perennial water sources in the area and study the possibility of use in adverse weather condition • Consider the lowest operational water levels and alternative sources as applicable. (Details of water intakes exposed to drought given in Appendix 13) **In the construction phase, take into account:** • Build a deeper pump wet chamber. • Identify the exact location where water seeps to the surface. **In the operational phase, consider:** • Water harvesting in the upper levels. Reforestation. • Monitoring the level of groundwater tables and volume in rivers/streams throughout the year. • Rational use of water.

	• Risk assessment study has identified intakes highly and moderately exposed to drought. Give priority at the design, construction and operational phases. • Salt water intrusion into rivers and water bodies. • Increased Total dissolved solids in ground water.	• Supply water to the population with water trucks in case of emergency situations. • Re-visit studies undertaken by NWSSB for the construction of permanent salt water barriers across rivers in southern and western provinces taking in to consideration the climate change impacts on precipitation and the sea level rise. Predicted sea level rise is given below. Source: Hazard profile Sri Lanka-2012 page 122. 2025 year sea level rise 0 .508 m 2050 year sea level rise 0 .658 m 2075 year sea level rise 0.808 m 2100 year sea level rise 0.958 m
Landslides	• Total or partial destruction of intake works. • Burial of structure. • In many cases, the source of the spring (Groundwater use as Intakes) is diverted affecting the production capacity of the aquifers. • Change of the physical and chemical characteristics of water. • Changing the course of the streams and thus affecting intake works. • Some of the Water Supply Schemes are located in landslide area. Level of exposure is identified in the risk assessment study.	**In the design phase, take into account:** • Risk assessment study has identified exposure level of infrastructure (most likely and expected) to landslides. (Level of exposure of Critical Infrastructure given in Appendix 14) Conduct detail hydro-geologic studies to assess the stability of soil at the specific location of identified infrastructure. • Hydro-geologic studies to determine the behavior of ground water that supplies the water sources in the region. Geo-dynamic studies to determine the changes that could happen in the area due to external factors such as the rain, etc. • Stabilizing and managing slopes. Brow ditches to avoid rain water infiltration in sloping terrains that can be therefore destabilize. • Reforestation with native plant species to stabilize soils. • Study the possibility of relocating proposed WSS highly and moderately exposed to landslides to safer locations. If not undertake detail hydro-geological studies to assess the stability of soil at he proposed sites. **In the construction phase, take into account:** • Avoid place identified as unstable. Locate works at stable locations **In the operational phase, consider:** • Rehabilitation of intake works if those are affected
Chemical hazards & oil leaks	• NWSDB transport large quantity of	**In the design phase, take into account:** • Include emergency design features such as Chlorine vent systems and emergency cylinder

(Part of this section need to shifted under TREATMENT PLANT)	chlorine gas from Paranthan Chemicals to be used at water treatment plants. Chlorine gas could be released to environment in the event of a road accident involving gas tanks. • Transporting hazardous chemicals from production facility as well as from port to users is a serious threat. • Accidental release chlorine gas at the treatment facility • Oil spills in roads could contaminate the close by water bodies and intake of water supply system • Unauthorised discharge of hazardous chemicals into water bodies	immersion ponds. Include Chorine Scrubbers, eye washing facilities and Safe gathering locations and PPE. **In the construction phase, take into account:** • No impacts **In the operational phase, consider:** • In selecting transport agencies to transport liquid chlorine gas, ensure that drivers have undergone a specific training on safe driving of gas tankers and minimize the risk of chlorine gas leaks in the event of an accident. • Mitigating risk of transport require involvement of several agencies such as Police, CEA, DMC/ Ministry of Disaster Management, and other state sector agencies controlling import and use of hazardous chemicals. Agree on a specific route and times to transport using road vehicles. Police to monitor the transport of chemicals to prevent deviation from agreed routes. • Conduct regular training to operators involve in handling chlorine gas to follow operation manuals. Most of the strategies to minimize the fuel spillages are beyond the NWSDB mandate. However, taking into consideration the impact of oil spills on water bodies used by NWSDB, the following could be promoted; • NWSDB could influence the regulating authorities to ensure the drivers using public roads for transporting fuel have a specific training on operating fuel tankers and handling oil spillages. NWSDB could initiate discussion with DMC, Police and Department of Motor Traffic to make these requirements mandatory. Engaging drivers without required capability to be made an offence. • Promote the use of railway for long distance transport of fuel. Most of the factories discharging hazardous chemicals are located within Western province and data base on coordinates of location, chemical used in production process and types of liquid waste discharged not available.

		• Collect information on factories, coordinates of location, chemical used and types liquid waste discharged. • Prepare exposure maps ad identify water bodies that could be exposed to chemical pollution. Conduct regular testing any possible pollution and take action to minimise the risk.

Table 3.2: At Drinking Water Storage (Accumulation), Flow Distribution systems and Brake pressure tanks

Hazard	Issues and Impact	Possible mitigation measures
Floods	• Polluted surface water flows into the accumulation, flow distribution and brake pressure chambers affecting the quality of water. • This surface water inundates valve chambers silting them up and hampering their operation. • They also rust metal and galvanized devices.	**In the design phase, take into account:** • Upstream drainage ditches to reduce runoff. • Include in the project information hydrological studies that allow the estimation of the rainfall characteristics in the region. • Plan to include drainage systems above the structures to prevent water seepages in to the soil. **In the construction phase, take into account:** • Raise the height of wall structure above the terrain level to avoid superficial waters (floods) to get into them. • Foresee inspection/cleaning points for all the hydraulic structures. • Fill-in any surrounding ditch to avoid water accumulation. **In the operational phase, consider:** • Clean up and silt removal from the structures. • Clean the surrounding area to avoid any potential water accumulation.
Landslides	• Total or partial destruction of the structures lying in the path of the landslide. • Accessories such as valves and unions get broken.	**In the design phase, take into account:** • Slopes stabilization and management. • Drainage ditches to avoid rain water infiltration in sloping terrains that can be therefore destabilize.

	• Loss of water due to leakage from damaged structures. Pollution of the water resources.	• Reforestation with native plant species to stabilize soils. **In the construction phase, take into account:** • Avoid building on vulnerable and landslide-prone areas**.** **In the operational phase, consider:** • Get familiar with the region to know alternative access routes to the system. Rehabilitate damaged structures.
Chemical hazards	Excess chlorine above the specified levels could be a health issue.	**In the design phase, take into account:** **In the construction phase, take into account:** **In the operational phase, consider:** • Regularly check the chlorine levels and make adjustment where necessary

Table 3.3: At Treatment and/or Filtering

Hazard	Issues and Impact	Possible mitigation measures
Floods	• Filters are blocked by sediments. • The filters stop working and so dirty water flows into the reservoirs. • Overflow from filtration units. • Water pollution • Treatment plant may dysfunction due to excessive turbidity.	**In the design phase, take into account:** • Include energy dissipaters to reduce/eliminate transport of solid materials. • Include by-pass pipes to make maintenance work easier. • Physical studies of the characteristics of turbid water in the rainy season to improve preliminary treatment. **In the construction phase, take into account:** • Raise the height of wall structure above the terrain level to avoid superficial waters (floods) to get into them. • Fill in any excavation to avoid water accumulation. **In the operational phase, consider:** • Frequent cleaning of filters in the rainy season.

		• Have replacement filters available when cleaning any silted filter. • Shutdown the treatment plant for a short peak time if production water quality standards cannot be met by the treatment plant. • Improve the treatment with use of better coagulant or coagulant aid.
Drought	• Treatment system and filters may get affected by Algae and other pollutants (taste -odor causing)	**In the design phase, take into account:** • Algae control systems (sonic methods and growth control measures) • Means of dosing Powdered Activated Carbon. **In the construction phase, take into account:** **In the operational phase, consider:** • Dosing of powdered activated carbon and increased chlorine dosing. • Checking. (THM) in final water.
Landslides	• Total or partial destruction of pre filters and slow sand filters structures. • The structure gets covered by soil material. • Transport of sediments and coarse materials. • Silting up of filtration beds. Changes in the physical and chemical characteristics of the water. • Damages to the treatment plant.	**In the design phase, take into account:** • Stabilization and management of the upstream watersheds. • Identify safe locations for pre-filters and slow filters. • Geo-dynamic studies to determine any changes in the region that could affect the systems, due to external factors such as rainfall. • Stabilization of slopes to reduce their instability. • (Semi)-impermeable ditches to deviate runoff water and decrease the infiltration that could destabilize the steep slopes. • Reforestation with native plants to stabilize soils. • Study structural safety of treatment plant and act to implement safety measures. **In the construction phase, take into account:**

		• Avoid building these filters or treatment plants on vulnerable spots exposed to landslides **In the operational phase, consider:** • Scheduled, periodic cleaning of filters and replacement of the bed filter.
Chemical hazards	• There could be chlorine gas leaks in Treatment Plants	**In the design phase, take into account:** • Include emergency design features such as Chlorine vent systems and emergency cylinder immersion ponds. Bottom ventilation facilities in chlorine rooms. Include Chorine Scrubbers, eye washing facilities and Safe gathering locations and PPE where applicable. **In the construction phase, take into account:** **In the operational phase, consider:** • Training on Chlorine Emergency management in a Chlorine Gas Leak. • Have an SOP for managing chemical hazards?

Table 3.4: Pump Stations/pump House

Hazard	Issues and Impact	Possible mitigation measures
Floods	• Surface waters flow into the installations and cause pollution. • Damages to electromechanical equipment. • Where water is pumped from a well, in case of a power failure, the resulting water hammer effect can cause a pipes collapse. • Damages to foundations. • Pumped water can be polluted by a raising contaminated groundwater.	**In the design phase, take into account:** • Carry out hydro-geological studies to suitably locate the well ensuring good flow rates. • Take preventive measures in case of power failures - parts, equipment, etc. - specially to prevent water hammer. • Construction of lateral drains. Equipment easy to disassemble. • Suitable anchoring facilities for the pumping equipment. • Plan suitable protection measures against erosion and an autonomous electricity generator.

	• Flood waters can dig out the structures and drag them away.	• Ensure floods do not affect electrical equipment. Verify, for water tanks, that the foundations where they are placed take into account the level of water tables; otherwise, the tanks could float if soil liquefaction takes place. • Pay attention to the relevant design High Flood Level in design of pump houses. **In the construction phase, take into account:** • Avoid working on collapsible soils. • The structures should lie above the ground to avoid runoff flow **In the operational phase, consider:** • Cleaning and maintenance using a pump. • Maintenance of the electromechanical equipment.
Drought	• During drought period water intakes may get contaminated with saline water. • Sometimes there could be issued of different insects during drought periods.	**In the design phase, take into account:** **In the construction phase, take into account:** **In the operational phase, consider:** • Regularly test the water quality. • If evidence of contamination with salt water detected, shutdown pumping stations.
Landslides	• Total or partial destruction of the pumping station. • The water tank gets buried. • The electromechanical equipment stops working. • Water gets polluted.	**In the design phase, take into account:** • Stabilization and management of the upstream watersheds. • Identification of safe locations for water tanks and the pumping station. • Geo-dynamic studies to determine any changes in the region that could affect the systems, due to external factors such as rainfall. • Stabilization of slopes to reduce their instability. • (Semi)-impermeable ditches to deviate runoff water and decrease the infiltration that could destabilize the steep slopes.

		• Reforestation with native plants to stabilize soils.
Chemical hazards	• Chlorine gas could be released to environment due to improper handling of gas cylinders. (In case the pump house is near the treatment plant).	**In the design phase, take into account:** **No action** **In the construction phase, take into account:** **No action** **In the operational phase, consider:** • Follow guideline indicated in the disaster preparedness response plan for water sector

Table 3.5: At Water Supply Reservoirs

Hazard	Issues and Impact	Possible mitigation measures
Landslides	• Total or partial destruction of the structures along the path of landslides. • Rupture of fittings such as valves. • Cracks in storage units. Loss of water though leakage.	**In the design phase, take into account:** • Carrying out geological studies to identify landslide-prone locations. • Build the facility at a less vulnerable location. • Reforestation with native plant species. Construction of retaining walls. • Verify, for buried reservoirs, that the foundations where they are placed take into account the level of water tables; otherwise, the tanks could float if soil liquefaction takes place. • Surface and sub-surface drainage to protect the foundations for reservoirs. • Plan for a perimeter wall. **In the construction phase, take into account:** • Construct drainage ditches. Install long enough spillways pipes to avoid erosion at the bottom of the tank. **In the operational phase, consider:** • Rehabilitation of the tank if the damages are not compromising the whole structure
Chemical hazards	There could be Chlorine Gas leak if the reservoir has an associated chlorine dosing facility.	**In the design phase, take into account:** • Inclusion of safety measures as mentioned above.

		In the construction phase, take into account: **In the operational phase, consider:** SOP for maintaining Chorine dosing facilities.

Table 3.6: At Supply Pipes and Transmission / Distribution Networks

Hazard	Issues and Impact	Possible mitigation measures
Floods	• Erosion affects the filling in the ditches due to poor compaction and low height of excavation, exposing pipes. • Deterioration of pipes due to soil subsidence. • Deterioration of control valves and purge/air chambers. • Loss of pipe alignment.	**In the design phase, take into account:** • Design distribution networks in circuits that permit the isolation of a sector that is threatened by a flood or overflowing ravine or river. • If there are hazardous sectors that cannot be avoided, plan as part of the investment a stock of spare pipes and other fittings. • Stabilize the soil along the area of transmission line to enhance the resilience of the WSS.. • Specify in the technical specifications a minimum depth of 0.70 m (Standard) and subsequent filling up. • Specify the compaction level on the filling work for supply and distribution lines. **In the construction phase, take into account:** • Choose areas that are not flood-prone. Check for water leaks. **In the operational phase, consider:** • Fill up and compact any eroded area**.** • Routine inspection of Transmission/ distribution systems • Conduct exposure, vulnerability and risk assessment as described in Chapter 2 of the report and identify distribution system located in high risk areas.

		• Fill and compact any area show sign of erosion as per technical specifications. Construct drain, ditches to divert rainfall to ravines.
Drought	• Obstructions due to decreased flow, hence reducing the minimum speed required to prevent sedimentation. • Water shortage or scarcity create social instabilities. • May lead to spread of diseases due to stagnant water in pipe lines and empty pipe conditions.	**In the design phase, take into account:** • Assure a minimum water flow to avoid sedimentation in the pipes. • If required identify more water sources. The basket strainer in a wet chamber needs to be placed 0.10 m above the bottom to facilitate sedimentation. • Include purge valves at low points in supply and distribution pipelines. **In the construction phase, take into account:** • Comply with the project's technical specifications. • Check for possible interconnection points with other networks or systems. **In the operational phase, consider:** • Make sure water flows continuously along all the sectors of the supply line or distribution network. • Mark on network layouts the connection points to alternate supply systems in emergency situations. • Increase the checks on residual Chlorine levels.
Landslides	• Pollution of transported water. Rupture of pipes thus interrupting water supply. • Interruption of flow due to the presence of sediments and other materials in pipes and other network elements. • Burial of pipes. • Pipe network sectors/Transmission pipelines could be dragged away.	**In the design phase, take into account:** • Identify, by means of geological studies, critical, landslide-prone areas. • Locate the supply line along more stable areas. • Use polyethylene pipes or pipes with flexible joints to span areas affected by landslides and provide the necessary protection. • Construction of retaining walls. • Use risk maps to define the location of networks. • Include in lines and networks that run along ditches on steep slopes

		retaining systems such as concrete cubes or similar structures. • Upper slopes management. • Reforestation with native plants **In the construction phase, take into account:** • Move away from detected, unstable areas. • Change the route of the supply line to more stable areas **In the operational phase, consider:** • Bury the pipeline at a minimum depth of 0.70 m(Standard) which can be increased according to the severity of the hazard. • Upper slope management to prevent landslides. • Conduct a detail soil investigation to identify risk levels of specific distribution system • Implement a soil stabilization programme to improve the resilience of the system.
Chemical hazards	• There could be Chlorine leak hazards at Chlorine Boosting stations in the distribution system.	**In the design phase, take into account:** • Designing Chlorine booster stations to include safety features as mentioned above. • Chlorinator room to be located within the water supply scheme premises **In the construction phase, take into account** **In the operational phase, consider:** • Check the proper functioning of Chlorine Booster stations. • Have SOP for Chlorine Booster stations.

Chapter 4: Preparedness for Emergency Response Plan

4. 1. Introduction

This Preparedness for Emergency Response Plan (ERP), which was jointly developed by the PUSL and NWSDB, facilitates water utilities in the development of an Emergency Response Plan (ERP) in compliance with the National Water Supply Drainage Board Act, Public Utility Service Act, and Sri Lanka Disaster Management Act. The National Drinking Water Policy, which was ratified by the government of Sri Lanka in 2010, and revised in 2024 mandates that the NWSDB provide drinking water to the communities and meet related essential requirements, such as health, in an uninterrupted manner, regardless of the circumstances. The Policy underscores the necessity of focusing on disaster risk reduction and preparedness in order to ensure that the affected population has access to a sufficient supply of water in the event of floods, droughts, landslides, and man-made disasters. In order to guarantee NWSDB clients' uninterrupted services, section 9 of the Policy has recommended the implementation of the following strategies.

- Establishing or adopting accepted standards to maintain continuous supply of basic water services to affected population even during disasters;
- Identified the need to promote institutional development and building the capacity of staff at all levels to manage the disaster efficiently and effectively.
- Develop mechanisms for effective donor coordination and optimum utilization of donor funds.
- Establish a separate fund for disaster preparedness to cover production and delivery costs of emergency drinking water supplies since disaster may also disrupt the revenue collection process.

Consequently, an essential instrument for the uninterrupted delivery of service is the ERP system that encompasses the strategies, resources, plans, and procedures of the NWSDB utility to prepare for and respond to an incident, whether natural or man-made, that poses a threat to life, property, or the environment. The ERP is primarily composed of procedures and protocols that must be activated to respond to a variety of hazards, including localized to large-scale floods, droughts, landslides, and chemical hazards, as well as system contamination.

The ERP may encompass the following: the establishment of an institutional response structure, the recall of personnel on vacation, and the notification of external agencies, including the Disaster Management Centre, Police, Fire Department, and first responders such as the Tri Forces. Additionally, personnel (position-based) emergency roles and responsibilities may be implemented. Additionally, it is imperative to promptly commence the documentation of expenditures, decisions, and actions taken in response to an incident. This documentation is crucial for the purpose of justifying incident costs and potentially requesting reimbursement after the incident has been resolved.
The primary guidance document for the compilation of ERP was the Institutional Disaster Management Plan guidelines issued by the Disaster Management Centre.

The ERP mainly address following components;

4.1.1. Risk Communication for Disaster Response

1. Disaster /Emergency response Officers/communication –Chain of command

Officers responsible to respond to disasters need to be identifies before disaster occur. Name of officers, their designation, responsibilities and contact details should be collected made available to management. The training completed and future training needs also shall be identified. Format for collection of information is given in appendix 16 as Table 4.1

2. Emergency Response Personnel/Communications- External Contact Information

This section addresses the other agencies to be contacted in the event of an emergency and essential details for the communication needs. Format for collection of information given in Appendix 15 as Table 4.2

3. Technical Agencies Responsible for warning generation

Number of technical agencies are responsible for formulation and dissemination of early warning messages. Name of the Technical agency, type of hazards warning generated by the agency, whom should be contacted to obtain further information must be available with the institute. Format for collection data given in Table 4.3 under Appendix 15

4.1.1.1: Other External Contacts

4. Customers

In the event of a disaster /emergency NWSDB will have to inform notify all customers in particular sensitive population, such as hospitals, schools, safety Centers, Industries, hotel, bulk purchasers etc. possibility of water interruption alternative arrangements made to supply water. Data and Information could be collected using format given as Table 4.4 in Appendix 15

5. Utility services

Services of utility providers will be required in the event of disaster to minimise the inconvenience to customers. Name of Utility service, contact personnel their telephone numbers need to be collected. In order to facilitate the process format developed and available in Appendix 15 as Table 4.5

6. Media

Media play a crucial role in keeping the people informed of disaster situation and dissemination of EW messages. They should be provided with latest information on impacts of disaster and progress of relief operations. Format for collection of information is given in Appendix 15 as table 4.6

7. Emergency Response Personnel and Communication Plan

Emergency communication plan will describe who is accountable for emergency response and operation procedures, who is responsible notifying Emergency Response Team, outside agencies what information will be released. Modes of communication and contingency measure for loss of communication is also included in the plan. The information could be collected using table 4.7 given in Appendix 15

8. Emergency Response Personnel, communication system and equipment

An inventory of communication equipment such as call center facilities, hot lines, emergency communication facilities, Mobile phones, satellite communication etc. personnel this equipment are

assigned to need to be prepared and available for decision makers. Format 4.8 in Appendix 15 could be used to prepare inventory and information of personnel involved

9. Emergency Response Personnel /communication and Personnel protection

Personal protection during Emergency response is need to be focused on the safe response to an emergency and covers Evacuation Procedures, Assembly Areas/Staff Accountability, Shelter Locations, and First Aid Equipment. Collect information using Table 4.9 in Appendix 15

10. Event Water System Evacuation Procedures

If the staff need to be evacuated to safe location there should be a plan to evacuate. Describe in detail the plan in Table 10 of Appendix 15

11. Assembly Area/ staff Accountability

Staff should be kept inform about the pending disaster situation and where they should assemble. Officer responsible for issuing instruction shall be identified and keep the staff informed. Table 4.11 could be used to keep the name of officer responsible and list of instructions to be given to the staff

12. Alternate Work & Shelter Locations for Employees

If the office has to be shifted to new location employees must know where the new location this information could be kept in a separate table for reference. Table 4.12 in Appendix 15 could be used.

4.1.2. Emergency Response Personnel/Communications Staff Training/Drills & capacity Building details.

Continuous capacity building of staff responsible for performing different response activities, communicating with response agencies, general public, media etc., are important requirement for successful operation of water supply systems ensuring uninterrupted water supply to all consumer**s**

13. Training required to enhance the capacity of emergency response personnel

Information on Frequency**,** of training, how training conducted, content of training who will attend the training course and proposed date to conduct the training programme. Table 4.13 in Appendix 15 could be used

14. Scheduled drills

Information on schedule drills, description of drills who will be attending and dates planned to held the drills are given in Table 4.14 of Appendix 15

15. Safety material

Detail types of safety material and where those are located given in table 4.15 in Appendix 15

4.1.3. Emergency Response System (Scheme) Description

Scheme Overview:
Population Served:

Each GND/Wards Served:

Managed by:

(Description of system, noting source types, bulk purchase, various pressure gradients, etc.)

Property Protection

Procedures for protecting and securing water system facilities, equipment, and vital records are also crucial for the uninterrupted water supply service during disaster/emergencies.

Protection and Security of Facilities, Equipment, and Vital Records

EXAMPLE: Facilities: Security cards are required for all access to buildings, etc… Maps: Vital Records (describe) are located in Director's office locked file with copies backed up on secure drive. Restricted areas (chemical rooms, electrical closets, etc.) may only be accessed by authorized personnel

Primary Components of the schemes

It is important to identify and mapped out all the components that are necessary to maintain effective operation. The Department defines effective operation as the capacity of a system to meet the average daily demand, while also ensuring that the volume and pressure are sufficient, where applicable, and that the potable water quality standards are met. The main item could be wells, Intakes treatment plants, Storage & Distribution system - Tanks, primary mains and pumping stations, Chemical Handling Facilities, chemical storage tanks, other key facilities, available water supply interconnections, purchases, and sales (specially during drought the price of sales), seasonal sources/backup sources/unapproved sources Information /data could be collected using table 4.16- table 4.25 given in Appendix15.

4.1.4. Water System Contingencies & Priorities

Water Usage

In order to ensure the efficient operation of our water supply during an emergency, this section prioritises the most effective use of resources and establishes water utilisation within service area. The chart below outlines the priority of each use, evaluation of the amount of water required, and the method of sustaining the use when using high, medium, or low. Information to be collected and kept in tables4.26- Table 29 in Appendix 15

Resource Inventory

4. 1.5. Physical Plant Resources

The purpose of this section is to provide a concise overview of the inventory of available resources, including generators, equipment, and supplies, that are either on-site or readily accessible off-site (e.g., a neighboring water system). Additionally, this section furnishes contact information for purveyors who offer emergency services, parts, equipment, and chemicals.

AUXILIARY POWER SOURCES

The auxiliary power capabilities listed in tables 4.30- 4.31 provide adequate auxiliary power to sustain primary components to ensure satisfactory treatment and delivery of drinking water.
Information on Auxiliary fuel storage, chemical supplies, spare part and service supplies to be collected in the form given as Tables 4.32- 4.37 in Appendix 15.

4. 1.6. Documentation/Guidance

Documents that establish the daily operational protocols, such as routine operation and management procedures and operational monitoring requirements, are listed in this section. In the event of an emergency, the individual who has been designated should be capable of executing the requisite procedures to guarantee the continuity of operations. Information on Manuals, report and plans, user advisories and Public Notices and distribution methods could be recorded in Table 4.38- Table 40. In Appendix 15

4.2. Emergency Situation Vulnerability and Risk Assessment

The chapter's risk assessment elucidates the comprehensive decision-making process by identifying the overall risk associated with the potable water supply of NWSDB. However, vulnerability and risk assessment during the specific emergency is also considered to be fundamental for the specific purpose of ERP, as it enhances the effectiveness of ERP.

The scale of the event and the associated impact, specifically on Power Outages, Major Distribution System Failure, Major Source Supply Failure, Major Treatment System Failure, Automated Control Failure (capacity of manual operations), and Internal and External Chemical Accidents, should be addressed in conjunction with emergency incidents such as flood, drought, landslides, and chemical hazards. The following applicable components should be addressed in light of the emergency situation, with respect to the aforementioned impacts due to hazards.

- Sources
- Treatment System
- Pumping System
- Transmission/Distribution System

- Personnel
- Power Supply
- Materials and Supplies
- Communications

The security and safety of the water supply infrastructure will be compromised if the details of the vulnerability and risk assessment of the water supply schemes and affiliated infrastructures are published to the general public. However, the results must be the foundation of the ERP. The information provided in the Chapter and annexure regarding the vulnerability, exposure, and risk of water supply schemes, treatment plants, and power houses can be utilised to ascertain the level of risk associated with each infrastructure. If location-based risk information is necessary, the methodology outlined in the chapter can be implemented.

4.3. Emergency Response

4.3.1. Major Steps for Emergency Response

The objectives of emergency response and management are to:

- Evaluate the emergency situation,
- Take necessary steps to protect public health while the emergency is being evaluated
- Confirm the emergency,
- Remediate the water system, if necessary,
- Return the system to safe, normal operation as soon as possible.

The response to a disaster/emergency must be promptly managed in order to achieve these objectives. A variety of steps, actions, and decision factors are involved in disaster/emergency response and management. The most critical information in this chapter is the comprehension of these critical components and the process of moving from one decision point to the next in order to accomplish these goals. The following is a concise summary of the primary components of disaster/emergency response:

Step 1: Determine whether a catastrophe or emergency is "possible," implement the necessary preliminary response measures to safeguard the public health and infrastructure of water supply schemes, and then advance to Step 2.

Hazard	Decision making on Possible disaster/emergency	Responsibility
Flood	Collect information disseminated from Meteorological Department/Irrigation Department/ Sri Lanka Land Development cooperation, Disaster Management Centre (DMC), Mahaweli Authority Sri Lanka (dg@mahaweligov.lk), Department of Agrarian Development (info@agrariandept.gov.lk), Etc.,	Person in charge of EW function at ERU - Level 4
	Monitor localized rainfall and wind visually and provide information to DGM/ERU	Level 1 OIC WSS
	Analyze all data/information collected on weather forecasting and review past experience of the drinking water supply infrastructure	DGM/ERU

	(Sources, Treatment System, Pumping System, Transmission/Distribution System etc.) assess the level risk Risk information to be disseminated to Officers at Level 1, 2 and 3.	
		DGM/ERU
Drought	Drought is a slow onset hazard and information on rainfall at local level, water levels of rivers, tanks, boreholes where intakes are established to be collected from local office of ID, Mahaweli Authority, DAD and disseminated to DGM/ERU	Level 1 - OIC Water Supply Scheme
	Analyze all information on weather forecasting and water management collected from relevant agencies, (Information disseminated from Meteorological Department/Irrigation Department/ Sri Lanka Mahaweli Authority, Disaster Management Centre, Department of Agrarian Development (DAD), (info@agrariandept.gov.lk),Natural resource Management Centre (NRMC) http//www.doa.gov.lk/nrmc/en/, International Water Management Institute IWMI- (http:/www.iwmi.cgiar.org) Etc., review past experience of the drinking water supply at highly affected WSS and determine the risk level. Designate information to officers at provincial, regional and local level.	DGM/ERU
	Maintain communication continuously with ID, MASL, DAD and IWM	DGM/ERU
Landslide	Regularly visit locations where critical structures located within landslide high risk zones and report any changes.	OIC WSS
	Study the information available on weather forecasting and landslide field indicators, review past experience of the landslide prone areas with respective to the critical infrastructure and information from OIC/WSS. Assess the risk and inform OIC/WSS, AE and AGM (Information disseminated from Meteorological Department/National Building Research Organization, Disaster Management Centre Etc.	DGM/ERU
Chemical Hazards	Study the information available on internal and external chemical hazards with respect to the critical infrastructure. (Information disseminated from Central Environment Authority Disaster Management Centre, Police Stations close to WSS, Divisional Secretary of the area Etc.	Person in charge of EW function at Level 4

Step 2.

Determine the credibility of a "possible" disaster/emergency by consulting with other DMC, hazard-specific technical agencies, the Department of Health, and other relevant agencies. If it is "credible," notify the

relevant agencies and the public, implement the appropriate response measures to safeguard public health and water supply schemes and infrastructure, and then proceed to Step 3.

Hazard	Decision making credible disaster/emergency	Responsibility
Flood	Consult Meteorological Department/Irrigation Department/ Sri Lanka Land Development cooperation, Disaster Management Centre (DMC), Ministry of Health Etc.	DGM/ERU
Drought	Study the seasonal weather forecast issued by Meteorological Department, International Water Management Institute and the rainfall in catchment areas to determine the impact on water supply.	Person in charge of EW function at Level 4
	Continuously monitor water levels at the intake (River, reservoir, tank etc.) and report to regional, provincial and national level authorities.	OIC WSS
Landslide	Consult Meteorological Department/National Building Research Organization, Disaster Management Centre Etc.	DGM/ERU
Chemical Hazards	Consult Central Environment Authority, Disaster Management Centre Etc., Police Media Unit, and Divisional Secretary of the area chemical hazard reported.	DGM/ERU

Step 3: Confirm a "credible" threat, which results in a "confirmed hazard incident." Activate the response plan and other response actions to safeguard public health and water supply schemes, and then proceed to Step 4.

Hazard	Decision making credible disaster/emergency	Responsibility
Flood	Evaluate all information received, identify infrastructure exposed to floods and WSS that could be affected by flood.	DGM/ERU
	Disseminate information to provincial (level 3, regional (level 2) and local (level 1) to activate the response plan	DGM/ERU
Drought	The drought is a slow onset hazard and develop over a long period of time. Continuously evaluate information collected and determine what WSS will be affected. The risk assessment report provides information on highly and moderately exposed WSS.	DGM/ERU DGM/ERU
	Disseminate information to provincial (level 3, regional (level 2) and local (level 1) to activate the response plan.	
Landslide	NBRO issue LS early warning in three stages; alert, warning and evacuation. WSS identified in the study as highly and moderately exposed to be more vigilant. In the event LS threat is imminent implement the LS Response plan.	OIC/WSS

Chemical Hazards	Identify the location of hazard and infrastructure that could be affected. Disseminate information to provincial (level 3, regional (level 2) and local (level 1) to activate the response plan.	DGM/ERU

Step 4 involves the remediation of the water system.
Step 5 involves the restoration of the water system to its normal, secure operation (recovery).
In order to determine the safety of drinking water, it is essential to obtain and analyses samples from the drinking water supply.

Answering the following important questions will cover all aspects of ERP while preparing the ERP for national to regional level layers of NWSDB.

- Who will respond?
- What level of personal protection do responders need in order to protect their safety?
- To whom call for emergency/disaster support and advocacy?
- When and where should samples be collected?
- Who will make disaster/emergency response decisions?
- When/ How/ whom conduct the damage and loss assessment
- Who and how will manage remediation and recovery activities?

4.3.2. Hazard Specific Plan

4.3.2.1. Flood Response

Flood Types

Riverine - Periodic overbank flow of rivers and streams.

Flash Flood - Quickly rising small streams after heavy rain.

Urban Flood - Overflow of storm sewer system usually due to poor drainage following heavy rain.

Coastal Flood - Flooding along coastal areas associated with severe storms, cyclone or other events.

Floods are responsible for a significant number of disaster emergencies in the drinking water supply sector of the country, and numerous regions are susceptible to flooding due to excessive rainfall. The infrastructure of the drinking water system, including wells, intakes, and treatment facilities, may be affected by flood waters that contain contaminants that are transported by surface waters or saturated soil. Bacteria, viruses, protozoa, or petroleum products from fuel spills in the vicinity may constitute contaminants. These types of contamination may pose a threat to public health. Even if the wellhead has not been flooded, water sources such as shallow wells located near a river or flood area that are used to supply potable water may be at an elevated risk. Appendix 2.9, 2.10, Table 2.16 contains information regarding the flood hazard, level of exposure, of the potable water supply elements.

Before the Flood

Keep flood Water Out

Item	Activity	Officer responsible
01	Sand bag, if possible, around structures and at building entrances.	OIC/WSS

Secure Water and Chemical Storage Tanks / Safeguard Chemical Supplies

Item	Activity	Officer responsible
01	Chemical supplies (hypochlorite, fluoride, corrosion control additives, etc.) and chemical solution tanks should be removed from areas of imminent flooding and stored in a secure location. However, if chemical solution tanks cannot be removed, raise the tank above the expected maximum flood height and secure the tank to reduce the chance of flotation or overturning.	OIC/WSS
02	Water storage tanks should be completely filled with water to be ballasted against flotation.	OIC/WSS
03	Pressurized chlorine (i.e., chlorine gas) cylinders should be removed from areas of imminent flooding if at all possible.	OIC/WSS
04	If the containers must remain in a flood warning area, they should be disconnected from any piping, closed, and process piping closed and secured.	OIC/WSS
05	Any open-ended joints should be capped or blinded. A one-ton chlorine container will float if empty or near empty. Securing the chlorine containers against flotation will be needed to resist the buoyant forces of "empty" containers	OIC/WSS

Surface Water Intake Preparation

Item	Activity	Officer responsible
06	Sand bag, if possible, around structures and at building entrances.	OIC/WSS
07	During a flood event, debris often increases within associated surface water bodies. Surface water intakes are at risk of becoming damaged or blocked. Ensure water storage tanks are filled to capacity and make provisions for temporary intakes in case the intake requires flushing or is completely blocked.	OIC/WTP
08	Intake structures and water treatment plants along rivers may be subject to damage from debris. If possible, remove the intake structure, such as barriers to prevent salt water intrusion, filters to prevent entry of small particles, any water pumps installed during drought period etc., before the flood.	OIC/WTP RE

Groundwater Intakes (Tube Wells/Shallow wells) Preparation

Item	Activity	Officer responsible
09	Ensure that the land surrounding the well is sloped away so that surface water does not flow towards the well. If re-grading around the well casing is required be sure that the casing terminates appropriately. Well casings must extend appropriately. Additionally, consider extending the casing above the 100-year flood level or alternatively sealing the top of the casing and extending the vent above the 100-year flood level.	RE
10	Consider protecting the area over the water line between the well and the treatment facility with sand bags. Procure sand bags required to protect the area before floods.	RE
11	Ensure that the integrity of the surface seal outside the casing is maintained and in good shape.	RE
12	Check that there has been no settling of the soil or that no cavity has developed around the outside of the well casing where surface water would be able to flow down to the aquifer.	RE
13	The well must have a tight-fitting waterproof cap. Many wells have unsealed caps or sanitary seals with vent holes. Some wells require vents for proper operation. If the well is not used for the duration of the flood event the vent holes should be plugged.	
14	To further reduce risk, carefully wrap the cap and well casing with durable sheet plastic and duct tape to form as tight a seal as possible.	RE
15	Sand bags can be placed around the well to protect the well from debris. When sealing the well cap and protecting the well, remember that any sealing material used will need to be removed in order to allow future servicing of the well	RE
16	For pumps at risk of becoming flooded, shut off the power just prior to credible level of flood.	OIC/WTP
17	Standby wells should be sealed as much as possible to avoid impact to the water source	RE
18	In addition, an abandoned well is an environmental liability and should be permanently decommissioned to ensure it will not act as a source of groundwater pollution now or in the future. Flood waters entering an abandoned well can contaminate an active well and the associated aquifer. If there is not enough time to do this now, it should be a priority after the flood; measures should be taken to temporarily seal the well from flood waters using sheet plastic and duct tape.	RE

Secure Electrical Assets

Item	Activity	Officer responsible
19	Remove generators and motors not in use to a safe location and make preparations for quick removal of those in service. It is recommended that generators and motors be equipped to accommodate quick removal with disconnect fittings rather than conventional pigtails.	RE

20	If flood waters are anticipated to inundate areas where electronic controls are housed, shutdown system components, programmable controllers, computers, and other field instruments. Shutdown any backup uninterruptible power supply (UPS) systems also because the UPS could maintain sufficient current to the equipment to destroy the instrumentation package when inundated by the flood waters.	OIC/WTP

Secure Other Assets

Item	**Activity**	Officer responsible
21	Move mobile equipment to higher ground, identified in advance as a preparedness measure, to prevent damaged by flood waters or debris.	OIC/WSS RE

Sampling and Disinfection Preparations

Item	**Activity**	Officer responsible
22	Maintain an adequate supply of coliform bottles to support sampling of the varying components of the system for at least a week. .	Testing lab

Customer Notification

Item	**Activity**	Officer responsible
23	In order to ensure the public water system is prepared to issue the notice as soon as possible, a Precautionary preparedness need to be taken including public awareness prior to the flood event occur. However, it is essential to issue customer notification on the status of the drinking water supply together with precautionary measures to ensure the safety of the consumers.	DGM/ERU DGM Provincial RE OIC/WSS
24	Contact officers from National Relief Services Center at divisional level to identify location of safe centers established and quantity of water required. Commence supply of water using water bowsers. Keep records of water supplied and the cost.	OIC/WSS

After the Flood

Item	Activity	Officer responsible
25	Once the flooding has subsided, responsible officers of the water supply schemes need to consult chemists or responsible officers to obtain the information on disinfection of the water system, sampling requirements	OIC/WSS
26	If suspect on fuel contamination with the flood situation in the water source, do not run the system, as the fuel contamination could spread throughout the treatment and distribution system, potentially damaging various components of the water system infrastructure. Wait for the conformation that water source is safe and free of contamination.	OIC/WTP
27	Take action to recover cost of water supply from relevant agencies.	OIC/WSS RE

4.3.2.2. Drought response

Drought could be categorized in to several types;

Meteorological drought - Prolonged period with less than average precipitation. Meteorological drought usually precedes the other kinds of droughts.

Agricultural drought - That affect crop production. Rainfall, soil condition and erosion are contributing factors.

Hydrological drought - When water storages, surface and underground, fall below statistical average.

Socioeconomic drought - Associated with supply & demand of some economic goods and also associated with reduced hydroelectric power generation.

Drought is a slow onset disaster and there is no clear demarcation of pre-disaster, during and post disaster phases. Inadequacy of sufficient water at the source usually providing water, is the main impact of drought on water supply sector. Contamination of water source due to salinity intrusion and algae formation experienced during drought are contributing factors. A deficit of rainfall below the annual average causes' dry spells and a prolonged deficit could trigger drought conditions. Droughts have resulted in significant economic, environmental, and social impacts causing damages and losses in agriculture, energy, food security, and water supply sectors. Drought exposure data indicates that 102 water intakes in 21 districts are highly exposed to drought and 255 intakes in 22 districts are moderately exposed**.** Appendix 2.11, 2.12, 2.13

Before Drought

Item	Activity	Officer responsible
01	Establish a drought monitoring cell under the Emergency Response Unit of NWSDB and continuously monitor the development of drought condition.	DGM/ERU
02	Disseminate warning messages to officers responsible at Provincial, Regional and WSS level.	DGM/ERU (An officer could be nominated to coordinate with EW agencies to collect information
03	Assess the number of consumers needing bowser during drought period and agree with suppliers of water bowsers and tanks to mobilize with short notice	OIC/WSS
04	Estimate additional funds required to provide water to affected customers and inform Regional (AE), Provincial (AGM) and, National level (DGM/ERU) authorities.	OIC/WSS

Surface Water Intake Preparation

Item	Activity	Officer responsible
05	Demand for surface water from other sector, agriculture and power generation will increase during prolong drought condition. Coordinate with ID, MASL and Provincial Irrigation Dept. and CEB for effective water resource management during drought.	DGM/ERU
06	In some water bodies formation of algae during drought is experienced which could clogged screen and pumps at water intakes. Action needs to be taken to remove algae near the intakes. Ensure that sufficient water treatment materials are available.	OICWSS and AE
07	Low precipitation in catchment areas and reduction of water release from major reservoirs and tanks result in saltwater intrusion along major rivers in western and southern provinces. Prepare sand bags to construct sand barriers to prevent salt water intrusion.	OIC/WSS AE

Groundwater Intakes (Tube Wells/Shallow wells) Preparation

Item	Activity	Officer responsible
08	Identify boreholes available to be used during drought period. Assess the condition of wells and if needed attend to repairs and maintain all the boreholes/wells in advance.	AE
09	Test water to ensure that water conforms to WHO standards. If needed arrange to treat water before distribution.	AE
10	Assess maximum quantity of water that could be drawn from the well without contamination. Establish facilities to install suitable pumps if needed to pump water to bowsers and mobile water tanks.	AE

Sampling and Disinfection Preparations

Item	Activity	Officer responsible
11	Maintain an adequate supply of sampling bottles to support regular sampling of water at the intakes to determine the level of contamination due to salt water intrusion and algae formation. Daily sampling may be needed in some instances.	AGM Regional level

Customer Notification

Item	Activity	Officer responsible
12	Ensure the public water system is prepared to issue the notice as soon as possible as a precautionary preparedness need before drought. (Issue of boil water directive decided case by case.)	AGM Regional level
13	Develop guidelines to improve public awareness on the expected drought situation and customer responsibility to minimize water wastages and not to use water for non-essential purposes such as washing vehicles, watering plants etc. Use public address system to disseminate the messages to customers	OIC/WSS AE
14	It is essential to issue customer notification on the status of the drinking water supply (sometimes water supplied with compromised quality) and possibility of limiting supply.	OIC/WSS AE

During and After Drought

Item	Activity	Officer responsible
15	Continue to test water samples near the water intake and if salt water intrusion is imminent, construct a temporary sand barrier to prevent entry of salt water in to water supply system.	Testing Lab
16	Assess the water available at the intake and limit the time of supply through pipe system.	AE
17	Keep the customers aware of the situation and times of water supply including warning to limit water to household use only during drought.	OIC/WSS and AE
18	Keep records of water supplied, number of customers served and cost of supply on daily basis. Requests to supply water to people outside WSS during drought to be entertained provided cost of supply is reimbursed.	OIC/WSS
19	Identify water supply schemes severely affected by drought and assess number of customers who should be provided with water using water bowsers/tankers and number of portable water tanks needed. Provide information to AGM, AE and OIC/WSS	DGM/ERU
20	Mobilize water bowsers and transport water from previously identified water source and distribute to customers severely affected. Continue water supply until situation improves. Inspect all water bowsers and tank to ensure that those are free of corrosion and equipped with lids to cover. Wash with clean water and disinfect all tanks, water pumps and hoses before use. Test water at the source and distribution points to ensure quality conform to the standard.	OIC/WSS

21	If available, establish movable Desalination plants in severely impacted areas where other water supply sources are not available, to supply water during drought period only.	DGM/ERU
22	Collect daily rainfall data and information on developing monsoonal rain from Meteorological Department and changes of river levels and reservoirs/tanks from Irrigation Department. Disseminate information to AGM at Provincial level AE at Regional level OIC /WSS.	DGM/ERU
23	Keep AGM Provinces, AE Divisional level and OIC WSS the informed on latest weather forecast	DGM/ERU
24	Release hired vehicles and equipment when the water supply system could be operational.	WSS

4.3.2.3. Landslide Response

Landslides have caused disaster situation in water supply schemes located in landslide prone districts of the country. Water intakes, treatment plants, transmission and distribution lines are impacted by landslide caused by heavy rainfall. Risk assessment study conducted covering water supply schemes in landslide prone 10 districts, highlighted infrastructure such as water intakes, treatment plants and storage facilities highly and moderately exposed to landslides. The annexure contains information regarding the landslide hazard, exposure water supply elements

Before Landslide

Item	Activity	Officer responsible
01	Nominate an officer at each level to receive and disseminate EW messages	DGM, AGM, AE and OIC/WSS
02	Register the Name and contact numbers of the officer at level 4 with EOC/DMC	DGM
03	Check the communication system is established to receive early w messages and other communication from DMC/NBRO/DoM	DGM/ERU
04	Check the communication system is established to disseminate the early warning massages to provincial, district and local level units.	-Do-
05	Record the EW messages (watch, alert and evacuation) on landslides send by DMC	Officer nominated at Level 4 –national level
06	Confirm the receipt of relevant EW messages and record the time and mode of communication.	Do -
07	Verify the messages from NBRO.	Do -
08	Inform DGM at ERU and record the time and mode of communication	Do -
09	Disseminate the EW messages to OIC/WSS, OIC/WTP. Record the time & mode of communication.	Do-
10	If officer not contactable inform the next senior officer.	Do -
11	Confirm receipt of messages. Record the time and mode of communication.	OIC/WSS, OIC/WTP
12	Verify from local NBRO office and the GN in the area latest information on LS.	OIC WSS, OIC/WTP
	Preparedness	
13	Attend the Monsoon forum organized by the DoM.	DGM/ERU
	Analyze exposure maps and identify infrastructure exposed to landslides.	DGM or senior officer

14	Enter into agreement with suppliers of vehicles and equipment to be mobilized immediately in the event of an emergency.	AE
15	Prepare/update list of agencies with names and telephone numbers at WSS level who are involved with response activities (GN, DS, DDMCU, NDRSC, NBRO regional Centre, Police, Armed Forces)	OIC/WSS, OIC/WTP
16	Cut and clean drains to divert rainwater from the areas exposed to landslides.	OIC/WTP
17	Request required funds to procure any emergency response material and hire equipment.	RE
18	Alert suppliers of impending landslides and have machinery and equipment ready to mobilize within a short notice.	AE
19	Assist NDRSC officer at DS level to identify locations free of LS to establish safe centers.	OIC/WSS
20	Contact NDRSC officer to find out number of safe centers established, number of people that would be accommodated.	OIC/WSS
21	Request Area Engineer to nominate Team to assess damages and losses in the water supply sector due to landslides	OIC/WSS
22	Appoint a team to conduct damage and loss assessment and request Training division of NWSDB to conduct a refresher training for all team members.	AGM Provincial level
23	Continue to check the EW messages from DMC and NBRO.	EW officer at level 4
24	Disseminate Landslide warning messages received from DMC to OIC/WSS, OIC/WTP	-do-
25	Keep on observing and recording changes in surrounding areas (Slanting tress, appearing of water spouts, loose rocks, boulders on the slope, cracks appearing).	OIC/WSS, OIC/WTP

During and After Landslide

Item	**Activity**	Officer responsible
01	Nominate an officer at each level to receive and disseminate EW messages.	DGM, AGM, AE and OIC/WSS
02	Register the Name and contact numbers of the officer at level 4 with EOC/DMC	DGM
03	Check the communication system is established to receive early warning messages and other communication from DMC/NBRO/DoM	DGM/ERU
04	Check the communication system is established to disseminate the early warning massages to provincial, district and local level units.	-Do-
05	Record the EW messages (watch, alert and evacuation) on landslides send by DMC	Officer nominated at Level 4 –national level
06	Confirm the receipt of relevant EW messages and record the time and mode of communication	Do -
07	Verify the messages from NBRO	Do -
08	Inform DGM at ERU and record the time and mode of communication	Do -
09	Disseminate the EW messages to OIC/WSS, OIC/WTP. Record the time & mode of communication	Do-
10	If officer not contactable inform the next senior officer.	Do -
11	Confirm receipt of messages. Record the time and mode of communication.	OIC/WSS, OIC/WTP

12	Verify from local NBRO office and the GN in the area latest information on LS.	OIC WSS, OIC/WTP
13	Continuously monitor the distribution lines of the WSS exposed to landslide.	OIC/WSS
14	Inspect exposed locations frequently to identify any signs of land movement such as slanting trees, appearance of water spouts, cracks on the surface etc.	OIC/WSS
15	Install extensometer with warning devises at locations where large diameter water transmission lines are exposed to landslides	RE
16	Restore water supply to consumers who are returning.	
14	Acknowledge the all-clear messages received from DMC	EW Officer at level 4
15	Inform DGM and disseminate the message to Provincial regional and local units	-do-
16	Support the team of officers appointed to conduct the damage and loss assessment	OIC/WSS OIC/WTP
17	Release all hired vehicles and equipment when the emergency phase is over.	AE

4.3.2.4. Chemical Hazard

Chemical hazards are due to technological failure or human error and warning could be issued only after the incident. Individual establishment using various types of chemicals in the production process, issue warning on accidental release of hazardous chemical/oil to air or water bodies after the accidents to the nearest police station or Divisional Secretary office. Rivers and streams could be polluted by chemical/ fuel while transporting on road or rail. There are several National agencies regulating and monitoring the use of chemicals in the production processes. DMC is legally empowered to disseminate early warning on identified disasters. However, as there is no mechanism to receive warning messages from producers or bulk user of chemicals, incidents of oil spillage to water bodies could be checked with the nearest Police Station, DMC officer at District level, Divisional Secretary office or from Grama Niladhari. Water intakes of WSS established near rivers/streams are exposed to chemical/oil pollution.

Before Chemical Hazard

Item	**Activity**	**Person responsible**
	Transport of chlorine gas from manufacturing plants to users	
01	Ensure that the vehicle hired to transport Chlorine gas are approved by relevant authority. Vehicle should be fitted with GPS facility to monitor the transport route, Driver must be provided with Personnel Protective Equipment such as • Self-contained breathing apparatus. • Positive pressure (blower) hose mask. • Industrial canister type mask. Protective clothing	DGM/ERU
02	Ensure that an emergency kit has been provided to drivers of vehicle transporting hazardous chemical to be used at any time.	DGM/ERU
03	Ensure that the driver is trained to handle an emergency situation.	DGM/ERU
04	Agree on transport route, and provide contact details of Police station on the route. Keep DMC inform of process.	DGM/ERU

06	Monitor the transport of chlorine gas from production unit to the NWSDB premises. Owner of the vehicle has to provide facilities to monitor the movement of vehicle.	DGM
07	**Chlorine gas at Storage facility**	
08	Provide Personnel Protective Equipment to all employers handling chlorine gas and ensure the use of same.	OIC/WTP
09	Check to ensure the retuning empty cylinders do not contain residual chlorine with damaged valves.	OIC/WTP
10	Ensure that Chlorine leakage detectors fitted in all the required places, directions and are in operation.	OIC/WTP
11	Check the Caustic solution scrubber through suction blower is in operation to handle chlorine leakages.	OIC/WTP
12	Leakage should always be attended by using Personnel Protective equipment	OIC/WTP
	Road accidents involving Fuel bowsers, fertilizer lorries	
13	Request Inspector General of Police to inform all police stations to inform NWSDB to provide information of any major accidents involving any vehicles transporting fuel and fertilizer which may pollute nearby water bodies.	DGM/ERU
14	Establish contacts with Police Communication division at Mirihana to get above information.	DGM/ERU
15	Negotiate with MEPA to get oil adsorption papers, pollutant diversion material to respond quickly in the event of oil spill polluting water bodies.	DGM/ERU
16	Disseminate information on accidents to AGM Provincial/ RE and OIC/WSS, DMC	DGM/ERU
17	Get the required material and mobilise first responders from NAVY, Air force and Army to help NWSDB to clean water body and prevent pollutants entry into intakes.	DGM/ERU/AGM / RE OIC/WSS
	Training	
18	Train staff handling all types of chemicals including chorine gas on 1st aid	AGM Provincial
19	Conduct in house Mock drills are on quarterly basis and Off sight mock drill once a year on handling chlorine gas, oil spills and other chemicals.	AGM/Provincial

After Chemical Hazard

Item	**Activity**	**Person responsible**
	Personal Precautions	
20	Evacuate the area immediately. Isolate the hazard area. Keep out unnecessary and unprotected personnel. Vapour or gas may accumulate in hazardous amounts in low-lying areas especially inside confined spaces, if ventilation is not sufficient. Remove or isolate incompatible materials as well as other hazardous materials.	OIC/WSS
	Methods for Containment and Clean-up Chlorine gas:	
21	**Small spills or leaks:** Stop or reduce leak if safe to do so. Ventilate the area to prevent the gas from accumulating, especially in confined spaces. **Moderate level of or leaks:**	OIC/WSS

	Stop or reduce leak if safe to do so. Ventilate the area to prevent the gas from accumulating, especially in confined spaces. If possible, turn leaking container to a position so that gas escapes rather than liquefied gas. Knock down gas with fog or fine water spray. Do not direct water at spill or source.	
22	Continuously report the action taken to reduce impacts and manage the spill. If needed request additional material and human resources from RE	OIC
	In the event of large spill	DGM/ERU
23	Isolate the area Inform the nearest AE, AGM, DGM/ERU, Police, DMC and Divisional secretary, and nearest hospital. Do not allow any person in to the contaminated area without protective gear.	OIC/WSS OIC/WTP
24	Request assistance from 1st responders.	OIC/WSS OIC/WTP
	Oil Spills in water bodies	
25	Monitor the spread of oil on the water surface. Test water near intake in the event water spillage spread to intake.	OIC/WTP
26	If the oil contamination is confirmed, Report the situation to AE, AGM and DGM/ERU and stop pumping water until the situation improves.	OIC/WTP

4.3.3. Emergency Recording

Keeping records of each hazard is also essential and following format is recommended for the purpose

Emergency situation: _____

Recovery Time Assessment: _____

Number of consumers affected: _____

Duration of supply Interuption: ----------

Quantity of water supplied using other means during interruption period: ----------

Action Plan:

- **Assessment:**
- **Immediate Actions**:
- **Notifications:**
- **Follow up:**
- **Review:**

4.3.4. Disaster Damage, loss and need assessment

Assessments estimate, first, the short-term government interventions required to initiate recovery and, second, the financial requirements to achieve overall post-disaster recovery, reconstruction and disaster risk management or reduction.

4.3.4.1 Preliminary Damage Assessment

Preliminary Damage Assessment important after an emergency to quickly assess the extent of the damage and the need for repair, replacement or recovery of facilities. Results of preliminary assessment will help to find out funds required to attend to urgent repairs before people are resettled at the original places of residence. Preliminary assessment Form in Table 4.41 given in the Appendix 16 could be used to enter the assessment results

4.3.4.2. Damage, Loss and need Assessment

Large scale disaster where human losses and infrastructure damages are very high, relief operations are conducted with the assistance of national and international level response organizations. Immediately after response phase damage and loss assessment need to be conducted to assess the recovery needs and cost of recovery. Methodology for conducting damage and loss assessment and need assessment was developed jointly by the United Nations, World Bank and European Union. After a catastrophic disaster event government could seek the support of UN agencies, WB and EU to provide Technical and Financial assistance to conduct the PDNA. The need assessment will provide information on the rehabilitation/reconstruction cost of damaged infrastructure. Infrastructure need to be rehabilitated /reconstructed and the cost. Build Back Better principal could be incorporated in rehabilitating damage infrastructure of water supply system. (Reference: Damage, Loss and Needs Assessment Guidance Notes, Volume A and PDNA GUIDELINES VOLUME B, Water and sanitation issued by GFDRR)

Water Supply systems

The water supply system can be grouped into two types, namely:

a. The **urban commercial water supply managed by NWSDB,** where water is supplied to houses, commercial and industrial users, offices etc. and fees are charged for the amount of water consumed per month;
b. The **rural water supply systems** or the community-based organizations scheme which include single wells (open production wells); closed well with hand pump; closed well with storage and electric water pump and tap stands.

The commercial water supply system is composed of the different types of infrastructure such as water intakes, storage facilities, treatment plants and distribution systems with pumping stations, pipelines for distribution, control facilities, and various equipment used to supply water to households and other commercial or industrial entities.

Damages

In the water supply sector, damages are cost of: a) repair of partially damaged assets and/or b) replacement of totally destroyed assets and infrastructure. For the commercial water supply, damages can happen under each of the various sub-systems such as:

- Water intake
- Treatment plant and storage
- Water distribution system

The types of assets in the commercial water sector are generally:

- Structures such as office buildings, storage buildings, water testing laboratories, etc.
- Office equipment and machinery like computers, control systems, air conditioners, etc.
- Vehicles, tools, and stock materials and supplies, chlorine and fuel storage facilities etc.

Rural water supply damages can occur when the wells, hand pumps and their support structures are totally or partially destroyed due to inundations and contaminations, among others.

Damages in the water supply system could occur at the time of, or shortly after the disaster although some damages may become obvious only after a longer period. Damages are measured in physical terms for which the monetary repair or replacement value is subsequently estimated.

Losses

Losses are the values of foregone revenues or income due to the change in economic flows (income and expenditures) during the period of recovery and reconstruction following the disaster. They are the current value of goods and services that were not and/or will not be produced over a time span due to the disaster until full recovery is attained.

Losses in the commercial water supply will include the following:

- Losses in revenues due to non-provision of water to the users during the period of rehabilitation and reconstruction.
- In the event of power cut, the added cost of the use of generator.
- Foregone sales in water due to the decline in demand from consumers that have been affected by the disaster. This can happen if a large number of households are destroyed and/or there is massive out migration after a disaster.
- Higher cost of chemicals and other inputs in ensuring the quality of drinking water.
- Higher water distribution costs when using tanker trucks to reach users.
- Higher cost due to more intensive operation of systems to compensate for water losses in damaged system components.
- Cost of cleaning of treatment plants and other sub-systems after flooding and removal of debris.

For the rural water supply where there are usually no fees charged to users, there are no losses in revenues. However, the government may incur losses if it will undertake cleaning operations and other activities to ensure that the water source is potable. Rural water supply systems are those used by the people that are not reached by the commercial water supply firms.

It should be noted, however, that manufacturers of bottled water and other similar industries are not under this sector. They should be considered under the commerce and industry sector.

In conducting a post-disaster damage and loss assessment in the water supply sector, the following steps are normally followed for every disaster-affected district.

Steps in Undertaking Post-Disaster Damage and Loss Assessment for Water Supply Sector

To have a complete assessment of the water supply sector, the NWSDB as the agency with expertise in the sector, is recommended to assess both the commercial and rural water supply systems.

Step 1. Collect and/or validate the baseline data for each of the disaster-affected District

Baseline information must be compiled and validated at the national, provincial or district levels before the field assessment prior to the occurrence of disaster. The table below must be completed to be used for the baseline information in the online system for the commercial water system.

Commercial water system

The commercial water supply is characterized by a system of processes (from water collection, treatment and distribution) where water is delivered by pipes to individual households for a certain amount of fee paid to the NWSDB.

Table 4.42. Baseline information on assets of NWSDB in the District

Name of District				
Number of consumers/Employees	**Male**		**Female**	
Types of Water Users	**Number of Clients**	**Daily Demand**	**Annual Demand**	**Rate**
		Liters/day	**Liters/Year**	**LKR/Liter**
Residential				
Commercial				
Industrial				
Others				
Total				
Average Income Per Year (LKR)				
Assets				
Components	**Average Replacement Cost (LKR)**		**Average Repair Cost (LKR)**	
Water Intake				
Structures				
Equipment				
Others				
Treatment Plant				
Structures				
Equipment				
Others				

Water Distribution		
Structures		
Equipment		
Others		
Main Office		
Structures		
Equipment		
Inventories		
Vehicles		
Others		

Notes in filling out Table 4.42:

- *It is possible that a water supply system located in one area serves the needs of other Districts or even the whole Province. In such a case, the assets of the water supply system may be located in several Districts. The assessment team must be cautious about the possibility of double counting.*
- *For the structures and equipment, the table can be expanded to include all the types of structures or buildings and equipment, especially those that are vital in the operation of the water supply system.*
- *Year 1 and Year 2 refer to the estimated water demand after the current year.*

Rural water supply system

Rural water supply system is generally composed of different types of water supply from open wells; closed wells with hand pumps; to common tap stands. In Sri Lanka, rural water supply is public in nature. The NWSDB should assist to conduct damage and loss assessment in Rural Water Supply system as they have required expertise.

Table 4.43. Baseline information on rural water supply in a district

Name of District:			
Type of Water Supply	**Number of Users (Families)**	**Average Replacement Cost (LKR)**	**Average Repair Cost (LKR)**
Type 1: Open production well			
Type 2: Closed well with hand pump			
Type 3: Closed well with storage and electric water pump and tap stands			
Type 4: Others			

Step 2. Estimate damages and losses

With the baseline information, field assessment should be undertaken in the affected districts after a disaster.

- ✓ **Step 2.1. Estimate the damages and losses to commercial water supply facilities in a district**

During the field visit, assessment team from NWSDB could explain the PDNA concept and methodology and request the officers at field level to fill the form. If DMC has developed an online system to assess the damages and losses only the authorized office from NWSDB should input the information provided by NWDB at the WSS level.

The value of damages and losses of the commercial water supply sector in the district can be summarized in the following table which will appear in the online reporting system.

Table 4.44. Damages and losses to NWSDB commercial water supply system

District				
Number of Clients Affected	**Residential**	**Commercial**	**Industrial**	**Others**
Number of Employees	**Male**		**Female**	
Damages				
Assets	**Number of Totally Destroyed Assets**	**Number of Partially Damaged Assets**	**Total Value of Damages (LKR)**	
Water Intake				
Structures				
Equipment				
Others				
Treatment Plant				
Structures				
Equipment				
Others				
Water Distribution				
Structures				
Equipment				
Others				
Main Office				
Structures				
Equipment				
Inventories				
Vehicles				
Others				
TOTAL				

Losses						
	Average Income per Year	Reduction in Income (%)		Total Losses (LKR/Year)		Total Loses (LKR)
	LKR/Year	Year 1	Year 2	Year 1	Year2	
Production Losses						
Other Losses						
Cleaning up of debris						
Higher operating costs						
Other unexpected expenses						
TOTAL						

Notes on Table 3:

- *Only the number of totally destroyed and partially damaged assets are required in the above table. If DMC has established an online system, it will automatically estimate the value of damages based on the 'Average Replacement Cost' and 'Average Repair Cost' from the baseline information table.*

✓ **Step 2.2. Estimate the damages and losses to rural water supply facilities in a district**

Rural water supply systems which are relatively simple should be assessed separately by the NSWDB. The following table will be used in the online system.

Table 4.45. Damages and losses in the rural water supply sector

District				
Damages				
Type of Water Supply	**Number of**			**Total Damages (LKR)**
	Families Affected	**Totally Destroyed Assets**	**Partially Damaged Assets**	
Type 1				
Type 2				
Type 3				
Type 4				
TOTAL				
Losses				
Type of Water Supply	**Types of Losses**			**Total Losses (LKR)**
	Cleaning up of debris	**Higher operating costs**	**Other unexpected expenses**	
Type 1				
Type 2				
Type 3				
Type 4				
TOTAL				

Notes in filling out Table 4:

- *Only the number of affected assets is required in the table. If the Online system is in place, it will automatically estimate the damages based on the replacement and repairs costs in the baseline information.*
- *For the estimated losses, the local authorities or communities in charge of the rural water supply system must be consulted.*

Step 2.3. Summarize the damages and losses in the sector in a District

Based on assessment of the commercial and rural water supply facilities, the damages and losses in monetary terms will be summarized in the following table.

Table 4.46. Summary of damages and losses in a district

Name of District:					
Number of Affected Clients of Commercial Water Supply	**Residential**	**Commercial**	**Industrial**	**Others**	**Total**
Number of Affected Rural Water Supply Users (Families)	**Type 1**	**Type 2**	**Type 3**	**Type 4**	**Total**
Type of Water Supply System	**Damages and Losses (LKR)**				**Total (LKR)**
	Year 1		**Year 2**		
	Damages	**Losses**	**Losses**		
Commercial Water Supply					
Rural Water Supply					
Type 1					
Type 2					
Type 3					
Type 4					
Total					
GRAND TOTAL					

Step 2.4. Summarize damages and losses in the water supply sector in the Province

The total estimated effects of the disaster in the province can be summarized by combining the values of damages and losses in the districts. The following table is used in the online system.

Table 4.47. Summary of damages and losses in the province

Name of Province:					
Number of Affected Clients of Commercial Water Supply	**Residential**	**Commercial**	**Industrial**	**Others**	**Total**
Number of Affected Rural Water Supply Users (Families)	**Type 1**	**Type 2**	**Type 3**	**Type 4**	**Total**
Type of Water Supply System NWSDB	**Damages and Losses (LKR)**				**Total (LKR)**
	Year 1			**Year 2**	
	Damages	**Losses**		**Losses**	
Commercial Water Supply					
District 1					

District N				
Total - Commercial Water Supply				
Rural Water Supply				
District 1				
District N				
Total - Rural Water Supply				
GRAND TOTAL				

Step 2.5. Summarize damages and losses in the water supply sector nationwide

A nationwide summary of the assessment will be created enumerating the damages and losses of the sector at each province. The data in the national summary should include all the information gathered by the various teams that assessed the different disaster-affected districts. The following table will be used for the national summary.

Table 4.4.8. Summary of damages and losses nationwide

Number of Affected Clients of Commercial Water Supply	**Residential**	**Commercial**	**Industrial**	**Others**	**Total**
Number of Affected Rural Water Supply Users (Families)	**Type 1**	**Type 2**	**Type 3**	**Type 4**	**Total**

Type of Water Supply System	**Damages and Losses (LKR)**			**Total (LKR)**
	Year 1		**Year 2**	
	Damages	**Losses**	**Losses**	
NWSDB Commercial Water Supply				
Province 1				
Province N				
Total - Commercial Water Supply				
Rural Water Supply				
Province 1				
Province N				
Total - Rural Water Supply				
GRAND TOTAL				

Chapter 5: Recovery and Reconstruction Plan

5.1. Background

Every community recognizes the significance of secure and consistent potable water. Disaster recovery planning is a critical component of water system management. The water supply infrastructures are susceptible to natural and man-made hazards, which result in minor to severe scale damages. Consequently, the water supply to the communities or customers is disrupted. The effects of each catastrophe are distinct and affect various components of a water system. Floods can result in widespread bacterial contamination and damage to infrastructures and distribution systems. Landslides can also cause damage to infrastructures and distribution systems. Droughts will affect the quality and quantity of water, which will disrupt the water supply. Chemical hazards will also affect the quality of water. The shared characteristic is that each emergency may jeopardize the capacity to provide safe and dependable potable water. Disaster recovery planning for water sector is a process that assists National Water Supply Drainage Board (NWSDB) in enhancing long-term resilience by integrating disaster risk reduction measures into the recovery process. This is achieved by adhering to the Build Back Better principles, which include the restoration and improvement of facilities as appropriate during the recovery and reconstruction phases.

5.2. Disaster Recovery Plan

Recovery can be accomplished by providing water supply services to the disaster-affected population at the same rates or tariffs, in the same quantity and quality, as they were prior to the disaster. Furthermore, the process of reconstruction is not complete until all physical assets that were devastated have been rebuilt and are operational, with the goal of achieving disaster risk reduction and resilience standards. The restoration of institutional governance in relation to system operation is a unique concern that must be addressed. Recovery needs encompass the financing requirements necessary to cover the higher-than-average cost of operating water supply and sanitation systems from the time of the catastrophe until complete recovery and reconstruction take place. This may involve the transient expense of distributing water via tanker trucks, the provision of bottled water, the special costs of wastewater removal and disposal during the emergency, and the increased cost of obtaining water from unaffected alternative sources during reconstruction. The government may be obligated to introduce or increase subsidies until reconstruction is complete in order to guarantee the financial stability of the utility.

Key steps of Recovery and Reconstruction is illustrated as follows for drinking water sector with additional requirements for disaster recovery

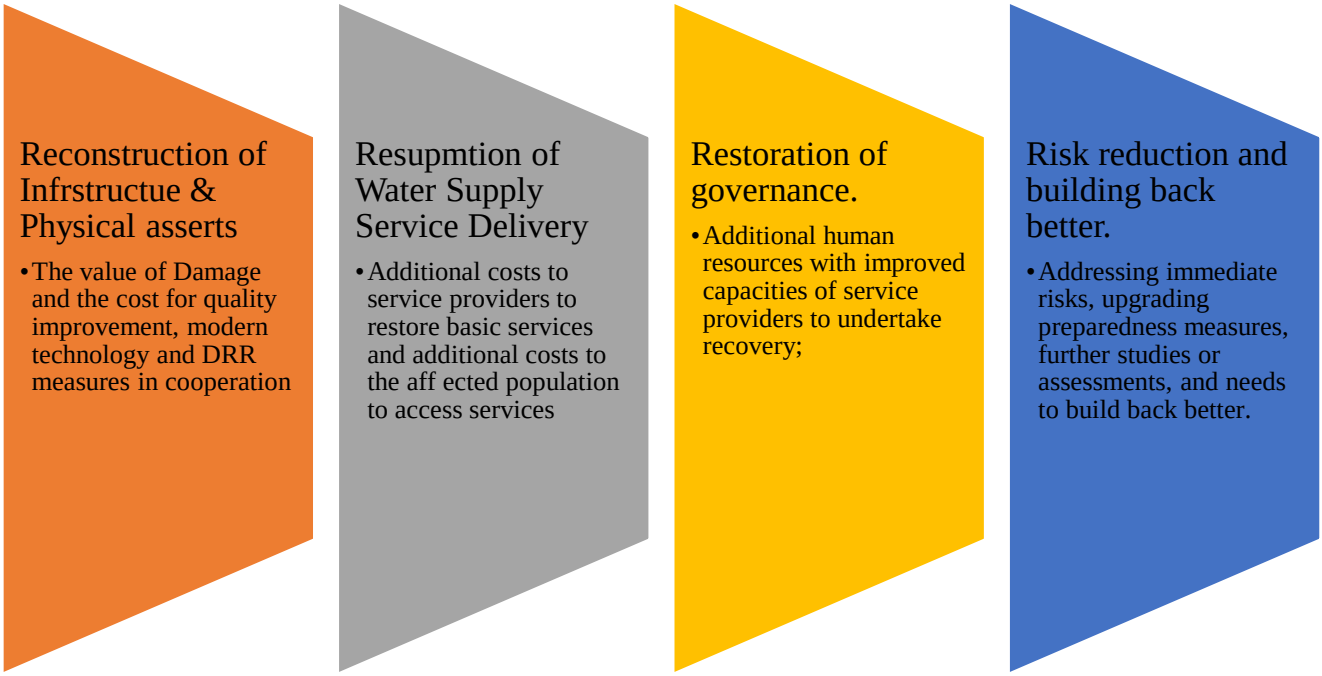

Figure 5.1. Key steps of Recovery and Reconstruction

5.2.1. Recovery for Small disaster Event

The DRF will fluctuate in accordance with the magnitude of the disaster, as the requirements and procedures will be altered. In general, after carrying out damage estimation within the institution following its own method, the annual budget allocation for the rehabilitation vote of NWSDB could be utilized for small-scale annual disasters, and the implementation could be conducted in accordance with the standard rehabilitation and maintenance procedures of NWSDB.

5.2.2. Recovery for Catastrophic Events

It is imperative to have a comprehensive disaster recovery plan in place following a calamitous disaster event, as the damages cannot be repaired using the organization's own resources or, in some cases, the internal budget. However, it may be necessary to solicit assistance from external sources during the interim period following the catastrophic event. In these circumstances, it is necessary to adhere to the internationally recognized procedures and methods for the identification of recovery needs and the assessment of post-disaster damage.

The recovery plan could be prepared in collaboration with the DMC, as the water sector has been identified as the lifeline service sector. It is crucial to adhere to the Post Disaster Need Assessment, which includes a detailed damage and loss assessment of the sector. The DRP could then be formulated based on this assessment.

Given that it is impossible to plan during or immediately following a calamitous event, even pre-disaster recovery planning must be completed in advance of disasters. The entire staff must be informed of the recovery process, procedures, responsibilities, and funding mechanism well in advance.

5.3. Process of Disaster Recovery Planning

A disaster recovery plan (DRP) is a formalized, structured approach that specifies how an organization can restart operations efficiently following a disaster caused by natural or human intervention. The purpose of disaster recovery planning is to minimize the impact of disasters on Water Supply operation and provide water to consumers without or minimum interruption. Disaster Recovery planning could be in two stages.

Stage 1: Pre-Disaster recovery planning

Stage 2. Post disaster recovery planning

5.3.1. Pre-Disaster Recovery Planning (PrDRP)

PrDRP is an endeavor to enhance disaster recovery initiatives, planning, and outcomes by preparing for them prior to the occurrence of a disaster. The concepts of PrDRP are predicated on the idea that numerous beneficial aspects can be established prior to a disaster in order to enhance recovery outcomes and facilitate Post-Disaster Recovery Planning (PoDRP).

PrDRP would prevent or mitigate the hurried decisions that result from post-disaster exigencies and enable development of a more comprehensive and effective Disaster Recovery Plan (DRP). It is a cyclical process that is continually enhanced by new information and experience of the situation. In addition, the process may involve the simultaneous execution of certain actions and steps, which enables the simultaneous execution of numerous PrDRP-related actions without the need to wait for the completion of certain previous steps.

Pre-disaster planning does not negate the necessity of post-disaster planning. Conversely, the pre-disaster planning process should be incorporated into the post-disaster recovery planning process. PrDRP guarantees that sufficient time and attention are allocated to the determination of critical recovery strategies and actions in the more difficult and demanding post-disaster conditions. PrDRP is also an effective method for integrating post-disaster lessons from previous disaster events into the PoDRP of future hazard events.

5.3.1.1. Pr-DRP in principle would include followings:

- **Designating and identifying the divisions, regional offices, and officials (Staff) who are responsible for the planning and implementation of recovery.**

  It is crucial to Identify the lead section or division within the institution in NWSDB, as well as the personnel within each agency who are designated to participate in various phases of Post Disaster Recovery Planning (PDRP), such as pre-disaster data management, Damage and loss data collection, and the production of Post Disaster Need Assessment (PDNA) and Disaster Recovery Framework (DRF). Conducting refresher training programme for those identified for conducting loss and damage assessment will facilitate the timely completion of post disaster assessment process.

- **Institutionalizing recovery and rehabilitation roles and responsibilities**. Incorporate recovery-related functions into the NWSDB policies and incorporate recovery responsibilities into the job descriptions of designated staff. Develop an intuitive organizational chart that includes the recovery process and/or generate an organizational chart for recovery planning and implementation.

Establish systems and procedures to facilitate the institutionalization of PrDRP and Post Disaster Recovery Planning (PoDRP) for specific infrastructure that are assigned to each division and regional office. This would entail the establishment of data management systems to acquire and update the baseline status of the respective assigned water supply infrastructure. These actions will reinforce the sense of ownership in the recovery process, and the designated staff will be more comfortable engaging in PodRP and implementation in the event of a disaster. This could be linked with the organization structure proposed under WSP for disaster response

- **Acquiring political commitment and validation**: The recovery's success is contingent upon political ownership at all levels. Sensitization and awareness-raising among identified key actors, as well as ongoing communication and dialogue, are essential components of pre-disaster recovery measures. The DGM responsible for emergency response actions or any other senior officer appointed to DRP should provide comprehensive briefing to the Minister and the Secretary under whose purview the subject of NWSDB pertains and convince them of the significance of the recovery framework and its implementation. They must be updated on a regular basis to ensure that they can inform the Cabinet of Ministers and the treasury, as well as to allocate the necessary resources for recovery.

- **Building capacity:** Evaluate the capabilities of the designated divisional and regional offices and personnel to manage disaster recovery, and develop or improve their capabilities. Financial systems are included in capacity building to expedite the recovery process. Training can be technical, such as the development of data management systems, including the design of databases, the identification of data sets, the frequency of updates, and the Post Disaster Need Assessment (PDNA) methodology, as well as the drafting of DRFs.

- In addition to **coordination and negotiations with stakeholders**, individuals involved in PDRP and implementation should also comprehend the role of communication, donor requirements, and the use of and management of recovery finance. Trainings can also serve as opportunities to establish baseline databases, establish pre-disaster data collection and updating mechanisms, and implement rapid data collection and assessment methodologies to expedite PDNAs, among other things.

- **Establish post-disaster procurement arrangements**: the development of recovery-related standards and protocols during the pre-disaster phase will expedite the recovery process, including data collection, assessments, prioritization, planning, and implementation. i.e., the establishment of common standards for reconstruction, the adaptation of standards to the local context, the reporting of changes and the related budgeting, monitoring, and evaluation, as well as the training of the appropriate personnel.

- **Training and enhancing the capacity of designated personnel**: • Recovery planning is designed to reconstruct the existing infrastructure to reduce risks, incorporate DRR measures to make it more resilient, and equip it with efficient technologies (through BBB measures) to better meet the needs of the people and ensure uninterrupted services are provided. The planning and implementing capacities of the key designated staff of the NWSDB will be enhanced by the implementation of properly planned training and capacity development.

- **Establishing a coordination system:** One of the primary strategies of DRP/PDNA is the establishment of common platforms for coordinated action within the various divisions' regional offices. This enables effective coordination with the primary disaster recovery framework, which is coordinated by the Disaster Management Centre.

- **Stakeholder engagement and validation**: It would be preferred to establish a validation team within the NWSDB.

- **Updating baseline data**: The absence of pre-established baseline data is a significant obstacle to the efficient conduct of a PDNA and the development of a sound DRF. In order to ensure that baseline data or the status of infrastructure prior to disasters is accessible, the designated division should have systems in place to collect and update it.

The following measures must be taken to ensure the effective and efficient implementation of the entire process when establishing the DRF within the NWSDB.

5. 3.1.2. Develop Capacity to Implement Disaster Assessments

- Determine the most suitable assessment tool for disaster scenarios in accordance with the NWSDB's specifications. Designate the divisions/sections or regional office that are responsible for the preparation and execution of post-disaster assessments in advance.
- Create training programs that replicate real-world conditions and offer examples of effective practices and lessons learnt in the context of assessments.
- Formulate rapid assessment methodologies to expedite PDNAs.
- Develop the pre-disaster (baseline) database (national and sectoral) to facilitate its rapid mobilization following the disaster.
- Develop recovery frameworks in advance of a disaster to enhance resilience.

5. 3.1.3. Prepare Recovery Frameworks Prior to a Disaster to Improve Resilience

- Define the vision and guiding principles of recovery processes.
- Clarify the roles and responsibilities of all potential of responsible officials in a recovery,
- Define pre-established coordination mechanisms.
- Share standards for reconstruction.
- Standardize reporting tools, whether they are related to budgeting or monitoring and evaluation.
- Define standards of eligibility of government assistance for the affected communities.
- Define sectoral standards for Building Back Better (BBB).

5. 3.1.4. Develop Predictable Financing Arrangements

- Prioritize the key policy objectives and identify in advance the post-disaster spending priorities.
- Build an aid-tracking mechanism that enables the lead agency to manage, disburse, and account for funds with local implementers.
- Consider disaster risk insurance mechanisms to increase the financial response capacity of national and subnational governments and secure cost-effective access to adequate funding for emergency response, reconstruction, and recovery.

5.3.2. Post Disaster Need Assessment and Full-Scale Recovery & Reconstruction

The NWSDB can decide to conduct a more comprehensive evaluation of damages, losses, and requirements in the afflicted sectors and geographical regions, contingent upon the severity of the disaster. Depending on the national context and the nature and size of the disaster, assessments can take on a variety of forms. In order to deploy qualified teams on the ground to conduct the assessment once the disaster strikes, it is crucial that NWSDB develop their capacity with regard to the various assessment methodologies prior to a disaster. The Post-Disaster Needs Assessment (PDNA) is a standardized methodology that was jointly developed by the EU, UN, and World Bank to assist governments in evaluating the damages, losses, and recovery requirements.

The DRF will establish realistic corresponding measures and available resources to implement the recovery in accordance with the requirements identified in a PDNA.

Major Steps in the PDNA is illustrated below Figure 5.2

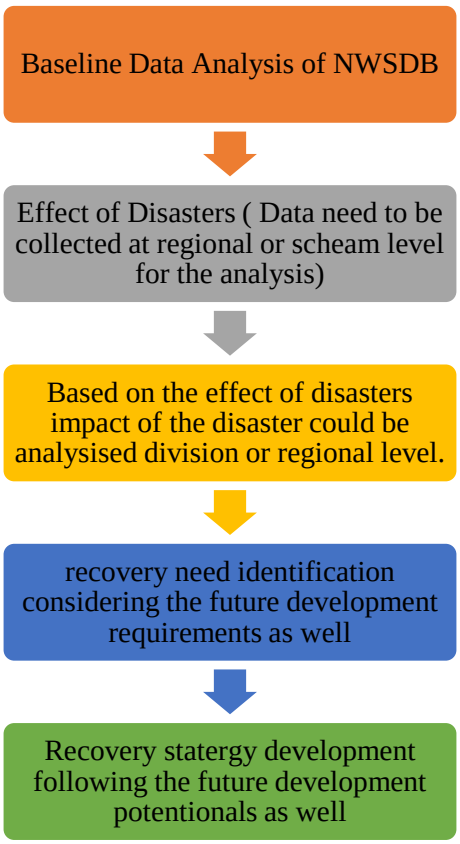

Figure 5.2. The five components of the PDNA methodology

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5.4. Resource mobilization and implementation of DRP

The mobilization of resources necessary for recovery is predicated on a well-crafted recovery strategy/DRF. Consequently, the recovery strategy/DRF that is developed during the PoDRP must either generate resource mobilization plans or revise and enhance the ones that were developed during the PrDRP. The NPD and the NBD will receive guidance and a strategy from the DRF to rebuild following the calamity. The PDNA Team should present the objectives and anticipated outcomes of the DRF's resource mobilization strategy, which should be subsequently approved by the government. Advocacy and communication should also be incorporated into the resource mobilization strategy to increase awareness among policy makers, potential donors, the media, and key population groups.

Depending on the circumstances, public funding may be prioritized for urgent recovery. DRF may contemplate donor assistance, such as the organization of donor conferences, to mobilize balance resources when internal national resources appear insufficient to support the recovery that is prioritized by DRF.

Chapter 6: Training Plan for Water Supply Sector related to Disaster Risk Management

Training Schedule for Drinking Water Supply Sector (NWSDB) related to Disaster risk Management

Module 1 - Introduction and Concept of Disaster Risk Reduction (DRR), Development in Drinking water supply sector including key concepts, frameworks and terminologies

Session 1.1 - Understanding and definition of hazards, risks, vulnerabilities, capacities and disasters

Content :

- Understanding and definition of hazards, risks, vulnerabilities, capacities and disasters
- Classification and categories of disasters
- Types of vulnerabilities
- Disaster and human misery
- Vulnerabilities and disaster risks
- Link between risks, vulnerability
- From relief to preparedness and mitigation
- Risk Reduction
- Question and Answer Session:

Methodology: Power Point Presentation, Open house discussion interactive session

Duration 60 minutes

Target Group WSP Team members

Session 1.2 - Drinking water sector Development and Disaster Management

Content :

- Development and Disaster Management
- Definition and Relationship
- Disaster – Development linkages
- Development, sustainable development, climate change and disasters
- Question and Answer Session

Methodology: - Power Point Presentation, Open house discussion interactive session

Duration - 60 minutes

Target Group : WSP Team members. Planning and Design Engineers, Sociologist.

Session : Session 1.3 - Overview of Disaster Context in Drinking water supply

Content :

- Overview of Disaster Context in Drinking water supply sector
- Recent major disaster events in and impact to drinking water supply sector
- Disasters caused by natural hazards and Human interventions
- Hazard proneness of drinking water supply sector – different hazards
- Risk Ranking and risk matrix for Drinking water supply sector
- Climate Change and Climate induced disasters – trends and impacts
- Question and Answer Session

Methodology: Power Point Presentation, Open house discussion interactive session

Duration 60 minutes

Target Group WSP Team members, Planning and Design Engineers.

Training Schedule for Drinking Water Supply Sector (NWSDB) related to Disaster risk Management

Module 2 - Mainstreaming DRR in development planning process with reference to drinking Water Supply Sector

Session 2.1 Mainstreaming DRR into Drinking Water Supply Sector Planning

Content:

- Mainstreaming DRR into Drinking water supply Sectoral Planning
- What is mainstreaming?
- Why mainstreaming is important?
- Multi-stakeholder involvement - why involvement of other stakeholders in planning and implementation should be prioritized and be a part of the planning process
- Development, sustainable development and disaster risk reduction
- Global initiatives, experiences and debates
- Sendai Framework for Disaster Risk Reduction and why and what activities are required for integration of DRR into drinking water supply sectoral developmental plans
- Why mainstreaming DRR in to development planning process is cost effective and how it will ensure sustainable development keeping in mind the increasing disaster risks in the national contexts
- Approaches for mainstreaming DRR in the developmental planning process in drinking water supply
- Guidelines for mainstreaming Disaster Risk Reduction in drinking water supply sector Planning
- Case study of a selected national flagship programme and how it can be utilized
- Tracking public investment on DRR: Case Studies from NWSDB
- Groups exercise to analyse risks, their ranking,
- Type of investment required for enhancing resilience and risk governance in Drinking water supply

Methodology: - Power Point presentation Open house discussion interactive session Plenary for presentation of group exercise

Duration -240 minutes

Target Group : WSP Team members, planning and Design Engineers.

Session 2.2 Mainstreaming DRR into Water supply sector development Plan

Content

- Impact of unplanned water supply development projects with unplanned urbanization & city Development
- Mainstreaming DRR in environment planning and city development plans and Water supply sector development: case studies and discussion

Methodology: Power Point presentation, Open house discussion, an interactive session Plenary for presentation of group exercise

Duration: 90 minutes

Target Group: WSP Team members, Planning and Design Engineers, Sociologists

Session 2.3 Issues related to women, children, elders, marginalized/Disadvantaged and underprivileged sections of the society, differently-able, youths in mainstreaming DRR in National and sub-national plans on Drinking water supply enhancement

Content

- Issues related to women, children, elders, marginalized/disadvantaged and underprivileged sections of the society, differently-able, youths in mainstreaming DRR in National and sub-national plans

Methodology: Power Point presentation Open house discussion interactive session Plenary for presentation of group exercise

Duration: 60 minutes

Target Group: WSP Team members, Planning and Design Engineers, Sociologists

Session 2.4: Climate Change and DRR – need for integration

Content :

- Climate Change and DRR – need for integration historical Risks, Future Threats" and follow-up discussion on the impact of climate change on communities living in Sri
- Integration of DRR and CCA and Mitigation into Development Planning
- Why and how • Ecosystem Based Adaptation – Rationale and Process
- Need for innovation, pilot projects and strategies for up scaling

Methodology: Power Point presentation Open house discussion interactive session Plenary for presentation of group exercise

Duration: 90 minutes

Target Group: WSP Team members, Planning and Design Engineers, Sociologists

Session 2.5: Incorporation of DRR and CCA into Sectoral Plans

Content:

- Incorporation of DRR and CCA into Sectoral Plans
- Linkage between National and provincial Climate Change Plan of Action and the DM Act, Policy and Plan
- Analyzing sectoral hazard and risk data and risk ranking
- Cost benefit ratio in terms of reduced per capita (unit) expenditure on response and recovery, deceased dependence on borrowings and subsidies and realization of planned targets
- Priority areas/sectors of integration
- Types of intervention for ensuring reduction in disaster loss, increasing resilience
- Group exercise on strategy for integrating DRR and CCA and mitigation into sectoral plans
- Group exercise to develop plans for f the sector

Methodology: - Power Point presentation Open house discussion interactive session Plenary for presentation of group exercise

Duration - 60 minutes

Target Group : WSP Team members, Planning and Design Engineers.

Training Schedule for Drinking Water Supply Sector (NWSDB) related to Disaster risk Management

Module 3 - Tools and Processes to mainstream DRR and CCA into developmental planning, financing, incentives and sustainability issues for mainstreaming

Session 3.1: Mainstreaming DRR in drinking water supply sector development planning: issues and challenges

Content -

- Mainstreaming DRR in drinking water supply sector development planning: issues and challenges-
- Mainstreaming DRR into drinking water supply sector national and sub-national planning national flagship programmes
- Group work for incorporating and mainstreaming issues and priorities of women, children, senior citizens, differently abled persons into drinking water supply sector sectoral plans

Methodoly - Power Point Presentation Open house discussion interactive session Plenary for Group Presentation

Duration 120 minutes

Target Group: WSP Team members, Planning and Design Engineers.

Session 3.2: Challenges in mainstreaming DRR in key Divisions at NWSDB

Content :

- Challenges in mainstreaming DRR in drinking water supply sector sectors-
- Instruments and incentives for mainstreaming DRR in drinking water supply sector development
- Developing partnerships and advocacy for mainstreaming DRR into drinking water supply sector
- Coordination and synergy across sector and levels, including the national and sub-national level for mainstreaming DRR -a panel discussion
- Initiatives and programmatic approaches for mainstreaming DRR – an in-depth analysis of selected national flagship programmes

Methodology : Panel discussions by 2 selected representatives from each group of exercise

Duration : 90 minutes

Target Group : WSP Team members, Planning and Design Engineers. Senior Chemists. Sociologists.

Session 3.3: Financing, strategic learning and action planning

Content:

- Financing, strategic learning and action planning
- Management Approach to DRR focusing on drinking water supply sector
- Financing options and budgetary allocations for mainstreaming DRR into drinking water supply sector
- Hazard specific or multi-hazard mitigation through developmental plans for specific ecosystem/location, communities, local governance and other institutions at different levels at drinking water supply section
- Hazard specific or multi-hazard prone mitigation plans specific ecosystem/location, communities, local governance and other institutions at different levels for (a) structural – roads, irrigation, flood embankments, landslide control walls, housing, plantation for soil stabilization, etc., bio-engineering interventions, etc.; and (b) non-structural – improvement in capacity building, training, incorporation DRR and climate change issues/challenges in education and health programme, advocacy, improved coordination
- Monitoring and evaluation as an exercise in strategic learning and action for mainstreaming DRR in drinking water supply sector development, including development of indicators for measuring outcomes
- 2 Group exercises

  (a) Exploring specific opportunities for DRR budget allocation for various Government schemes

  (b) Developing outcome indicators

Methodology: Plenary Session Group Presentation and summary of the presentation and its key learnings Plenary Session

Duration ; 90 minutes

Target Group:

Session 3.4: Tools to be used for the Exercise

Content;

- Tools to be used for field exercise – Group Exercise
- Detailing tools like Sectoral Checklists, mapping tools, etc. for integration of DRR/CCA into sectoral plans and schemes
- Group Exercises • Group Presentation

Methodology Power Point Presentation Open house discussion interactive session Plenary for presentation of group exercise

Duration: 90 Minutes

Target Group: WSP Team members, Planning and Design Engineers.

Session 3.5: Partnerships for mainstreaming DRR into drinking water Supply sector development

Content;

- Successful partnership between national agencies at various levels as well as between national and external development agencies.

Methodology: Power Point presentation Open house discussion interactive session Plenary for presentation of group exercise

Duration: 90 Minutes

Target Group: WSP Team members, Stakeholder Organizations, (Eg., CEA, DMC, Ministry of Industries.), Chemists, Sociologists.

Session 3.6: Group Exercise for Revision and final preparation of the suggested sector plans

Content;

- Group Exercise for Revision and final preparation of the Drinking water supply sector plans with brief methodology,
- Budgets, source of finance, monitoring indicators and linkages with existing (or proposed) schemes based on field experience Strategic action planning
- Preparation of road map for mainstreaming DRR
- Responsibility Sharing Matrix Role of different stakeholders for facilitating and improving upon the efforts to mainstream DRR into Drinking water supply sector planning

Methodology: Power Point presentation Open house discussion interactive session Plenary for presentation of group exercise

Duration: 90 Minutes

Target Group: WSP Team members, Planning and Design Sections of RSCs and Head Office

Training Schedule for Drinking Water Supply Sector (NWSDB) related to Disaster risk Management

Module 4. - Understand the post disaster Need Assessment and recovery planning

Session 4.1. Understand the Post Disaster Need Assessment

Content:

- Concepts and definition of Post Disaster need assessment
- Conceptual framework on Resilient Recovery
- Inter sector linkages
- Cross cutting issues

Methodology: - Power Point presentation Open house discussion interactive session

Duration - 60 minutes

Target Group : WSP Team members, planning and Design Engineers.

Session 4.2 Pre-disaster base line Data for NWSDB to conduct a PDNA efficiently

Content

- Overview of Pre-Disaster Data Sets (PDBD) focusing on NWSDB
- Why PDBD is required and how it will facilitate the Post Disaster Damage and Loss Assessment process.
- Present the Case study on developing a data set for NWSDB regarding the damage and loss assessment process.

Methodology: Power Point presentation, Group exercise based on the case study and Plenary for presentation of group exercise

Duration: 90 minutes

Target Group: WSP Team members, Planning and Design Engineers, Sociologists

Session 4.3 Post Disaster Need assessment focusing NWSDB

Content

- Introducing the case study.
- Estimating Disaster Lossless and Damages based on the case study Data sets developed during training session 4.2
- Introduction of formats for collection and assessing the losses and damages in the water sector
- How to assess the recovery needs based on the disaster damages assessed above.
- Building Back Better Concept and how to develop a disaster recovery plan
- How and from where to mobilize resources to implement recovery plan

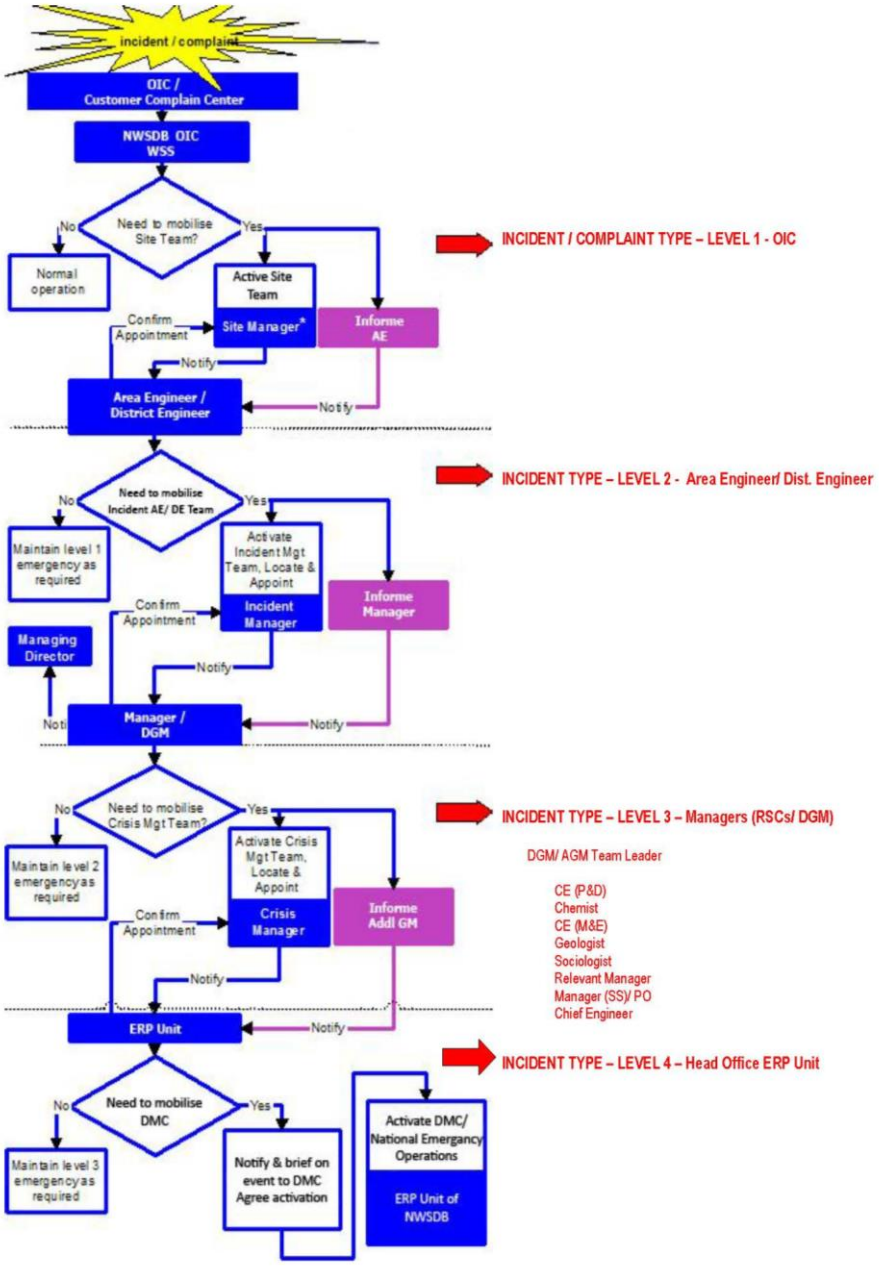
.

Methodology:	Power Point presentation. Hand on exercise on assessing the needs based on damages in water sector due to the disaster. Presentation, Open house discussion interactive session Plenary for presentation of group exercise
Duration:	90 minutes
Target Group:	WSP Team members, Planning and Design Engineers, Sociologists

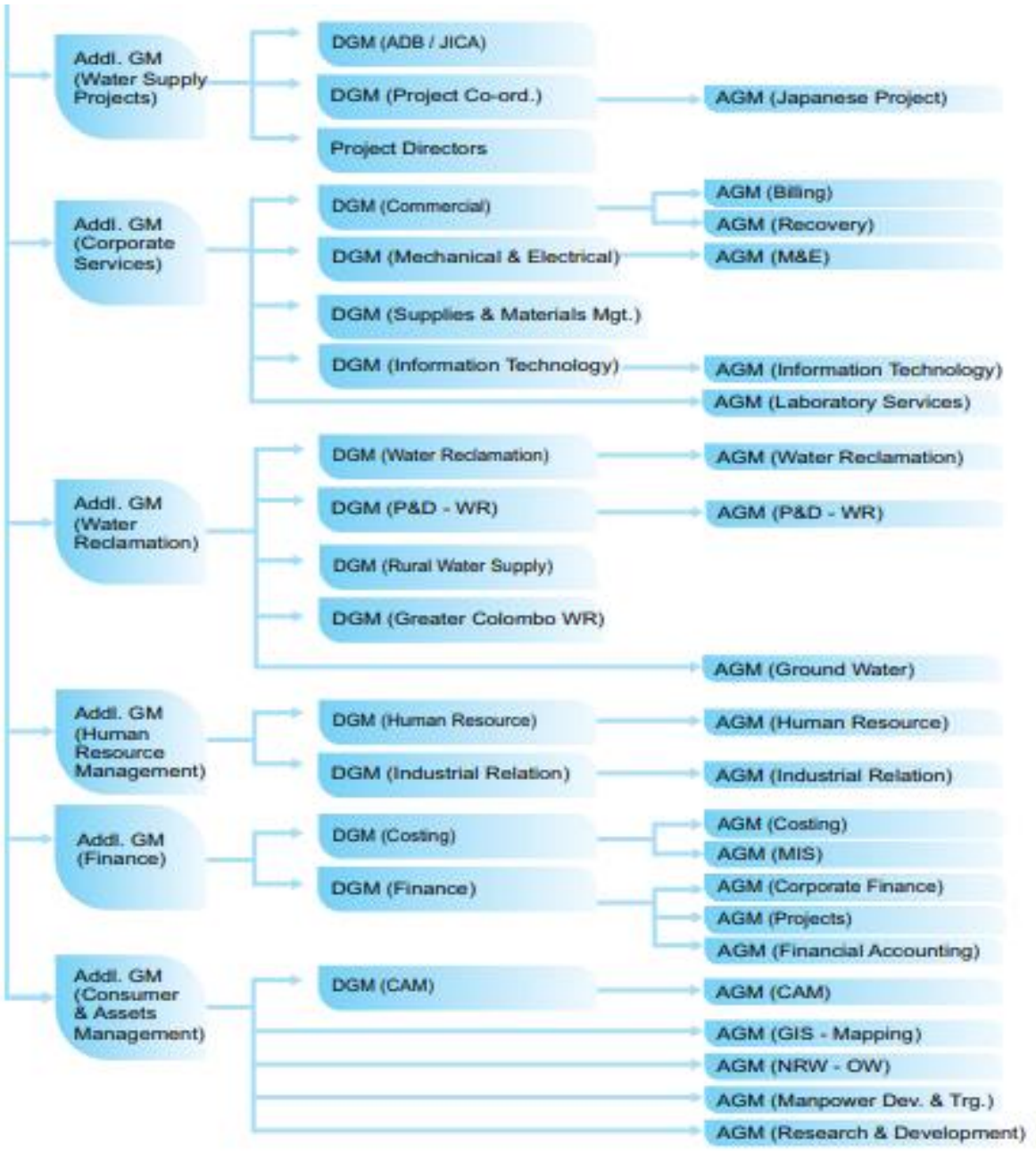
Module 5: Regional training Module

Based on the above four training module region training authorities to develop a training module to address the area specific training need of the regional staff considering the frequent disasters encountered and the resources available.

Appendices



Appendix 1.1: Organization structure and operation procedure for management of disaster as per WSP



Appendix 1.2: Organization structure of NWSDB

Appendix 2.3: The details of the element at risk considered for the study

Operational Regions	District	Water Sources			Treatment Plants			Water distribution lines
		Catchments	Tube wells/ Groundwater	Community Supply	Intakes	Chemical Building	Pump House	
Central	Kandy	Mahaweli River, Maha Oya, Deduru Oya 3	Dartry, Naranwita(2), Kuda oya bank(2), Rajapilla (two wells are located closer to each other)(2), Madadeniya(2), Alagoda(2), Ovissa(2), Dombagammana 14	No	Hanguran Oya, Raja ela (Ulapane Oya), New Peacock ela (Nayapana Ela), Pissellawa Oya (P*, Amunupura ela, Delwatta oya (Gampolawatta stream), Kokka oya, Ma Oya, Mahaweli Ganga, Nilambe oya, Mahaweli Ganga-Victoria Reservoir, Hantana estate stream 1&2, Kota Ganga, Rangala Oya, Kospothu Oya, Hulu Ganga, Dobagammana BH, Bologala BH, Alagoda BH, Galhinna*		Mahaweli Ganga (2)	Nawalapitiya, Gampola-Ulapane, Gampola, Datry, Gampolawatta, Doluwa, Marassana, Welamboda, Udu/Yatinuwara, Kandy South, Udu/Yatinuwara, Haragama, Kundasale, Hatana, Akurana, Alawathugoda, Pathadumbara, Ankumbura, Poojapitiya, Hedeniya, KMC, Pathadumbara, polgolla, Medadumbara, Galagedara, Kundasale, Ankumbura
	Mathale	Mahaweli River, Kala Oya	Udathenna(3), Alahera, Lenameeya	No	Mahaweli Ganga CEB channel, Elkaduwa 02 streams (collected to 01 tank), Sudu Ganga, Pussella stream (Gammaduwa oya), Mahaweli Ganga, Nalanda reservoir, Ibbankattuwa wewa		Sudu Ganga	Ukuwela, Udatenna, Matale, Pussella, Wilgamuwa, Naula, Dambulla New & Dambulla Old
	Nuwaraeliya	Kelani River, Mahaweli River	Nuwara Eliya	No	Kirindi Ela, Maskeliya oya (Mahaneluwa oya), Invery stream, Duke Nose Stream, Great Western stream, Nanu oya, Piti oya (Thagarmalai), Kaduru Oya, Kupane Oya (Weathersick), Dunsinan Fall, Kurudu Oya, Helboda Oya (Pussella Oya), Mul Oya			Kahawatta - Palmadulla, Maskeliya, Hatton(2), Talawakele, Kotagala, Ginigathhena, Ragala, Pundaluoya, Walapane, Pussellawa, Rikillagaskada
Eastern	Trincomale	Verugal Aru, Mahaweli River, Yan Oya	Lalikadu Kulam, Thandamuripu(2), Yan Oya(2)	No	Mahaweli Ganga (2), Kanthale Wewa/Mahaweli Ganga, Yanoya Ganga/ Thondamarippu Wells		Kanthale Wewa/Mahaweli Ganga	Serunuwara, Eachchilampattu, Andankulam, Daniyagama, Wellaimanal, Kantale, Kappalthurai, Mahamar, Sampalthivu, Thampalagamam, Varothayangar, wanela, Muthur, Thoppur, Pulmoddai

Operational Regions	**District**	**Water Sources**			**Treatment Plants**			**Water distribution lines**
		Catchments	**Tubewells/ Groundwater**	**Community Supply**	**Intakes**	**Chemical Building**	**Pump House**	
	Baticaloa	Magalavatavan Aru	No	No	Unnichchi Wewa, Kala wewa - Yoda Ela		Unnichchai Wewa	Batticaloa, Maradankadawal, Kekirawa, Ihalagama(Kalawewa)
	Ampara	Heda Oya, Pannel Oya, Gal Oya, Mundeni Aru, Mahaweli River	Heda Oya, Meegaswatte, Galodei(2)	No	Sagamam Tanks, Kondawattuwana Wewa, Himudurawa Wewa, Bore Hole, Rambaken Oya, Bambarawana Wewa, Nagasthalawa Wewa, Mahaweli Ganga, Mawanawela Wewa		Kondawattuwana Wewa, Himuduraw a Wewa, Weeragoda Wewa, Sagamam Tanks	Thirukkovil, Addalachchenai, Akkaraipattu, Oluvil-palamunai, Ampara, Damana, Hingurana, Irakkamam, Kalmunai, Karaithivu, Madana, Maruthamunai,Ninthavur, Sainthanaruthu, Thottama, Kallar, Bakkiella, Central-Camp, Dhadayanthalawa, Gonagolla, Inginiyagala, Namaloya, Paragahakelle, Uhana, Varipathanchenai, Mandoor, Kaluwanchikudy, Padiyathalawa, Mahaoya, Sandunpura, Lihiniyagama, Dehiattakandiya, Mawanagama
North Central	Polonnaruwa	Mahaweli River	Mahiyangana Road, Elahera Road 1&2, Dimbulagala Stage I, AGA Quarts, Rest house road, DS Ground, WRB new BH 1&2	No	Jayanthi Wewa, Yoda ela, BH 1, Near paddy field Elehera Para BH, ZD Ela, Iddapichcha Lake, Dalukana wewa, Mahaweli Ganga, Weeragoda Wewa, Parakrama Samudraya, Minneriya Ela, Kaudulla Wewa			Wadinagala, Bakamoona, Aralaganwila, Dimbulagala, Manampitiya, Gallella, Polonnaruwa, Sammanthurai, Polonnaruwa, Bendiwewa, Sewagama, Minneriya, Hingurakgoda, Medirigiriya

	Anuradapura	Kala Oya, Malwathu Oya, Moderagama Aru, Yan Oya, Ma Oya	Isurumuniya 11, Isurumuniya 1, Mihinthalaya WSS1(4), Mihinthalaya WSS Bunglow, Upuldeniya Road I&II, A/P Road Massalawa, Koonwewa Road II&III, Upuldeniya Road III, Trinco Road, Kebitigollawa WSS Pradesiya, saba well, Nabadagasdigiliya, Koonwewa Road V, Aurwedik Hospital Medawachiya, Sulamans Land, lower part of Kudawewa, Walpola (old), Uper part of Kudawewa, Close udawewa, Upper part of the Mahawewa, Bus stand Medawachchiya, Lower	No	Galnewa Wewa, Koon Wewa, Nallachchiya wewa, Thuruwila wewa, Nuwara wewa, Thisa wewa, Wessagiriya BH, Nanbankadawala RD BH, Stie office BH, Bus Stand BH 6, Temple Road BH 4, *, Malwathu oya		Nuwara wewa	Galnewa, Eppawala, Thabuttegama, Anuradhapura-east (Wijayapura), Anuradhapura-South (Talawa), Nachchiyaduwa, Thuruwila, Anuradhapura New Town, Anuradhapura-North (Jaffna-Junction), Anuradhapura-New-Town, Mihintale, Sacred-City, Oyamaduwa, Medawchchiya, Thanthirimale, Kebithigollewa

			part of Medawachiya Mahawewa, WSS office site Medawachiya, Kulikkada Walpola road, Horopotana Bus Stand, Railway town (Manner road), Medawachchiya Road (PH NO 111), first well from Medawachchiya, Medawachchiya Road (PH VI) Infront of Gramaraksaka point, Medawachchiya Road Kebitigollawa Gammedda, Kebitigollawa WSS, Pahala Usgollawa, Mahanetiyawa, Gravel Road Padaviya, Lower Padaviya, WSS 111&IV Padaviya					
North Western	Kurunegala	Maha Oya, Deduru Oya, Mi Oya	Athuruwela rd., Walakumbura rd., Welikumbura, Dampelessa(2), Near bridge Wariyapola, P/H land, Maguru oya, Anuradahapura Road, Near udangawa temple Ambanpola, Udangawa, Close to "Mee" oya, Close to Palukadawara rd.	No	Ma oya(4), BH, Kospothu oya, Shallow well, Deduru oya(2), Kolamunu oya, Kurunegala lake, Wennoruwa wewa, Deduru oya, Kuda oya(2), Maguru oya, Magalle wewa, BH, Nikeweratiya WSS, Galgamuwa WSS, Mee oya, 2 BH (used in dry season)		Kurunegala lake, Wennoruwa wewa, Deduru oya, Magalle wewa	Alawwa - polgahawela(2), Pannala, Giriullla, Narammala, Mawathagama(2), Abanpola - Ogodapola - Dodangaslanda(3), Hettipola, GKWSSP(Zone 3), KMC, Ibbagamuwa, Gokarella, Chilaw, Wariyapola, Mahawa, Nikaweratiya, Galgamuwa

	Puttlam	Maha Oya, Ratmal Oya, Karambalan Oya, Deduru Oya, Mi Oya, Tiladiaya, Moongil Aru, Kala Oya	Lunuwila road(2), Kokkalamulla(4), Nelumpokuna (right bank of kadupitiya stream(4), Munneswaram(4), Malwatta, TWS-Thiththakade, In side T/Plant, Outside T/Plant Chilaw, Munneswaram (temple), Udappuwa, Thennankuriyawa(3), Thattawa, Diyawannawa, Anuradhapura road(2), Charch land, At T/Plant, In front of T/plant, Kingsly House, Bommakka Devalaya, Abeyrama temple, Manalkundu, Abusahuman house, Block land, Thambapanni, Viluke, Rahamath Nagar	No	Ma oya, BH(4), BH SP2, BH SP3, BH 147, BH 145, Katupiti Oya, Manakkulama BH, BH 5/800, BH 5/448, BH 1, BH 2, BH 3, BH 4, BH 5, Kala oya		Deduru Oya, Kala oya	Dankotuwa, Wennappuwa, Andigama(3), Naththandiya, Kakkapalliya, Anamaduwa, Puttlam
Northern	Jaffna	Delf, Mandaithive, Kayts, Jaffna, Karainagar	Delf(2), Mandaithivu, Velanai(2), Kaithady, Kayts, Araly(2), Vaddukodai, Chunnakam, Karainagar(2), Nilawarei(2), Karaveddy(2), Wallipuram, Manalkadu(4)	No	RO plant, Allapiddy - 01 dug well and 8 collection wells(6), Tube wells 1, Dug well, Tube wells 2, Dug well, Tube wells 1, Dug well 1&2, Dug wells 2, Dug wells 1, Chunnakkam Dug well, Pokkanai Tube well 1,2,&3, 2 New tube well, Dug well 1,2,&3, Nilaweray Tube well 1, 2 &3, Karaveddy -Dug well, Vallipuram Intake - Dug wells 1,2,3,&4, Vallipuram Intake - Tube wells 1-6			Nainathivu, Kayts, Mandaitivu(6), Velanai, Analaithivu, Vempirai, Kaithady, Vempirai, Arali, Vaddukkoddai(2), Chunnakam(2), Karainagar, Vatharavittai, Karaveddy, Point-Pedro, Valvettithurai(3),
	Multhiuv	Pali Aru, Per Aru	Pandiyankulam(2), Oddusudan(2), Mallavi(6), Thanniuththu(2), Wattappalai	No	Tube wells 1,2, Tube well 3, Tube well 1, Tube well 3, Tube well 4, Tube well 5, Tube well 2, Dug well 1, Nedunkerney - Tube well 1, Nedunkerney - Dug well 1			Pandiyankulam(2), Mallavi(6), Oddusuddan, Nedunkerny(2)
	Kilinochchi	Palllavarayankuddu, Kanakarayan Aru	Mulankavil(5), Kilinochchi(2), Kilinochchi dry Aru	No	Surface Water (Dry Aru), Karadipokku 01 dug well, o1 tube well		Surface Water (Dry Aru)	Killinochchi(2)

	Vavuniya	Malwathu Oya, Paranki Aru	Vavuniya town limit(9), Peraru Reservoir		Per Aru, Oddusuddan - Tube well 1, Oddusuddan - Tube well 2		Per Aru	Vavuniya, Oddusuddan, Nedunkerny(2)
	Mannar	Giant's Tank, Nay Aru, Pali Aru, Palllavarayankuddu	Murunkan well field(10), Periamadu(2), Vellankulam(2), Mulankavil(2)	No	Dug well No:05, Bore Hole No:03, Dug well No:04, Dug well No:03, Bore Hole No:02, Dug well No:02, Bore Hole No:01, Dug well No:01, Bore Hole No:01, Bore Hole No:02, Bore Hole No:03, Bore Hole No:04, Bore Hole No:05, Bore Hole No:06, Bore Hole No:07, Bore Hole No:08, Bore Hole No:09, Bore Hole No:10, Bore Hole No:11, Pump House - L03, Periyamadu, Pump House -L02, Pump House -L04, Pump house -137, Pump house -136, Pump house -135			Madu(8), Adampan, Erukkalampiddy, Mannar, Murunkan, Thiruketheeswaram, Vankalai, Mannar(11), Vidathalathivu(3), Periyamadu, Vellankulam (Thevanpiddy)(3)
Sabaragamuwa	Kegalle	Kelani Ganga, Attanagalu Oya, Maha Oya	Gonagala(2)	No	Walawe Ganga (2), Kelani ganga, Udawalawa, Edurapola Ela		Ma Oya	Balangoda(2), Awissawella, Udawalawa, Bulathkohupitiya
	Rathnapura	Walawe Ganga, Kalu Ganga	Nivithigala, Kiriella	No	Kelani River, Bore Hole, Maha Oya, Bisodola, Wee Oya, Edurapola Ela, Kalu Ganga(2), Seethagangula, Watapotha Ela(2), Seethagangula branch (Nallathanni oya), Nachchimale Stream, Kirindi Ela, Nachchimale Stream, Wey Ganga, Kalatuwawa Reservoir, Rakwana Ganga, Eraporuwa Ganga			Ruwawella, Kiriella, Dehiowita, Eheliyagoda, Yatiyanthota, Bulathkohupitiya, Rathnapura(2), Sri Padaya, Niwithigala(2), Nallatanniya, Ingiriya, Kahawatta - Palmadulla, Ingiriya, Kahawatta - Palmadulla, Kaduwela, Maharagama, Pannipitiya, Homagama, Pelanwatta,Gelagedara, Godakawela, Kolonna
Southern	Galle	Gin Ganga	Kabeel watta	No	Gingaga(3), BH 1, BH 3		Gingaga(3)	Koggala, Ahangama, Akmeemana - Habaraduwa, Bope-Poddala, Hapugala, Wakwella, Galle, Baddegama, Balapitiya, Batapola, Elpitiya, Ambalangoda, Hikkaduwa, Udugama, Pitigala

	Matara	Nilwala Ganga, Dikwella, Polwatta Ganga, Gin Ganga	Near Nuga Tree old in Dikwella, Nariyawatta, Town Pitabaddara(2),	No	BE2, Kananke - Polathumodara, Nilwala Ganga, BH2, BH3, Nilwala Ganga, BH2(2), Ambagadola stream, (Stream)Dola, Gingaga		Nilwala Ganga	Radampala, Weligama, Matara, Malimbada, Devinuwara, Dikwella, Gandara, Kottagoda, Kudawella, Thihagoda, Karagoda - Uyangoda, Hakmana, Akuressa, Makandura, Pitabeddara, Urubokka, Katuwana, Deniyaya
	Hambantota	Kirama Oya, Walawe Ganga, Urubokka Oya, Kachigala, Kirindi Oya, Nilwala Ganga	No	NO	BH & Spring, Murutawela reserviour, Kattakaduwawewa, Kiridioya, Lunugamvehera, Uruboku Wewa, Ridiyagamawewa, Mankganga, Dola, Kiridioya, Walaweganga, BH, Eraminiyaya Tank, Kiramaoya		Ridiyagamawewa, Murutawela reserviour, Kattakaduwawewa	Beliatta, Muruthawela, Walasmulla, Ranna, Tissamaharama, Kirinda, Wakamulla, Ridiyagama, Kataragama, Kirama, Bundala, Ambalanthota, Hungama, Kirinda, Angunukolapelassa, Nalagama
Uva	Badulla	Walawe Ganga, Mahaweli Ganga, Kirindi Oya	No	No	Ma Oya(3), Narangala Oya, Kahagolla, Ohiya, Ellathota, Kirindi Oya, Katuwethenna Stream, Mullepihilla spring, Meepilimana, Uma Oya, Demodara, Morethota Stream, Punchikele, Bomuru Ella, Badulu Oya, Mahaweli, Mahaweli River, Rathkinda Reservoir			Rambukkana, Mawanella, Aranayaka, Aranayaka & Hemmathagama, Diyathalawa, Boralanda, Divithotawela, Bandarawela, Makuluella, Bogahakumbura, Madowita, Mullepihilla, Keppitipola, Divithotawela, Welimada, Demodara, Hali Ela, Medawala, Ambagasdoowa, Badulla, Mahiyanganaya, Giradurukotte, Rathkinda

	Moneragala	Menik Ganga, Kirindi Oya, Kumbukkan Oya, Heda Oya, Gal Oya, Mundeni Aru	Kukurampola, Udaganawa well, Preschool in Buttala, Air force Buttala, Dikyaya well, Bangalagoda, OIC office in Badalkumbura, Pussallawa Temple, Karavila Road, Near AGA office in Siyambalanduwa, Medagama fair, Medagama OIC office, Wellasa School, Rathupasketiya	No	Walawe Ganga, Ridiyagamawewa, Nagas ella, Kuda Oya, Kiridi Oya, Gurugoda Oya, Alikotta Ella, Ice Phila, Minigamuwa BH, Menik Ganga, Dobagammana BH, Bologala BH, Alagoda BH, Galhinna BH(2), Kumbukkan Oya, Maragala Oya, Vilana BH, Rajapihilla BH, Ovissa BH, Hedaoya Ganga/ Bore hole, Heda Oya, Muthukandiya Wewa, Nayakandura Ela, Nagaha Ella		Maragala Oya	Sewanagala, Hambanthota, Ruhunupura, Sooriyawewa, Gonagaldeniya, Warakapola, Thanamalwila, Kegalle, Wellawaya(2), Minigamuwa, Buttala, Poojapitiya(2), Okkampitiya, Madulla, Monaragala, Alawathugoda, Harispaththuwa, Alawathugoda, Pottuvil, Siyabalanduwa(2), Bibila, Medagama
Western-Northern	Gampaha	Kelani Ganga, Attanagalu Oya, Maha Oya	Attanagalu Oya bank, Attanagalu Oya, Yakkala Treatment plant, Vidiyawatta, Kotugoda Road, Near Temple, Pokuna Road, Near Paddyfield of Mr. Dudly, Ranpokunagama WSS - Pump House, Ranpokunagama WSS - Pump House, Industrial Zone (BOI) - I, Ambagahawatta Pump House, Pradeshiya Sabha Premises, Industrial Zone (BOI) - ii, Wegowa Pump House, Diulapitiya Road, Nalanda, MeerigamaWSS(3), Nalla Pump house, Diulapitiya WSS - ii, Thekkawatta, Kotadeniyawa, Welihinda,Thekkawatta, Diulapitiya WSS - Thekkawatta	No	Kalani Ganga(4), Chandrika Wewa, Attanagallu Oya(3), Bore hole(4), Dhandugam oya, Shallow well, Ma Oya		Kalani Ganga, Attanagallu Oya, Dhandugam oya	Athurugiriya, Kelaniya, Welisara, Biyagama - Dompe, Mahara, Ragama, Ja-Ela, Katunayake, Pugoda, Kirindiwela, Ranpokunugama, Urapola Attanagalla, Embilipitiya, Gampaha, Yakkala, Udugampola, Nittabuwa, Raddolugama, Veyangoda, Minuwangoda, Bataleeya, Meerigama, Divulapitiya, Negambo

Western-Central	Colombo	Kelani Ganga	No	No	Labugama Reservoir, Kalu Ganga, Kelani Ganga		Awissawella(2)	Kaduwela, Maharagama, Pannipitiya, Homagama, Pelanwatta, Gelagedara, Aluthgama, Beruwala, Kaluthara, Payagala, Bombuwala, Pilaminawatta, Wadduwa, Slave-Island, Hultsdroft, Thimbirigasyaya, Pamankada, Mattakuliya, Kotahena, Maligawatta, Borella, Battaramulla - Hokandara, Kotte, Kolonnawa- Kotikawatta-Mulleriyawa, Dehiwala
Western-South	Kalutara	Benthota Ganga, Kalu Ganga	No	No	Bore Hole, Waththawa Dola, Kalu Ganga		Kalu Ganga,	Kiriella, Matugama, Miriswatta, Piliyandala, Wadduwa, Moratuwa, Horana, Bandaragama, Kumbuka, Panadura

Appendix 2.4: Percentage of catchment area covered and number of risk elements exposed to floods

Operational Regions	District	Water Sources			Treatment Plants					
		Catchments (Area as %)	Tube wells		Chemical Building/treatment		Pump House			
			Exposed	Not Exposed	Not Exposed	Exposed	Not Exposed	Exposed	Not Exposed	Exposed
Central	Kandy	Kelan River (0.2), Mahaweli River (89.11), Maha Oya (7.97), Deduru Oya (2.72)	0	13	19	0	2	1	29	No
	Mathale	Mahaweli River (71.1), Yan Oya (1.99), Malwathu Oya (0.41), Kala Oya (25.0), Deduru Oya (1.5)	0	6	7	0	1	1	10	
	Nuwaraeliya	Kelani River (24.17), Walawe River (1.21), Kalu River (0.1), Mahaweli River (74.52)	0	1	3	0	0	1	15	
Eastern	Trincomale	Mahaweli River (27.16), Kantalai Aru (12.69), Palampotta Aru (2.92), Panna Oya (8.87), Pankulam Aru (14.98), Kunchikumban Aru (7.53), Palakutti Aru (0.82), Yan Oya (8.57), Mee Oya (3.17), Ma Oya (2.34), Uppu Aru (4.13)	5	0	4	0	1	9	10	
	Baticaloa	Gal Oya (0.25), Andella Oya (5.64), Thumpankeni (0.74), Namakada Aru (0.73), Mandipattu Aru (3.65), Pathanthoddathne Aru (4.64), Vett Aru (1.02), Magalavatavan Aru (9.43), Mundeni Aru 15.38), Miyangolla Ela (7.44), Maduru Oya (21.85), Pulliyanpota Aru (4.2), Kirimechchi Odai (3.84), Bodigoda Aru (3.96), Mandan Aru 1.13), Makarachchi Aru (0.65), Mahaweli Ganga (0.4)	0	0	2	0	0	0	1	
	Ampara	Kumbukkan Oya (2.0), Baguru Oya (2.57), Girikula Oya (0.32), Helawa Aru (0.96), Wila Oya 5.59), Heda Oya (3.9), Karanda Oya (7.01), Semani Aru (1.66), Tandiadi Aru (0.8), Kangikadichi Aru (1.76), Rufus Kulam (0.67), Pannel Oya (4.11), Ambalam Oya (2.38), Gal Oya (17.85), Andella Oya (9.84), Mandipattu Aru (0.07), Magalavatavan Aru (1.97), Mundeni Aru (18.31), Miyangolla Ela (0.02), Maduru Oya (6.61), Mahaweli Ganga (6.14)	0	4	9	0	3	0	14	
North Central	Polonnaruwa	Maduru Oya (9.71), Bodigoda Aru (2.22), Mandan Aru (0.16), Makarachchi Aru (1.16), Mahaweli Ganga (84.96), Kantalai Aru (1.19), Yan Oya (0.46)	2	7	10	0	1	3	13	
	Anuradapura	Mahaweli Ganga (0.05), Kantalai Aru (1.12), Pankulam Aru (1.4), Yan Oya (17.25), Mee Oya (1.02), Ma Oya (10.51), Kanakarayan Aru (0.05), Paranki Aru (0.05), Malwathu Oya (0.02), Aruvi Aru (32.97), Kal Aru (1.98), Moderagama Aru (12.98), Kala Oya (20.5), Mi Oya (0.02), Deduru Oya (0.08)	1	38	9	0	1	3	46	
North Western	Kurunegala	Karambalan Oya (12.21), Ratmal Oya (3.48), Maha Oya (9.11), Mahaweli Ganga (0.01), Kala Oya (8.21), Mi Oya (14.91), Kalagama Oya (0.01), Rathambala Oya (2.03), Deduru Oya (50.0)	1	12	14	1	2	6	17	
	Puttlam	Karambalan Oya (6.43), Ratmal Oya (3.02), Maha Oya (3.25), Moderagama Aru (3.97), Kala Oya (14.51), Moongil Aru (3.33), Mi Oya (26.63), Madurankuli Aru (2.11), Kalagama Oya (4.55), Rathambala Oya (5.17), Deduru Oya (4.49)	9	30	9	0	1	12	31	
Northern	Jaffna	Delf (4.92), Jaffna (81.89), Karainagar (2.35), Kayts (6.62)	10	12	18	0	0	10	12	

	Multhiuv	Ma Oya (1.07), Churiyan Aru (1.77), Chavar Aru 2.3), Palladi Aru (2.33), Mannal Aru (6.66), Kodalikallu Aru (3.72), Per Aru (15.2), Kalmaduru Aru (4.23), Maruthapillay Aru (2.38), Theravil Aru (4.18), Piramenthal Aru (2.55), Nethali Aru 2.86), Kanakarayan Aru 12.64), Kalawalappu Aru 0.05), Akkarayan Aru (4.0), Mandekal Aru (5.51), Pallavarayan Kadu Aru (3.69), Pali Aru (10.2), Chappai Aru (0.12), Paranki Aru (7.6), Nay Aru (2.47)	1	12	10	0	0	1	12	
	Kilinochchi	Theravil Aru (0.5), Piramenthal Aru (2.15), Nethali Aru (4.22), Kanakarayan Aru (23.45), Kalawalappu Aru (5.0), Akkarayan Aru (12.77), Mandekal Aru (15.94), Pallavarayan Kadu Aru (6.96)	1	6	0	1	0	2	6	
	Vavuniya	Ma Oya (10.76), Churiyan Aru (2.16), Mannal Aru (3.67), Per Aru (4.78), Kanakarayan Aru (14.63), Pali Aru (7.3), Paranki Aru (24.13), Nay Aru (4.6), Malwathu Oya (27.94)	0	9	3	0	1	0	10	
	Mannar	Pali Aru (3.56), Chappai Aru (3.64), Paranki Aru (9.99), Nay Aru (19.29), Malwathu Oya (11.94), Kal Aru (6.75), Moderagama Aru (4.14)	11	5	25	0	0	11	5	
Sabaragamuwa	Kegalle	Kelani Ganga (61.93), Maha Oya (33.09), Attanagalu Oya (4.43), Kalu Ganga (0.28), Deduru Oya (0.34)	2	0	3	1	0	7	7	
	Rathnapura	Kelani Ganga (2.3), Nilwala Ganga (0.27), Urubokka Oya (0.25), Kachigala (0.52), Walawe Ganga (40.63), Kalu Ganga (54.62), Gin Ganga (1.39)	2	0	18	0	0	4	10	
Southern	Galle	Koggala Lake (3.39), Polwatta Ganga (9.28), Nilwala Ganga (2.9), Kalu Ganga (0.46), Benthota Ganga (19.16), Madu Ganga (4.52), Madampe Lake (5.88), Telwatta Ganga (3.28), Ratgama Lake (0.98), Gin Ganga (46.4)	1	0	3	2	1	4	0	
	Matara	Polwatta Ganga (6.8), Nilwala Ganga (70.38), Seenimodara Oya (0.51), Kirama Oya (3.82), Urubokka Oya (1.48), Gin Ganga (9.38)	3	1	9	1	0	9	2	
	Hambantota	Nilwala Ganga (1.79), Seenimodara Oya (1.62), Kirama Oya (6.05), Rekawa Oya (3.53), Urubokka Oya (12.2), Kachigala (7.95), Walawe Ganga (12.6), Karagan Oya (3.26), Malala Oya (11.74), Embilikala Oya (2.68), Kirindi Oya 11.3), Bambawe Aru (3.2), Mahasiliwa Oya (0.71), Butawa Oya (2.0), Menik Ganga (3.63), Katupila Aru (2.99), Kuranda Aru (3.86), Nabadagas Aru (2.65), Karambe Aru (2.0), Kumbukkan Oya (0.94)	0	0	11	1	1	1	11	
Uva	Badulla	Walawe Ganga (8.5), Kirindi Oya (9.47), Menik Ganga (1.58), Kumbukkan Oya (3.42), Gal Oya (0.56), Maduru Oya (9.69), Mahaweli Ganga (66.77)	0	0	20	0	1	0	27	
	Moneragala	Walawe Ganga (10.53), Malala Oya (2.0), Kirindi Oya (10.56), Menik Ganga (19.76), Katupila Aru (0.38), Kuranda Aru (0.82), Nabadagas Aru (0.46), Kumbukkan Oya (17.37), Baguru Oya (0.48), Wila Oya (4.35), Heda Oya (7.55), Karanda Oya (2.12), Pannel Oya (0.2), Gal Oya (18.38), Magalavatavan Aru (1.14), Mundeni Aru (2.72), Maduru Oya (0.66), Mahaweli Ganga (0.38)	0	14	22	0	2	0	21	
Western-Northern	Gampaha	Kelani Ganga (23.77), Attanagalu Oya (57.48), Maha Oya (18.75)	11	10	8	3	0	19	10	
Western-Central	Colombo	Kelani Ganga (65.35), Bolgoda Ganga (27.6), Kalu River (2.45), Beire Lake (1.88), Kirulapana (2.71)	0	0	2	2	0	6	6	
Western-South	Kalutara	Kelani River (0.65), Bolgioda Ganga (14.84), Benthota Ganga (25.47), Kalu Ganga (58.13), Gin Ganga (0.37)	0	0	2	1	0	3	1	

Appendix 2.5: Exposure of Proposed Water Intakes and treatment plants to Flood Hazard

Operational Regions	District	Proposed Project Name	Water Sources	Treatment Plants	
			Catchment	Intakes	
				Exposed	Not Exposed
Central	Kandy	Nawalapitiya Pallegama Water Supply Project	Kabaragala Ella and Sharmrock Reservoir		Yes
		Ganga Ihala Korale Water Supply Project	Maha Oya		Yes
		Kothmale Riverside Water Supply Project	Existing Mahaweli scheme intake, Nayapana		Yes
		Pupuressa Atabage Water Supply Project	Atabage oya at Delta estate		Yes
		Augmentation of Marassana WTP	Ma Oya		Yes
		Kandy South water Service Improvement Project	Mahaweli River		Yes
		Augmentation of Balagolla WTP	Victoria Reservoir		Yes
		Hasalaka Water Supply Project	Mahaweli River - Weraganthota		Yes
		Kundasale Haragama WSP	Mahaweli River - Gohagoda		Yes
		Hatharaliyadda Water Supply Project	Rambukkan oya		Yes
		Installation of 1500m3/day package TP for Medadumbara WSS & Pipe Laying	Hulu Ganga		Yes
		Medadumbara Panwila Water Supply Project	┬áMoragaha Oya, Perudeesan Ela		Yes
	Mathale	Naula Wahakotte Water Supply Project	Nalanda reservoir at Demada oya	Yes	
		Greater Dambulla Stage II	Ibbankatuwa wewa	Yes	
	Nuwaraeliya	Nanuoya Water Supply Project	Ice ganga at Bangalahatha		Yes
		Pundaluoya Water Supply Project	Dunshinen Estate in Pundaluoya South		Yes
		Hapugasthalawa Water Supply Project	Thelissagala and Katugolla Lake		Yes
Eastern	Trincomale	Water Source improvement in Eachchliampattu WSS	Mahaweli River - Kallai Arrippu		Yes
		Construction of intake (28000cum/day) at Allai Knathale and Laying raw water transmission main from Allai Kanthale to Kanthale WTP	Mahaweli River at Allai Intake	Yes	
		Upgrading Kanthale WTP capacity from 54,000 cum/day to 72,000cum/day including treated water transmission from Kantale WTP to Kappalthurai	Mahaweli River at Allai Intake	Yes	
		Service level improvement to Trincomalee City and Sorrounding areas	Kanthale Reservoir -Mahaweli River		Yes
		Upgrading Muthur WTP & Intake improvement at Neelapola	Mahaweli River at Neelapola	Yes	
		Upgrading Muthur WTP & Intake improvement at Neelapola	Mahaweli River at Neelapola	Yes	
		Increasing service coverage and Service level improvement at Dehiwatha, Thoppur and surrounding areas	Mahaweli River -Neelapola	Yes	
		Increasing service coverage and Service level improvement in Dehiwatha, Thoppur and surrounding areas	Mahaweli River -Neelapola	Yes	
		Water supply extension to Naddouththu and Sorrounding areas from Muthu WTP	Mahaweli River -Neelapola	Yes	
		Water supply extension to Naddouththu and Sorrounding areas from Muthu WTP	Mahaweli River -Neelapola	Yes	
		Intake Improvement of Integrated Trincomalee WSS at Allai Kanthale	Mahaweli River -Neelapola	Yes	

		Intake Improvement of Integrated Trincomalee WSS at Allai Kanthale	Mahaweli River -Neelapola	Yes	
		Water supply extension to Muthur East areas from Muthur WTP and Distribution Improvement	Mahaweli River - Neelapola		Yes
		Greater Trincomalee Expansion WSP	Pan Oya Reservoir		Yes
		Morawewa & Gomarankadawala Water Supply Project in trincomalee District	Bellikada Tank		Yes
		Padavisipura Water Supply Project in Trincomalee District	Yan Oya Reservoir	Yes	
	Baticaloa	Heda Oya Water Supply Project	Hedaoya Reservoir		Yes
		Batticaloa South WSP	Navagiri Aru Tank		Yes
		Increase service coverage in Unnichchai and surrounding areas	Unnichchai	Yes	
		Improvement of Kokkadichcholai WSS	Unnichchai	Yes	
		Valachchanai WSP	Rugam Tank	Yes	
		Augmentation of Valachchanai Paper Mill WSS	Rugam Tank	Yes	
		Batticaloa West WSP	Vahaneri Tank		Yes
		Batticaloa North WSP (Vaharai WSP)	Kaddumurivu Tank		Yes
	Ampara	Improvement of Service level at Panama WSS	GW		Yes
		Improvement to Thirukkovil WSS	Ambalan Oya Reservoir		Yes
		Improvement of Bangalawadiya WTP at Sammanthurai	Weeragoda		Yes
		Dehiyaththa kandiya Water Supply Project	Ulhitiya Reservoir		Yes
		Improvement of Padiyathalawa WSS	Mundeni Aru at Warapitiya, Padiyathalawa	Yes	
		Padiyathalawa WSP	Mundeni Aru	Yes	
		Improvement of Dehiytakandiya & Lihiniyagama WSS	Nagasthalawa Tank, Lihiniyaga, Dihiyathakandiya		Yes
North Central	Polonnaruwa	Towns East of Polonnaruwa Water Supply Project	Elahera - Ambanganga		Yes
		Augmentation of Gallella WTP	Mahaweli River	Yes	
		Augmentation of Polonnaruwa Old WTP	Parakkrama Samudraya		Yes
		Improvements to Minneriya WTP & WSS	Minneriya		Yes
		Medirigiriya WTP -Phase 2	Kawdulla wewa		Yes
	Anuradapura	Galnewa ΓÇô Palagala Water Supply Project (Restructured for immediate need)	Kala Wewa (Left bank)		Yes
		Kalawewa WSS Improvements	Kalawewa (Yodha Ela Right bank canal)		Yes
		Construction of a 5,000m3/day capacity WTP at Galnewa	Galnewa wewa		Yes
		Palugaswewa water supply project (Restructured for immediate need)	Habarana Tank		Yes
		Thambuttegama WSP	Angamuwa Tank		Yes
		Eppawala, Rajanganaya, Nochchiyagama & Giribawa Integrated WSP	Angamuwa Tank		Yes
		Galenbindunuwewa Water Supply Project	Huruluwewa		Yes
		Augmentation of Thuruwila WTP	Thuruwila		Yes
		Anuradhapura South Phase II WSP (Restructured for immediate need)	Thuruwila Tank		Yes

		Anuradhapura South Phase II WSP (Restructured for immediate need)	Eru wewa		Yes
		Future Expansion for Anuradhapura City - South Area	Nachchaduwa tank		Yes
		Augmentation of Thissawewa WTP	Thissawewa		Yes
		Anuradhapura South Phase II WSP (Restructured for immediate need)	Nuwarawewa		Yes
		Anuradhapura North Water Supply Project - Phase I	Mahakanadarawa wewa		Yes
		Greater Anuradhapura North & Greater Trincomalee Integrated Water Supply Project	Proposed Lower Malwathu Oya Reservoir		Yes
		Future Expansion for Anuradhapura City - North Area	Proposed Lower Malwathu Oya Reservoir		Yes
		Amuradhapura North Phase II WSP	Yan Oya Reservoir		
North Western	Kurunegala	Bingirya - Udubaddawa & Makadura-Pannala-Kuliyapitiya Integrated WSP - Phase I (02 Nos. 20000m3/d WTP)	Maha Oya		Yes
		Polgahawela - Pothuhera - Alawwa Integrated water Supply Project	Maha Oya		Yes
		Weerabugedara WSP	Maha Oya		Yes
		Giriulla - Dambadeniya- Narammala Water Supply Project.	Maha Oya		Yes
		Mawathagama Water Supply Project	Kospathu Oya		Yes
		Katupotha - Bamunakotuwa - Panduwasnuwara WSP	Deduru Oya reservoir (At LBC)	Yes	
		Extension to Rasnayakapura	Magalle Tank		Yes
		Polpithigama WSP	Hakwatuna Oya	Yes	
		Galgamuwa - Ehatuwewa - Ambanpola Water Supply Project	Siyabalagamuwa Tank		Yes
	Puttlam	Naththandiya Mahawewa IWSP	Maha Oya	Yes	
		Dankotuwa WSP - Phase I	Maha Oya	Yes	
		Nattandiya - Wennappuwa Water Supply Scheme	Kokkala mulla	Yes	
		Kakkapalliya Water Supply Project	Kadupiti Oya		Yes
		Chilaw WSP - Stage II	Deduru Oya	Yes	
		Kakkapalliya WSP Stage 11	Kadupiti Oya		Yes
		Karuwalagaswewa WSP	Kala Oya at Neelabemma		Yes
		Puttalam Water Supply Project - Stage II	Kala Oya	Yes	
		Kalpitiya WSP	Kala Oya at Eluwankulama	Yes	
Northern	Jaffna	Jaffna Kilinochchi IWSP Stage II	Iranamadhu Tank	Yes	
		Improvement of WTP in Thottaveli, Murunkan & Point Pedro	Ground Water, PPT - Ground water	Yes	
		Improvement of WTP in Thottaveli, Murunkan & Point Pedro	Ground Water, PPT - Ground water		Yes
		Improvements to Existing Water Supply Schemes in Thaiyaddi & Vadakkachchi	Thaiyiddy - Ground Water	Yes	
		Augmentation of Delft WSS	Seawater		Yes
		Chunnakam WSP		Yes	
		Improvement of WTP in Thottaveli, Murunkan & Point Pedro	Ground Water, PPT - Ground water	Yes	
		Point Pedro & VVT (RO plant) WSS	Sea water		Yes
		Improvements to Existing Water Supply Schemes in Thaiyaddi & Vadakkachchi	Vaddakachchi - DryAru		Yes
		Kankasanthurei WSS Stage I	Brackish water		Yes
		Chulipuram WSS Stage I	Brackish water		Yes

	Multhiuv	Mankulam WSP - Cost for Feasibility Studies & Desgin TCE is 28,000 MN	Parangi Aru		Yes
		Augmentation of Pandiankulam & Mallavi WSS	Karumpuliyan Kulam		Yes
		Service level improvement Mankulam WSS	GW		Yes
		Augmentation of Oddusuddan & Nedunkerny WSS (Stage 1 & 2)	Thaddayankulam		Yes
		Greater Mullaitivu WSP - Cost for Feasibility Studies & Design	Per Aru		Yes
	Kilinochchi	Groundwater Source Development in Northern region	Omanthai		Yes
		Groundwater Source Development in Northern region	Omanthai		Yes
		Groundwater Source Development in Northern region	Sannar		Yes
		Groundwater Source Development in Northern region	Kilinochchi	Yes	
		Improvements to Existing Water Supply Schemes in Thaiyaddi & Vadakkachchi	Thaiyaddi	Yes	
		Improvement to Existing WTP at Kilinochchi	Dry Aru	Yes	
		Paranthan to Palai Transmission Main	Dry Aru	Yes	
		Improvement to Akkarayan WSS	GW Well	Yes	
	Vavuniya	Greater Vavuniya WSS - Cost for Feasibility Studies & Desgin	Proposed Lower Malwathu Oya Reservoir	Yes	
		Service Level Improvement in Cheddikulam WSP	GW		Yes
		Service Level Improvement in Cheddikulam WSP	GW		Yes
		Service Level Improvement in Cheddikulam WSP	GW		Yes
		Service Level Improvement in Cheddikulam WSP	GW		Yes
		Peraru Bund raising for additional 0.8MCM	Peraru reservoir		Yes
		Improvement to Omanthai WSS	Dry Aru		Yes
	Mannar	Greater Mannar WSP NOTE: Phase 1 & 2 combined	Kal Aru		Yes
		Service level improvement in Musali Water supply Scheme	Tube Well		Yes
		Service level improvement in Musali Water supply Scheme	Tube Well		Yes
		Service level improvement in Musali Water supply Scheme	Tube Well		Yes
		Service level improvement in Musali Water supply Scheme	Tube Well		Yes
		Service level improvement in Musali Water supply Scheme	Tube Well		Yes
		Rehabilitation of Thalai Mannar WSS	Ground Water	Yes	
		Greater Jaffna WSP	Pali Aru		Yes
		Ground Water Source Development in Northern region	Ground Water	Yes	
Sabaragamuwa	Kegalle	Upgrading Dehiowita WTP & Distribution Improvements	Maha Oya	Yes	

		Integration of Kegalle WSS - capacity 16,000m3/day	Kelani Ganga		Yes
		Upgrading existing Ruwanwella water treatment plant	Kalani River	Yes	
		Improvements of the Intake weir of Yatiyanthota Water Treatment Plant	Wee Oya	Yes	
		Ruwanwella WSP	Gurugoda Oya	Yes	
		Hemmathagama WSP	Maha Oya		Yes
		Supply and laying of gravity transmission main to Adurapotha tank	Guru Goda Oya	Yes	
		Upgrading Moronthota WTP and associated Transmission and Distribution System improvements	Gurugoda OYa		Yes
		Upgrading existing Warakapola WTP & Distribution Improvements	Kuda Oya		Yes
		Upgrading Mawanella WTP and associated Transmission and Distribution System improvements	Maha Oya		Yes
		Warakapola Water Supply Project - 16,000 m3/day	Maha Oya		Yes
		Integration of Kegalle WSS	Maha Oya		Yes
		Rambukkana Water Supply Project - 16,000m3/day capacity	Maha Oya		Yes
		WASSIP	Maha Oya		Yes
	Rathnapura	Embilipitiya paper mill- Capacity 30,000 m3/day	Chandrika Wewa		Yes
		Balangoda Stage II	Ereporuwa (Kolonna)		Yes
		Kalawana WSP	Koswatta Ganga		Yes
		Doloswala, Nivithigala, Karavita Water Supply Project- Capacity 4500m3/day	Hangamu Ganga		Yes
		Augmentation of Kahawatte WTP and distribution expansion to Opanayake	Way Ganga		Yes
		Upgrading Pelmadulla WTP & Distribution Improvements	Kirindi Ella		Yes
		Balangoda Stage II	Walawe Ganga		Yes
		Augmentation of old Balangoda WTP & Laying of DI pumping main	Walawe River		Yes
		Greater Ratnapura Stage II - Upgrade from 6,000m3/day to 18,000m3/day	Kalu Ganga	Yes	
		Kiriella Water Supply Project - 3000 m3/day	Kalu Ganga	Yes	
		Improving of existing Kiriella WTP & Distribution Improvements	Deep BH		Yes
		Kuruvita Water Supply Project- Capacity 5000 m3/day	Kuru Ganga		Yes
		Dehiowita Water Supply Project- Capacity 16,000m3/day	Seethawaka Ganga	Yes	
		Construction of Intake at Thalavitiya, Raw water transmission and Aerator for improving quality of service in Eheliyagoda WSS	Seethawaka Ganga	Yes	
		Eheliyagoda Water Supply Project-Capacity 14,000m3/day	Seethawaka Ganga	Yes	
Southern	Galle	Imaduwa WSP	Polathumodara River		Yes
		Greater Galle stage III WSP	Gin River	Yes	

		Capacity improvement and distribution expansion project of Baddegama WSS	Gin River	Yes	
		Baddegama IWSP-Stage I	Gin River	Yes	
		Baddegagama IWSP-Stage II	Gin River	Yes	
		Capacity improvement and distribution expansion project of Udugama WSS	Gin River	Yes	
		Capacity improvement and distribution expansion project of Pitigala WSS	Branch of Benthara River		Yes
	Matara	Mathara Stage V	Nilwala River (Katuwangoda)	Yes	
		Augmentation of Hallala WSS	Polathumodara River		Yes
		Augmentation of Hakmnana WSS	Kirama Ara	Yes	
		Capacity Enhancement & Distribution Expansion project of Hakmana WSS	Kirama Ara	Yes	
		Deyyandara-Mulatiyana WSP	Kirama Ara (Deyyandara)	Yes	
		Morawaka WSP	Nilwala River	Yes	
		Deniyaya WSP	Gin River	Yes	
	Hambantota	Nawayalawila source Improvement Project of Tangalle WSS	Nawayalawila Reservoir	Yes	
		Augmentation of Kattakaduwa WTP and distribution expansion project of Ranna WSS	Uruboku Oya		Yes
		Wakamulla WSS (Phase 2)	Uruboku Oya		Yes
		Ruhunupura Stage II	Ridiyagama Tank		Yes
		Augmentation of Muruthawela WSS and Distribution Expansion	Muruthawela Reservoir		Yes
		Muruthawela Long Term WSP- Phase I & II (Phase I - 14,000 Mn, Phase II - 7,000 Mn)	Muruthawela Reservoir		Yes
		Augmentation of Bundala WSS	Kirindi Oya		Yes
		Barawakumbuka short term Phase I	Walawe River		Yes
		Barawakumbuka short term Phase II	Walawe River		Yes
		Middeniya Angukukola Long term improvement WSP Phase II	Chandrika wewa	Yes	
		Augmentation of Katuwana WSS	Athdolakanda, Beerideniya & Nebilidola streams		Yes
		Capacity improvement and distribution expansion project of Lunugamwehera WSS Phase I & II	Lunugamwehera Reservoir		Yes
		Lunugamwera IWSP phase I & II (Phase I- 6600 Mn Phase II - 8041 Mn)	Lunugamwehera Reservoir		Yes
		Hambantota Industrial zone WSP - Feasibility & Detail Design work	Udawalawa Tank		Yes
		Kataragama Long term Phase I &II	Menik Ganga		Yes
		Capacity improvement and distribution expansion project of Kataragama WSS (Short Term)	Meniak Ganga		Yes
Uva	Badulla	Haldummulla Wsp (WaSSIP Additional Financing-Pending)	Walawe River		Yes
		Gawarammana Bogahakumbura WSP	Ambewela Reservoir	Yes	
		Bandarawela WSP phase I &II	Dayaraba reservoir at Uma oya		Yes
		Yahalarawa WSP	Uma Oya at Puhulpola		Yes
		Welimada Stage II	Uma Oya - Daragala		Yes
		Springvelly WSP	Black pool		Yes

		Gretaer Ambagasdoowa WSP	Bomuruella Reservoir	Yes	
		Thaldena Meegahakiula WSP	Baduluoya (Proposed impounding reservoir near Dunhida)		Yes
		Improvemnts to Kandekatiya wss	Badulu Oya		Yes
		Loggaloya WSP	Loggaloya reservoir		Yes
		Design works of Morana WSP	Morana reservoir		Yes
		Ulhitiya WSP	Ulhitiya Reservoir		Yes
	Moneragala	Thanamalvila Sevanagala Integrated WSP	Udawalawe Reservoir		Yes
		Design works of Buttalae Stage ii (From Weheragala)	Weheragala Reservoir		Yes
		Hambegamuwa WSP	Kandiyapita reservoir		Yes
		Improvement to Icepihilla WTP, Wellawaya WSS	Ice pihilla		Yes
		Wellawaya Stage II phase Il	Alikote Tank		Yes
		Wellawaya Stage II phase I	Alikote Tank		Yes
		Badalkumbura WSP	Menik Ganga		Yes
		Design works of Greater Monaragala WSP (30,000m3/d)	Proposed Nakkala reservoir		Yes
		Design of Medagama WSP from new source	Kumbukkan Oya		Yes
		Water Treatment Improvement in Monaragala District WSS (Medagama, Siyabalanduwa, Sewanagala)	Medagama- Nagahaella Stream		Yes
		Bibila Medagama WSS -Phase l	Mallipotha Tank		Yes
		Bibila Medagama Phase ll	Mallipotha Tank		Yes
		Madulla WSP	Senanayake Samudraya		Yes
Western-Northern	Gampaha	Mabima Water Supply Project - Stage I	Kelani Ganga	Yes	
		Katana Water Supply Project - Stage II	Kelani Ganga	Yes	
		Extension of Intake Structure at Pugoda	Kelani Ganga	Yes	
		Augmentation of Ranpokunawatta WTP	Kelani Ganga	Yes	
		Kiridiwela Water Supply Project - Stage II	Kelani Ganga	Yes	
		Kiridiwela Water Supply Project ΓÇô Stage I	Kelani Ganga	Yes	
		Augmentation of Yakkala WSS	Aththanagalu Oya	Yes	
		Augmentation of Gampaha WTP	Aththanagalu Oya	Yes	
		Augmentation of Veyangoda WSS	Aththanagalu Oya	Yes	
		Augmentation of Nittambuwa WSS	Aththanagalu Oya	Yes	
		Gamapaha Attanagalla Minuwangoda WSP - Stage I (ongoing project)	Basnagoda Reservoir	Yes	
		Gampaha Attanagalla Minuwangoda WSP - Stage II	Basnagoda Reservoir	Yes	
		Rehabilitation of Raddolugama WSS	Dandugam Oya	Yes	
		Mirigama Water Supply Project - Stage I	Maha Oya		Yes
		Mirigama Water Supply Scheme ΓÇô Stage II	Maha Oya		Yes
		Augmentation of Divulapitiya WTP	Maha Oya	Yes	
		Divulapitiya Water Supply Scheme ΓÇô Stage II	Maha Oya	Yes	
		Divulapitiya Water Supply Project - Stage I	Maha Oya	Yes	

Western-Central	Colombo	Ambatale Water Treatment Plant Expansion Project	Kelani Ganga	Yes	
		Construction of New Water Treatment Plant at Awissawella	Seethawaka River	Yes	
		Improvement of Awissawella Water Treatment Plant	Seethawaka River	Yes	
		Weliwita Water Supply Project - Head Works (Stage-1)	Kelani Ganga	Yes	
Western-South	Kalutara	Kethhena Improvement & Expansion Project	Kuda Ganga	Yes	
		Kethhena Improvement & Expansion Project	Kalu Ganga	Yes	
		Capacity Improvement of Kadana WTP	Kalu Ganga	Yes	
		Ingiriya Water Supply Improvement Project	Nachimale Dola		Yes

Appendix 2.6: Details of Exposure of Water Sources to Landslide

Operational Regions	District	Divisional Secretariat	Water sources	Landslide Susceptibility Level			
				Not Likely	Modest Level	Expected	Most Likely
Central	Kandy	Doluwa	Delwaththa Ela	Yes			
			Koka oya	Yes			
			Ground Water Naranwita		Yes		
		Poojapitiya	Ground Water Alagoda	Yes			
			Ground Water Dombagammana		Yes		
			Ground Water Ovissa	Yes			
		Thumpane	Ground WaterKuda oya bank		Yes		
		Udapalatha	Ground Water Dartry		Yes		
			Pussella oya		Yes		
			Amunupura ela			Yes	
			Mahaweli River		Yes		
			Ground Water Naranwita	Yes			
		Ganga Ihala Korale	Maha Oya				Yes
			Raja ela				Yes
		Harispattuwa	Walpolatenna Stream (Kospothu Oya, Deduru Oya Branch)		Yes		
			Mahaweli River		Yes		
			Rajapilla (two wells are located closer to each other)		Yes		
			Rajapilla (two wells are located closer to each other)		Yes		
			Madadeniya	Yes			
			Madadeniya	Yes			
		Kandy Four Gravets & Gangawata Korale	Mahaweli River	Yes			
		Kundasale	Mahaweli River	Yes			
		Medadumbara	Kota Ganga				Yes
		Panvila	Hulu Ganga		Yes		
		Pathadumbara	Mahaweli River	Yes			
		Pathahewaheta	Maa Oya		Yes		
		Udapalatha	Pussella oya		Yes		

			Amunupura ela			Yes	
			Dartry		Yes		
			Naranwita	Yes			
			Mahaweli River			Yes	
		Poojapitiya	Alagoda	Yes			
			Alagoda	Yes			
			Ovissa	Yes			
			Dombagammana		Yes		
		Tumpane	Kuda oya bank		Yes		
			Kuda oya bank		Yes		
		Udunuwara	Mahaweli River			Yes	
		Minipe	Mahaweli River	Yes			
	Matale	Naula	Ground Water Alahera			Yes	
			Ground Water Lenameeya		Yes		
			Ground Water Nalanda school		Yes		
		Rattota	Ground Water Udathenna		Yes		
			Hapuhinna Oya, Hunugala Oya	Yes			
			Mahaweli River		Yes		
		Ukuwela	Mahaweli River		Yes		
		Pallepola	Nalanda Tank	Yes			
	Nuwara Eliya	Nuwara Eliya	Ground Water Nuwara Eliya		Yes		
			Ambewela stream	Yes			
			Great Westen				Yes
			Thagaramalai (Mahaweli River)			Yes	
			Uma Oya		Yes		
		Ambagamuwa	Branch of Seethagangula	Yes			
			Kaduru Oya		Yes		
			Kelani River		Yes		
			Maskeliya Oya		Yes		
		Hanguranketha	Mul Oya		Yes		
		Kothmale	Dunsinan fall			Yes	
			Helboda oya		Yes		
		Walapane	Halgran oya	Yes			
			Kurudu Oya				Yes
			Weathersick (Kupane Oya)	Yes			
North Weste	Kurunegala	Narammala	Ground WaterWalakumbura rd.	Yes			
			Ground Water Welikumbura, Dampelessa	Yes			
		Ibbagamuwa	Kuda Oya	Yes			
		Mallawapitiya	Deduru Oya	Yes			
		Rideegama	Deduru Oya	Yes			
			Kolamunu Oya	Yes			
		Mawathagama	Kospothu Oya	Yes			
Sabaragamuwa	Kegalle	Dehiovita	Ground Water Gonagala	Yes			
			Maha Oya/Kahanawita Ela			Yes	
		Ruwanwella	Ground Water Gonagala		Yes		
			Halloluoya	Yes			
			Kelani River	Yes			
			Nagas ella			Yes	
		Aranayaka	Ambalakanda Ela		Yes		
		Bulathkohupitiya	Endurapotha Ela	Yes			

		Kegalle	Gurugoda Oya				Yes
		Mawanella	Maha Oya	Yes			
		Rambukkana	Maha Oya	Yes			
		Warakapola	Kuda Oya	Yes			
			Maha Oya	Yes			
		Yatiyanthota	Wee Oya		Yes		
	Ratnapura	Kiriella	Ground Water Kiriella	Yes			
		Nivithigala	Ground Water Nivithigala	Yes			
			Watapotha Spring		Yes		
		Eheliyagoda	Biso Dola			Yes	
		Godakawela	Rakwana Ganga			Yes	
		Imbulpe	Walawe Ganga			Yes	
		Kolonna	Eraporuwa Ganga		Yes		
		Pelmadulla	Kirindi Ella		Yes		
			Wey Ganga	Yes			
		Ratnapura	Kalu Ganga	Yes			
Sourthern	Galle	Nagoda	Ground Water Kabeel watta	Yes			
	Hambantota	Walasmulla	Kirama Sapugaha stream	Yes			
	Matara	Pitabeddara	Ground Water Nariyawatta	Yes			
			Ground Water Town Pitabaddara	Yes			
		Kotapola	Gin Ganga	Yes			
		Pasgoda	Katuwana Nembili stream	Yes			
		Welipitiya	Polwathu Ganga	Yes			
Uva	Badulla	Badulla	Badulu Oya	Yes			
			Badulu Oya		Yes		
			Bi-water steam		Yes		
			Wewassa stream		Yes		
		Bandarawela	Ellethota stream		Yes		
			Kirindi Oya		Yes		
			Liyanagahawela stream		Yes		
		Haldummulla	Kadireshan ela	Yes			
			Need wood spring				Yes
		Hali Ela	Badulu Oya			Yes	
			Dehigolla spring	Yes			
			Morethota stream	Yes			
			Welangolla stream	Yes			
		Haputhale	Amunakale Spring		Yes		
			Kahagolla spring			Yes	
			Magiripura spring		Yes		
			Mathotilla Oya		Yes		
			Rohamton spring	Yes			
		Kandaketiya	Kandaketiya stream		Yes		
		Welimada	Mathotilla Oya	Yes			
			Punchikale		Yes		
			Silmiyapura spring		Yes		
			Uma Oya		Yes		
			Meepilimana Tank		Yes		
		Uva Paranagama	Hal Oya	Yes			
	Moneragala	Badalkumbura	Ground Water Bangalagoda			Yes	
			Ground Water Karavila Road		Yes		

			Ground Water OIC office	Yes			
			Ground Water Pussallawa Temple	Yes			
		Bibila	Ground Water Rathupasketiya	Yes			
			Ground Water Wellasa School	Yes			
		Moneragala	Heda Oya		Yes		
			Kumbukkan Oya		Yes		
		Wellawaya	Maha Oya			Yes	
West Central	Colombo	Seethawaka	Seethawaka ganga		Yes		
		Padukka	Kalatuwawa Tank			Yes	
		Padukka	Labugama Tank		Yes		
West South	Kalutra	Dodangoda	Kalu Gaga			Yes	
		Ingiriya	Ingiriya Nachchimale Ela		Yes		
		Madurawala	Kalu Gaga	Yes			
		Mathugama	Matugama Weththawe Ela			Yes	

Appendix 2.7: Details of the Exposure of Proposed water Sources/ intakes to landslides

Operational Regions	District	Proposed Project Name	Water Sources	Treatment Plants/ Intakes			
			Catchment	Level of exposure			
				Not Likely	Modest	Expected	Most Likely
Central	Kandy	Nawalapitiya Pallegama Water Supply Project	Mahaweli Ganga				Yes
		Ganga Ihala Korale Water Supply Project	Mahaweli Ganga			Yes	
		Kothmale Riverside Water Supply Project	Mahaweli Ganga	Yes			
		Pupuressa Atabage Water Supply Project	u				
		Augmentation of Marassana WTP					
		Kandy South water Service Improvement Project					
		Augmentation of Balagolla WTP					
		Kundasale Haragama WSP					
		Hatharaliyadda Water Supply Project					
		Installation of 1500m3/day package TP for Medadumbara WSS & Pipe Laying	Mahaweli Ganga	Yes			
		Medadumbara Panwila Water Supply Project	Mahaweli Ganga				Yes
	Mathale	Naula Wahakotte Water Supply Project	Mahaweli Ganga	Yes			
	Nuwaraeliya	Gawarammana Bogahakumbura WSP	Mahaweli Ganga	Yes			
		Nanuoya Water Supply Project	Mahaweli Ganga		Yes		
		Gretaer Ambagasdoowa WSP	Mahaweli Ganga		Yes		
		Pundaluoya Water Supply Project	Mahaweli Ganga			Yes	
		Hapugasthalawa Water Supply Project	Mahaweli Ganga		Yes		
North Western	Kurunegala	Polgahawela - Pothuhera - Alawwa Integrated water Supply Project	Maha Oya	Yes			
		Polgahawela - Pothuhera - Alawwa Integrated water Supply Project	Maha Oya	Yes			
		Weerabugedara WSP	Maha Oya	Yes			

		Weerabugedara WSP	Maha Oya	Yes			
		Mawathagama Water Supply Project	Deduru Oya	Yes			
Sabaragamuwa	Kegalle	Dehiowita Water Supply Project- Capacity 16,000m3/day	Kelani Ganga			Yes	
		Construction of Intake at Thalavitiya, Raw water transmission and Aerator for improving quality of service in Eheliyagoda WSS	Kelani Ganga		Yes		
		Eheliyagoda Water Supply Project- Capacity 14,000m3/day	Kelani Ganga		Yes		
		Upgrading Dehiowita WTP & Distribution Improvements	Kelani Ganga			Yes	
		Intergration of Kegalle WSS - capacity 16,000m3/day	Kelani Ganga			Yes	
		Upgrading existing Ruwanwella water treatment plant	Kelani Ganga	Yes			
		Improvements of the Intake weir of Yatiyanthota Water Treatment Plant	Kelani Ganga		Yes		
		Ruwanwella WSP	Kelani Ganga	Yes			
		Hemmathagama WSP	Maha Oya				Yes
		Supply and laying of gravity transmission main to Adurapotha tank	Kelani Ganga				Yes
		Upgrading Moronthota WTP and associated Transmission and Distribution System improvements	Kelani Ganga	Yes			
		Upgrading existing Warakapola WTP & Distribution Improvements	Maha Oya	Yes			
		Upgrading Mawanella WTP and associated Transmission and Distribution System improvements	Maha Oya	Yes			
		Warakapola Water Supply Project - 16,000 m3/day	Maha Oya	Yes			
		Integration of Kegalle WSS	Maha Oya	Yes			
		Rambukkana Water Supply Project - 16,000m3/day capacity	Maha Oya	Yes			
		WASSIP	Maha Oya	Yes			
	Rathnapura	Balangoda Stage II	Walawe Ganga		Yes		
		Kalawana WSP	Kalu Ganga	Yes			
		Doloswala, Nivithigala, Karavita Water Supply Project- Capacity 4500m3/day	Kalu Ganga	Yes			
		Augmentation of Kahawatte WTP and distribution expansion to Opanayake	Kalu Ganga	Yes			
		Upgrading Pelmadulla WTP & Distribution Improvements	Kalu Ganga		Yes		
		Balangoda Stage II	Walawe Ganga			Yes	
		Augmentation of old Balangoda WTP & Laying of DI pumping main	Walawe Ganga			Yes	
		Greater Ratnapura Stage II - Upgrade from 6,000m3/day to 18,000m3/day	Kalu Ganga	Yes			
		Kiriella Water Supply Project - 3000 m3/day	Kalu Ganga	Yes			
		Improving of existing Kiriella WTP & Distribution Improvements	Kalu Ganga	Yes			
		Ingiriya Water Supply Improvement Project	Kalu Ganga	Yes			
		Kuruvita Water Supply Project- Capacity 5000 m3/day	Kalu Ganga				Yes
Southern	Hambantota	Augmentation of Katuwana WSS	Urubokka Oya	Yes			

	Galle	Capacity improvement and distribution expansion project of Udugama WSS	Gin Ganga	Yes			
		Capacity improvement and distribution expansion project of Pitigala WSS	Bentota Ganga	Yes			
	Matara	Imaduwa WSP	Polwatta Ganga	Yes			
		Augmentation of Hallala WSS	Polwatta Ganga	Yes			
		Augmentation of Hakmnana WSS	Nilwala Ganga	Yes			
		Capacity Enhancement & Distribution Expansion project of Hakmana WSS	Nilwala Ganga	Yes			
		Deyyandara-Mulatiyana WSP	Nilwala Ganga	Yes			
		Morawaka WSP	Nilwala Ganga	Yes			
		Deniyaya WSP	Bambawe Ara	Yes			
Uva	Badulla	Haldummulla Wsp (WaSSIP Additional Financing-Pending)	Walawe Ganga		Yes		
		Bandarawela WSP phase I &II	Mahaweli Ganga				Yes
		Yahalarawa WSP	Mahaweli Ganga	Yes			
		Welimada Stage II	Mahaweli Ganga		Yes		
		Springvelly WSP	Mahaweli Ganga	Yes			
		Water Treatment Improvement in Monaragala District WSS (Medagama, Siyabalanduwa, Sewanagala)	Mahaweli Ganga		Yes		
		Thaldena Meegahakiula WSP	Mahaweli Ganga		Yes		
		Improvemnts to Kandekatiya wss	Mahaweli Ganga	Yes			
		Bibila Medagama WSS -Phase l	Mahaweli Ganga		Yes		
		Loggaloya WSP	Mahaweli Ganga		Yes		
		Design works of Morana WSP	Mahaweli Ganga		Yes		
	Moneragala	Hambegamuwa WSP	Walawe Ganga	Yes			
		Improvement to Icepihilla WTP, Wellawaya WSS	Kirindi Oya	Yes			
		Wellawaya Stage II phase Il	Kirindi Oya		Yes		
		Wellawaya Stage II phase I	Kirindi Oya		Yes		
		Badalkumbura WSP	Menik Ganga			Yes	
		Design works of Greater Monaragala WSP (30,000m3/d)	Kumbukkan Oya	Yes			
		Design of Medagama WSP from new source	Kumbukkan Oya	Yes			
		Bibila Medagama Phase ll	Gal Oya	Yes			
Western-Northern	Gampaha	Gamapaha Attanagalla Minuwangoda WSP - Stage I (ongoing project)	Attanagalu Oya		Yes		
		Gampaha Attanagalla Minuwangoda WSP - Stage II	Attanagalu Oya		Yes		
Western-Central	Colombo	Construction of New Water Treatment Plant at Awissawella	Kelani Ganga	Yes			
		Improvement of Awissawella Water Treatment Plant	Kelani Ganga		Yes		
Western-South	Kalutara	Kethhena Improvement & Expansion Project	Kalu Ganga		Yes		
		Mathugama	1				

Appendix 2.8: Water Intakes Expose to Drought Hazard

Operational Regions	District	Divisional Secretariat	Water Sources								
			Catchments			Tube wells			Community Supply		
			High	Moderate	Low	High	Moderate	Low	High	Moderate	Low
Central	Kandy	Doluwa	1	1			1				
		Ganga Ihala Korale		2							
		Harispattuwa		2			4				
		Kandy Four Gravets & Gangawata Korale			1						
		Kundasale			1						
		Medadumbara		1							
		Minipe		1							
		Panvila		1							
		Pathadumbara		1							
		Pathahewaheta		1							
		Pujapitiya					1				
		Thumpane					1				
		Udapalatha		3			2				
		Udunuwara		1							
	Mathale	Dambulla		1							
		Naula				2					
		Pallepola			1		1				
		Rattota		2			3				
		Ukuwela		1							
	Nuwaraeliya	Ambagamuwa		4	1						
		Hanguranketha		1							
		Kothmale	1	1							
		Nuwara Eliya		4			1				
		Walapane		3							
Eastern	Trincomale	Kanthalai	1		1						
		Kuchchaveli					5				
		Muttur		1							
		Verugal Eachchilampattu	1								
	Baticaloa	Manmunai West	1								
	Ampara	Pottuvil				1					
		Thirukkovil	2								
		Damana			1						
		Ampara			1						
		Uhana	1	2							
		Padiyathalawa				1	2				
		Dehiattakandiya		2	1						
North Central	Polonnaruwa	Elahera			2			1			

		Dimbulagala		1			3				
		Thamankaduwa	1		1						
		Hingurakgoda		1			3				
		Lankapura				2					
		Medirigiriya		1							
	Anuradapura	Galnewa			1						
		Horowpothana					1				
		Ipalogama			1						
		Kahatagasdigiliya					5	4			
		Kebithigollewa					5	1			
		Kekirawa			1						
		Mahawilachchiya		1			1				
		Medawachchiya					10	1			
		Mihinthale						5			
		Nachchaduwa			1						
		Nuwaragam Palatha Central			1		1	1			
		Nuwaragam Palatha East			1						
		Padaviya					1	3			
		Thalawa			2						
		Thambuttegama			1						
North Western	Kurunegala	Ambanpola			1		2				
		Galgamuwa				2					
		Ibbagamuwa		1							
		Mallawapitiya		1							
		Mawathagama		1							
		Narammala	1			1	2				
		Nikaweratiya			1						
		Pannala	1				1				
		Ridigama		2							
		Wariyapola			2		4				
	Puttlam	Anamaduwa					4	1			
		Arachchikattuwa					1				
		Chilaw				1	1	7			
		Dankotuwa		1							

		Madampe					4				
		Mahawewa		1							
		Nattandiya					4				
		Pallama		1							
		Puttalam					3	10			
		Wanathavilluwa	1				1				
		Wennappuwa					2				
	Jaffna	Delft					2				
		Island North (Kayts)				3					
		Island South (Velanai)				1	2				
		Karainagar				2					
		Thenmaradchy (Chavakachcheri)				1					
		Vadamaradchy North (Point Pedro)				5					
		Vadamaradchy South-West (Karaveddy)				2					
		Valikamam East (Kopay)				2					
Northern		Valikamam South (Uduvil)				1					
		Valikamam West (Chankanai)				3					
	Multhiuv	Manthai East				2					
		Maritimepattu				1	2				
		Oddusuddan				2					
		Thunukkai					6				
	Kilinochchi	Karachchi	1			2					
		Poonakary					5				
	Vavuniya	Vavuniya			1		7	2			
	Mannar	Manthai West				6					
		Nanattan				10					
	Kegalle	Aranayaka		1							
		Bulathkohupitiya	1								
		Dehiovita		1			1				
		Kegalle	1								
		Mawanella		1							
		Rambukkana		1							
		Ruwanwella		3			1				
Sabaragamuwa		Warakapola	2								
		Yatiyanthota	1								
	Rathnapura	Eheliyagoda		1							
		Embilipitiya	1	2							
		Godakawela		1							
		Imbulpe		1							
		Kiriella					1				

		Kolonna		1							
		Nivithigala		1			1				
		Pelmadulla	1	1							
		Ratnapura	1	1							
Southern	Hambantota	Ambalantota	1	2							
		Angunakolapelessa		2							
		Lunugamvehera		1							
		Tangalle	1	1							
		Tissamaharama	2								
		Walasmulla			2						
	Galle	Baddegama		2							
		Bope-Poddala		1							
		Nagoda					1				
	Matara	Athuraliya		2							
		Dickwella				1					
		Kamburupitiya	1								
		Kotapola		1							
		Pasgoda		1							
		Pitabeddara					3				
		Thihagoda		1							
		Welipitiya		1							
Uva	Badulla	Badulla		4							
		Bandarawela	1	2							
		Haldummulla	2								
		Hali-Ela		4							
		Haputale		5							
		Kandaketiya	1								
		Mahiyanganaya		2							
		Uva Paranagama		1							
		Welimada		3	2						
	Moneragala	Badalkumbura					4				
		Bibile					2				
		Buttala		1			5				
		Katharagama		1							
		Madulla			1						
		Medagama					2				
		Moneragala	1	1							
		Siyambalanduwa					1				
		Thanamalvila			1						
		Wellawaya		1							
Western-Northern	Gampaha	Attanagalla		1			2				
		Biyagama		1							
		Divulapitiya	1			3					
		Dompe		2							
		Gampaha		1			4				
		Katana	2								
		Minuwangoda				7	1				
		Mirigama				2	2				

Western-Central	Colombo	Kaduwela		1							
		Kolonnawa		1							
		Padukka			2						
		Seethawaka		2							
Western-South	Kalutara	Dodangoda		1							
		Ingiriya		1							
		Madurawala		1							

Appendix 2.9: Details of Exposure to Water Treatment Plants / Intakes to Drought

Operational Regions	District	Divisional Secretariat	No of Water Treatment plants / Intakes Expose to Drought Hazard			
			High	Moderate	Low	Grand Total
Central	Kandy	Doluwa	1	2		3
		Ganga Ihala Korale		1		1
		Harispattuwa		1		1
		Kandy Four Gravets & Gangawata Korale		1	1	2
		Kundasale			1	1
		Medadumbara	1			1
		Panvila		1		1
		Pasbage Korale		1		1
		Pathadumbara		1		1
		Pathahewaheta		1		1
		Pujapitiya		1		1
		Thumpane		1		1
		Udapalatha		3		3
		Udunuwara		1		1
	Matale	Ambanganga Korale		1		1
		Dambulla	1			1
		Matale		1		1
		Pallepola			1	1
		Rattota		1		1
		Ukuwela		1		1
		Wilgamuwa	1			1
	Nuwara Eliya	Ambagamuwa		4	1	5
		Hanguranketha	1			1
		Kothmale	1	1		2
		Nuwara Eliya		2		2
		Walapane		2		2
Eastern	Ampara	Ampara			1	1
		Dehiattakandiya	2	1	1	4
		Mahaoya	1			1
		Padiyathalawa	1			1
		Thirukkovil	1			1
		Uhana	1			1
	Batticaloa	Koralai Pattu North (Vaharai)		1		1
		Manmunai West	1			1
	Trincomalee	Kanthalai			1	1
		Kuchchaveli		1		1
		Muttur		1		1
		Verugal Eachchilampattu	1			1
Northern	Jaffna	Island North (Kayts)	1			1
		Island South (Velanai)	8			8
		Karainagar	2			2
		Thenmaradchy (Chavakachcheri)	3			3
		Vadamaradchy North (Point Pedro)	3			3

		Valikamam East (Kopay)	1			1
		Valikamam South (Uduvil)	1			1
		Valikamam West (Chankanai)	3			3
	Kilinochchi	Karachchi	2			2
	Mannar	Madhu		8		8
		Mannar Town		11		11
		Manthai West	7			7
	Mullaitivu	Manthai East	2	1		3
		Oddusuddan	2			2
		Thunukkai	5			5
	Vavuniya	Vavuniya			1	1
		Vavuniya North		2		2
North Central	Anuradhapura	Galnewa			1	1
		Mahawilachchiya		2		2
		Medawachchiya		1		1
		Nachchaduwa			1	1
		Nuwaragam Palatha Central			1	1
		Nuwaragam Palatha East			1	1
		Thalawa			1	1
		Thambuttegama			1	1
	Polonnaruwa	Dimbulagala	1	1	1	3
		Elahera	1	1		2
		Hingurakgoda		1		1
		Medirigiriya		1		1
		Thamankaduwa		1	1	2
		Welikanda			1	1
North Western	Kurunegala	Alawwa		1		1
		Ambanpola		1	1	2
		Bingiriya		1		1
		Ibbagamuwa		1		1
		Kurunegala		1		1
		Mawathagama		2		2
		Narammala		1		1
		Nikaweratiya			1	1
		Pannala	1	1		2
		Polgahawela		1		1
		Ridigama		3		3
		Wariyapola		1		1
	Puttalam	Anamaduwa		1		1
		Dankotuwa		1		1
		Madampe		1		1
		Nattandiya		3		3
		Pallama		1		1
		Wanathavilluwa	1			1
		Wennappuwa		1		1
Sabaragamuwa	Kegalle	Bulathkohupitiya		1		1
		Dehiovita		1		1
		Deraniyagala		2		2
		Ruwanwella		1		1

	Ratnapura	Balangoda		1		1
		Eheliyagoda	1	3	1	5
		Embilipitiya	2			2
		Godakawela		1		1
		Imbulpe		1		1
		Kahawatta		1		1
		Kuruvita	1	2		3
		Nivithigala	1	1		2
		Ratnapura		2		2
		Weligepola	1	1		2
Sourthern	Galle	Baddegama		1		1
		Bope-Poddala		2		2
		Nagoda		1		1
		Niyagama		1		1
	Hambantota	Ambalantota	1	2		3
		Angunakolapelessa		1		1
		Beliatta		1		1
		Lunugamvehera		1		1
		Sooriyawewa		1		1
		Tangalle	1	1		2
		Tissamaharama	3			3
		Walasmulla		1	1	2
	Matara	Akuressa		1		1
		Dickwella	1			1
		Hakmana	1			1
		Kamburupitiya	1			1
		Kotapola		1		1
		Malimbada	1			1
		Mulatiyana		1		1
		Pasgoda		2		2
		Pitabeddara		1		1
		Thihagoda		1		1
		Welipitiya		1		1
Uva	Moneragala	Badalkumbura		2		2
		Bibile		2		2
		Buttala		2		2
		Katharagama	1			1
		Moneragala	2			2
		Siyambalanduwa		1	2	3
		Thanamalvila		3	1	4
		Wellawaya	2	3		5
	Badulla	Badulla		1		1
		Bandarawela		2		2
		Ella		1		1
		Haldummulla	3	1		4
		Hali-Ela		2		2
		Haputale		1		1
		Mahiyanganaya		2	1	3
		Uva Paranagama		2		2
		Welimada		4		4
West Central	Colombo	Homagama		1		1

		Kolonnawa		1		1
		Padukka		1		1
		Seethawaka		2		2
West North	Gampaha	Attanagalla		3		3
		Biyagama		1		1
		Divulapitiya	1			1
		Dompe		3		3
		Gampaha		1		1
		Katana	1	1		2
		Minuwangoda	1	1		2
		Mirigama		2		2
West South	Kalutara	Madurawala		1		1
		Mathugama	1			1
		Palindanuwara		1		1

Appendix 2.10: Proposed Water sources and Intakes Exposed to Drought

Operational Regions	District	Proposed Project Name	Water Sources						Treatment Plants/ Intakes		
			Catchment			Tube wells			Level of exposure		
			High	Moderate	Low	High	Moderate	Low	High	Moderate	Low
Central	Kandy	Augmentation of Balagolla WTP			Yes						1
		Augmentation of Marassana WTP		Yes						1	
		Ganga Ihala Korale Water Supply Project		Yes						1	
		Hasalaka Water Supply Project		Yes						1	
		Hatharaliyadda Water Supply Project		Yes						1	
		Installation of 1500m3/day package TP for Medadumbara WSS & Pipe Laying		Yes						1	
		Kandy South Water Service Improvement Project		Yes						1	
		Kothmale Riverside Water Supply Project		Yes						1	
		Kundasale Haragama WSP		Yes						1	
		Medadumbara Panwila Water Supply Project		Yes						1	
		Nawalapitiya Pallegama Water Supply Project		Yes						1	
		Pupuressa Atabage Water Supply Project		Yes						1	
	Mathale	Greater Dambulla Stage II		Yes						1	
		Naula Wahakotte Water Supply Project			Yes						1
	Nuwaraeliya	Hapugasthalawa Water Supply Project		Yes						1	
		Nanuoya Water Supply Project		Yes						1	
		Pundaluoya Water Supply Project		Yes						1	
Eastern	Trincomalee	Construction of intake (28000cum/day) at Allai Knathale and Laying raw water transmission main from Allai Kanthale to Kanthale WTP	Yes						1		
		Greater Trincomalee Expansion WSP		Yes						1	
		Increasing service coverage and Service level improvement in Dehiwatha, Thoppur and surrounding areas		Yes						2	
		Intake Improvement of Integrated Trincomalee WSS at Allai Kanthale		Yes						2	

		Morawewa & Gomarankadawala Water Supply Project in Trincomalee District			Yes						1
		Padavisipura Water Supply Project in Trincomalee District	Yes						1		
		Service level improvement to Trincomalee City and surrounding areas			Yes				1		
		Upgrading Kanthale WTP capacity from 54,000 cum/day to 72,000cum/day including treated water transmission from Kantale WTP to Kappalthurai	Yes						1		
		Upgrading Muthur WTP & Intake improvement at Neelapola		Yes						2	
		Water Source Improvement in Eachchliampattu WSS	Yes						1		
		Water supply extension to Muthur East areas from Muthur WTP and Distribution Improvement			Yes						1
		Water supply extension to Naddouththu and Sorrounding areas from Muthu WTP		Yes						2	
	Baticaloa	Augmentation of Valachchanai Paper Mill WSS		Yes						1	
		Batticaloa North WSP (Vaharai WSP)		Yes						1	
		Batticaloa South WSP	Yes						1		
		Batticaloa West WSP		Yes						1	
		Heda Oya Water Supply Project			Yes						1
		Improvement of Kokkadichcholai WSS	Yes						1		
		Increase service coverage in Unnichchai and surrounding areas	Yes						1		
		Valachchanai WSP		Yes						1	
	Ampara	Dehiyaththa kandiya Water Supply Project			Yes						1
		Improvement of Bangalawadiya WTP at Sammanthurai	Yes						1		
		Improvement of Dehiytakandiya & Lihiniyagama WSS		Yes						1	
		Improvement of Padiyathalawa WSS	Yes						1		
		Improvement of Service level at Panama WSS		Yes						1	
		Improvement to Thirukkovil WSS		Yes						1	
		Padiyathalawa WSP	Yes						1		
North Central	Polonnaruwa	Augmentation of Gallella WTP	Yes						1		
		Augmentation of Polonnaruwa Old WTP			Yes						1
		Improvements to Minneriya WTP & WSS		Yes						1	

		Medirigiriya WTP -Phase 2		Yes						1	
		Towns East of Polonnaruwa Water Supply Project	Yes						1		
	Anuradapura	Amuradhapura North Phase II WSP			Yes						1
		Anuradhapura North Water Supply Project - Phase I			Yes						1
		Anuradhapura South Phase II WSP (Restructured for immediate need)		Yes	Yes					2	1
		Augmentation of Thissawewa WTP			Yes						1
		Augmentation of Thuruwila WTP			Yes						1
		Construction of a 5,000m3/day capacity WTP at Galnewa			Yes						1
		Eppawala, Rajanganaya, Nochchiyagama & Giribawa Integrated WSP			Yes						1
		Future Expansion for Anuradhapura City - North Area		Yes						1	
		Future Expansion for Anuradhapura City - South Area		Yes						1	
		Galenbindunuwewa Water Supply Project			Yes						1
		Galnewa ΓÇô Palagala Water Supply Project (Restructured for immediate need)		Yes						1	
		Greater Anuradhapura North & Greater Trincomalee Integrated Water Supply Project		Yes						1	
		Kalawewa WSS Improvements			Yes						1
		Palugaswewa water supply project (Restructured for immediate need)			Yes						1
		Thambuttegama WSP			Yes						1
North Western	Kurunegala	Bingirya - Udubaddawa & Makadura-Pannala- Kuliyapitiya Integrated WSP - Phase I (02 Nos. 20000m3/d WTP)	Yes						1		
		Extension to Rasnayakapura			Yes					1	
		Galgamuwa - Ehatuwewa - Ambanpola Water Supply Project			Yes					1	
		Giriulla - Dambadeniya- Narammala Water Supply Project.	Yes						1		
		Katupotha - Bamunakotuwa - Panduwasnuwara WSP			Yes						1
		Mawathagama Water Supply Project		Yes						1	
		Polgahawela - Pothuhera - Alawwa Integrated water Supply Project		Yes						1	
		Polpithigama WSP			Yes						1

		Weerabugedara WSP		Yes						1	
	Puttlam	Chilaw WSP - Stage II		Yes						1	
		Dankotuwa WSP - Phase I		Yes						1	
		Kakkapalliya Water Supply Project		Yes						1	
		Kakkapalliya WSP Stage 11		Yes						1	
		Kalpitiya WSP	Yes						1		
		Karuwalagaswewa WSP	Yes						1		
		Naththandiya Mahawewa IWSP	Yes						1		
		Nattandiya - Wennappuwa Water Supply Scheme		Yes						1	
		Puttalam Water Supply Project - Stage II	Yes						1		
Northern	Jaffna	Augmentation of Delft WSS	Yes						1		
		Chulipuram WSS Stage I	Yes						1		
		Chunnakam WSP	Yes								
		Improvement of WTP in Thottaveli, Murunkan & Point Pedro				Yes			3		
		Improvements to Existing Water Supply Schemes in Thaiyaddi & Vadakkachchi	Yes			Yes			2		
		Jaffna Kilinochchi IWSP Stage II	Yes						1		
		Kankasanthurei WSS Stage I	Yes						1		
		Point Pedro & VVT (RO plant) WSS	Yes						1		
	Multhiuv	Augmentation of Oddusuddan & Nedunkerny WSS (Stage 1 & 2)		Yes						1	
		Augmentation of Pandiankulam & Mallavi WSS	Yes						1		
		Greater Mullaitivu WSP - Cost for Feasibility Studies & Design		Yes						1	
		Mankulam WSP - Cost for Feasibility Studies & Desgin TCE is 28,000 MN	Yes						1		
		Service level improvement Mankulam WSS					Yes			1	
	Kilinochchi	Groundwater Source Development in Northern Region				Yes	Yes		2	2	
		Improvement to Akkarayan WSS				Yes			1		
		Improvement to Existing WTP at Kilinochchi	Yes						1		
		Improvements to Existing Water Supply Schemes in Thaiyaddi & Vadakkachchi				Yes			1		

		Paranthan to Palai Transmission Main	Yes						1		
	Vavuniya	Greater Vavuniya WSS - Cost for Feasibility Studies & Desgin		Yes						1	
		Improvement to Omanthai WSS					Yes			1	
		Peraru Bund raising for additional 0.8MCM			Yes						1
		Service Level Improvement in Cheddikulam WSP					Yes			4	
	Mannar	Greater Jaffna WSP	Yes						1		
		Greater Mannar WSP NOTE: Phase 1 & 2 combined		Yes						1	
		Ground Water Source Development in Northern region				Yes				1	
		Rehabilitation of Thalai Mannar WSS				Yes			1		
		Service level improvement in Musali Water supply Scheme					Yes	Yes		4	1
Sabaragamuwa	Kegalle	Hemmathagama WSP		Yes						1	
		Improvements of the Intake weir of Yatiyanthota Water Treatment Plant	Yes						1		
		Integration of Kegalle WSS		Yes						1	
		Integration of Kegalle WSS - capacity 16,000m3/day	Yes						1		
		Rambukkana Water Supply Project - 16,000m3/day capacity		Yes						1	
		Ruwanwella WSP		Yes						1	
		Supply and laying of gravity transmission main to Adurapotha tank	Yes						1		
		Upgrading Dehiowita WTP & Distribution Improvements		Yes						1	
		Upgrading existing Ruwanwella water treatment plant		Yes						1	
		Upgrading existing Warakapola WTP & Distribution Improvements	Yes						1		
		Upgrading Mawanella WTP and associated Transmission and Distribution System improvements		Yes						1	
		Upgrading Moronthota WTP and associated Transmission and Distribution System improvements	Yes						1		
		Warakapola Water Supply Project - 16,000 m3/day	Yes						1		
		WASSIP	Yes						1		
	Rathnapura	Augmentation of Kahawatte WTP and distribution expansion to Opanayake		Yes						1	

		Augmentation of old Balangoda WTP & Laying of DI pumping main		Yes						1	
		Balangoda Stage II		Yes						2	
		Construction of Intake at Thalavitiya, Raw water transmission and Aerator for improving quality of service in Eheliyagoda WSS		Yes						1	
		Dehiowita Water Supply Project- Capacity 16,000m3/day	Yes						1		
		Doloswala, Nivithigala, Karavita Water Supply Project- Capacity 4500m3/day	Yes						1		
		Eheliyagoda Water Supply Project-Capacity 14,000m3/day		Yes						1	
		Embilipitiya paper mill- Capacity 30,000 m3/day		Yes						1	
		Greater Ratnapura Stage II - Upgrade from 6,000m3/day to 18,000m3/day		Yes						1	
		Improving of existing Kiriella WTP & Distribution Improvements		Yes						1	
		Kalawana WSP		Yes						1	
		Kiriella Water Supply Project - 3000 m3/day		Yes						1	
		Kuruvita Water Supply Project- Capacity 5000 m3/day		Yes						1	
		Upgrading Pelmadulla WTP & Distribution Improvements	Yes						1		
Southern	Hambantota	Augmentation of Muruthawela WSS and Distribution Expansion			Yes						1
		Augmentation of Bundala WSS	Yes						1		
		Augmentation of Kattakaduwa WTP and distribution expansion project of Ranna WSS	Yes						1		
		Augmentation of Katuwana WSS		Yes						1	
		Barawakumbuka short term Phase I	Yes						1		
		Barawakumbuka short term Phase II	Yes						1		
		Capacity improvement and distribution expansion project of Kataragama WSS (Short Term)		Yes						1	
		Capacity improvement and distribution expansion project of Lunugamwehera WSS Phase I & II		Yes						1	
		Hambantota Industrial zone WSP - Feasibility & Detail Design work			Yes						1
		Kataragama Long term Phase I &II		Yes						1	

		Lunugamwera IWSP phase I & II (Phase I- 6600 Mn Phase II - 8041 Mn)		Yes						1	
		Middeniya Angukukola Long term improvement WSP Phase II		Yes						1	
		Muruthawela Long Term WSP- Phase I & II (Phase I - 14,000 Mn, Phase II - 7,000 Mn)			Yes						1
		Nawayalawila source Improvement Project of Tangalle WSS		Yes						1	
		Ruhunupura Stage II		Yes						1	
		Wakamulla WSS (Phase 2)		Yes						1	
	Galle	Baddegagama IWSP-Stage II		Yes						1	
		Baddegama IWSP-Stage I		Yes						1	
		Capacity improvement and distribution expansion project of Baddegama WSS		Yes						1	
		Capacity improvement and distribution expansion project of Pitigala WSS		Yes						1	
		Capacity improvement and distribution expansion project of Udugama WSS		Yes						1	
		Greater Galle stage III WSP		Yes						1	
		Imaduwa WSP		Yes						1	
	Matara	Augmentation of Hakmnana WSS		Yes						1	
		Augmentation of Hallala WSS		Yes						1	
		Capacity Enhancement & Distribution Expansion project of Hakmana WSS		Yes						1	
		Deniyaya WSP		Yes						1	
		Deyyandara-Mulatiyana WSP		Yes						1	
		Mathara Stage V	Yes						1		
		Morawaka WSP		Yes						1	
Uva	Badulla	Bandarawela WSP phase I &II		Yes						1	
		Design works of Morana WSP	Yes						1		
		Gawarammana Bogahakumbura WSP		Yes						1	
		Gretaer Ambagasdoowa WSP			Yes						1
		Haldummulla Wsp (WaSSIP Additional Financing-Pending)		Yes						1	
		Improvemnts to Kandekatiya wss		Yes						1	

		Loggaloya WSP		Yes						1	
		Springvelly WSP		Yes						1	
		Thaldena Meegahakiula WSP		Yes						1	
		Ulhitiya WSP			Yes						1
		Welimada Stage II		Yes					1		
		Yahalarawa WSP			Yes						1
	Moneragala	Badalkumbura WSP		Yes						1	
		Bibila Medagama Phase ll		Yes						1	
		Bibila Medagama WSS -Phase l	Yes						1		
		Design of Medagama WSP from a new source		Yes						1	
		Design works of Greater Monaragala WSP (30,000m3/d)		Yes						1	
		Design works of Buttalae Stage ii (From Weheragala)		Yes						1	
		Hambegamuwa WSP		Yes						1	
		Improvement to Icepihilla WTP, Wellawaya WSS		Yes						1	
		Madulla WSP		Yes						1	
		Thanamalvila Sevanagala Integrated WSP			Yes						1
		Water Treatment Improvement in Monaragala District WSS (Medagama, Siyabalanduwa, Sewanagala)		Yes						1	
		Wellawaya Stage II phase I		Yes						1	
		Wellawaya Stage II phase Il		Yes						1	
Western-Northern	Gampaha	Augmentation of Divulapitiya WTP	Yes						1		
		Augmentation of Gampaha WTP		Yes						1	
		Augmentation of Nittambuwa WSS		Yes						1	
		Augmentation of Ranpokunawatta WTP		Yes						1	
		Augmentation of Veyangoda WSS		Yes						1	
		Augmentation of Yakkala WSS		Yes						1	
		Divulapitiya Water Supply Project - Stage I	Yes						1		
		Divulapitiya Water Supply Scheme ΓÇô Stage II	Yes						1		
		Extension of Intake Structure at Pugoda		Yes						1	
		Gamapaha Attanagalla Minuwangoda WSP - Stage I (ongoing project)		Yes						1	

		Gampaha Attanagalla Minuwangoda WSP - Stage II		Yes						1	
		Katana Water Supply Project - Stage II		Yes						1	
		Kiridiwela Water Supply Project - Stage II		Yes						1	
		Kiridiwela Water Supply Project ΓÇô Stage I		Yes						1	
		Mabima Water Supply Project - Stage I		Yes						1	
		Mirigama Water Supply Project - Stage I		Yes						1	
		Mirigama Water Supply Scheme ΓÇô Stage II		Yes						1	
		Rehabilitation of Raddolugama WSS	Yes						1		
Western-Central	Colombo	Ambatale Water Treatment Plant Expansion Project		Yes						1	
		Construction of New Water Treatment Plant at Awissawella		Yes						1	
		Improvement of Awissawella Water Treatment Plant		Yes						1	
		Weliwita Water Supply Project - Head Works (Stage-1)		Yes						1	
Western-South	Kalutara	Capacity Improvement of Kadana WTP		Yes						1	
		Ingiriya Water Supply Improvement Project		Yes						1	
		Kethhena Improvement & Expansion Project		Yes						2	

Annexure 2.11: Summarized details of water Intakes exposed to floods

Operational Regions	District	Divisional Secretariat	Water Sources
Central	Matale	Pallepola	Nalanda Tank
	Nuwara Eliya	Ambagamuwa	Kelani River
Eastern	Trincomalee	Kuchchaveli	Lalikadu Kulam
		Kuchchaveli	Ground Water - Thandamuripu
		Kuchchaveli	Ground Water - Yan Oya
		Kantalae	Mahaweli River
		Muttur	Mahaweli River
		Kantalae	Kanthale Wewa
North Central	Anuradhapura	Padaviya	Ground Water
		Mahavilachchiya	Malwathuoya
		Thalawa	Koonwewa Tank
	Polonnaruwa	Lankapura	Ground Water - WRB new BH 1
		Lankapura	Ground Water - WRB new BH 2
		Thamankaduwa	Mahaweli River
North West	Kurunegala	Galgamuwa	Close to "Mee" oya
		Ambanpola	MeeOya
		Narammala	Maha Oya
		Pannala	Maha Oya
		Wariyapola	Maguru Oya
			Deduru Oya reservoir
	Puttalam	Chilaw	Ground Water - In side T/Plant
			Ground Water - Munneswaram
			Ground Water - Munneswaram (temple)
			Ground Water - Outside T/Plant
			Ground Water - TWS - Thiththakade
		Nattandiya	Ground Water -Kokkalamulla
		Dankotuwa	Maha Oya
		Mahawewa	Kadupiti Oya
		Pallama	Deduru Oya
Northern	Jaffna	Delft	Ground Water Delft

		Vadamaradchy North	Ground Water Manalkadu
		Vadamaradchy North	Ground WaterWallipuram
		Velanai	Ground Water Velanai
		Velanai	Ground Water Mandaithivu 32
	Kilinochchi	Karachchi	Ground Water Kilinochchi
		Karachchi	Kilinochchi dry Aru
	Mannar	Manthai West	Ground Water Periamadu
	Mannar	Nanaddan	Ground Water - Murunkan well field
	Mullaitivu	Maritimepattu	Ground Water - Wattappalai
Sabaragamuwa	Kandy	Udapalatha	Mahaweli River
		Dehiovita	Ground Water Gonagala
		Ruwanwella	Ground Water Gonagala
		Bulathkohupitiya	Endurapotha Ela
		Dehiovita	Maha Oya/Kahanawita Ela
		Kegalle	Gurugoda Oya
		Ruwanwella	Kelani River
		Yatiyanthota	Wee Oya
	Ratnapura	Kiriella	Ground Water - Kiriella
		Nivithigala	Ground Water - Nivithigala
		Ratnapura	Kalu Ganga
Sourthern	Galle	Nagoda	Ground Water Kabeel watta
		Baddegama	Gin Ganga
		Bope-Poddala	Gin Ganga
	Hambantota	Tangalle	Kirama Oya
	Matara	Pitabeddara	Ground Water - Nariyawatta
		Pitabeddara	Ground Water - Town Pitabaddara
		Athuraliya	Nilwala River
		Kamburupitiya	Nilwala River
		Kotapola	Gin Ganga
		Pasgoda	Katuwana Nembili stream
		Thihagoda	Nilwala River
West South	Kalutara	Ingiriya	Ingiriya Nachchimale Ela
		Madurawala	Kalu Gaga
		Dodangoda	Kalu Gaga
West Central	Colombo	Kaduwela	Kelani River

		Seethawaka	Seethawaka ganga
		Padukka	Kalatuwawa Tank
		Padukka	labugama Tank
West North	Gampaha	Divulapitiya	Ground Water iulapitiya WSS - ii, Thekkawatta
		Divulapitiya	Ground Water Diulapitiya WSS – Thekkawatta
		Divulapitiya	Ground Water Kotadeniyawa, Welihinda,Thekkawatta
		Gampaha	Ground Water Attanagalu Oya Bank
		Gampaha	Ground WaterAttanagalu Oya bank
		Gampaha	Ground Water Vidiyawatta
		Gampaha	Ground Water Yakkala Treatment plant
		Minuwangoda	Ground Water Ambagahawatta Pump House
		Minuwangoda	Ground Water Industrial Zone (BOI) - ii
		Minuwangoda	Ground Water Kotugoda Road, Near Temple
		Minuwangoda	Ground Water Wegowa Pump House
		Attanagalla	Attanagalu Oya
		Biyagama	Kelani River
		Divulapitiya	Maha Oya
		Dompe	Kelani River
		Katana	Maha Oya
		Minuwangoda	Attanagalu Oya (Dandugam Oya)

Appendix 2.12: Details of Water Treatment Plants Exposed to Flood

Operational Regions	District	Divisional Secretariat	Name of Water Treatment Plant	Source	Area Covered
North West	Kurunegala	Ambanpola	Galgamuwa - Mee Oya	Mee oya, 2 BH (used in dry season)	Galgamuwa
		Bingiriya	Vilaththawa/ Chilaw	Deduru Oya	Chilaw
		Pannala	Pannala	Ma Oya	Pannala
Northern	Jaffna	Vadamaradchy North	Karaveddy -Dug well	Karaveddy - Dug well	Karaveddy, Point-Pedro, Valvettithurai
		Vadamaradchy North	Vallipuram, Point Pedro		
		Vadamaradchy North	Karaveddy -Dug well	Vallipuram Intake - Tube wells 1-6	Karaveddy, Point-Pedro, Valvettithurai
		Vadamaradchy North	Vallipuram Intake - Dug wells 1,2,3, &4, Tube wells 1-6 Vallipuram, Point Pedro		
		Vadamaradchy North	Vallipuram Intake - Dug wells 1,2,3, &4, Tube wells 1-6 Vallipuram, Point Pedro	Vallipuram Intake - Dug wells 1,2,3, &4	Karaveddy, Point-Pedro, Valvettithurai
		Velanai	Tube wells 1 Water supply lane, Velanai	Tube wells 1	Velanai
	Kilinochchi	Karachchi	Karadipokku 01 dug well, 01 tube well Wilson Roa*	Karadipokku 01 dug well, o1 tube well	Killinochchi
		Karachchi	Surface Water (Dry Aru), Wilson Road, Kilinochchi	Surface Water (Dry Aru)	Killinochchi
	Mannar	Manthai West	Periyamadu	Periyamadu	Periyamadu
Sabaragamuwa	Kegalle	Dehiovita	Kotabodawatta	Kelani Ganga	Awissawella
		Deraniyagala	Weliharanawa	Walawe Ganga	Balangoda
	Ratnapura	Nivithigala	Muwagama	Kalu Ganga	Rathnapura
Sourthern	Galle	Baddegama	Baddegama	Gingaga	Baddegama, Balapitiya, Batapola, Elpitiya, Ambalangoda, Hikkaduwa
		Bope-Poddala	Wakwella	Gingaga	Wakwella, Galle
	Hambantota	Ambalantota	Kirindioya	Lunugamvehera	Kirinda
		Tangalle	Muruthawela	Murutawela reservoir	Muruthawela, Walasmulla
		Walasmulla	Kataragama	Mankganga	Kataragama
	Matara	Thihagoda	Thihagoda	BH2	Thihagoda
		Malimbada	Malimbada / Nadugala	Nilwala Ganga	Matara, Malimbada, Devinuwara, Dikwella, Gandara, Kottagoda, Kudawella
		Kamburupitiya	Karagoda Uyangoda	(blank)	Karagoda - Uyangoda

	Colombo	Kolonnawa	Ambatale	Kelani Ganga	Slave-Island, Hultsdroft, Thimbirigasyaya, Pamankada, Mattakuliya, Kotahena,Maligawatta, Borella, Battaramulla - Hokandara, Kotte, Kolonnawa- Kotikawatta-Mulleriyawa, Dehiwala
	Colombo	Seethawaka	Kosgama/ Akarawita	Kelani Ganga	Kosgama
West Central	Colombo	Seethawaka	Penrithwatta	Kelani Ganga	Awissawella
	Gampaha	Biyagama	Pattiwila	Kalani Ganga	Kelaniya, Welisara, Biyagama - Dompe, Mahara, Ragama, Ja-Ela, Katunayake
	Gampaha	Dompe	Chico	Kalani Ganga	Athurugiriya
	Gampaha	Dompe	Pugoda	Kelani Ganga	Pugoda
	Gampaha	Dompe	Ranpokunawatta	Kelani Ganga	Kirindiwela, Ranpokunugama, Urapola Attanagalla
	Gampaha	Gampaha	Gampaha/ Yakkala	Attanagallu Oya	Gampaha, Yakkala
	Gampaha	Katana	Bambukuliya	Ma Oya	Negambo
West North	Gampaha		Raddolugama	Dhandugam oya	Raddolugama
West-South	Kalutara	Madurawala	Kandana	Kalu Ganga	Miriswatta, Piliyandala, Wadduwa, Moratuwa, Horana, Bandaragama, Kumbuka, Panadura

Appendix 2.13: Summary of Water Intakes exposed to drought

Operational Regions	District	Divisional Secretariat	No of Water Treatment plants / Intakes Expose to Drought Hazard	
			High	Moderate
Central	Kandy	Doluwa	1	2
		Ganga Ihala Korale		1
		Harispattuwa		1
		Kandy Four Gravets & Gangawata Korale		1
		Medadumbara	1	
		Panvila		1
		Pasbage Korale		1
		Pathadumbara		1
		Pathahewaheta		1
		Pujapitiya		1
		Thumpane		1
		Udapalatha		3
		Udunuwara		1
	Matale	Ambanganga Korale		1
		Dambulla	1	
		Matale		1
		Rattota		1
		Ukuwela		1
		Wilgamuwa	1	
	Nuwara Eliya	Ambagamuwa		4
		Hanguranketha	1	
		Kothmale	1	1
		Nuwara Eliya		2
		Walapane		2
		Dehiattakandiya	2	1
		Mahaoya	1	
		Padiyathalawa	1	
		Thirukkovil	1	
		Uhana	1	
	Batticaloa	Koralai Pattu North (Vaharai)		1
		Manmunai West	1	
		Kuchchaveli		1
		Muttur		1
		Verugal Eachchilampattu	1	
Northern	Jaffna	Island North (Kayts)	1	
		Island South (Velanai)	8	
		Karainagar	2	
		Thenmaradchy (Chavakachcheri)	3	
		Vadamaradchy North (Point Pedro)	3	

Operational Regions	District	Divisional Secretariat	No of Water Treatment plants / Intakes Expose to Drought Hazard	
			High	Moderate
		Valikamam East (Kopay)	1	
		Valikamam South (Uduvil)	1	
		Valikamam West (Chankanai)	3	
	Kilinochchi	Karachchi	2	
	Mannar	Madhu		8
		Mannar Town		11
		Manthai West	7	
	Mullaitivu	Manthai East	2	1
		Oddusuddan	2	
		Thunukkai	5	
		Vavuniya North		2
		Mahawilachchiya		2
		Medawachchiya		1
	Polonnaruwa	Dimbulagala	1	1
		Elahera	1	1
		Hingurakgoda		1
		Medirigiriya		1
		Thamankaduwa		1
North Western	Kurunegala	Alawwa		1
		Ambanpola		1
		Bingiriya		1
		Ibbagamuwa		1
		Kurunegala		1
		Mawathagama		2
		Narammala		1
		Pannala	1	1
		Polgahawela		1
		Ridigama		3
		Wariyapola		1
	Puttalam	Anamaduwa		1
		Dankotuwa		1
		Madampe		1
		Nattandiya		3
		Pallama		1
		Wanathavilluwa	1	
		Wennappuwa		1
Sabaragamuwa	Kegalle	Bulathkohupitiya		1
		Dehiovita		1
		Deraniyagala		2
		Ruwanwella		1
	Ratnapura	Balangoda		1
		Eheliyagoda	1	3
		Embilipitiya	2	
		Godakawela		1
		Imbulpe		1

Operational Regions	District	Divisional Secretariat	No of Water Treatment plants / Intakes Expose to Drought Hazard	
			High	Moderate
		Kahawatta		1
		Kuruvita	1	2
		Nivithigala	1	1
		Ratnapura		2
		Weligepola	1	1
Sourthern	Galle	Baddegama		1
		Bope-Poddala		2
		Nagoda		1
		Niyagama		1
	Hambantota	Ambalantota	1	2
		Angunakolapelessa		1
		Beliatta		1
		Lunugamvehera		1
		Sooriyawewa		1
		Tangalle	1	1
		Tissamaharama	3	
		Walasmulla		1
	Matara	Akuressa		1
		Dickwella	1	
		Hakmana	1	
		Kamburupitiya	1	
		Kotapola		1
		Malimbada	1	
		Mulatiyana		1
		Pasgoda		2
		Pitabeddara		1
		Thihagoda		1
		Welipitiya		1
Uva	Moneragala	Badalkumbura		2
		Bibile		2
		Buttala		2
		Katharagama	1	
		Moneragala	2	
		Siyambalanduwa		1
		Thanamalvila		3
		Wellawaya	2	3
	Badulla	Badulla		1
		Bandarawela		2
		Ella		1
		Haldummulla	3	1
		Hali-Ela		2
		Haputale		1
		Mahiyanganaya		2
		Uva Paranagama		2
		Welimada		4
West Central	Colombo	Homagama		1
		Kolonnawa		1

Operational Regions	District	Divisional Secretariat	No of Water Treatment plants / Intakes Expose to Drought Hazard	
			High	Moderate
		Padukka		1
		Seethawaka		2
West North	Gampaha	Attanagalla		3
		Biyagama		1
		Divulapitiya	1	
		Dompe		3
		Gampaha		1
		Katana	1	1
		Minuwangoda	1	1
		Mirigama		2
West South	Kalutara	Madurawala		1
		Mathugama	1	
		Palindanuwara		1

Appendix 14: Level of Exposure of Critical Infrastructure of WSS to Landslide

Operational Regions	District	Water Sources					Treatment Plants												Main Distribution Lines			
		Catchments (Area as %)	Tube wells				Intakes				Chemical Building/Treatment				Pump House							
			Not Likely	Modest	Expected	Most Likely	Not Likely	Modest	Expected	Most Likely	Not Likely	Modest	Expected	Most Likely	Not Likely	Modest	Expected	Most Likely	Not Likely	Modest	Expected	Most Likely
Central	Kandy	Kelan River (0.2), Mahaweli River (89.11), Maha Oya (7.97), Deduru Oya (2.72)	7	6	0	0	9	13	2	3	0	1	1	0	6	11	1	1	No			
	Mathale	Mahaweli River (71.1), Yan Oya (1.99), Malwathu Oya (0.41), Kala Oya (25.0), Deduru Oya (1.5)	0	5	1	0	2	7	1	0	0	1	0	0	1	3	1	0				
	Nuwaraeliya	Kelani River (24.17), Walawe River (1.21), Kalu River (0.1), Mahaweli River (74.52)	0	1	0	0	4	8	2	2					2	9	1	0				
North Western	Kurunegala	Karambalan Oya (12.21), Ratmal Oya (3.48), Maha Oya (9.11), Mahaweli Ganga (0.01), Kala Oya (8.21), Mi Oya (14.91), Kalagama Oya (0.01), Rathambala Oya (2.03), Deduru Oya (50.0)	3	0	0	0	6	0	0	0					6	1	0	0				
Sabaragamuwa	Kegalle	Kelani Ganga (61.93), Maha Oya (33.09), Attanagalu Oya (4.43), Kalu Ganga (0.28), Deduru Oya (0.34)	1	2	0	0	8	3	2	1	2	0	1	0	3	2	0	1				
	Rathnapura	Kelani Ganga (2.3), Nilwala Ganga (0.27), Urubokka Oya (0.25), Kachigala (0.52), Walawe Ganga (40.63), Kalu Ganga (54.62), Gin Ganga (1.39)	2	0	0	0	5	3	3	0					8	5	5	0				
Southern	Galle	Koggala Lake (3.39), Polwatta Ganga (9.28), Nilwala Ganga (2.9), Kalu Ganga (0.46), Benthota Ganga (19.16), Madu Ganga (4.52), Madampe Lake (5.88), Telwatta Ganga (3.28), Ratgama Lake (0.98), Gin Ganga (46.4)	1	0	0	0	1	0	0	0					0	1	1	0				
	Matara	Polwatta Ganga (6.8), Nilwala Ganga (70.38), Seenimodara Oya (0.51), Kirama Oya (3.82), Urubokka Oya (1.48), Gin Ganga (9.38)	3	0	0	0	6	0	0	0					5	3	0	0				

Appendix 15- Formats for collection of data for Preparedness and Response Planning

TABLE 4.1: DISASTER/EMERGENCY RESPONSE OFFICERS/COMMUNICATIONS- CHAIN OF COMMAND

Name/Title	Responsibilities During Emergencies	Contact Details	Training/ Capacity

Table 4.2: Emergency Response Personnel/Communications- External Contact Information

Agency	Contact/Title	Contact Information	Notification Criteria
Disaster Management Center/DDMCUs			
SL ARMY			
SL NAVY			
SL Air Force			
Police			
Fire Department			
Health Department			

Table 4.3: Technical Agencies responsible for warning generation

Type of Hazard	Name of the agency	Contact Information
Floods	Irrigation Dept.	
Drought	DoM,	
Landslides	NBRO	
Chemical hazards	CEA	
Cyclone/High winds	DoM	
Lightning	DoM	

Table 4.4: Priority Notification Customers: (Sensitive populations such as hospitals, schools, Safety Centers, Industries etc., -bulk purchasers)

Facility Name	Contact	Population Type	Phone (24/7)/Hot lines

Table 4.5: Utility services:

Organization	Provider/Contact	Phone (day)	Phone (24/7) Hot Line
Electricity			
Gas Company			
Local Government			
Service Provider - Communication			

Table 4.6: Media:

ORGANIZATION	CONTACT	PHONE # (DAY)	PHONE # (24/7)
Newspaper – Local			
Newspaper – Regional			
Radio			
Television			
Social Media Liaison			

TABLE 4.7: EMERGENCY RESPONSE PERSONNEL/COMMUNICATIONS PLAN

Emergency Response Communication Plan describes who is accountable for operating procedures and decision points to address:

1) Internal/external communication plans (i.e. who is responsible for notifying Emergency response Team, outside agencies, etc. and what information is to be relayed)
2) Modes of communication to the public and how are they implemented

Contingency measures for loss of communications

TABLE 4.8: EMERGENCY RESPONSE PERSONNEL/COMMUNICATIONS SYSTEM AND EQUIPMENT INVENTORY

An inventory of communications systems and equipment (e.g. Call center facilities, hot line and emergency communication facilities, mobile phones, etc.) is as follows:

TYPE	ASSIGNED TO	LOCATION	NUMBER

Table 4.9: Emergency Response Personnel/Communications on Personnel Protection

Personal protection during Emergency response is need to be focused on the safe response to an emergency and covers Evacuation Procedures, Assembly Areas/Staff Accountability, Shelter Locations, and First Aid Equipment.

4.10: Water System Evacuation Procedures

Describe the plan in detail

Table 4.11: Assembly Areas/Staff Accountability
Officers responsible to arrange assembly areas and issue instructions

Table 4.12: Alternate Work & Shelter Locations for Employees

Table 4.13: Required Training:

Frequency (annually/Quarterly)	Course type (In House/ Online)	Course Description	Attendees	Date Held

Table 4.14: Scheduled Drills:

Frequency Frequency(annually/Quarterly)	**Description**	**Attendees**	**Date Held**

4.15: Safety Materials:

Type	**Location**
Toxic material detection and testing supplies	
Emergency food and water supplies	
Emergency PPE (note what PPE are present at each location)	
Other equipment (note what is present at each location)	

Table 4.16: Wells

SOURCE/ WELL (NAME)	DEPTH/LOCATION	AVAILABLE YIELD	TREATMENT REQUIREMENTS/ASSOCIATED TREATMENT PLANT

Table 4.17: Intakes

INTAKE (NAME)	LOCATION	AVAILABLE YIELD	TREATMENT REQUIREMENTS/ASSOCIATED TREATMENT PLANT

Table 4.18: Treatment plants

TREATMENT PLANT (NAME)	LOCATION	AVAILABLE YIELD	TREATMENT TRAINER DETAILS

Table 4.19: Storage & Distribution system - Tanks, primary mains and pumping stations

LOCATION	AREA SERVED	COMMENTS

Table 4.20: Chemical Handling Facilities

FACILITY NAME	LOCATION	DISTANCE	CHEMICAL AND EXPOSURE PATHWAY

Table 4.21: Chemical Storage Tanks

FACILITY NAME	LOCATION	DISTANCE	CHEMICAL AND EXPOSURE PATHWAY

Table 4.22: Other Key Facilities

LOCATION	FUNCTION	COMMENTS

Table 4.23: Available Water Supply Interconnections
Purchases:

Provider Name and Contact Info	**Location(s)**	***MAIN SIZE AND CAPACITY***	***CONTRACT TYPE AND LIMITATIONS***	***SERVICE AREA / AVAILABILITY / RESPONSE TIME***

Table 4.24: Sales: (During drought NWSDB supply water at agreed cost)

Provider Name and Contact Info	**Location(s)**	***MAIN SIZE AND CAPACITY***	***CONTRACT TYPE AND LIMITATIONS***	***SERVICE AREA / AVAILABILITY / RESPONSE TIME***

Table 4.25: Seasonal Sources/Backup Sources/Unapproved Sources

These kinds of sources are to be used in extreme emergency situations with temporary approvals

SOURCE TYPE	SOURCE LOCATION	AVAILABLE YIELD	TREATMENT REQUIREMENTS

Table 4.16: Wells

SOURCE/ WELL (NAME)	DEPTH/LOCATION	AVAILABLE YIELD	TREATMENT REQUIREMENTS/ASSOCIATED TREATMENT PLANT

Table 4.17: Intakes

INTAKE (NAME)	LOCATION	AVAILABLE YIELD	TREATMENT REQUIREMENTS/ASSOCIATED TREATMENT PLANT

Table 4.18: Treatment plants

TREATMENT PLANT (NAME)	LOCATION	AVAILABLE YIELD	TREATMENT TRAINER DETAILS

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FACILITY NAME	LOCATION	DISTANCE	CHEMICAL AND EXPOSURE PATHWAY

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FACILITY NAME	LOCATION	DISTANCE	CHEMICAL AND EXPOSURE PATHWAY

Table 4.22: Other Key Facilities

LOCATION	FUNCTION	COMMENTS

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Purchases:

Provider Name and Contact Info	**Location(s)**	***MAIN SIZE AND CAPACITY***	***CONTRACT TYPE AND LIMITATIONS***	***SERVICE AREA / AVAILABILITY / RESPONSE TIME***

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Table 4.25: Seasonal Sources/Backup Sources/Unapproved Sources

These kinds of sources are to be used in extreme emergency situations with temporary approvals

SOURCE TYPE	SOURCE LOCATION	AVAILABLE YIELD	TREATMENT REQUIREMENTS

Table 4.16: Wells

SOURCE/ WELL (NAME)	DEPTH/LOCATION	AVAILABLE YIELD	TREATMENT REQUIREMENTS/ASSOCIATED TREATMENT PLANT

Table 4.17: Intakes

INTAKE (NAME)	LOCATION	AVAILABLE YIELD	TREATMENT REQUIREMENTS/ASSOCIATED TREATMENT PLANT

Table 4.18: Treatment plants

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LOCATION	FUNCTION	COMMENTS

Table 4.23: Available Water Supply Interconnections
Purchases:

Provider Name and Contact Info	**Location(s)**	***MAIN SIZE AND CAPACITY***	***CONTRACT TYPE AND LIMITATIONS***	***SERVICE AREA / AVAILABILITY / RESPONSE TIME***

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Provider Name and Contact Info	**Location(s)**	***MAIN SIZE AND CAPACITY***	***CONTRACT TYPE AND LIMITATIONS***	***SERVICE AREA / AVAILABILITY / RESPONSE TIME***

Table 4.25: Seasonal Sources/Backup Sources/Unapproved Sources
These kinds of sources are to be used in extreme emergency situations with temporary approvals

SOURCE TYPE	SOURCE LOCATION	AVAILABLE YIELD	TREATMENT REQUIREMENTS

Table 4.26: Evaluation of water required

	System Capacity:					
	2021		**2022**		**2023**	
Demand (MGD)	***Million Gallons Per day***	***% Purchased***	***Million Gallons Per day***	***% Purchased***	***Million Gallons Per day***	***% Purchased***
Average Daily						
Maximum Daily						
Peak Daily						

FOR THE EFFECTIVE OPERATION AVERAGE SYSTEM'S ABILITY REQUIRED TO MEET TO PROVIDE DAILY DEMAND, WHILE MEETING DRINKING WATER QUALITY STANDARDS.

Table 4.27: Prioritization

Use Category	**Priority (High, Medium, Low)**	**Daily Water Demand (MGD)**	**Method of Sustaining Use / Emergency Contingencies Beyond Standard Response**
Sanitary			
Industrial/Commercial			
Potable (cooking, drinking, hygiene)			
Sensitive Populations-Hospitals			

Primary Component Emergency Provisions

Table 4.28: Details contingencies for sustaining primary components:

PRIMARY COMPONENT	**Emergency Contingency Procedures**
Treatment	
PUMPING	
Distribution	

Table 4.29: Water Restrictions

Adopted water use restrictions to be implemented by NWSDB during emergency or disasters are also important for the uninterrupted water supply

PHASE I Restrictions (available water supply levels determined to be below normal) **PHASE II Restrictions** (substantial threat to the public health and welfare) **PHASE III Restrictions** (disaster stage)

TABLE 4.30: FIXED AUXILIARY POWER SOURCES

Location	**Powers: (***facility and/or equipment***)**	**Details** *(Type/Capacity/Fuel & Rate of Consumption)*	**Specific Instructions** *(Location of manual/exercise schedule/etc.)*	**Inventoried**

Table 4.31: PORTABLE AUXILIARY POWER SOURCES

Location	**Capable of Powering: (***facility and/or equipment***)**	**Details** *(Type/Capacity/Fuel & Rate of Consumption)*	**Specific Instructions** *(Location of manual/exercise schedule/etc.)*	**Inventoried**

Auxiliary power sources should be inventoried to determine voltage, phase configuration, horsepower/amperage and other requirements.

Table 4.32: Auxiliary Fuel Storage

Type	**Tank Capacity**	**Location**

Table 4. 33: Pumping Equipment /Spare Pump Parts

Type/Manufacturer	**Service Capabilities**	**Location**

Table 4.34: Distribution Components

Table 4.35: CHEMICALS SUPPLIES

CHEMICAL	*LOCATION*

Table 4.36: Spare Parts

Part	**Location**

TABLE 4. 37: CONTACT INFORMATION FOR EQUIPMENT REPAIR, SUPPLIES, & SERVICES

Organization	**Name/Contact/ Contract Information**	**Phone (day)**	**Phone (24/7)**
Electrician			
Plumber			
Pump Installer			
Excavator/Backhoe Operator			
Equipment Rental or Cooperative (eg. heavy equipment)			
Equipment Rental (i.e. Chlorinators)			
Equipment Repair			
SCADA Repair			
Pump Supplier			
Well Driller			
Pipe Supplier			
Analytical Laboratory(s)			
Chemical Supplier(s)			
Primary Fuel Supplier (s			
Alternate Fuel Supply			

Table 4.38: Operational manuals and reports

Item	**Location**
Generator start up manuals	
Daily Operator Reports	
Technical Manuals	
Business Continuity Plan (Essential Functions/Resources)	
Lockout-Tag out Manual	
Other	

Water Use Advisories/Public Notices

Table 4.39: Templates for Water Use Advisories: (Include here or reference where they may be found)

Detail of advisories	Location

Table 4.40: Distribution Methods: (Protocols for Email, newspaper, door to door, etc.)

Detail of material for distribution	Method of distribution

Table 4.38: Manuals, Reports and Plans

Item	Location
Generator start up manuals	
Daily Operator Reports	
Technical Manuals	
Business Continuity Plan (Essential Functions/Resources)	
Lockout-Tag out Manual	
Other	

Water Use Advisories/Public Notices

Table 4.39: Templates for Water Use Advisories: (Include here or reference where they may be found)

Detail of advisories	Location

Table 4.40: Distribution Methods: (Protocols for Email, newspaper, door to door, etc.)

Detail of material for distribution	Method of distribution

Appendix 2.16

Table 4.41: Preliminary assessment Form

Water Sources (River/Groundwater Wells)	Yes	No	N/A
Physical damage	☐	☐	☐
Pump or motor failure	☐	☐	☐
Power source operating properly	☐	☐	☐
Test for water quality contamination	☐	☐	☐
Treatment Facilities	Yes	No	N/A
Physical damage	☐	☐	☐
Equipment operating properly	☐	☐	☐
Power source operating properly	☐	☐	☐
Chemical spills or release	☐	☐	☐
Water Storage Facilities	Yes	No	N/A
Physical damage	☐	☐	☐
Leaks	☐	☐	☐
Buckling	☐	☐	☐
Damage to inlet/outlet pipes	☐	☐	☐
Distribution System	Yes	No	N/A
Physical damage	☐	☐	☐
Leaks	☐	☐	☐
Main breaks	☐	☐	☐
Pressure loss	☐	☐	☐
Cross connection concerns	☐	☐	☐
Interconnections compromised	☐	☐	☐
Other system damage (e.g. reservoirs, vehicles, etc.)			
Description of Damage:			
Estimated Cost to Repair Damage:			
Estimated time to repair and restoration services			

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