



INTEGRATED WATERSHED MANAGEMENT PLAN THIMCHHU SUB-WATERSHEDS



**ROYAL GOVERNMENT OF BHUTAN
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PERIOD OF THE PLAN

This Plan is valid for the period of 5 years from July 2018 to June 2023

AUTHORITY FOR PREPARATION, REVIEW AND APPROVAL

The authority for preparation of this plan was given to the Watershed Management Division, Department of Forests, Ministry of Agriculture, Royal Government of Bhutan.

PROVISION FOR REVISIONS AND CHANGES

This Plan may be revised during the period when it is in effect. If major changes occur in the watershed, or if new information becomes available, that may have significant bearing on the implementation of the Plan, the Head of Department, DoFPS, can authorise a revision of this plan.

APPROVAL

This plan has been examined by a wide section of user groups, clients and organisations. The plan was presented and endorsed by theTAC meeting held on 13th March, 2018. It has been further reviewed and recommended for implementation by the Director, Department of Forests (DoFPS) and approved by the Honourable Secretary, Ministry of Agriculture, Royal Government of Bhutan.

Submitted for approval:

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Lastly, we would like to express our gratitude to Director, DoFPS for his guidance and support in the preparation of Management plan.

Glossary of Bhutanese terms

<i>Chhu</i>	River
<i>Chiwog</i>	Group of villages
<i>Chuzing</i>	Paddy field
<i>Dzong</i>	Fort/monastery
<i>Dzongda</i>	District Administrator/Governor
<i>Dzongkhag</i>	District
<i>Geog</i>	Block/Administrative unit
<i>Gup</i>	Elected leader of a geog
<i>Kamzhing</i>	Dryland
<i>Mangmi</i>	Deputy elected leader of a geog
<i>Thromdey</i>	City / town
<i>Tshogpa</i>	Elected head of a Chiwog

Acronyms

B.C	Biological Corridor
BDBL	Bhutan Development Bank Limited
BT FEC	Bhutan Trust Fund for Environmental Conservation
BTO	Bhutan Toilet Organization
C.F	Community Forest
DITT	Department of Information Technology and Telecom
DoFPS	Department of Forests and Park Services
FMU	Forest Management Unit
FNCA	Forest And Nature Conservation Act
FRMD	Forest Resource Management Division
FP	Forest Policy 2011
JDNP	Jigme Dorji National Park
LA	Land Act
LFA	Logical Framework Analysis
MoAF	Ministry of Agriculture and Forests
MoH	Ministry of Health
MoWHS	Ministry of Works and Human Settlement
NCD	Nature Conservation Division
NEC	National Environment Commission
NLCS	National Land Commission
NWFP	Non-wood Forest Product
RNR	Renewable Natural Resources
RSPN	Royal Society for Protection of Nature
TCBL	Tourism Council of Bhutan
TD	Territorial Division
WA	Water Act 2011
WMD	Watershed Management Division
UWICER	Ugyen Wangchuck Institute for Conservation and Environmental Research

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1 Introduction

Bhutan is a mountainous country located in the Eastern Himalayas, with rugged topography and a wide variety of ecological conditions. Most of the rivers originate in the Himalayas and flow south to the Brahmaputra River in India. As per the land use planning project (LUPP),1997, Bhutan is geographically divided into five major and two minor river basins (Figure 1 and Table 1). Human activities take place in all of these basins, each of which is made up of a number of sub-watersheds. Sustainable management of the natural resources in these watersheds is critical to the well-being of the inhabitants and also of downstream water users.

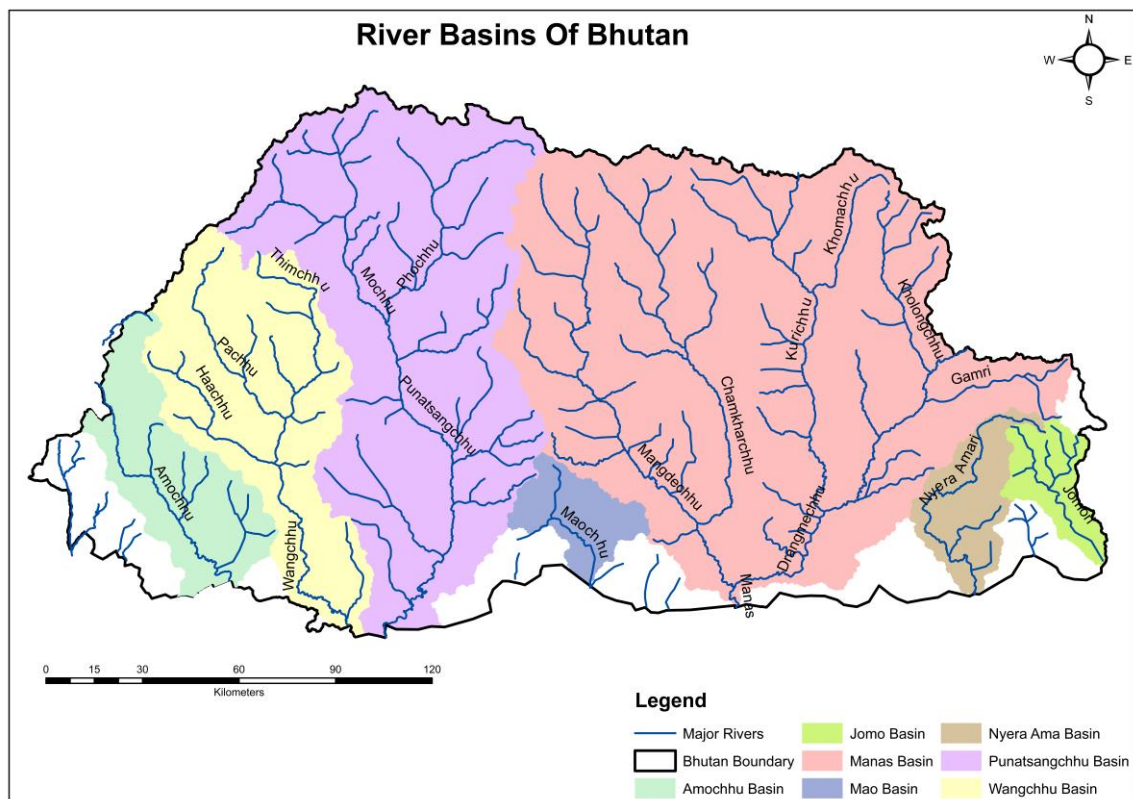


Figure 1. Major and minor river basins in Bhutan

Table 1. River basins and their tributaries in Bhutan

Sl. No	River Basins	Area (ha)	Basin category	Tributaries
1.	Wangchhu	4,60,176	Major	Haachhu, Pachhu, Thimchhu
2	Punatsangchhu	2 9,73,270	Major	Mochhu, Phochhu, Dangchhu, Dagachhu

3	Manas	3 15,95,521	Major	Mangdechhu, Chamkharchhu, Kurichhu, Drangmechhu, Kholongchhu
4	Amochhu	4 2,21,156	Major	
5	Nyera-Amachhu	1,13,970	Major	
6	Maochhu	6 85,783	Minor	Kharchhu, Gongchhu, Gulechhu, Ruthalgongchhu
7	Jomochhu	75,247	Minor	

1.1 Policy Setting

The importance of sustainable management of the country's watersheds has been accorded the highest priority in the country's regulatory framework including:

- Article 5 of the Constitution of the Kingdom of Bhutan, 2008
- Fundamental vision document, Bhutan 2020
- National Forest Policy 2011
- Forest and Nature Conservation Act 1995
- Land Act 2007
- Bhutan Water Vision 2025
- Bhutan Water Policy 2008
- Water Act of Bhutan 2011
- Water Regulation of Bhutan 2014

The clear intent of the policy settings is that effective watershed management should aim to maintain and improve watershed conditions and, where possible, contribute to sustainable livelihoods.

1.2 Rationale

In the year 2010 the rapid assessment along the Thimphu chhu sub-basin with the use of Watershed classification guideline 2010 (WMD) was carried out. The total number of 13 watershed that falls within the Thimphu chhu was indicated as pristine and normal condition. With the increasing trend in population, expanding town areas, infrastructure development. These changes are likely increase pressure/deterioration on natural use of resources and water resources in near future. Beside this, Thimphu drinking water is sufficient only for 30% of the area receives 24 hours water supply while remaining 70% receives intermittent supplies ranging from 3 to 8 hours a day (Kuensel, 24/01/2018). Therefore, the watershed ID # 68 (Chamgang) & 67 (Motithang) is classified as "critical

by function" during the rapid assessment, because it is used as drinking water source for Thimphu city and was selected for the management plan with numerous stakeholder consultation as shown in Figure 2. And along with the above watershed the watershed ID # 47,48,74 were also selected for the management plan because they are the head water source to Thimphu drinking water.



Figure 2. Watershed ID 67 and 68

1.3 Purposes

After the rapid assessments and given the rationale of the management plan, what were the main purposes developed for the plan.

2 Description of the watershed area

The Watershed Management Division (WMD) has delineated 186 watersheds in the whole country using a threshold of 5000 ha (50 km²) and has assigned unique numbers for each watershed as identity number of a particular watershed for effective watershed management planning and implementation. Their condition is being systematically assessed and those assessed as degraded or critical are targeted for the development of individual (or grouped) management plans.

The Wangchhu major basin consist of 19 watersheds out of 186 watersheds in Bhutan. The Wangchhu basin covers 4 main Dzongkhags and 4 other Dzongkhags which partly falls in the basin. From the 4 main Dzongkhags, 6 geogs under Haa are in the basin but only small areas of Gakiling (0.16 km²) and Sombeykha (0.06 km²) geogs are inside the Wangchhu

basin. Under Paro Dzongkhag all the 10 geogs are inside the basin. Under Thimphu Dzongkhag, most of Lingzhi geog is outside the basin. Under Chukha Dzongkhag, 2 geogs of Logchina and Phuntsholing are completely outside the basin while only 0.01 km² of Sampheling geog is inside the basin. Part of 5 geogs from Dagana Dzongkhag also falls under Wangchhu basin of which Lhamozingkha (55.7 km²) and Dorona (30.8 km²) are substantial. There are also very small parts of 2 geogs each from Gasa, Punakha and Wangduephodrang falling inside the Wangchhu basin (Table 2).

Table 2. Details of dzongkhags, geogs and area in the Wangchhu basin

Dzongkhag	No. of Geogs	Area(km²)	Remarks
Haa	6	589.89	Gakiling & Sombeykha are almost out of the Wangchhu basin.
Paro	10	1277.4	All the 10 geogs have some portion or all inside thebasin.
Thimphu	8	1444.9	329 km ² of Lingzhi geog is out of the basin, only 49 km ² is inside Wang Chhu
Chukha	9	1206.7	Logchina & Phuntsholing geogs are completely out of the basin; only 0.01 km ² of Sampheling geog is inside.
Dagana	5	88.00	Tseza, Deorali, Lhamozingkha, Dorona, Kalizingkha.
Punakha	2	0.51	Kabisa and Toepisa
Gasa	2	0.31	Goenkham and Goenkhatoy
Wangdue	2	0.20	Gasey Tshowom and Nahi
Total	44	4608	

Source: Rapid Classification of Watersheds in the Wangchhu Basin

Out of 19 watersheds in Wangchhu basin 10 of the watersheds & part of 3 watersheds (WS ID: 13, 16 & 71) falls under the Thimphu dzongkhag within which watershed ID 67 (225 km²) and 68 (104 km²) has been classified as “critical by function” from the Rapid assessment done in 2010. Through the process of consultation, it is known that watershed ids 47, 48 and 74 were headwaters of degraded watershed. Therefore, these watersheds were also included in the management plan as shown in the figure 3.

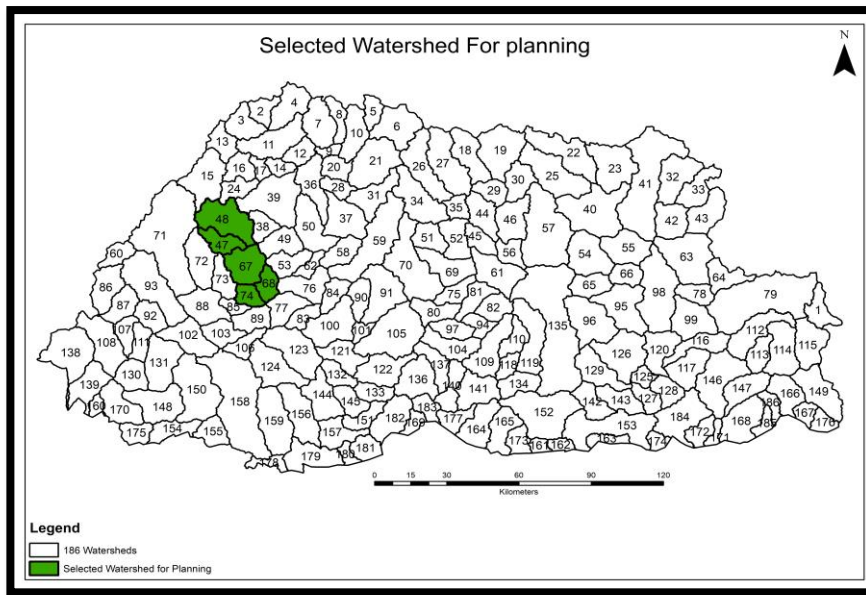


Figure 3. Map showing selected watersheds in Thimphu for the development of Management plan

2.1 Geophysical and administrative description – watershed maps

The watersheds which are selected for planning falls under Naro, Kawang, Chang and Dagala geogs. The watershed area extends from 27°23'0.14"N to 27° 47' 17.85" N and 89°34' 28.46" E to 89° 33'28.68" E. It has a total area of 85513.25 hectares with elevation ranging from about 2200 to 5700 m.a.s.l.

There is a total of eight community forests (CF) in the watershed as shown in the figure 3. All CFs fall within the watershed except for Khasakha CF (56% of this CF is within the watershed) (Table 3).

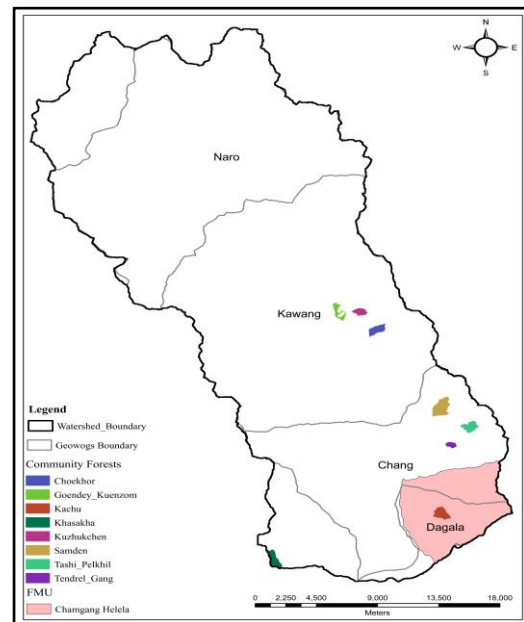


Figure 4. Map showing Community Forests and Forest Management Unit

Chamgang-Helela Forest Management Unit falls within the watershed. The total area of FMU is 4693 Ha out of which 4591 Ha falls inside the watershed.

Table 3. Community Forests coverage

Sl. No	Community Forests	Total Area (Ha)	Area within WS (Ha)
1	Samden	150.32	150.32
2	Kuzhukchen	49.95	49.95
3	Khasakha	165.25	91.77
4	Kachu	89.17	89.17
5	Tendrel_Gang	30.61	30.61
6	Choekhor	76.48	76.48
7	Goendey_Kuenzom	58.67	58.67
8	Tashi_Pelkhil	78.41	78.41
	Total	698.85	625.38

2.2 Water discharge

Several discharge measurements were carried out for different seasonal for authenticate water supply over the year. Discharge measurement for major streams were measured using the velocity area (float) method. The highest measurement was recorded in Dodeyna chhu with 18590 l/sec.

Table 4. Discharge / flow collected using velocity area method

Sl.no.	Stream Name	Q(m ³ /s)	Q(l/s)	Q(L/day)
1	Lumjangsa or Dhanachu-Intake1	0.24	243	20978711
2	Reebomsa-Intake2	0.32	316	27268079
3	Rechuthangkha	0.03	33	2818984
4	Tshanamchu	0.57	569	49120104
5	Badhuzampa & Hawomchhu	0.01	12	1056242
6	Dodeyna chhu	18.59	18590	1606207955
7	Charichhu	11.04	11041	953945572
8	Khemree chhu_Motithang Source	0.09	86	7396841
9	Kushuchen Rongchhu	0.21	207.3	17911567
10	Menchhu Karpo	0.13	131.6	11370240
11	Chemena	0.03	29.8	2573897
12	Chamjakha	0.06	59.8	5168049
13	Dechenphug Rongchhu	1.18	1179.8	101936291
14	Nimashong Rongchhu	0.90	897.4	77536653
15	Tango Rongchhu	0.68	678.9	58660343
16	Taba Rongchhu	0.22	216.9	18739200



Figure 3. Discharge measurement at during field assessment

2.3 Water quality – Chamgang quality and include other watersheds

Water quality parameters in terms pH, EC, TDS, salt content which are within our acceptable range were measured using PCS tester-Eutech instrument as shown in table 5 and Chamgang water quality such as microbiological (*E.coli*) and chemical parameter were measured by using Japanese water testing kits.

Table 5. Water quality test

Stream Name	pH	EC ($\mu\text{S}/\text{cm}$)	TDS (ppm)	Salt (ppt)	Temp ($^{\circ}\text{C}$)
Lumjangsa or Dhanachu-Intake1	7.55	19.7	15.1	0.01	15.1
Reebomsa-Intake2	7.62	9.8	7.2	0.01	
Rechuthangkha (police & BHU intake)	8.09	35.1	20.2	0.01	15
Tshanamchu	7.9	15.1	12.2	0.01	15.7
Water source-Badhuzampa & Hawom	6.7	21.1	12.4	0.01	9.7
Dodeyna city (new intake)	8.41	182.9	134	0.09	16.9
Cherichhu	8.4	101.4	72.5	0.05	15.8
Khemree chhu-Motithang Source	8.4	28.6	19.8	0.01	12.8
Chokhor Damagang	8.62	40	28.2	0.02	16.5
Kushuchen Rongchhu	7.8	19.2	14	0.01	13.9
Menchhu Karpo	7.49	24.2	18.4	0.01	18.0
Chemena	8.07	18.3	12.7	0.01	19.0

Dosethu	7.42	35.3	25.1	0.02	15.0
Dekhiling pang	8.18	117.6	82.9	0.06	18.0
Chamjakha	7.53	15.1	10.7	0.01	17.0
Dechenphug Rongchhu	8.09	24.5	14.1	0.01	14.7
Nimashong Rongchhu	8.3	20.6	15.2	0.01	16.8
Nimashong stream	7.74	27.3	19.1	0.01	16.3
Hoding	7.71	19.7	14.2	0.01	17.8
Tango Rongchhu	7.94	17.9	35.3	0.02	17.9
Taba Rongchhu	8.2	30.8	22.4	0.02	17.1
Taba Stream	8.01	36.6	26.1	0.02	16.6
Wangchuk Resort stream	7.85	24.9	17.8	0.01	16.5

2.4 Landuse types

The total no of chiwogs, villages, households and populations in each geog which falls in the selected watersheds are given in the table below.

Table 6. Total number of chiwogs, villages, households & population

Geog	No. of chiwogs	No. of villages	No. of Households	Population
Chang	5	11	277	3137
Dagala	5	37	143	1497
Kawang	5	33	397	2582
Naro	5	20	69	189

Source: Statistical handbook of Thimphu Dzongkhag 2016

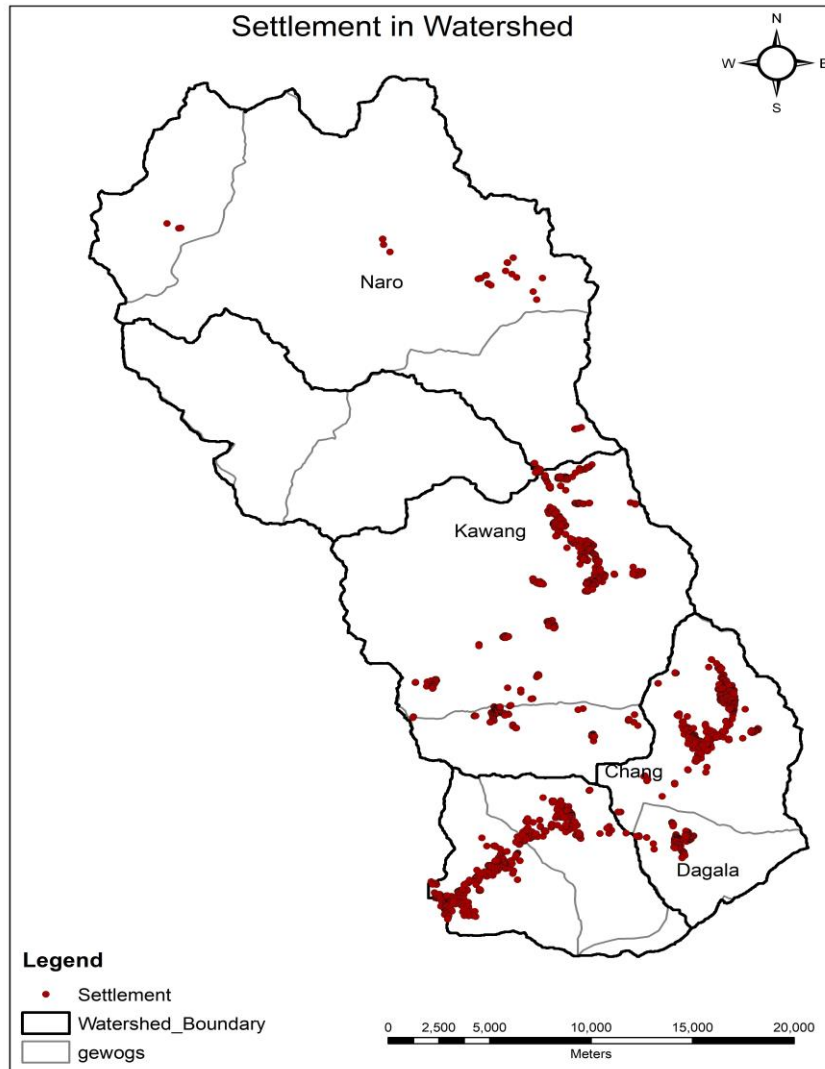


Figure 5. Map showing settlements in 4 geogs

2.5 Agriculture cropping pattern

The majority of population residing in the four geogs (Chang, Naro, Kawang, Dagala) under Thimphu watershed mainly depends on agriculture and livestock farming. The farming system is dominated by dry land and paddy cultivation. The paddy cultivation exists only in lower part of watershed in Kawang & Chang geog. The main dominant crop cultivated in the dry land are potato, chilly, cabbage, cauliflower etc. and the farmers derive main cash income from sale of these produce and non-wood forest produces (NWFPs) collected nearby forests. However, mixed farming systems are also practiced in the lower valleys of Kawang and Chang geog, characterized by wetland rice farming and other cash crops such as fruits like apples, plums, pears and vegetables like cauliflower, cabbage, broccoli, potato, carrot, tomato and chilli are also grown. The total area of 100.89Ac of land are under paddy cultivation in Kawang and Chang geog with an annual production of

2145.5 kg/ac (Thimphu, 2016). The total dry land in these four geog is estimated around 863.13 ac (Thimphu, 2016).

Table 7. Agriculture Production in Thimphu watershed

Crop	Crop Parameters	Geogs			
		Dagala	Kawang	Naro	Chang
Paddy	Cultivated area (ac)		73		27.89
	Production (Mt)		163.812		59.489
	Yield (Kg/ac)		2158		2133
Potato	Cultivated area (ac)	12.00	29.00	4.00	
	Production (Mt)	69.600	226.2	16.188	
	Yield (Kg/ac)	5800	7800	4047	
Chilli	Cultivated area (ac)	0.80	4.00		
	Production (Mt)	0.560	15.110		
	Yield (Kg/ac)	700	3778		
Cabbage	Cultivated area (ac)	1.00	5.00	3.00	
	Production (Mt)	1.5	39.165	12.099	
	Yield (Kg/ac)	1500	7833	4033	
Cauliflower	Cultivated area (Ac)	1.00	5.00	2.50	
	Production (Mt)	0.850	15.00	4.738	
	Yield (Kg/Ac)	850	3000	1895	
Fruits plants (apple)	Total trees		2500		
	Bearing trees		2000		
	Production (Mt)		46.500		
	Yield (Kg/bearing trees)		23		

Source: (Thimphu, 2016)Pg:162,198,384,123)

Yak is the most dominant livestock prevailing in Dagala and Naro geog and each chewog have designated areas for winter, spring, summer and autumn within the watershed. Cattles were also found in the lower valley of Dagala and Kawang.

Table 8. Livestock numbers in Thimphu Watershed

Livestock	Dagala	Kawang	Naro
Yak	2920		2283
Cattle	160	381	-
Poultry	608	206	-
sheep	2	-	-
Goat	15	-	-
Equine	195	36	338

2.6 Climate

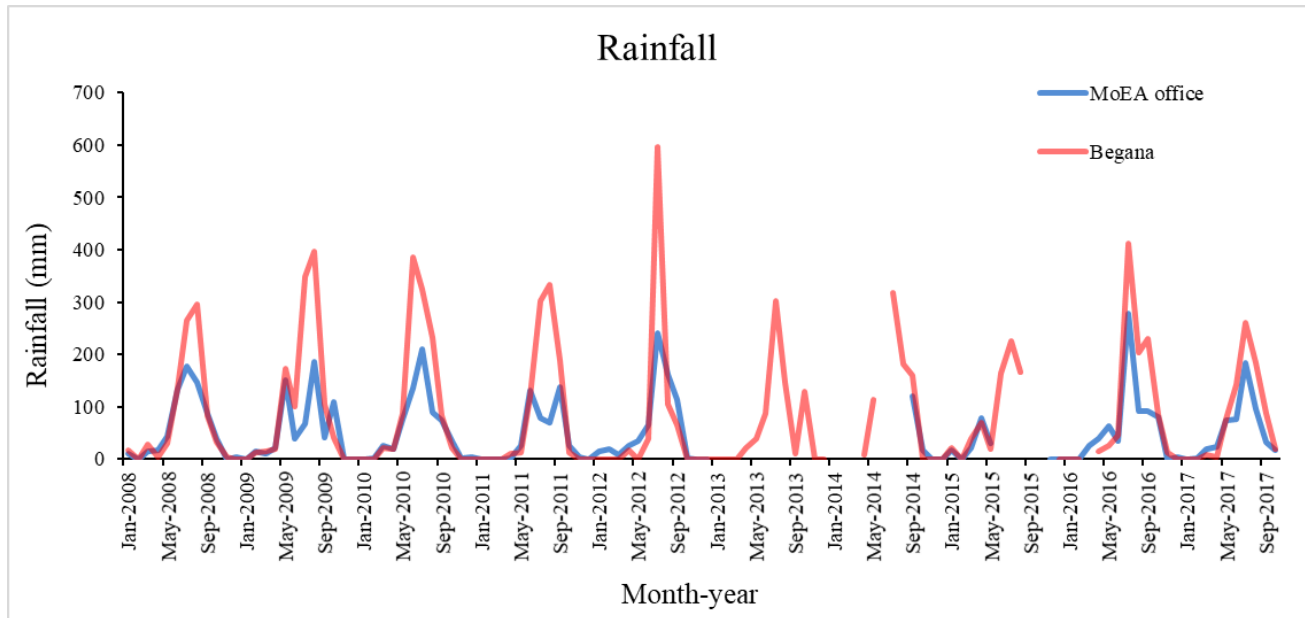


Figure 6. Rainfall data at Begana and MoEA office climate station

There are two Automated Weather Station (Class C-Climatology) located in Thimphu viz. at Begana (upstream) at an elevation of 2492 m.a.s.l and MoEA complex at an elevation of 2358 m.a.s.l installed and managed by the National Center for Hydrology and Meteorology (NCHM). Parameters observed by Class C stations are temperature (maximum/minimum), rainfall and relative humidity. The rainfall data of the two station for the period of past 10 years were analyzed as shown in figure 6. The total rainfall at Begana ranges from 700-1200 mm in a year and from 475-710 mm at MoEA complex with average monthly maximum in July.

The average Temperature maximum for the past 10 year is 18.8°C and minimum is 7.9°C in Begana whereas average temperature maximum is 20.9°C and 8°C minimum temperature. The relative humidity is higher in Begana with 76% than in MoEA complex (66.7%).

Watershed management Division also installed a temperature and relative humidity data logger at Chamgang (Water treatment plant) and Motithang area (Bhutan Takin Preserve) in 2017.

3 Watershed Management Planning Processes

The plan was drafted by Watershed Management Division by the Wangchhu core team members. It was subsequently endorsed by stakeholders through consultation workshop,

followed by endorsement by the Technical Advisory Committee (TAC) of the Department of Forests and Park Services.

4 Issues Impacting Watershed Services

Through various stakeholder meetings with the local leaders, communities in the concern sub-watersheds/ Geogs, issues that degraded the watersheds were identified and categorized. The effect and causes of the core problem were derived from identified issues which were validated through field assessment and surveys by the team members. Major issues/concern that arose were related to water sources quantity and quality for drinking, domestic and irrigation purposes.

4.1 Issues

4.1.1 Springs, rivers and domestic water supply contamination

Reasons for contamination:

- Dumping of waste in the watershed (rivers and streams)
- Lack of awareness of impact of dumping of wastes
- Water storage tank at household not cleaned regularly
- Inadequate infrastructure for collecting household waste
- Dumping of sewerage and waste in Chamgang by (police and prison)
- Car washing
- Overflow of septic tanks
- Contamination by livestock
- Lack of monitoring of existing regulation related to dumping of waste
- Cremation ash dumped into river.
- Inadequate treatment of sewerage
- Open defecation in streams
- Dumping of construction waste (truck loads)
- Exposed pipe lines in the drains

Effect:

- Decrease in the ecotourism experience (aesthetic values)
- Increase water borne diseases-bad effect on public health
- Decrease aquatic health (ecosystem health)

4.1.2 Drying up of water sources (Springs and Lakes)

Cause:

- Destruction of wetlands (marshes)

- Excessive firewood collection in Alpine areas
- Climatic changes (reduced snowfall, erratic rainfall) glacier melts
- Forest fire
- Trampling of water sources by domestic animals
- Earthquake
- Excessive timber extraction (riparian)
- Developmental activities (road construction) & infrastructure – (downstream) close to water sources

Effect: Reduction of water for downstream use (human+ ecosystem use)

4.1.3 Shortage of domestic water

Causes

- Unreliable water source
- Weak awareness on water use & mismanagement (Household taps)
- Increase in commercial water use
- Increase In population

Effects:

- Increase in conflict between competing users
- Increase in hardship
- Poor sanitation

4.1.4 Degradation of natural resources in watershed

The primary cause of natural resources and water resources degradation is the high population density in the area; development of infrastructure for hydropower projects, satellite towns, school and construction of roads (feeder and farm roads) contributes towards forest degradation.

FMU

More than 50% of the forests in the Wangchhu basin are conifer forest, which are very susceptible to fire, especially blue pine forest. According to the Master Plan for Forestry Development (1991), 35,000 ha of degraded forest are in the Wangchhu basin (22,500 ha in Chukha and 13,000 ha in Thimphu, Paro, Haa combined) representing 15% of total degraded forests land in the country. (Wangchuk, 2011).

Causes:

- Non-environmental friendly infrastructure development (roads, football fields, settlement houses)
- Forest fire
- Excessive firewood collection in Alpine areas

- Grazing of bamboo seedlings by livestock
- Wild boar + Yak destroying natural soil cover
- Excessive tunneling by marmot
- Natural landslide & erosion
- Extraction of top soil for compost & other uses, exposing impermeable sub-soil
- Unsustainable extraction of natural resources (timber+ NWFPs+ boulders)

Effects:

- Reduction of long term availability of natural resources (timber, NWFP, boulders)
- Loss of ecosystem services and stability
- Adverse impact on water quality & quantity
- Adverse impact on livelihood
- Reduction of long term availability of natural resources (timber, NWFP, boulders)

4.1.5 Inadequate infrastructure and weak coordination for domestic and irrigation water supply

Causes: Poor planning coordination & implementation of irrigation & domestic water supply

Effects:

- Erratic, irregular supply of domestic & irrigation water
- Increased hardship



Figure 4. Logical Framework Analysis Team

5 References

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Annexure I: Logical Framework Analysis Matrix

Outputs	Activities	Verifiable indicators	Responsible agency/person for implementation	Collaborating partners	Local area-based plan	Budget (Nu. in million)
<i>Objective 1. To reduce contamination of springs, rivers & domestic water supply to meet with Bhutan Water Quality Standard.</i>						
1.1. Awareness among communities on the importance of contributing to an uncontaminated environment, particularly water bodies.	1.1.1. Develop training material (Audio-visual documentary, brochures, posters, training program for awareness campaign including e-waste)	Training Materials	WMD	ICS-MoAF, NEC, Dzongkhag, Thromdey TCBL, TD, JDNP MoWHS, Clean Bhutan, RSPN MoH	WMD Annual Plan	0.7
	1.1.2. Carry out annual public awareness program including e-waste in 3 geogs (3x5) and Thromdey (5)	20 awareness program 200 individuals	Dzongkhag/Thromdey	WMD, NEC TCBL, Geog TD, JDNP MoWHS, Clean Bhutan, RSPN, MoH	Dzongkhag Thromdey Annual Plan	0.8
	1.1.3. Carry out field visit for 15 Chiwogs and 2 study tour for capacity building of the stakeholders	15 Field Visit Report- (15x30 heads x7daysx 315) + (7days x Nu. 8000 x 15) = 1.8 M 1 study tour Report - (USD 200x10 daysx15 heads) + (Nu. 80000 x 15) = 1.23 M	Dzongkhag/Thromdey	WMD, TD, JDNP TCBL, Geog, NEC, MoWHS, Clean Bhutan, RSPN, MoH	Dzongkhag/Thromdey Annual Plan	3.0
1.2. Effective monitoring, policing of the existing policies & regulations	1.2.1. Carry out stakeholder meeting	Minutes of the meeting	WMD	NEC, Dzongkhag Geog, Thromdey MoH, MoWHS, Clean Bhutan, TD, JDNP Greener way, RSPN	WMD Annual Plan	0.3

related to water & waste management.	1.2.2. Develop a synthesis report, consolidating policy and regulation on water and waste management (including e-waste, effluent from workshops, medical waste)	Synthesis report	NEC	Dzongkhag, Thromdey MoWHS, E waste – DITT, MoH, TD, JDNP, WMD	NEC Annual Plan	0.5
	1.2.3. Carry out sensitization workshop on enforcement of existing water and waste regulations	Workshop report (15 x 3 geogs) (100 Thromdey officials) 10 dzongkhag officials	NEC	Dzongkhag, Geog Thromdey, TD, JDNP, MoWHS, MoH, DITT WMD	NEC Annual Plan	1.0
	1.2.4. Install 108 signage on waste (carry in carry out policy) (every tourist camp, 3 each in geogs)	Number of signage	Geog / TCBL	Dzongkhag, TD, JDNP	Geog / Annual Plan	1.0
	1.2.5. Carry out monitoring and compliance of the existing regulations	Biannual Monitoring Report Biannual Compliance incidence report	NEC	Geog, TD, JDNP, TCBL, MoWHS, MoH, NEC, DITT, WMD Dzongkhag, Thromdey	NEC Annual Plan	1.2
1.3. Adequate household waste collection facilities installed at strategic locations & managed efficiently.	1.3.1. Identify and map the strategic locations for waste collection facility	Map	Geog / Thromdey	Dzongkhag, NEC WMD, TD, JDNP MoH, MoWHS, DITT RSPN, Clean Bhutan	Geog / Thromdey Annual Plan	0.5
	1.3.2. Design, procure and install waste collection facilities (Enclosed collection bins for all types of waste with CCTV)	Design Drawing of the facility Number of facilities installed (40,000 Nu per set)	Dzongkhag / Thromdey	Geog, NEC, WMD, TD, JDNP, MoH, MoWHS, DITT, Clean Bhutan, RSPN	Dzongkhag/ Thromdey Annual Plan	0.2

	1.3.3. Carry out awareness on waste segregation	48 awareness program (3 programs in Thromdey, 45 programs - 3 programs in each chiwog)	Dzongkhag / Thromdey	Geog, WMD, NEC, TD, JDNP, MoH, MoWHS, DITT, Clean Bhutan, RSPN	Dzongkhag/ Thromdey Annual Plan	1.0
	1.3.4. Support with incentives in form of kind (transportation) to scrap dealers - incentives provided only in gewogs and remote areas (Dagala and Naro) - outsource (legalize) (rework and reanalyze this activity scrap dealers vs rag pickers. Gewog vs. Thromdey and transfer station or transportation)	Incentives provided	Dzongkhag Geog TD JDNP	NEC TCBL	Gewog Annual Plan	
	1.3.5 Procure garbage truck in Thimphu Dzongkhag Status: two trucks in dzongkhag, one offroad Recommendations - outsource - create transfer station and transportation	1 garbage truck procured	Dzongkhag	NEC Geog TD JDNP	Dzongkhag Annual Plan	3.0

	1.3.6 construct compost plant to absorb organic waste from Thromdey - at gewog level, biogas to be explored	Compost plant installed and operated	Thromdey/ Dzongkhag	NEC, MoAF, DoRE, MoEA	Dzongkhag/ Thromdey Annual Plan	
1.4. Adequate toilet facilities with proper & convenient access at strategic location established & managed properly.	1.4.1. Identify strategic locations for public toilets	1. Map developed 2. Drawing and Design	Geog / Thromdey	Dzongkhag, TD, JDNP TCBL, BTO - Bhutan Toilet Org., Dr. Toilet, MoH, MoWHS	Geog / Thromdey Annual Plan	0.2
	1.4.2. Build public toilets (as per 1.4.1)	Toilets built (Motithang, Changzamtog, Taba, Changjiji, Chubachhu, Olakha, Dechenling)	Thromdey	Dzongkhag, TD, JDNP, TCBL, BTO	Geog / Thromdey Annual Plan	7.0
	1.4.3. Explore and pilot alternatives to pit toilet in high altitudes away from water bodies	1. Design and drawing 2. 8 Pilot toilets (Wangdo, Dungdo, Gatala - Dagala Geog) (5 Chiwogs in Naro Geog)	Dzongkhag	MOH, TD, JDNP, TCBL, Clean Bhutan	Dzongkhag Annual Plan	1.5
	1.4.4. Carry out monitoring and compliance for public toilets (1.4.2)	Biannual Monitoring report Biannual Compliance report	MoH, MoWHS	Bhutan Toilet Org., Thromdey, Dzongkhag Geog, TCBL	MoH / MoWHS Annual Plan	0.1
1.5. Improved pipelines for water distribution in the city.	1.5.1. Map the areas for re-pipelining - Detailed inventory map - Study NRW rates and recommend solutions to reduce the rates	Comprehensive map of the water distribution system including pipeline in Thimphu City	MOWHS Thromdey		Thromdey Annual Plan / MoWHS / WMD	1.5

	(possibility of carrying out this component during the plan period)					
	Capacity building of plumbers and operators					
	1.5.2. Carry out re-pipelining for exposed and haphazard pipelines	New pipelines	Thromdey	MOWHS	Thromdey Annual Plan	
	1.5.3. Carry out monitoring (report from Thromdey Thuemey)	Biannual Monitoring report	MOWHS	MOH, NEC, WMD, Thromdey	MOWHS Annual Plan	0.3
1.6 Effluents standards maintained	1.6.1. All houses in Thimphu connected with sewer network					
Objective 2. To protect the water sources and investigate the drying up of springs & lakes.						
2.1. Awareness among communities on wetland conservation.	2.1.1. Develop training material (Audio-visual documentary, brochures, posters, training program for awareness campaign including e-waste)	Training Materials	WMD	ICS, NEC, Dzongkhag, Geog, TD, JDNP	WMD Annual Plan	
	2.1.2. Carry out public awareness program including e-waste	15 awareness program	Dzongkhag	WMD, NEC, Geog, TD, JDNP	Dzongkhag Annual Plan	
	2.1.3. Carry out field visit and study tour (exchange visit, in country, ex country)	15 Field Visits and 1 study tours Reports	Dzongkhag	WMD	Dzongkhag Annual Plan	
2.2. Investigation of drying water sources.	2.2.1. Carry out study	Reports	WMD	Geog, TD, JDNP, Dzongkhag, UWICER, MoWHS, MoH	WMD Annual Plan	2.0
	2.2.2. Implement recommendations of study to rehabilitate springs and water sources	Implementation reports	Geog	WMD, TD, JDNP, Dzongkhag	WMD Annual Plan	2.0

2.3. Effective application of regulations that impinge on development activities close to water source.	2.3.1. Carry out mapping of watersheds and identify critical areas to guide future development	Reports, zonation maps	WMD	Geog, Dzongkhag, Thromdey, TD, FRMD, NLCS	WMD Annual Plan	0.3
	2.3.2. Obtain endorsement from concerned authority	Endorsed document	Geog / Thromdey	Geog, Dzongkhag, Thromdey, TD, FRMD, NLCS	Geog / Thromdey Annual Work Plan	0.1
	2.3.3. Monitor development activities close to water source	Annual Monitoring Report	Dzongkhag/ TD/JDNP	NEC, WMD	Dzongkhag/TD/ JDNP Annual Plan	0.5
	2.3.4. Prepare a case report against developers who contravene regulations	Number of case reports	Dzongkhag/ TD/JDNP	NEC, WMD	Dzongkhag/TD/ JDNP Annual Plan	0.3
Objective 3. To ensure reliable domestic water supply for present & future generation in the watershed.						
3.1. Awareness on conservation & efficient use of water.	3.1.1. Develop training material (Audio-visual documentary, brochures, posters, training program for awareness campaign)	Training Materials	MoWHS / MoH	NEC, ICS, Dzongkhag, Geog, Thromdey, WMD,	MoWHS / MoH Annual Plan	
	3.1.2. Carry out two public awareness program (15 chiwogs & 1 Thromdey)	32 awareness program	Dzongkhag / Thromdey	WMD, NEC, Geog, TD, JDNP, MoWHS, MoH	Dzongkhag / Thromdey Annual Plan	
3.2. Comprehensive domestic water distribution & management plan. - Effective implementation of Water safety plan	3.2.1. Carry out survey of the proposed water source	Survey report	Geog/ Thromdey	MoH, MoWHS	Geog / Thromdey Annual Plan	0.5
	3.2.2. Conduct study on the current demand and the projected future demand - water budgeting	Study Report	MoH/MoWHS/ Dzongkhag	Geog, Thromdey, Dzongkhag, WMD, NEC	MoH / MoWHS Annual Plan Water Safety Plan	0.2
	3.2.3. Prepare a plan for comprehensive water distribution system	Plan	MOH/MOWHS	Geog, Thromdey, Dzongkhag, WMD, NEC	MOH/MOWHS Annual Plan Water Safety Plan	0.1
	3.2.4. Pilot rain water harvesting materials for	Number of households (institutions,	Dzongkhag / Thromdey	MoWHS, RSPN, WMD	Dzongkhag / Thromdey Plan	3.0

	prioritized locations at household level in the watershed	monasteries, car washing workshops) supported 100 nos				
Objective 4. To remove/mitigate degrading influence and rehabilitate the ecosystem in the watershed.						
4.1. Awareness on the benefit of natural resources harvesting/ management.	4.1.1. Develop training material (Audio-visual documentary, brochures, posters, training program for awareness campaign)	Training Materials	SFED	ICS, Dzongkhag, Geog, TD, JDNP, FRMD, WMD	SFED Annual Plan	
	4.1.2. Carry out public awareness program	15 awareness program	SFED	Dzongkhag, Geog, TD, JDNP, FRMD, WMD	SFED Annual Plan	
4.2. Local area forest management plan.	4.2.1. Conduct inventory of natural resources focusing on degrading influences in the watershed Can be carried during the plan periods	Inventory Report	TD	FRMD, WMD, SFED	TD Annual Plan	Get from Dagana or Chamkhar chhu
	4.2.2. Develop plan	Plan	TD	FRMD, WMD, SFED	TD Annual Plan	
4.3. Rehabilitation of point sources of erosion.	4.3.1. Conduct assessment of the point source of erosion	Assessment Report	NSSC	Geog, Dzongkhag, TD, JDNP, WMD	NSSC Annual Plan	0.2
	4.3.2. Develop a plan of intervention	Implementation Plan	NSSC	Geog, Dzongkhag, TD, JDNP, WMD	NSSC Annual Plan	3.0
	4.3.3. Implement the plan	Field visit Photographs	NSSC	Geog, Dzongkhag, TD, JDNP, WMD	NSSC Annual Plan	
			Total Budget Nu.			36

Annexure II: Causes and Effects of the Core problems

