

**BASIN MANAGEMENT MANUAL
FOR
LOCAL SELF GOVERNMENT INSTITUTIONS**



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**Basin Management Manual for
Local Self Government Institutions
(English)**

March 2015

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FOREWORD

Well being of our water resources and its sources face harsh challenges these times as they are under severe threat of over-exploitation and neglect. As custodians of natural resources Local Self Government Institutions (LSGIs) have great role to play in their management, sustenance and allocation of resources. But considering the complexity of issues involved, the management of our rivers and other water bodies are not an easy task. Being the premier institute for imparting knowledge and skills to LSGIs, Kerala Institute of Local Administration (KILA) is keen on issues related to natural resource management and water is prime on its agenda. KILA is already involved in watershed management in LSGIs. It is in this context that KILA decided to bring out Basin Management Manual –BMM- to support the LSGIs. The BMM is pre cursor for an in-depth understanding about the basins and water bodies to LSGIs prior to their attempt to prepare a Basin Management Plan. The Manual documents all necessary components in basin management, its data requirements and sources. It also brings out all stakeholders and their role in management and attempt a governance model.

17/03/2015

Dr. P.P. Balan

Director, KILA

ACKNOWLEDGEMENT

Writing of this Manual is heavily indebted to several documents available online, with the core idea borrowed from a few. Among them one is the *Guidelines for Preparation of River Basin Management Plan*, Basin Planning and Management Organization, Central Water Commission Government of India, 2007. It said that ‘...Planning is a continuous process. Therefore, master plan should be reviewed and modified periodically to incorporate up-to-date information on various factors affecting decision-making.’ The insistence for maintaining a dynamic data for basin management is derived from this. The aforementioned guideline details all relevant topics and features but stops short of a process that could be translated for practitioners on the ground.

The content flexibility to suit Basin Management Manual in its present form is inspired from the *Model Guidelines for River Basin Management Planning in Armenia*, US Agency for International Development, 2008. It is a truly process intensive, ‘make do’ document that is at the same time scientific. The elaborate characterization process, its definitions and method of detailing etc. offered ways to simplify/modify for the purpose of this Manual.

The preparation of the Manual was also helped by *Water Sharing in the Nile River Valley*, Using GIS/Remote Sensing for the Sustainable Use of Natural Resources, UNEP/DEWA/GRID–Geneva, 1999-2000. It is a very detailed and technical document that helps to understand the complexity involved in basin management and water sharing process. All above documents are for further reading.

The premise for setting the Manual was set thanks to the internal discussions within KILA. Data requirements for each characterization, its identification, selection of samples etc are owing to the contribution of Dr. Latha, Ms. Anita and Mr. Jayaraj. The task of identifying data sources and their possible availability was achieved through several sittings with experts. Mr. D. Sanki compiled and tabulated Powers on Panchayat/Municipalities relevant for (River) Basin Management in Kerala that is a ready reckoner and is annexed in the Manual. It truly is very valuable.

Finally, my gratefulness to Dr. J.B. Rajan and KILA for initiating the idea of a Basin Manual and also having provided the impetus to broaden the scope of the Manual both for its reach to all LSGIs as well as for multi-stakeholder practice. While this Manual is a result of efforts of various people, any limitation herein lies with me.

Hari Kumar TP

Contents

Foreword	i
Acknowledgement	iii
Acronyms	ix
Basis for the Manual	xi-xiv
Section I Basin Characterization	
Chapter 1: Physical Characterization	1-10
1.1 Key Terminologies	3
1.2 Data Requirements	4
1.3 Process: Descriptive & Tabular Representation	6
Chapter 2: Hydrological Characterization	11-20
2.1 Key Terminologies	13
2.2 Data Requirements	14
2.3 Process: Descriptive & Tabular Representation	16
Chapter 3: Eco-Bio-Enviro Characterization	21-31
3.1 Key Terminologies	23
3.2 Data Requirements	24
3.3 Process: Descriptive & Tabular Representation	26
Chapter 4: Geographical Characterization	33-40
4.1 Key Terminologies	35
4.2 Data Requirements	36
4.3 Process: Descriptive & Tabular Representation	37
Chapter 5: Economic Characterization	41-51
5.1 Key Terminologies	43
5.2 Data Requirements	43
5.3 Process: Descriptive & Tabular Representation	46
Chapter 6: Social Characterization	53-60
6.1 Key Terminologies	55
6.2 Data Requirements	55
6.3 Process: Descriptive & Tabular Representation	57
Section II Outcome & Action Plan	61-84
7.1 Outcome	63
7.2 Action Plan	64
7.3 Linkages with overall Basin character	66
7.4 Conclusion	69
Section III Governance	85-93
8.1 Stakeholders	87
8.2 Governance Structure	88
8.3 Mode of Operations	90
8.4 Monitoring	92
Annexures	95-119
I Powers on Panchayat/Municipalities Relevant for (River) Basin Management in Kerala	97
II Address of Departments for Data	120
III Legal Instruments - Policies, Act & Rules	121

List of Figures

Figure 1	Basin Characterization	xii
Figure 2	Meanders	4
Figure 3	Orgin of a River	5
Figure 4	Sands of Bharathapuzha	15
Figure 5	Riparian Vegetation	23
Figure 6	Estuarine Crab	25
Figure 7	Estuary	35
Figure 8	Mangroves	36
Figure 9	Pilgrimage Tourists	45
Figure 10	Boat on River	56
Figure 11	Characterization Process	63
Figure 12	Constituents of PRGS	88
Figure 13	PRGS Decision Making Process	91

List of Tables

Section I

1.1	Key Terminologies in Physical Characterization	3
1.2	Data for Physical Characterization	4
1.3	Listing of Physical Factors & Data Sources	7
1.4	Particulers of Data Collection Method - LSGIs Level	9
1.5	Physical Factors LSLIs Level	9
1.6	Physical Factors District Level	9
1.7	Physical Factors Basin Level	10
2.1	Key Terminologies in Hydrological Characterization	13
2.2	Data Requirements for Hydrological Characterization	14
2.3	Listing of major Hydrological Factors & Data Sources	17
2.4	Pariculers of Data Collection Method LSGIs Level	19
2.5	Hydrological Factor: Micro Watershed Outside forested Areas LSGIs Level	19
2.6	Hydrological Factors: Land Use in Micro Watershed Outside Forested Areas LSGIs Level	19
2.7	Hydrological Factors: Land Use in Micro Watershed Outsid Forested Areas District Level	20
2.8	Hydrological Factors Basin Level	20
3.1	Key Terminologies in Eco-Bio-Enviro Characterization	23
3.2	Data for Eco-Bio-Enviro Characterization	24
3.3	Listing of Major Eco-Bio-Enviro Factors & Data Sources	27
3.4	Pariculers of Data Collection Method LSGIs Level	29
3.5	Eco-Bio-Enviro Factors LSGIs Level	30
3.6	Eco-Bio-Enviro Factors:Bird Diversity & Habitat LSGIs Level	30
3.7	Eco-Bio-Enviro Factors District Level	30

3.8	Eco-Bio-Enviro Factors Basin Level	31
4.1	Key Terminologies in Geographic Characterization	335
4.2	Data Requirements for Geographic Characterization	36
4.3	Listing of Major Geographic Factors & Possible Data Sources	38
4.4	Particulars of Data Collection Method - LSGIs Level	39
4.5	Geographical Factors LSGI Level	39
4.6	Geographical Factors District Level	40
4.7	Geographical Factors Basin Level	40
5.1	Key Terminologies in Economic Characterization	43
5.2	Data Requirements for Economic Characterization	43
5.3	Listing of Major Economic Factors & Possible Data Sources	47
5.4	Particulars of Data Collection Method - LSGIs Level	50
5.5	Economic Factors LSGIs Level	50
5.6	Economic Factors District Level	50
5.7	Economic Factors Basin Level	51
6.1	Key Terminologies in Social Characterization	55
6.2	Data Requirements for Social Characterization	55
6.3	Listing of Social Factors & Data Sources	58
6.4	Particulars of Data Collection Method - LSGIs Level	59
6.5	Social Factors LSGIs Level	59
6.6	Social Factors District Level	60
6.7	Social Factors Basin Level	61
Section II		
7.1	Action Plan: Interventions	65
7.2	Action Plan: Sectoral & Budget Integration	65
7.3	Action Plan: Inter-Sub Matrix Linkages	65
7.4	Physical Factor - River Bank	66
7.5	River Bank: Data Summary	66
7.6	River Bank : List of Maps	67
7.7	Action Plan : Interventions	67
7.8	Action Plan: Sectoral & Fund Integration	68
7.9	Action Plan: Inter-Sub Matrix Linkages	68
7.10	Hydrological Factor - Watershed	69
7.11	Watershed Outside Forested Areas: Data Summary	69
7.12	Watershed Outside Forested Areas: Data Summary	69
7.13	Watershed Outside Forested Areas: Data Summary	70
7.14	Watershed Outside Forested Areas: Data Summary	70
7.15	Watershed Outside Forested Areas: Data Summary	70
7.16	Watershed Outside Forested Areas: List of Maps	70
7.17	Action Plan: Interventions	70
7.18	Action Plan: Sectoral & Fund Integration	72
7.19	Action Plan: Inter-Sub Matrix Linkages	73

7.20	Eco-Bio-Enviro Factor-Pollution Load	73
7.21	Pollution Load: Data Summary	74
7.22	Pollution Load: Impacts	75
7.23	Pollution Load List of Maps	75
7.24	Action Plan: Interventions	75
7.25	Action Plan: Sectoral & Fund Integration	77
7.26	Action Plan: Inter-Sub Matrix Linkages	77
7.27	Economic Factor - Sand Mining	78
7.28	Sand Mining: Data Summary	78
7.29	Sand Mining: List of Maps	79
7.30	Action Plan: Interventions	79
7.31	Action Plan: Sectoral & Fund Integration	80
7.32	Action Plan: Inter-Sub Matrix Linkages	80
7.33	Economic Factor - Rice Farming	81
7.34	Demography & Farming: Data Summary	81
7.35	Rice Farming: Data Summary	81
7.36	Action Plan: Interventions	82
7.37	Action Plan: Sectoral & Fund Integration	83
7.38	Action Plan: Inter-Sub Matrix Linkages	83
Section III		
8.1	User Group Membership	89
8.2	Management Cell Membership	89
8.3	Scrutiny Cell Membership	90

List of Boxes

Box 1	Delineation of Watersheds into Tiny Micro Watersheds	13
Box 2	Stakeholders	87
Box 3	Property Regimes	87
Box 4	Where is All the Earth's Water?	88
Box 5	Transparency	92
Box 6	Monitoring	92

Acronyms

ADAC	–	Agency for Development of Aqua Culture
BMM	–	Basin Management Manual
BMP	–	Basin Management Plan
BTR	–	Basic Tax Register
CADA	–	Command Area Development Authority
CESS	–	Centre for Earth Science Studies
CWC	–	Centre for Water Commission
CWRDM	–	Centre for Water Research and Management
CZMA	–	Coastal Zone Management Authority
CZMP	–	Coastal Zone Management Plan
DTPC	–	District Tourism Promotion Council
GIS	–	Geographical Informatics System
IRTC	–	Integrated Rural Technology Centre
ITDC	–	India Tourism Development Corporation
IWMP–RDD	–	Integrated Watershed Management Programme, Rural Development Department
KFRI	–	Kerala Forest Research Institute
KILA	–	Kerala Institute of Local Administration
KRWSA	–	Kerala Rural Water Supply and Sanitation Agency
KSEB	–	Kerala State Electricity Board
KSREC	–	Kerala State Remote Sensing and Environment Centre
KSWTD	–	Kerala State Water Transport Department
KTDC	–	Kerala Tourism Development Corporation
LSGIs	–	Local Self Government Institutions
NABARD	–	National Bank of Agriculture and Rural Development
NRSA	–	National Remote Sensing Agency
PTPC	–	Panchayat Tourism Promotion Council
PCB	–	Pollution Control Board
PCK	–	Plantation Corporation Kerala
PWD	–	Public Works Department
PRA	–	Participatory Rural Appraisal
PRGS	–	Participatory Resource Governance System
RRA	–	Rapid Rural Appraisal
RMC	–	River Management Cell
SFCK	–	State Farming Corporation of Kerala
VFPCK	–	Vegetable and Fruit Promotional Council of Kerala

Basis for the Manual

Focus

This Basin Management Manual was originally meant for Local Self Government Institutions (LSGIs) of two Backward Regions Grant Fund (BRGF) districts of Wayanad and Palakkad, for protection and management of the Kabani River and the Bharathapuzha respectively. As discussions deepened, it became evident that the evolved approach and the Manual could be useful to other LSGIs, stakeholders and managers in the preparation of Basin Management Plan (BMP). It is an accepted fact that there is no single river or water body in the state that is not threatened of its natural existence. Effluent discharge, waste dumping, sand mining, river and river bank encroachment, and unsustainable water extraction are major threats to all waterbodies. The impacts of these development induced threats are several and severe, while a holistic management approach is lacking. Keeping in view of these, water bodies in Kerala especially its rivers, lakes and also the groundwater sources are considered as the basis for this Manual. The pressures and impacts are considered with interventionist detail. This Manual is only a forerunner to preparation of a BMP. Every water body calls for detailed and in-depth study and analysis to identify its natural conditions, potentials and threats. While the threats are discussed, it is imperative to have an agency to coordinate and take a lead role in the management and protection of waterbodies. In the Kerala context, this could be the LSGIs to an effective extent. If protected forest areas are delineated, the LSGIs have their jurisdiction spread across the state through its 978 Rural, 65 Urban and 1 Cantonment. (978 GPs, 60 Municipalities, 5 Municipal Corporations, 1 Cantonment.) LSGIs could bring together all stakeholders and coordinate the management activities. But the task ahead is painstaking, complex and costly.

Before venturing into the tempting call of basin management, it is essential that LSGIs and other stakeholders make an informed entry. The basin management involves almost all schools of modern science and management techniques. It must be aligned with local wisdom and practices too. This Manual is envisioned keeping the LSGIs as central, and with the active cooperation of other agencies and stakeholders. All essential natural, social and economic features of a waterbody are considered so that the basin characteristics are scientifically evaluated for preparation of a realistic BMP.

Approach to the Basin Management Manual (BMM)

- 1 This Manual is conceived keeping in mind the LSGIs core mandate to decentralized governance and to instill changes from below. The Manual intended to support the LSGIs in preparation of a Basin Management Plan keeping in mind these two central premises.
- 2 All LSGIs located on either bank of a river or of a water body are considered potential water managers in the Manual.
- 3 The term basin is used in generic, qualifying for river, stream, lake, etc with all or any natural feature applicable. As basin management is usually referred to river basins the features, process described in the Manual shall reflect to that effect to a great degree. The significance however is protection and management of water body within the jurisdiction of LSGIs, scientifically.
- 4 A water body whether it is a river or lake is considered as a single unit for the purpose of management. That is, throughout their entire length - from the point of origin to the innate confluence with the ocean or other waterbody (as in a river) or the volume it occupies (as in a lake), irrespective of political boundaries.
- 5 It is proposed to document all natural and human activities taking place in and along a water body within the jurisdiction of each LSGI. The Manual keeps aware that each LSGI may have only a limited area in its control. The intent is not fragmentation but a rational division for data accuracy while mapping the whole and for later interventions.
- 6 The Manual segregates data of all available features of the water body in every possible detail. This is to conscientize the water managers and stakeholders, the magnitude and intricacy while they attempt effective interventions in basin management.

- 7 The proposal is to generate ‘dynamic data’ or ‘transactional data’ denoting information that asynchronously changes as further updates to the information become available. This is based on the principle that the water body is alive and undergoes perpetual transformation; therefore all pertaining data must also be alive.
- 8 During preparation of the BMP, it proposes to generate a dynamic database through survey, research or both with the active participation of water managers, local communities and people, stakeholders, scientists, and experts on Information Technology experts.
- 9 This Manual does not detail the complex analysis involved while preparing a BMP, since the analysis and outcome in the real case scenario shall be based on authentic data or samples drawn from the ground. Instead the Manual provides an overview of the process.
- 10 The Manual recognizes that its prime mandate is to provide the LSGIs an action plan for effective interventions in order to maintain healthy water bodies. It also takes into account that LSGIs have systems in place for projects, budgets and three-tier integration for larger project implementation.
- 11 The Manual outlines a governance structure representing the LSGIs and the basin stakeholders for joint action. Its functions can be flexible taking into account local situations and needs. The prime reference however is the basin health and the earnest desire is that it shall not be compromised.
- 12 Evaluation and corrective action is proposed at individual LSGI level, at district and inter-district levels to envelop the entire water body and ultimately to fruitful basin management.

Structure

The Manual is founded on three thematic matrices represented as:

- 1 Section I Basin Characterization
- 2 Section II Outcome and Action Plan for LSGIs
- 3 Section III Governance Structure

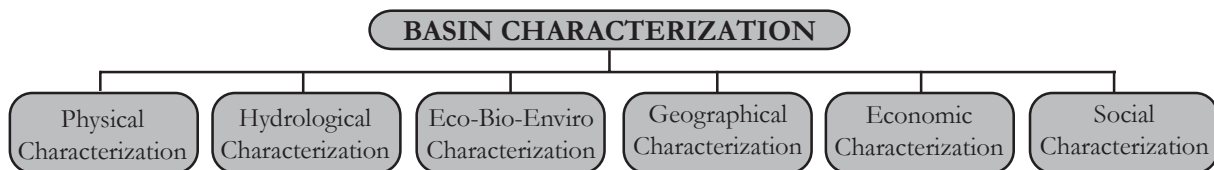
Section I

1 Basin Characterization

Basin characterization: As the preliminary step in planning, basin characterization is considered the most important. It is the listing of all major characteristics of a basin. The Manual divides these characteristics into six categories aligning with national and international classifications but also taking into account the indigenous requirements. They are in the following order:

- 1 Physical Characterization
- 2 Hydrological Characterization
- 3 Eco-Bio-Enviro Characterization
- 4 Geographical Characterization
- 5 Economic Characterization
- 6 Social Characterization

Fig. 1: Basin Characterization



This Manual presents each of these characteristics as separate short chapters. A typical characterization chapter will have tables of:

- a) Key Technical Terminologies (KTT)
- b) Data Requirements (DR)
- c) A Descriptive cum Tabular Representation (DTR) of the process depicting dynamic data requirements, its possible sources and how to collect and collate it at different levels.

This is further detailing as:

a) Key Technical Terminologies (KTT)

Several terminologies in basin characterization are unfamiliar to layman. Prior to proceeding to the characterization process, technical terminologies are tabled first along with the definition or the description.

b) Data Requirements (DR)

Prior to detailing data requirements, the table provides all identified major factors and data requirements of a particular characterization segment. This serves an ‘at a glance’ purpose prior to the detailing process.

c) Process: Descriptive cum Tabular Representation (DTR)

The Descriptive cum Tabular Representation is to engage the LSGIs why a particular set of data is required for basin characterization. It is divided into two sections: 1) Data Collection and b) Data Collation and Tabulation for Analysis.

2 Data collection

This section reveals the magnitude of data requirements in each characterization and its sub factors, lists potential secondary sources and availability Primary data requirement is emphasized in the absence of or inadequacy of secondary data.

Descriptive cum Tabular Format for each Section will have a brief introductory note followed by rational for each process in data collection as:

- 1 Why do LSGIs need data* in basin planning?
- 2 What all data is required?
- 3 Where do LSGIs gather the data?
- 4 What necessary caution and criteria are required while collecting data?
- 5 How do LSGIs validate the data?
- 6 How do LSGIs collate the data?

3 Data Collation, Tabulation

The collected data is collated first at LSGIs level then at the level of all basin LSGIs in the district and all basin districts to arrive at basin level status. The expected outcome is the data on current status of each characteristic that stands ready for expert analysis.

Section II

Outcome and Action Plan for LSGIs

This Manual provides only an overview of the analysis process, because analyses are conducted on real data or samples drawn from the ground. However, samples of handpicked outcome of characterization process are provided for familiarizing. An Action Plan is worked out in detail since the mandate of this Manual is to empower the LSGIs for effective Basin Management. This section has two segments:

- a) Matrices for LSGIs level Action Plan
- b) Sample handpicked factor with relevant tables and matrices

a) Matrices for LSGIs level Action Plan

The Action Plan for LSGIs is worked out so that they can take action based on the recommendations of the BMP. This is in the form of three matrices for simple but effective understanding and action. Based on the criticality of each problem, LSGIs are provided five interventional options for corrective action viz. regulation, restoration, protection, ban, and education.

**Note. This refers to Six Characteristics identified vice versa Physical, Hydrological, Eco-Bio-Environmental, Graphical, Economic and Social in respective sections.*

LSGIs intervention to problems is aligned to their sector plans; productive, service and infrastructure. It is also linked to three-tier integration; Grama Panchayat, Block Panchayat and District Panchayat respectively for individual or collective action and also with other funds and finally, the Action Plan portrays a holistic approach to management. Each factor is linked to the other, each characterization to the other and also their inter-linkages in the over all Basin Plan.

b) Handpicked Factors with Relevant Entries as Sample

These samples represent both the data requirement and Action Plan. One handpicked factor from the characterization process with tables and output matrices represent the Action Plan and its relevant inter-linkages in LSGIs intervention in Basin Management. All but geographical characterization samples are represented.

Section III

Governance Structures

The governance structure is founded on the principles of participation, rights and responsibilities i.e. if there are rights there are responsibilities also. This section details; (a) who and how stakeholders and their rights can be determined, (b) governance structure that takes into account all stakeholders, LSGIs and the interest of the basin, (c) the operational mode of participatory governance and (d) monitoring mechanisms.

a) Stakeholders

This Manual proposes to list out all stakeholders, their activities and stakes. This shall provide the quantum of pressure on basin resources and their role in basin management.

b) Governance System

The Manual proposes a Participatory Resource Governance System (PRGS), a governance structure for all beneficiary stakeholders involved in the basin. This includes various government institutions, departments and private user groups directly linked to the basin. Space for a neutral body to operate within the structure is also proposed.

c) Operational Mode

The operation is founded on democratic space for all stakeholders while keeping intact the powers and rights of the LSGIs in decision making. It is a tree-tier system with User Groups, a Scrutiny Cell and a Management Cell designed to work in harmony.

d) Monitoring

The monitoring is proposed at several layers. They include monitoring of resource status, its extraction status, methods and practices in the basin management and also short-term and long-term monitoring mechanisms.

Section I

Basin Characterization

Chapter 1

Physical Characterization

- ▶ **Key Terminologies**
- ▶ **Data Requirements**
- ▶ **Process: Descriptive & Tabular Representation**

1.1 Key Terminologies

Unlike in our day to day usage, the characterization process uses its own terminologies to describe different features and facets of a basin – of a river, lake or other waterbody. Listed below are terminologies that classify the physical characteristics, its description explained for the Basin Manual reader (Table 1.1).

Table 1.1: Key Terminologies in Physical Characterization

#	Key Terminologies	Description
1	River Basin	The land area drained by a river and its tributaries.
2	Stream or Channel	The structure and form of a stream or channel.
3	Morphology River Channel	A body of water, the river in this case, that flows deeper in the center and moves along a path which is physically confined by the river bed and/or banks. “Channel” is a synonym of “strait” but that usage usually refers to a smaller body of water (fresh, salt or brackish) running along a channel and is connected by two larger bodies of water (the sea).
4	Stream Order	Measure of the relative size of streams. Stream sizes range from the smallest, first-order, to the largest.
5	River Bed/River Bank	A river bed/bank is the channel bottom of a stream, river or creek; the physical confine of the normal water flow. The lateral confines or channel margins, during all but flood stage known as the stream banks or river banks. In fact, a flood occurs when a stream overflows its banks and flows onto its flood plain. As a general rule, the bed is that part of the channel, just at the “normal” water line and the banks are that part above the water line. However, because water flow varies, this differentiation is subject to local interpretation. Usually, the bed is kept clear of terrestrial vegetation whereas the banks are subjected to water flow only during unusual or perhaps infrequent high water stages and therefore, might support vegetation some or much of the time.
6	Riparian Zone	Relating to or inhabiting the banks of a natural course of water. Riparian zones are ecologically diverse and contribute to the health of other aquatic ecosystems by filtering out pollutants and preventing erosion.
7	Flood Plain	The flat area bordering a river, composed of sediment deposited during flooding.
8	Delta	A landform that is formed at the mouth of a river where that river flows into an ocean, sea, estuary, lake, reservoir, flat arid area, or another river. Deltas are formed from the deposition of the sediment carried by the river as the flow leaves the mouth of the river. Over long periods of time, this deposition builds the characteristic geographic pattern of a river delta.
9	Estuary	A partly enclosed coastal body of water with one or more rivers or streams flowing into it, and with a free connection to the open sea. Estuaries form a transition zone between river environments and ocean environments and are subject to both marine influences, such as tides, waves, and the influx of saline water; and riverine influences, such as flows of fresh water and sediment. The inflow of both seawater and freshwater provide high levels of nutrients in both the water column and sediment, making estuaries among the most productive natural habitats in the world.
10	Meanders	To follow a winding and turning course/Circuitous windings or sinuosities, as of a stream or path/snake like windings.
11	Sediment	Soil, sand, and minerals washed from land into water, usually after rain. Sediment can destroy fish-nesting areas, clog animal habitats, and cloud waters so that sunlight does not reach aquatic plants
12	Tributary	A stream or river that flows into a larger river or lake

Fig 2 : Meanders



1.2 Data Requirements ¹

In basin management, updating data is essential i.e. to keep data alive or dynamic. The term physical characterization envelops several important factors and sub-factors that call for separate recording. All significant factors for physical characterization are listed so that LSGIs and stakeholders have an informed participation during Basin Management Plan preparation. (Table 1.2).

Table 1.2: Data for Physical Characterisation

#	Physical Factors	Data Requirements
1	River Basin	1 Origin of the River 2 Area of the Basin 3 Number of Main Tributaries in the Basin 4 Inter - State Nature of the Basin
2	Stream (Channel or Fluvio) Morphology.	1 Channel pattern 2 Channel geometry at several points along a river channel, including network of tributaries within the drainage basin
3	River Channel	1 Width and depth of channel – to be assessed during November-December
4	River Bed	1 Geological base of the river-bed - to be assessed at every 1 km interval
5	River Bank	1 Sloping land beside the river - to be assessed 2 Slope stability – to be for every 1 km along the length of the river
6	Riparian Zone	1 Length and Width – based on the stream order from which riparian zone will be gauged 2 Depending on the LSGIs through which the stream flows
7	Flood Plain	1 Length and Width 2 Seasonal connectivity with the river 3 Composition of (Sediments) of the flood plain
8	Delta	1 History of delta formation 2 Extent of delta 3 Characteristics – type, sedimentary structure
9	Estuary	1 Extent 2 Classification 3 Seasonality Variations
10	Meanders (Snake like winding)	1. Number of meanders in the river 2. Historical data – how the meanders have changed or disappeared

¹ Factor listed below are general but not exhaustive; individual basin may have its physical particularities that could be listed only during the characterisation process

#	Physical Factors	Data Requirements
11	Sand Deposits - Midlands - Plains	1 Width and depth of sand deposit 2 Type of sand – clay, alluvium, gravel etc. 3 Rate of deposit
12	Sediment	1 Sedimentation Inside Reservoirs 2 Downstream of Dams 3 Sediment Composition 4 Rate of Sedimentation
13	Tributary	1 Number of Tributaries 2 Origin and length of each tributary till its confluence with main river /major tributary 3 Local names of the tributary
14	Pools and Riffles	1 Major pools and riffles in the river (in upstream areas only) 2 Location
15	Waterfalls	1 Major Waterfalls 2 Location 3 Length and Fall 4 Seasonality
16	Reservoir Check Dam	1 Height 2 Width 3 Water spread Area

Fig 3 : Origin of a River



1.3 Process: Descriptive & Tabular Representation

1.3.1 Introduction

In basin characterization it is important to capture facets that constitute the basin naturally. These are the physical-geographic-biological including the hydrological characteristics that works in union to form the basin. As it is impossible to delineate basin characteristics without human presence or interferences, such influences also shall creep into this exercise. The significance of capturing the physical characteristics is that we get to see and familiarize a basin in its entirety. The process is technical and calls for the presence of professionals and for their expertise to the basin for documenting the characteristics.

1.3.2 Data Collection

(i) Why do LSGIs need physical data in basin planning?

Physical data (along with other characteristics) is to assess the condition of a basin and also its status from a physical perspective. Physical characteristics are drawn primarily to document various sensitive ecological zones and features which otherwise do not get the attention they call for; but are integral parts that constitute the whole. For reasons of accuracy and later for basin protection strategies each of these features need careful delineation for basin characterization.

(ii) What all data is required?

Physical data includes every stage of the river or water body from its origin to its natural rest when it debouches into the ocean or in some cases into another larger water body. Data on river bed, the sediment it carries and its composition, the tributaries, different formations like the delta and estuary all need to be documented in precision. Data on the status of river banks, the riparian vegetations etc., are essential factors that need to be documented.

(iii) Where do LSGIs gather the physical data?

● Secondary Data

- a) The search must begin with any basin management studies conducted in full or in sections by specialized institutions or universities or by any other agencies for secondary data purposes. Secondary data may also be available with government departments like research institutes like Department of Forests, Irrigation, Electricity Board and institutions like CESS, KFRI, etc. Though such published sources may not be studies depicting the entire, these could nevertheless provide data on specific factors like catchment area, watersheds, riparian zones etc.
- b) All general books on rivers in the state must be procured especially those relating to the basin of interest to the LSGIs
- c) Satellite and Remote Sensing imageries
- d) Any and all maps available are precious and must be procured.
- e) Search for old photographs could be made with possible date and age ascertained.

● Primary Data

- a) It is essential to have complete data on the physical features
- b) It is recommended that LSGIs collectively approach the primary data collection with a definite work plan.
- c) PRA or RRA methods are essential to gather information on changes that has occurred to features like river banks, riparian vegetations, flood plains etc., that has vital significance to assess the changes taken place and thereby its affects and impacts.
- d) Maps of all major physical features are to be prepared.
- e) Seek service of photographers with interest and expertise in nature/wildlife to photo/video documentation of physical features.

Listed in table 1.3 are all major physical factors and secondary data sources required for the physical characterization of a basin along with agencies and also methods for data collection. These agencies and sources may possess data or maps in whole or part or none at all. LSGIs can approach these agencies for generating required data or maps professionally.

Table 1.3: Listing of Physical Factors & Data Sources

#	Physical Factors	Data Sources	
		Secondary	Primary
1	River Basin	1 Landuse Board – River Basin Map with Sub and Micro Watershed Boundaries 2 KSREC 3 NRSA 4 CESS 5 KFRI 6 Google maps 7 LSGIs <i>Vikasana Rekha</i> (Development Report) 1996	1 Watershed Master Plan prepared by LSGIs 2009 -12 2 Survey 3 Mapping 4 RRA
2	Stream (Channel or Fluvio)Morphology	1 Department of Soil Survey 2 Department of Soil Conservation 3 Landuse board	1 Survey 2 Mapping
3	River Channel	1 RMC (Department of Revenue)	1 Survey 2 Mapping
4	River Bed	1 RMC	1 Survey 2 Mapping
5	River Bank	1 RMC 2 Panchayat Office	1 Survey 2 Mapping 3 RRA 4 Photographs
6	Riparian Zone	1 RMC 2 KFRI	1 Survey 2 Mapping 3 RRA
7	Flood Plain	1 RMC 2 Panchayat Office	1 Survey 2 Mapping 3 RRA
8	Delta	1 RMC	1 Survey 2 Mapping 3 RRA
9	Estuary	1 CESS 2 CWRDM 3 CZMP	1 Survey 2 Mapping 3 RRA
10	Meanders (Snake like winding)	1 KSREC 2 NRSA 3 Satellite Imageries 4 Kerala Land Use Board 5 Google Maps	1 Survey 2 Mapping 3 RRA
11	Sand Deposits - Midlands - Plains	1 RMC 2 CESS	1 Survey 2 Mapping 3 RRA
12	Sediment	1 RMC 2 CESS 3 Department of Geology	1 Survey 2 RRA
13	Tributary	1 RMC 2 KSREC 3 Satellite Imageries 4 Google Maps	1 Survey 2 Mapping 3 RRA

#	Physical Factors	Data Sources	
		Secondary	Primary
14	Pools and Riffles	1 RMC	1 Survey 2 Mapping 3 RRA
15	Waterfalls	1 RMC 2 Department of Forests 3 KFRI	1 Survey 2 Mapping 3 RRA
16	Reservoir - Check Dam	1 Department of Forests 2 RMC 3 DAM Authority 4 Electricity Board 5 Panchayat Records	

(vi) What necessary caution and criteria are required while collecting physical data?

- a) All available secondary data should be verified with onsite visits and comparisons
- b) Age of data is a prime criterion especially for secondary data, this is to ensure data consistency and uniformity
- c) Selecting common software by all LSGIs is mandatory for uniformity, output consistency. There are several software available for Integrated River Modeling.

(v) Data Validation

For physical characterization at LSGIs level, data collected should ensure the followings:

- a) Textual history of River & Physical characteristics
- b) Table of Stream Morphology
- c) Table of River Channel width & Length
- d) Table on River Geological Base
- e) Table of Reclamations (Bank & Bed)
- f) Topographic Maps or Imagery of the River Basin
- g) Maps of River Banks
- h) Maps of Riparian Zone
- i) Maps of Flood Plains
- j) Maps of Delta
- k) Map of Estuaries/s
- l) Maps & Imageries of Meanders
- m) Maps of Tributaries
- n) Maps of Pools & Riffles & Regions
- o) Maps of Waterfalls & Regions
- p) Maps of Reservoirs & Check Dam locations

(vi) How do LSGIs collate the data?

Data collection is a meticulous process and the data voluminous. It seeks several batches of data collectors and supervisory personnel involvement. Therefore documenting the method has prime significance. The collating process also involves different stages; first at LSGIs level followed by collation of all basin LSGIs at district level and finally all basin districts put together to arrive at the basin level. The digitization and the Geographical Information System (GIS) will greatly depend on the data collection process and data accuracy.

(vii) Data Tabulation

Prior to collating the physical data it is important to clearly specify data collection method; whether it is survey, estimations obtained through PRA etc. The collection process should be clearly tabulated indicating whether the source is primary or secondary and in case of secondary the date of publication and source. (Table 1.4).

Table 1.4: Particulars of Data Collection Method - LSGIs Level

#	Physical Factor	Secondary Data			Primary Data	
		Source		Date	Method	Date
1						
2						
Total						

(viii) LSGIs Level Status

All major physical factors identified may not be present in all LSGIs. For example estuaries may in general be located only with coastal or near coast LSGIs. Similarly, river origin may not be within Panchayat jurisdiction as all major Kerala rivers originate in the forest regions of Western Ghats. But Panchayats along river basins will have common physical factors like river bed, river bank, riparian zone etc. that shall be recorded at respective LSGIs level. When LSGI have thus recorded data on its physical factors and validated it with relevant maps and also textual history it shall provide the existing status of all physical factors of the basin under its jurisdiction.

Based on factors available, individual LSGI may tabulate and record relevant physical factors as. (Table 1.5).

Table 1.5: Physical Factors LSGIs Level²

River Basin	River Bed Geological Base (Every 1 Km)					River Bank Slope Stability (Every 1 Km)					Riparian Zone		Reclamations River Bank	Check Dams		
	Land Area	1	2	3	4	5	1	2	3	4	5	Length	Width	Area	Length	Width

(ix) District Level Status

All LSGIs that has basin presence shall have generated its data on physical factors represent in their jurisdiction. When these are collated at district level it shall reflect enhanced number of physical factors of the basin. Presence of more factors shall be now representing as the number of LSGIs increase. Factors missing in some LSGIs could now be seen present in other LSGIs thus giving a more elaborate and fuller representation of physical factors. Collating data from all LSGIs in the district shall provide the district level status of physical features. (Table 1.6).

Table 1.6: Physical Factors District Level

#	Name of LSGI	River Basin	River Bed Geological Base	River Bank Slope Stability	Riparian Zone	Reclamations River Bank	Tributaries	Sand Deposits
1								
2								
Total								

(x) Basin Level Status

Collating data from all LSGIs present in all districts is the final move to arrive at all identified physical factors of a basin. In an emphatic bottom-up process LSGIs shall possess the ground level dynamic data, put together the district level totals and finally the districts together to cumulate for the entire basin. In other words, the process shall equip itself with the status of physical factors of a basin from its origin to the confluence. (Table 1.7).

² Factors indicated are representation of the whole, might vary from LSGI to LSGI & increase at district and basin level

Table 1.7: Physical Factors Basin Level

#	Name of LSGI	River Basin	River Bed Geological Base	River Bank Slope Stability	Riparian Zone	Reclamations River Bank	Tributaries	Sand Deposits	Meanders	Estuary	Reservoirs/ Checkdams
1											
2											
Grand Total											

1.3.3 Conclusion

Systematic collection and collation of data as above mentioned provides the quantum of physical factors in a basin. During the data collection process on real situation all micro sectoral details will be exposed. Taking stock of the status through above process provide the status of all identified physical factors in the LSGI and move to the next level for analysis. Later during the preparation of the Action Plan each of these factors will translated in prescribed matrices to suit LSGIs interventions and action. (Ref. Section II for Sample Physical Factor - River Bank Protection, detailing the Action Plan process).

Chapter 2

Hydrological Characterization

- ▶ Key Terminologies
- ▶ Data Requirements
- ▶ Process: Descriptive & Tabular Representation

2.1 Key Terminologies

Characterization process uses its own terminologies to describe different features and facets of a basin – of a river, lake or other waterbody. Listed table 2.1 are terminologies that classify the hydrological characteristics, its description for the Basin Manual reader.

Table 2.1: Key Terminologies in Hydrological Characterization

#	Key Terminologies	Description
1	Hydrological	Study of the water; its occurrence, circulation and distribution, its chemical and physical properties, and its interaction with the environment, including its relationship to living things.
2	Run-off	Drainage or flood discharge that leaves an area as surface flow or as pipeline flow. Has reached a channel or pipeline by either surface or sub-surface routes.
3	Basin Yield	The annual yield of a basin (expressed in inches), which is obtained by dividing annual flow by drainage area.
4	Stream Order (Channel Order)	The designation by a dimensionless integer (figure/numeral/digit) series (1, 2, 3, ...) of the relative position of stream segments in the network of a drainage basin. Also known as channel order.
5	Stream Velocity	The speed of the water in the stream. Units are distance per time (e.g., meters per second or feet per second).
6	pH of Water	An expression of the intensity of the basic or acid condition of a liquid; may range from 0 to 14, where 0 is the most acid and 7 is neutral. Natural waters usually have a pH between 6.5 and 8.5.
7	Turbidity	The cloudy appearance of water caused by the presence of suspended and colloidal matter. In the waterworks field, a turbidity measurement is used to indicate the clarity of water. Technically, turbidity is an optical property of the water based on the amount of light reflected by suspended particles. Turbidity cannot be directly equated to suspended solids because white particles reflect more light than dark-colored particles and many small particles will reflect more light than an equivalent large particle.
8	Agro Climatic Zone	Four parameters that together evolve distinct agronomic environments wherein a distinct cropping pattern flourishes are altitude, rainfall pattern, soil type and topography

Box 1:

Delineation of Watersheds into Tiny Micro Watersheds

#	Watershed Grade from Region to micro watershed	Stream Order No. in Plains	Stream order No. in Hills and uplands	App. Area in sq.km.	Watershed Code
1	Region				4
2	Basin	8	11	500000 and above	4A
3	Catchment	9	10	500000 to 100000	4A2
4	Sub Catchment	6	9	1000000 to 5000	4A2A
5	Watershed	5	8	5000 to 1000	4A2A7
6	Sub Watershed	4	7	1000 to 500	4A2A7 b
7	Mini Watershed	3	6	500 to 200	4A2A7 b2
8	Micro watershed grade 1	2	5	200 to 100	4A2A7 b2b
9	Micro watershed grade 2	1	4	100 to 50	4A2A7 b2b1
10	Micro watershed grade 3		3	50 to 10	4A2A7 b2b1a
11	Micro watershed grade 4		2	10 to 5	4A2A7 b2b1a2
12	Micro watershed grade 5		1	5 to 1	4A2A7 b2b1a2a

2.2 Data Requirements¹

In basin management, updating data is essential i.e. to keep data alive or dynamic. The term hydrological characterization envelops several important factors and sub-factors that call for separate recording. All significant factors for hydrological characterization are listed so that LSGIs and stakeholders have an informed participation during Basin Management Plan preparation. (Table 2.2).

Table 2.2: Data Requirement for Hydrological Characterisation

#	Hydrological Factors	Data Requirements
1	1 Rainfall 2 Agro Climatic Zone 3 Temperature 4 Wind Speed 5 Evaporation	1 Rainfall pattern for the last 50 years (collected from different parts of the basin) 2 Features & Distribution 3 Seasonal/variations 4 Strength/Wind Force Scale 5 Rate/amount of Evaporation
2	Run-off	1 Number of Run-offs 2 Position (Surface run off from different parts of the basin)
3	Basin Yield	1 Total water flowing through the basin 2 Apportion (allocate) for different needs 3 Historical, present and futuristic taking into consideration the Geological Surprises
4	Perennial Stream and Seasonal Stream	1 Number of streams in the river basin that flow throughout the year 2 Number of streams that dry up after monsoons by November – December 3 Location (part of which tributary)
5	Stream Order (Channel Order)	1 Number of Stream Segments 2 Relative Position (From origin to the confluence with main river)
6	Stream Velocity.	1 Flow dynamics in the river basin – through different stream orders
7	Flows	1 Undammed River (River flows during different seasons) a High Flows b Low Flows c In Stream Flows 2 Dammed River a Daily flow pattern with the fluctuations
8	Watersheds (Within the Basin)	1 Number 2 Area 3 Typology of Micro – Sub- watershed 4 Extent of area under forest 5 Human habitation 6 Agriculture 7 Waste land in the watershed
9	Flash Floods	1 Sudden floods created during monsoon 2 Artificial floods by dam releases
10	Recharge	1 Wells 2 Rivers 3 Other water bodies – ponds, lakes, wetlands
11	Water Table	1 Ground water 2 Surface water table (to be measured at regular intervals in the river basin at different locations)
12	pH of Water	1 In River 2 Other water (to be measured at different locations)

¹ Factors listed below are general but not exhaustive; individual basin may have its hydrological particularities that could be listed only during the characterization process

#	Hydrological Factors	Data Requirements
13	Turbidity	1 River 2 Lake 3 Other water bodies (to be assessed at fixed stations and seasons)

Fig 4 : Sands of Bharathapuzha



2.3 Process: Descriptive cum Tabular Representation

2.3.1 Introduction

Hydrology is the study of water and all its related properties. Basins have historically supported various water dependent activities and it still continues to be, the difference being that the current level of exploitation has surpassed its capacity to rejuvenate. In basin characterization hydrological characteristics are central along with physical-geographic–biological characteristics.

2.3.2 Data Collection

(i) Why do LSGIs need Hydrological data in basin planning?

Hydrological data is mainly to understand the status of water in the basin and its associates including its entire properties. LSGIs require this data in basin planning because it is the study of the water; its occurrence, circulation and distribution, its chemical and physical properties, and its interaction with the environment, including its relationship to living beings. Through hydrological characterization LSGIs will gain vital information about the water availability and quality and the sources that contribute in generating and maintaining the basin. LSGIs can utilize this data to plan their agricultural and other water dependent activities. Later in Basin Management hydrological data shall play a key role in calculating water quality, water use and water balance.

(ii) What all data is required ?

- a) All data that augment water in the basin are essential for hydrological characterization. This includes data on rainfall, basin water yield, streams and its features, watersheds in the basin area etc.
- b) Data on surface and ground water level and table, turbidity of river, lake and other water bodies are also essential
- c) Chemical properties of water have to be measured and documented
- d) Another important data requirement is the water allocation for different uses like irrigation, drinking and municipal use, industrial purposes etc
- e) Data for present as well as historical water use are required for future water use projections

(iii) Where do LSGIs gather the Hydrological data?

● Secondary data

- a) As in the case of physical and biological data, the search for hydrological data must begin with any basin management studies conducted in full or in sections by specialized institutions or universities or by other agencies.
- b) Data on rainfall is available with meteorological agencies, Dept of Forests and also with large plantations. Department of Irrigation, Electricity Board, Department of Forests, Water Authority etc., shall have data related to rivers, streams, water flow etc.
- c) The LSGIs could have data on watersheds. Water use data can be obtained from Panchayats or Municipal records.
- d) Universities and colleges may have data on chemical properties provided studies have been conducted. Pollution Control Board also would be helpful with data on water quality etc.
- e) Acquire copy of River Atlas of Kerala
- f) Acquire copy of Watershed Atlas of India (Published by All India Soil & Land Use Survey, Ministry of Agriculture and Cooperation, Govt. of India, 1990)
- g) All general published books on rivers and river basins in the state must be procured especially those relating to the basin of interest to the respective LSGIs
- h) Satellite and Remote Sensing imageries
- i) Any and all maps available on river basin and surrounds are precious and must be procured.
- j) Search for old photographs could be made with possible date and age ascertained.

● Primary data

- a) Approach to primary data collection must be similar to the physical, biological characterization method adopted so that LSGIs collectively work on this with a definite work plan for the entire basin.

- b) PRA or RRA methods are essential to gather information on historical water use, history and position of streams, runoffs etc.
- c) Maps of all major features are to be prepared.
- d) Seek service of photographers with keen interest and expertise in nature/wildlife to photo/video documentation of physical features.

Table 2.3 lists all major factors required for the hydrological characterization of a basin. What has also been attempted for the benefit of the LSGIs is to list out agencies and also methods for data collection. Listed secondary data sources are agencies or sources that may possess data or maps in parts or specimen or none at all. But there are agencies that can be approached for generating required data or maps professionally.

Table 2.3: Listing of Major Hydrological Factors & Data Sources

#	Physical Factors	Data Sources	
		Secondary	Primary
1	1 Rainfall 2 Agro Climatic Zone 3 Temperature 4 Wind Speed 5 Evaporation	1 Department of Meteorology 2 Department of Irrigation 3 Department of Forests 4 Planters' Records 5 Rubber Board 6 IRTC 7 Electricity Board 8 Public Works Department 9 Agriculture University 10 KISSAN Kerala 11 Central Water Commission	1 RRA
2	Run-off	1 Department of Irrigation 2 Department of Forests 3 CWRDM 4 Department of Ground Water 5 CESS 6 River Management Cell	1 Survey 2 RRA 3 Mapping
3	Basin Yield	1 Department of Irrigation	1 Survey
4	Perennial Stream and Seasonal Stream	1 Department of Forests 2 Department of Irrigation 3 Satellite Imageries 4 PWD/Irrigation 5 CESS	1 Survey 2 RRA 3 Mapping
5	Stream Order (Channel Order) First order stream to fifth order stream	1 Department of Irrigation 2 Satellite Imageries 3 Survey Map of India – Toposheet	1 Survey 2 Mapping
6	Stream Velocity	1 Department of Irrigation 2 CESS 3 CWRDM	1 Survey
7	Flows	1 Department of Irrigation 2 CESS 3 CWRDM	1 Survey 2 Mapping
8	Watersheds (Within the Basin)	1 Department of Agriculture 2 Department of Irrigation 3 Panchayat - Land Records 4 Department of Soil Conservation 5 Rural Development	1 Survey 2 Mapping 3 RRA

#	Physical Factors	Data Sources	
		Secondary Sources	Primary Sources
		6 Hariyali- RDD 7 IWMP-RDD 8 Planning Board- Western Ghats Cell 9 NABARD	
9	Flash Floods	1 Department of Irrigation 2 Department of Forests 3 KFRI 4 CESS	1 Survey 2 RRA
10	Recharge	1 Department of Irrigation 2 Department of Revenue	1 Survey 2 RRA
11	Water Table/Level	1 Department of Ground Water 2 Department of Irrigation 3 Kerala Water Authority 4 CESS	1 Survey 2 Mapping 3 RRA
12	pH of Water	1 Kerala Water Authority - Testing Lab 2 Pollution Control Board 3 Department of Irrigation 4 CWRDM 5 CESS 6 Educational Institutions/Universities	1 Survey
13	Turbidity	1 Kerala Water Authority 2 Department of Irrigation 3 CESS 4 Pollution Control Board	1 Survey 2 RRA
14	Water Quality	1 Kerala Water Authority 2 Pollution Control Board	1 Survey 2 RRA

(iv) What necessary caution and criteria are required while collecting Hydrological data?

- a) All available secondary data should be verified for its history and authenticity – verify for author, publisher, date etc
- b) Make on-site visits for verification of secondary data wherever applicable
- c) Age of data is a prime criterion especially for secondary data, this is to ensure data consistency and uniformity
- d) There are several software available for Integrated River Modeling. Selecting a common software by all LSGIs is mandatory for uniformity and for output consistency

(v) Data Validation

For Hydrological characterization at LSGIs level, data collected should ensure the following:

- a) Table of Rainfall
- b) Table of Perennial Streams
- c) Table of Seasonal Streams
- d) Table of Flows for Undammed River
- e) Table of Runoffs
- f) Table of Basin Yield
- g) Table on Water use for Irrigation, Industries, Municipal use
- h) Table of Flows for Dammed River
- i) Table of Watersheds in the Basin Area
- j) Table on Groundwater Table
- k) Table on Surface Water Tables

- l) Table on pH of Water in River
- m) Table of pH in other Waterbodies
- n) Maps of Runoffs
- o) Maps of Streams and Stream Order
- p) Maps of Watersheds
- q) Textual History of Rainfalls
- r) Textual History of Watersheds in the Basin Area
- s) Textual History of Flash Floods, Natural and Human-Induced

(vi) How do LSGIs collate the data?

Collection of Hydrological data is distinctive; that LSGIs can collect with expert support and that can be collected and collated by scientists and specialized institutions. This is because data pertaining to hydrological factors are largely technical. The collected data can be collated first at LSGIs level followed by collation of all basin LSGIs at district level and finally all basin districts put together to arrive at the basin level.

(vii) Data Tabulation

Data pertaining to hydrological factors belong to both secondary and primary sources. While collating it is important to clearly specify the method adopted. In case of primary data, it should specify the method; survey, RRA or through any other process. The collection process should be clearly tabulated indicating whether the source is primary or secondary and also the date on which the data was published in case of secondary data (Table 2.4).

Table 2.4: Particulars of Data Collection Method - LSGIs Level

#	Hydrological Factor	Secondary Data		Primary Data	
		Source	Date	Method	Date
1					
2					
Total					

viii) LSGIs Level Status

Data pertaining to factors for hydrological characterization are predominantly technical, some of them in forested areas and also with several concerned departments. (Tables 2.5 & 2.6) Among hydrological factors, prominent data that LSGIs can collate is the data on watersheds that has a very crucial role in the basin management. Data on land use and crop type in watershed area is another factor that each LSGI can generate.

Table 2.5: Hydrological Factor:Micro Watershed Outside Forested Areas LSGIs Level

#	Type	Length (Kms)	Characteristics	
			Perennial	Seasonal (Months)
1				
2				
Total				

Table 2.6: Hydrological Factors: Land Use in Micro Watershed Outside Forested Areas LSGIs Level

#	Land Use in Watershed Area		Type of Crops in Watershed Area	
	Cultivable Land (Ha)	Waste Land (Ha)	Annual Crops (Ha)	Seasonal Crops (Ha)
1				
2				
Total				

ix) District Level Status

Hydrological data at district level will be concurrent with the LSGIs level as most other factors shall be technical and considered at basin level. However, data LSGIs generate on watersheds, land use and crop in watershed areas are central to hydrological characterization. The district level data would provide the scope for LSGIs direct intervention later in basin management. (Table 2.7).

**Table 2.7: Hydrological Factors
Land Use in Micro Watershed Outside Forested Areas District Level**

#	LSGIs	Micro Watershed Outside Forested Areas				Micro Watershed Outside Forested Areas		Micro Watershed Outside Forested Areas	
		Type	Length	Perennial	Seasonal	Cultivable Land (Ha)	Waste Land (Ha)	Annual Crops (Ha)	Seasonal Crops (Ha)
1									
2									
Total									

(x) Basin Level Status

Several hydrological factors identified are technical requiring scientific expertise in data collection. While rain fall, basin yield, stream order etc are common to the entire basin water level, chemical quality of water etc are collected at different points and frequency, requiring special instruments and laboratory facilities (Table 2.8).

Table 2.8: Hydrological Factors Basin Level

#	Districts	Rainfall Pattern	Run-Off		Water Level		pH of Water		Watersheds		Streams		Basin Yield	
		Past 50 Years	Number	Position	Ground Water	Surface Water	River	Other Water Bodies	Within Basin	Outside Forested Area	Perennial	Seasonal	Total Water Flow	Allocations
1														
2														
Total														

2.3.3 Conclusion

Water availability and the quality of water determine the life of a river. A mighty river is in fact a very delicate combination of several factors. Over exploitation of this resource and human insensitivity greatly alters the river integrity, especially its hydrological character. By taking stock of all hydrological factors through a very intensive process the current status is determined. This primary level collation and tabulation shall thus provide the status of all significant hydrological factors identified and move to the next level for analysis. Later during the preparation of the action plan each of these factors will translated in prescribed matrices to suit LSGIs action. (Ref. Section II, for Sample Hydrological Factor- Watershed, detailing the Action Plan process).

Chapter 3

Eco- Bio- Environmental Characterization

- ▶ Key Terminologies
- ▶ Data Requirements
- ▶ Process: Descriptive & Tabular Representation

3.1 Key Terminologies

Listed below are terminologies that classify the Eco-Bio-Enviro characteristics, its definition or description explained for the BMM reader (Table 3.1).

Table 3.1: Key Terminologies in Eco-Bio-Enviro Characterization

#	Key Terminologies	Description
1	Habitat	The place where a population (e.g. human, animal, plant, microorganism) lives and its surroundings, both living and non-living.
2	Catchment	The catching or collecting of water, especially rainfall
3	Protected areas	Protected areas are locations which receive protection because of their environmental, cultural or similar value. A large number of kinds of protected area exist, which vary by level of protection and by the enabling laws of each country or rules of international organization. Examples include parks, reserves and wildlife sanctuaries
4	Riparian Habitat	Relating to or inhabiting the banks of a natural course of water. Riparian zones are ecologically diverse and contribute to the health of other aquatic ecosystems by filtering out pollutants and preventing erosion
5	Ecosystem + Values (Ecosystem Values - no technical definition found)	<p>The complex system of plant, animal, fungal, and microorganism communities and their associated non-living environment interacting as an ecological unit. Ecosystems have no fixed boundaries; instead their parameters are set to the scientific, management, or policy question being examined. Depending upon the purpose of analysis, a single lake, a watershed, or an entire region could be considered an ecosystem.</p> <p>“... ecological value generally as the level of benefits that the space, water, minerals, biota, and all other factors that make up natural ecosystems provide to support native life forms. Ecological values can accrue to both humans and nonhumans alike. To humans, these benefits typically are bestowed externally as cleaner air and water. To nonhuman species, these ecological benefits are usually much more direct and on-site. Ecosystems contribute their greatest ecological value when they are in their most natural state. In their most natural state, they are at their peak of natural health and provide their greatest level of native life support. Native life support is the ecological value of Wilderness”.</p> <p>(The Natural Ecological Value of Wilderness:, Cordell, H. Ken; Murphy, Danielle; Riitters, Kurt H.; Harvard, J.E., III; 2005)</p>

Fig 5: Riparian Vegetation



3.2 Data Requirements ¹

In basin management, updating data is essential i.e. to keep data alive or dynamic. The term Eco-Bio-Enviro characterization envelops several important factors and sub-factors that call for separate recording. All significant factors for Eco-Bio-Enviro characterization are listed so that LSGIs and stakeholders have an informed participation during Basin Management Plan preparation. (Table 3.2).

Table 3.2: Data Requirements for Eco-Bio-Enviro Characterization

#	Eco-Bio-Enviro Factors	Data Requirements
1	Fish Diversity and Habitats	<ol style="list-style-type: none"> 1 Number and Citing 2 Diversity 3 Geographic Spread 4 Threats 5 Dependence on Habitat 6 Ecosystem Values
2	Bird Diversity and Habitats	<ol style="list-style-type: none"> 1 Number and Citing 2 Diversity 3 Geographic Spread 4 Resident/ Migrant/ Local Migrant 5 Threats 6 Dependence on Habitat 7 Ecosystem Values
3	Wild Life Habitats	<ol style="list-style-type: none"> 1 Number And Citing 2 Diversity 3 Geographic Spread 4 Threats 5 Dependence On Habitat 6 Ecosystem Value
4	Forested Catchment	<ol style="list-style-type: none"> 1 Area of Forested Catchment within the Basin under Kerala Forest Department 2 Leased out Forest Land under Various Agencies (PCK, SFCK) 3 Diversity 4 Threats 5 Value 6 Ecosystem Values
5	Protected Areas	<ol style="list-style-type: none"> 1 Wild Life Sanctuaries 2 National Parks 3 Tiger Reserves in the River Basin 4 Elephant Reserve 5 Threats
6	Buffer Zones around PAs	<ol style="list-style-type: none"> 1 Identify and 2 Delineate
7	Riparian Habitat	<ol style="list-style-type: none"> 1 Riparian Flora 2 Fauna 3 Riparian Islands 4 Threats
8	Pools and Riffle Habitats	<ol style="list-style-type: none"> 1 Fish 2 Other Species 3 Threats
9	Backwaters	<ol style="list-style-type: none"> 1 Area 2 Extent 3 Diversity 4 Threats 5 Ecosystem Values

¹ Factors listed below are general but not exhaustive; individual basin may have its particularities that could be listed only during the characterization process

#	Eco-Bio-Enviro Factors	Data Requirements
10	Wetlands	<ol style="list-style-type: none"> 1 Upland Valley Swamps 2 Upland Wetlands 3 Downstream Wetlands 4 Extent 5 Diversity 6 Threats 7 Ecosystem Values
11	Mangroves	<ol style="list-style-type: none"> 1 Area 2 Diversity of Flora and Fauna 3 Dependence of Flora and Fauna on Habitat 4 Threats 5 Ecosystem Values
12	Pollution Load	<ol style="list-style-type: none"> 1 Typology 2 Source of Pollution 3 Amount of Pollution 4 Impacts
13	Salinity	<ol style="list-style-type: none"> 1 Saline Ingress Status 2 Salinity Maps over Years
14	Other Fauna	<ol style="list-style-type: none"> 1 Amphibians 2 Reptiles 3 Insects etc. (Depending on the available citing)
15	Sand Mining	<ol style="list-style-type: none"> 1 River Stretch Mined 2 Quantity of Sand Mined 3 No of <i>Kadavus</i> 4 Impacts on Aquatic Eco-system and Bio-diversity 5 Impact on Water Table
16	Other Mining	<ol style="list-style-type: none"> 1 Area and Location 2 Quantity Mined 3 Impacts on Biodiversity 4 Impact on Water Resources

Fig 6: Estuarine Crab



3.3 Process: Descriptive cum Tabular Representation

3.3.1 Introduction

In basin characterization ecological-biological–environmental (Eco-Bio-Enviro) characteristics should be read along with physical-geographic–hydrological characteristics that work in union. As the title indicates it is a combination of all life forms, its relation to one another and living circumstances. The factors in this section are very diverse requiring experts from different scientific orders.

3.3.2 Data Collection

(i) Why do LSGIs need Eco-Bio-Enviro data in basin planning?

The focus of this section is primarily to understand the condition of the basin and resources attached and dependent on it. All biological forms – the living organisms – the flora and fauna - present and their habitats have great significance to determine the ecological diversity and status. The second important aspect is the impacts of pollution discharged into the basin through various human activities. This includes the threats to wetlands, mangroves, riparian habitats etc. The impacts of pollution on aquatic ecosystems and biodiversity need quantification. The documenting of this is very significant to assess the impacts on habitats and life forms, and threats it poses that later is essential for mitigating measures in BMP. The biological diversity, human activities and diverse water resources would have significant role to play while setting environmental objectives, ecosystem values and standards for future basin use.

(ii) What all data is required?

Eco-Bio-Enviro data includes all entities and their habitats collected and mapped. Data related to different habitats and ecological zones are to be collected including backwaters, wetlands and mangroves. All natural vegetations are to be documented. Should generate data on fish and bird diversity; their habitats, regions and spread. Data on aquatic flora, fauna including aquatic invertebrates, if available would be very significant. Forested catchment areas, protected area (PAs), buffer zones etc should be documented. Other significant data requirement is the impact of different types of mining on aquatic ecosystems, biodiversity and water resources. (Economic Characterizations would collect data on mining; type, size and area).

(iii) Where do LSGIs gather the Eco-Bio-Enviro data?

● Secondary data

- a) The search must begin with any basin management studies conducted in full or in sections by specialized institutions or universities or by other agencies for secondary data purposes. Possibilities for secondary data especially on aquatic biological species are high with biological student community and science colleges and universities.
- b) Data on PAs, Wild Life Habitats and Wild Life Reserves are well documented and available with Dept of Forests and Park Managers.
- c) Secondary data may also be available with government departments like Dept of Forests, Irrigation, CESS, CMFRI, KFRI, Electricity board, Pollution Control Board etc.
- d) Acquire copy of River Atlas of Kerala
- e) All general published books on rivers and river basins in the state must be procured especially those relating to the basin of interest to the LSGIs
- f) Satellite and Remote Sensing imageries
- g) Any and all maps available are precious and must be procured.
- h) Search for old photographs could be made with possible date and age ascertained.

● Primary data

- a) Primary data collection is inevitable in the absence of any prior basin management plan
- b) Approach to primary data collection must be similar to the physical characterization method adopted so that LSGIs collectively work on this with a definite work plan for the entire basin.
- c) PRA or RRA methods are essential to gather information on history and sighting of fish and bird diversity and changes that might have occurred. General changes and threats to different habitats and ecosystems like wetlands and mangroves can also be gathered by these methods.
- d) PRA or RRA could be very productive to document impacts of pollution on human health and aquatic life over the years.

- e) Maps of all major features are to be prepared.
- f) Seek service of photographers with keen interest and expertise in nature/wildlife to photo/video documentation of physical features.

Listed below are all major Eco-Bio-Enviro factors and secondary data sources required for the physical characterization of a basin along with agencies and also methods for data collection (Table 3.3). These agencies and sources may possess data or maps in whole or part or none at all. LSGIs can approach these agencies for generating required data or maps professionally. wherever blank; secondary sources are to be identified during the process of characterization

Table 3.3: Listing of Major Eco-Bio-Enviro Factors & Possible Data Sources

#	Physical Factors	Data Sources	
		Secondary	Primary
1	Fish Diversity and Habitats	<ol style="list-style-type: none"> 1 Department of Fisheries 2 CMFRI 3 Department of Forests - Studies on Western Ghats Aquatic Life 4 Colleges/Universities - Studies on Western Ghats Aquatic Life 5 KFRI - Studies on Western Ghats Aquatic Life 6 Department of Irrigation 	<ol style="list-style-type: none"> 1 Survey 2 Habitat Mapping 3 RRA
2	Bird Diversity and Habitats	<ol style="list-style-type: none"> 1 Department of Forests 2 Colleges/Universities - Studies on Western Ghats Aquatic Life 3 KFRI 4 Nature Clubs 	<ol style="list-style-type: none"> 1 Survey 2 Habitat Mapping 3 RRA
3	Wild Life Habitats	<ol style="list-style-type: none"> 1 Department of Forests 2 PA & Park Managers 3 Satellite Imageries 4 KFRI 	
4	Forested Catchment	<ol style="list-style-type: none"> 1 Department of Forests 2 Department of Irrigation 3 KFRI 4 Kerala State Electricity Board 	<ol style="list-style-type: none"> 1 Survey 2 Mapping
5	Protected Areas	<ol style="list-style-type: none"> 1 Department of Forests 2 PA & Park Managers 3 KFRI 4 Satellite Imageries 	
6	Ecological Sensitive Areas	<ol style="list-style-type: none"> 1 Department of Environment, Western Ghats Ecology Expert Panel (WGEEP) Kerala* – Report 2 Department of Environment & Climate Change# 	
7	Buffer Zones around PAs	<ol style="list-style-type: none"> 1 Department of Forests 2 Satellite Imageries 	<ol style="list-style-type: none"> 1 Survey 2 Mapping
8	Riparian Habitat	<ol style="list-style-type: none"> 1 Department of Forests 2 Department of Fisheries 3 KFRI 4 Colleges/Universities - Studies on Riparian Habitats 	<ol style="list-style-type: none"> 1 Survey 2 Mapping 3 RRA

* River Conservation programmes

Involve in various environmental technology activities of Local Self Government institutions, information on environmental technologies and develop a database system.

#	Physical Factors	Data Sources	
		Secondary	Primary
9	Pools and Riffle Habitats	1 KFRI 2 Colleges/Universities - Studies	1 Survey 2 Mapping 3 RRA
10	Backwaters	1 Department of Forests 2 CESS 3 CZM Authority for Coastal Zone Management Plan 4 Satellite Imageries	1 Survey 2 Mapping 3 RRA
11	Wetlands	1 Department of Forests 2 CESS 3 CZM Authority for Coastal Zone Management Plan 4 Satellite Imageries	1 Survey 2 Mapping 3 RRA
12	Mangroves	1 Department of Forests 2 CESS 3 CZM Authority for Coastal Zone Management Plan 4 Satellite Imageries 5 Colleges/Universities	1 Survey 2 Mapping 3 RRA
13	Pollution Load	1 Pollution Control Board 2 Department of Environment & Climate Change 3 Industry Records 4 Panchayath Records 5 Department of Health	1 Survey 2 RRA
14	Salinity	1 CESS 2 Department of Irrigation 3 CZM Authority for Coastal Zone Management Plan 4 Department of Agriculture	1 Survey 2 Mapping 3 RRA
15	Other Fauna	1 Department of Environment, Kerala* – Report - Western Ghats Ecology Expert Panel (WGEEP) 2 Colleges/Universities for Studies on Western Ghats 3 Department of Forests	1 Survey 2 Mapping 3 RRA
16	Sand Mining	1 Department of Mining and Geology 2 Panchayat Records 3 Department of Irrigation 4 CESS	1 Survey 2 Mapping 3 RRA
17	Other Mining	1 Department of Mining and Geology 2 Panchayat Records 3 Department of Irrigation	1 Survey 2 Mapping 3 RRA

(vi) What necessary caution and criteria are required while collecting Eco-Bio-Enviro data?

- Published data on PAs, Wild Life Habitats, National Parks etc., are abundant that shall require informed filtering
- Associate experts while PRA/RRA for fish, bird and other fauna habitats and spread
- All available secondary data should be verified with onsite visits and comparisons
- Age of data is a prime criterion especially for secondary data, this is to ensure data consistency and uniformity
- There is several software available for Integrated River Modeling. Selecting common software by all LSGIs is mandatory for uniformity, output consistency.

(v) Data Validation

For Eco-Bio-Enviro characterization at LSGIs level, data collected should ensure the following:

- a) Table listing all Ecological Zones
- b) Table of Major Vegetation Types
- c) Table of Riparian Vegetation
- d) Table of Mangrove areas, Flora & Fauna
- e) Table of Fish & other Aquatic Species
- f) Table of Birds with special reference to its Migrant Status
- g) Table of Mining sites and Type
- h) Table on Major Chemical Fertilizers
- i) Table on Major Chemical Pesticides
- j) Table on Pollution related health issues/diseases
- k) Maps of Salinity Ingress
- l) Maps of Effluent Discharge Points/ Sites
- m) Maps of Solid Waste Dumping Sites
- n) Maps of all Ecological Zones
- o) Maps of Wetlands, Mangroves, Backwaters
- p) Maps of Fish Habitats
- q) Maps of Bird Habitats

(vi) How do LSGIs collate the data?

Collecting and collating data on Eco-Bio-Enviro factors are very sensitive as it has to also accommodate living species like fish, mammals and birds etc. Secondary sources are prominent in Eco-Bio-Enviro data related to forest and protected areas. As for the LSGIs documenting mining activities, pollution sources etc. are very important. Clubbing together ecological, biological and environmental characteristics together makes its interdependency evident. As in all other cases the collating process involves different stages; first at LSGIs level followed by collation of all basin LSGIs at district level and finally all basin districts put together to arrive at the basin level.

(vii) Data Tabulation

Prior to collating the Eco-Bio-Enviro data it is important to clearly specify data collection method; whether it is primary or secondary, through survey, estimations obtained through PRA etc. The collection process should be clearly tabulated indicating whether the source is primary or secondary and in case of secondary the date of publication and source. (Table 3.4).

Table 3.4: Particulars of Data Collection Method - LSGIs Level

#	Eco-Bio-Enviro factors	Secondary Data		Primary Data	
		Source	Date	Method	Date
1					
2					
Total					

(viii) LSGIs Level Status

Eco-Bio-Enviro Factors at LSGIs level can vary between LSGIs depending on the resource availability. But economic activity like sand mining, human negligence and insensitivity causing water pollution etc are common to all rivers and waterbodies. These shall be recorded at respective LSGIs level. When LSGI have thus recorded data on its Eco-Bio-Enviro factors and validated it with relevant maps and also textual history it shall provide the existing status of all Eco-Bio-Enviro factors of the basin under its jurisdiction. Based on factors available, individual LSGI may tabulate and record relevant Eco-Bio-Enviro factors as. (Table 3.5).

Table 3.5: Eco-Bio-Enviro Factors LSGIs Level²

Sand Mining					Pollution Load			Salinity		Fish Diversity and Habitats						
River Stretch Mined	Quantity of Sand Mined	No. of Kadavus	Impacts on Aquatic Ecosystem and Biodiversity	Impact on Water Table	Typology	Source of Pollution	Amount of Pollution	Impacts	Saline Ingress Status	Salinity Maps over Years	Number and Citing	Diversity	Geographic Spread	Threats	Dependence on Habitat	Ecosystem Values
1																
2																

LSGIs also have to deal with live animals like birds and other living species while collecting and collating data on Eco-Bio-Enviro Factors. It is very important to document them since they are part and parcel of the basin and their presence usually signifies the health of the waterbody they depend upon. Considering their significance LSGIs can record them in detail. (Table 3.6).

Table 3.6: Eco-Bio-Enviro Factors: Bird Diversity & Habitats LSGIs Level

#	Species				Citing (Reference)	Habitats (No.)	Geographical Spread (Area)	Threats		Dependence on Habitat	E-Values
	Name	Resident	Migrant	Local Migrant				Type	No.		
1											
2											
Total											

(ix) District Level Status

As the data collating process progress to district level comprising all LSGIs in the district, the number of Eco-Bio-Enviro Factors increases as they represent presence of diverse factors, thus making the characteristics more diverse and richer. (Table 3.7).

Table 3.7: Eco-Bio-Enviro Factors District Level

#	LSGI	Sand Mining	Pollution Load	Salinity	Fish Diversity and Habitats	Mangroves	Backwaters
1							
2							
Total							

(x) Basin Level Status

Eco-Bio-Enviro factors like catchment area, Protected Area (PAs), buffer zones, wild life habitats etc., have defined authority as most of these are within the Dept. of Forests jurisdiction. Collating data of these can be comparably straightforward since they are well documented. But this shall require the guidance of experts while collating at basin level. Data gathered on downstream factors like the wetlands, backwaters, mangroves, fish, birds and their habitats etc. call for more accuracy while collating at basin level as these can also be in the domain of LSGIs. Factors like sand mining and mining of other resources, pollution etc., could be common factors for most LSGIs but while collating at basin level these factors should be carefully tabulated and recorded. It is these downstream factors that have strong bearing on the overall health of the basin. This primary level collation and tabulation shall thus provide the status of all significant Eco-Bio-Enviro factors identified. (Table 3.8).

² Factors indicated in Table are representative, can vary from LSGIs to LSGIs, will increase at district and basin level

Table 3.8: Eco-Bio-Enviro Factors Basin Level

#	Districts	Forested Catchments	Wildlife Habitats	Protected Area	Sand Mining	Pollution Load	Salinity	Fish Diversity and Habitats	Managroves	Backwaters	Other Mining
1											
2											
	Total										

3.3.3 Conclusion

Eco-Bio-Enviro factors are crucial to basin health. The symbiotic relationship between the living and non-living when disturbed is disastrous to the overall basin. This shall be evidenced once the collated data is analyzed. Later during the preparation of the action plan each of these factors will be translated in prescribed matrices to suit LSGIs action. (Ref. Section II, for Sample Eco-Bio-Enviro Factor- Pollution Load, detailing the Action Plan process).

Chapter 4

Geographical Characterization

- ▶ Key Terminologies
 - ▶ Data Requirements
 - ▶ Process: Descriptive & Tabular Representation
-

4.1 Key Terminologies

Characterization process uses its own terminologies to describe different features and facets of a basin of a river, lake or other waterbody. Listed below are terminologies that classify the Geographical characteristics, its definition or description explained for the basin manual reader. (Table 4.1).

Table 4.1: Key Terminologies in Geographical Characterization

#	Key Terminologies	Description
1	Coastal Zone	Lands and waters adjacent to the coast that exert an influence on the uses of the sea and its ecology, or whose uses and ecology are affected by the sea OR Coastal waters and adjacent lands that exert a measurable influence on the uses of the seas and their resources and biota.
2	River Mouth	The opposite end of a river from its source. The mouth is where a river flows into an ocean, sea, estuary, lake, reservoir, flat arid area or another river. It is also where an important part of the hydrological cycle takes place - the rivers freshwater combining with the seas saltwater.
3	Estuary	A partly enclosed coastal body of water with one or more rivers or streams flowing into it, and with a free connection to the open sea. Estuaries form a transition zone between river environments and ocean environments and are subject to both marine influences, such as tides, waves, and the influx of saline water; and riverine influences, such as flows of fresh water and sediment. The inflow of both seawater and freshwater provide high levels of nutrients in both the water column and sediment, making estuaries among the most productive natural habitats in the world
4	Gradient and Slope	Areas with steep rise and slope vulnerable to landslides and erosion
5	Ecosystem + Values (Ecosystem Values -no technical definition found)	<p>The complex system of plant, animal, fungal, and microorganism communities and their associated non-living environment interacting as an ecological unit. Ecosystems have no fixed boundaries; instead their parameters are set to the scientific, management, or policy question being examined. Depending upon the purpose of analysis, a single lake, a watershed, or an entire region could be considered an ecosystem.</p> <p>“... ecological value generally as the level of benefits that the space, water, minerals, biota, and all other factors that make up natural ecosystems provide to support native life forms. Ecological values can accrue to both humans and nonhumans alike. To humans, these benefits typically are bestowed externally as cleaner air and water. To nonhuman species, these ecological benefits are usually much more direct and on-site. Ecosystems contribute their greatest ecological value when they are in their most natural state. In their most natural state, they are at their peak of natural health and provide their greatest level of native life support. Native life support is the ecological value of Wilderness”.</p> <p>(The natural Ecological Value of Wilderness., Cordell, H. Ken; Murphy, Danielle; Riitters, Kurt H.; Harvard, J.E., III; 2005).</p>

Fig 7: Estuary



4.2 Data Requirements¹

In basin management, updating data is essential i.e. to keep data alive or dynamic. The term geographic characterization envelops several important factors and sub-factors that call for separate recording. All significant factors for geographic characterization are listed so that LSGIs and stakeholders have an informed participation during Basin Management Plan preparation. (Table 4.2).

Table 4.2: Data Requirements for Geographical Characterization

#	Geographical Factors	Data Requirements
1	Origin of River	The region within the (Western Ghats) in which the river basin falls. (eg. River Chalakudy originates from Anamalais in the Southern Western Ghats)
2	Highlands	Extent of area within river basin falling in highland
3	Midland	Extent of area within river basin falling in midland
4	Plains	Extent of area within river basin falling in plains
5	Coastal Zone	1 Estuary 2 River Mouth 3 Tidal influence areas of other water bodies
6	Gradient and Slope	Areas with steep gradient and slope vulnerable to landslides and erosion
7	Land Use in the River Basin (area)	1 Cultivable Land 2 Grasslands 3 Forests 4 Urban Settlements 5 Industrial/Commercial purposes
8	Threats to Land Use in the River Basin	1 Area Lost to Hill Mining 2 Reclamation of Wetlands 3 Reclamation of Paddy Lands
9	Water Resources in the River Basin LSGIs - Ponds - Lakes - Wetlands - Paddy Lands	1 Extent 2 Area 3 Local Names 4 Use and Dependence 5 Threats-Effluents 6 Ecosystem Values (Features, Functions, Services & Value)

Fig 8 : Mangroves



¹ Factors listed are general but not exhaustive; individual basin may have its particularities that could be listed only during the characterization process

4.3 Process: Descriptive cum Tabular Representation

4.3.1 Introduction

Geographical characteristics provide the general features such as types of land area, locations, other water bodies, resources and features of an area. It is best to draw these characteristics separately as it helps to have end to end features drawn especially on the land use and the course a waterbody takes.

4.3.2 Data Collection

(i) Why do LSGIs need geographical data in basin planning?

The data is mainly to assess the overall land use, and locations and geographical features through which a waterbody takes its course. The data is important to understand the different types of land and the area through which it flows. It also provides features like cultivable lands, urban and industrial land use in basin area. Geographical characteristics also assess the threats especially due to human interventions. Data obtained is critical to assess basin status from origin to the end. This shall be one of the key information along with physical and economic characterization in pressure and impact assessment. The basin management plan shall derive from this assessed and analyzed data, roles of different agencies and stakeholders including that of the LSGIs in the overall basin plan.

(ii) What all data is required?

Data on land use in basin area with emphasis on geographical point of view like cultivable lands, urban settlements and industrial land use are required. Natural features like grass lands and forest areas are also important. Data on area lost to hill mining, reclamation of wetlands and paddy lands are very essential. From the point of view of LSGIs in the basin, data on other waterbodies like ponds, lakes etc., need to be detailed. Their use, functions and dependency including threats if any, need to be collected.

(iii) Where do LSGIs gather the geographical data?

● Secondary data

- a) Water Atlas Kerala, *Keralathile Nadikal* and other published works are available on general geographic features of rivers in Kerala.
- b) Secondary Data published by various government departments on land use and forested land are available with Department of Revenue, Department of Agriculture, Department of Forests etc.
- c) Basin dependent LSGIs have data on land use and local features like ponds and lakes in their respective panchayats.
- d) CZMP of Kerala will have data on estuaries and tidal influence area that the coastal LSGIs can refer to.
- e) All general books on rivers in the state must be procured especially those relating to the basin of interest to the LSGIs.
- f) Satellite and Remote Sensing imageries.
- g) Any and all maps available of the river in different districts are precious and must be procured.
- h) Search for old photographs could be made with possible date and age ascertained.

Primary data

- - a) Table 4.3 lists all major geographical factors required for the geographical characterization of a basin.
 - b) Primary data should be generated especially on human induced severe threats like extent of hill mining areas, wetland and paddy land reclamations. This can be through surveys and Participatory Rural Appraisal (PRA).
 - c) All such threats must be mapped.
 - d) Seek service of photographers with keen interest and expertise in nature/wildlife to photo/video documentation of physical features.

Listed secondary data sources are agencies or sources that may possess data or maps in parts or specimen or none at all. But these are agencies that can be approached for generating required data or maps professionally e.g. Dept of Revenue, Forests etc. Wherever blank, secondary sources are to be identified during the process of characterization. These agencies and sources may possess data or maps in whole or part or none at all. LSGIs can approach these agencies for generating required data or maps professionally (Table 4.3).

Table 4.3: Listing of Major Geographical Factors & Possible Data Sources

#	Physical Factors	Data Sources	
		Secondary	Primary
1	Origin of River	1 Water Atlas Kerala 2 Landuse Board for Watershed Atlas of Kerala 3 Rivers of Kerala 4 <i>Keralathile Nadbikal</i> 5 Department of Forests	
2	Highlands	1 Water Atlas Kerala 2 Rivers of Kerala 3 <i>Keralathile Nadbikal</i> 4 Landuse Board for Watershed Atlas of Kerala	1 Survey
3	Midlands	1 Water Atlas Kerala 2 Rivers of Kerala 3 <i>Keralathile Nadbikal</i> 4 Landuse Board for Watershed Atlas of Kerala	1 Survey
4	Plains	1 Water Atlas Kerala 2 Rivers of Kerala 3 <i>Keralathile Nadbikal</i> 4 Landuse board	1 Survey
5	Coastal Zones	1 Water Atlas Kerala 2 CZM Authority for Coastal Zone Management Plan 3 CESS 4 Rivers of Kerala 5 Panchayat Office	1 Survey
6	Gradient and Slope	1 Department of Forests 2 CESS 3 Department of Revenue - R MC 4 KFRI	1 Survey 2 RRA
7	Land Use in the Basin (area) 1 Cultivable Land 2 Grasslands 3 Forests 4 Urban Settlements 5 Industrial/Commercial purposes	1 Department of Revenue 2 Department of Agriculture 3 Department of Forests 4 Panchayat Office 5 Department of Town planning 6 Department of Industries	1 Survey 2 RRA 3 Mapping
8	Threats to Land Use in the Basin. 1 Area Lost to Hill Mining 2 Reclamation of Wetlands 3 Reclamation of Paddy Lands	1 Department of Revenue – Paddy Fields 2 Department of Mining and Geology 3 Panchayat Office – Mining Records 4 Department of Agriculture 5 Coastal Zone Management Authority - Wetland & Reclamation Records	1 Survey 2 RRA 3 Mapping
9	Water Resources in the Basin LSGIs - Ponds - Lakes - Wetlands - Paddy Lands	1 Panchayat Office Records 2 Panchayat for Resource Maps 3 Department of Statistics 4 Department of Revenue	1 Survey 2 RRA 3 Mapping

² Geographical factors and sources may vary according to local conditions

(iv) What necessary caution and criteria are required while collecting Geographical data?

- Geographical particulars are significant for land use and the course a river shall take. Secondary data on threats and on land use changes need verification
- Age of data is a prime criterion especially for secondary data, this is to ensure data consistency and uniformity
- Primary Data Collection Format Standardization is key to maintain data uniformity between panchayat, district and overall basin characterization
- There is several software available for Integrated River Modeling. Selection of Common Software is very essential for Primary Data collection, tabulation and analysis to ensure output stability.

(v) Data Validation

- For Geographical Characterization at LSGIs level, data collected should ensure the following:
- Maps of all Land uses
- Maps of all threats, Areas and Land use changes and conversions
- Maps of Gradient & Slopes
- Table on length of River Basin falling areas
- Table on threats to land use in river basin
- Table on Water Resources in the Basin Area
- Textual History of Land use change, conversions
- Textual History of Threats; Mining & Reclamation
- Textual History of Water Resources in the area

(vi) How do LSGIs collate the data?

Geographical factors essential for basin characterization are within the boundaries of basin LSGIs. Most activities in this region are also carried out with their permission. It is voluminous and seeks several batches of data collectors and supervisory personnel involvement. Tendencies to ignore or underplay undesired development activities should be carefully checked while collecting data. The collating process from individual LSGIs to district level followed by basin level data shall unfold the path through which river basin flows. Also revealing is the extent of human intervention within and along its banks.

(vii) Data Tabulation

PRA, RRA, mapping and photo documentation has significant role in procuring Geographical factors. It is therefore of vital importance to clearly specify the method opted to obtain the data. In case of primary data, it should specify the method; survey, RRA or through any other process. The collection process should be clearly tabulated indicating whether the source is primary or secondary and also the date on which the data was published for secondary data. (Table 4.4).

Table 4.4: Particulars of Data Collection Method - LSGIs Level

#	Geographical Factors	Secondary Data		Primary Data	
		Source	Date	Method	Date
1					
2					
Total					

viii) LSGIs Level Status

As it is evident that geographical factors vary from place to place like, highlands, midlands, coastal regions etc, individual LSGIs will have features based on their location. All data collected based on major factors identified in general and also in specific at individual LSGI level, should be collated to arrive at the total of each factor. For example different land uses and threats in the LSGI should be tabulated. This primary level collation and tabulation shall thus provide the status of all identified geographical factors in the LSGI and move to the next level for analysis. (Table 4.5).

Table 4.5: Geographical Factors LSGI Level ³

Extent of Basin (Area)			Land Use in the River Basin (Area)					Threats to Land Use in the River Basin		
High Lands	Mid Lands	Plains	Cultivable Land	Grass lands	Forests	Urban Settlements	Industrial/Commercial purposes	Area Lost to Hill Mining	Reclamation of Wetlands	Reclamation of Paddy Lands

³ Factors indicated are representative only, might vary from LSGI to LSGI & increase at district and basin level

(ix) District Level Status

All LSGIs that have basin presence shall have generated their data on geographic factors in their jurisdiction. When these are collated at district level it shall reflect enhanced number of geographical factors of the basin. Factors missing in some LSGIs could now be seen present in other LSGIs thus giving. Collating data from all LSGIs in the district shall provide the district level status of geographical features. (Table 4.6).

Table 4.6: Geographical Factors District Level

#	Name of LSGI	Extent of Basin (Area)	Land Use in the River Basin (Area)	Threats to Land Use in the River Basin	Water Resources in the River Basin LSGIs	Coastal Zone
1						
2						
Total						

(x) Basin Level Status

Collating data from all LSGIs present in all districts is the final move to arrive at identified geographic factors of a basin. It now provides the different terrains and land uses in the basin area. Data on factors with human intervention would also have been evident now like hill mining. The collation of entire data provides the status of geographical features in its entirety. (Table 4.7).

Table 4.7: Geographical Factors Basin Level

#	Districts	Origin of River	Gradient and Slope	Extent of Basin	Land Use in the River Basin (Area)	Threats to Land Use in the River Basin	Water Resources in the River Basin Districts	Coastal Zone
1								
2								
Total								

4.3.3 Conclusion

Data collected and collated on geographical features are both attractive and alarming. As the data, maps and also photographs would provide the natural formation of gradient and slope and different land features on the one hand. But also the devastating picture of hill mining and deforestation. Having generated and collated the geographic factors to provide the current status, it is left to the next level for analysis. Later during the preparation of the action plan each of these factors will translated in prescribed matrices to suit LSGIs action.

Chapter 5

Economic Characterization

- ▶ Key Terminologies
- ▶ Data Requirements
- ▶ Process: Descriptive & Tabular Representation

5.1 Key Terminologies

Listed below are some key terminologies that are used in Economic Characterization. Its definition or description explained for the basin manual reader (Table 5.1):

Table 5.1: Key Terminologies in Economic Characterization

#	Key Terminologies	Description
1	Homestead Farming	Farming carried out in the household compound for a single extended family, formally characterized by an all natural and earth friendly farming approach.
2	Floodplain farming	Farming taking place in river bottoms where annual floods deposit rich sediments and minerals on a regular basis allowing agriculture to thrive
3	Typology	The study of types -a system used for putting things into groups according to how they are similar: the study of how things can be divided into different types
4	Forest produce	From the point of view of usage, forest produce can be categorized into three types: Timber, Non Timber [NTFPs] and Minor Minerals
5	Ayacut	Area served by an irrigation project such as a canal, dam or a tank
6	Cropping Pattern	The acreage distribution of different crops in any one year in a given farm area. A change in a cropping pattern from one year to the next can occur by changing the relative acreage of existing crops, and/or by introducing new crops, and/or by cropping existing crops.

5.2: Data Requirements¹

In basin management, updating data is essential i.e. to keep data alive or dynamic. The term economic characterization envelops several important factors and sub-factors that call for separate recording. All significant factors for economic characterization are listed so that LSGIs and stakeholders have an informed participation during Basin Management Plan preparation. (Table 5.2):

Table 5.2: Data Requirements for Economic Characterization

#	Economic Factors	Data Requirements
1	Distribution of Land	1 <25 cent 2 25 to 250 cent 3 250 to 500 cent 4 >500 cent
2	Rice farming	1 Income to Farm Family 2 Income to dependents 3 Total employment 4 Fertilizers Type & Annual Use 5 Pesticides Type & Annual use
3	Homestead farming & Animal Husbandry	1 Income to Farm Family 2 Income to dependents 3 Total employment 4 Fertilizers Type & Annual Use 5 Pesticides Type & Annual use
4	Floodplain Farming	1 Income to Farm Family 2 Income to Dependents 3 Total Employment 4 Fertilizers Type & Annual Use 5 Pesticides Type & Annual use

¹ Factors listed below are general but not exhaustive; individual basin may have its particularities that could be listed only during the characterization process

#	Economic Factors	Data Requirements
5	Plantations -Individual -Industrial	1 Income to Planter 2 Income to Dependents 3 Total Employment 4 Fertilizers Type & Annual Use 5 Pesticides Type & Annual use
6	Livestock Farming -Dairy -Poultry	1 Type & Size of Farm 2 Livestock Census 3 Water Consumption 4 Energy Consumption 5 Waste Generated and Management 6 Effluent Treatment and Management 7 Income 8 Income to Dependents 9 Total Employment
7	Fisheries - Wild Catch - Fish/Prawn Culture	1 Income 2 Income to Dependents 3 Total Employment 4 Total Catch 5 Major Species 6 Feed and Pesticides
8	Tribes	1 Occupation 2 Income
9	Other communities -Weavers -Potters -Others	1 Income 2 Income to Dependents 3 Total Employment 4 Raw Materials
10	Sand Mining	1 Sand Audit Reports 2 Employment & Income 3 Revenue from Sand Mining to LSGIs 4 River Management Funds
11	Other Mining -Laterite -Granite -Clay -Others	1 Mining Area 2 Employment & Income 3 Revenue to the mining agency 4 Revenue to the LSGIs / Government
12	Industries	1 Typology 2 Location 3 Raw Materials 4 Water Consumption 5 Energy Consumption 6 Waste Generated and Management 7 Effluent Treatment and Management 8 Employment & Income 9 Revenue to Industry 10 Revenue to LSGI
13	Forest Produces -Timber -Non-timber -Minor minerals	1 Type of Products 2 Total harvested/collected 3 Revenue

#	Economic Factors	Data Requirements
14	Tourism Facilities	1 Location 2 Type of Ownership – Private, Public, Local Initiatives 3 Water Consumption 4 Energy Consumption 5 Solid and Liquid Waste Generation 6 Waste Management Systems 7 Revenue to Tourism Provider 8 Revenue to LSGIs 9 Employment & Income
15	Irrigation -Major -Minor	1 Details and Capacity 2 Canal Length 3 Ayacut Details 4 Cropping Pattern 5 Flow Regulation 6 Threats
16	Drinking Water -Individual -Community Based -Large Scale Schemes -Industrial Purposes	1 Sources 2 Location(s) 3 Capacity 4 Distribution 5 Population benefitted 6 Revenue Accrued 7 Problems
17	Inland Waterways	1 Name(s) & Location(s) 2 Historical Use 3 Present Use- Transport, Goods Movement

Fig 9 : Pilgrimage Tourists



5.3 Process: Descriptive & Tabular Representation

5.3.1 Introduction

Data on Economic Characteristics is one of the key data in determining the basin characterization. It represents all human activities and interests on a natural resource; its monetary value as determined by our economic systems. Economic data is usually used for analysis along with social data because of its inter-dependency.

5.3.2 Data Collection

(i) Why do LSGIs need economic data in basin planning?

Economic data is mainly to assess three important features those have direct impact on the basin. These are the pattern of water use in the basin, the runoff and wastewater discharge. In the social characterization, the major social user groups in the basin region are identified. Here they shall be looked at in economic perspective with their earnings and income playing the major role. Economic data on agriculture especially its use of fertilizer and pesticide are important as possible impacts on water resources. Similarly economic data on industries and service industry like tourism are important for their water consumption, waste and effluent discharges. Data obtained is critical to assess the economic situation along with social development on the basin region and the pressure on water resources. The basin management plan shall derive from this the pressures and impacts.

(ii) What all data is required?

- a) Data on employment and income of all social groups are important. This includes economic data on different types of agriculture practices and population involved Economic data on fishing and fishery practices are important
- b) All types of mining activities especially sand mining and its economics
- c) All types of industries including service industry like tourism is very essential
- d) Another major area of economic interest in basin context is the drinking water systems distribution etc
- e) Maps of major fishing areas, mining and sand mining areas and of irrigation systems must be generated

(iii) Where do LSGIs gather the economic data?

● Secondary data

- a) Secondary Data published by various government departments on agriculture, industries, mining, labour, fisheries and tourism are available.
- b) LSGIs will have detailed data on sand mining in their respective basin regions.
- c) All data pertaining to drinking water supply systems are in control of LSGIs.
- d) For larger water supply systems, data can be gathered from Department of Irrigation.
- e) Census Reports can be of general use and for comparison.

● Primary data

- a) It is essential to generate primary data on economic factors for its accuracy and contemporary status.
- b) A socio-economic survey therefore is strongly recommended.
- c) Equally important is to gather primary data on fertilizers and pesticides used, industrial effluents and waste, tourism impacts on water bodies and their waste management systems.
- d) Opinion and experience of impacts of various industries, mining activities and tourism facilities can be generated through PRAs and RRAs.
- e) Maps of mining sites, waste and effluent disposals, dumping yards etc., can be through site visits.

Table 5.3 lists all major economic factors required for the economic characterization of the basin. What is also attempted is listing of agencies and also methods for data collection: Listed secondary data sources are agencies or sources that may possess data or maps in parts or full. But these are agencies that can be approached for generating required data or maps professionally. E.g: Department of Agriculture, Department of Tribal Welfare, and Department of Tourism etc. Wherever secondary sources are left blank, it is to be identified during the process of characterization.

Table 5.3: Listing of Major Economic Factors & Possible Data Sources

#	Physical Factors	Data Sources	
		Secondary	Primary
1	Distribution of Land	1 Census Reports 2 Panchayat Office Tax Records 3 Department of Revenue	1 Survey
2	Rice Farming/ Paddy field	1 <i>Thanneerthada</i> Data Bank 2 Department of Agriculture 3 Department of Revenue 4 Panchayat Office for Tax Records 5 Census Reports 6 Department of Economic Statistics 7 Village Records for BTR (Basic Tax Register)	1 Survey for income & expenditure 2 Fertilizer & Pesticide Dealers 3 RRA
3	Homestead Farming & Animal Husbandry	1 Department of Agriculture 2 Department of Animal Husbandry 3 Panchayat Records 4 Census Reports	1 Survey 2 RRA
4	Garden Farming	1 Department of Agriculture 2 HortiCorp 3 VFPCCK	1 Survey 2 RRA
5	Flood Plain Farming	1 Panchayat Records	1 Survey 2 RRA 3 Mapping
6	Plantations -Individual -Industrial	1 Planters Records 2 Department of Revenue 3 Department of Taxes 4 Plantation Corporation 5 Department of Forests 6 Department of Agriculture 7 Department of Labour 8 Department of Panchayat through Panchayat 9 Panchayat Office for Employment Records 10 Census Reports	1 Survey 2 RRA
7	Fertilizers & Pesticides	1 Department of Agriculture 2 Fertilizers & Chemical Dealers 3 Plantation Corporation 4 Planters Records	1 Survey 2 RRA
8	Livestock Farming -Dairy -Poultry	1 Department of Animal Husbandry 2 Dairy and Poultry farms 3 Farm Owners Records 4 Department of Small Scale Industries 5 Veterinary Hospitals 6 Census Reports	1 Survey 2 RRA
9	Fisheries - Wild Catch - Fish/Prawn Culture	1 Department of Fisheries 2 Inland fisheries development authority 3 Panchayat Office 4 Census Reports	1 Survey 2 RRA

#	Physical Factors	Data Sources	
		Secondary	Primary
		5 Farm Owners Records 6 Aquaculture development authority 7 Fisheries Development Agencies	
10	Tribes	1 Department of Tribal Welfare 2 KILA 3 Department of Forests 4 Department of Panchayats 5 Census Reports	1 Survey 2 RRA
11	Other Communities -Weavers -Bamboo workers, Grass & Rattan etc -Potters, Coir -Others	1 Census Report 2 Panchayat Records 3 Kerala State Small Scale Industries Development Corporation	1 Survey 2 RRA
12	Sand Mining	1 LSGI Department 2 Panchayat Office for Mining Records 3 Panchayat Office for River Protection Committee 4 Department of Mining and Geology 5 Department of Revenue 6 Town Planning Reports 7 Mining Contractors' Records 8 Census records	1 Survey 2 RRA 3 Mapping
13	Other Mining - Laterite -Granite -Clay -Others	1 Department of Mining & Geology 2 Mining Contractors' Records 3 Panchayat Office 4 Department of Labour	1 Survey 2 RRA 3 Mapping
14	Industries	1 Department of Industries 2 Department of Labour 3 Kerala State Electricity Board 4 Pollution Control Board 5 Panchayat Office	1 Survey 2 RRA 3 Mapping
15	Forest Produce	1 Department of Forests 2 Department of Tribal Welfare 3 Tribal welfare society	1 Survey 2 RRA 3 Mapping
16	Tourism Facilities	1 Tourism Providers' Records 2 Department of Tourism 3 DTPC, KTDC, ITDC, PTPC 4 Kerala State Electricity Board 5 Panchayat Office	1 Survey – Mapping 2 RRA – (Use & Threats) 1 Survey
17	Irrigation -Major -Minor	1 Panchayat Office 2 Department of Irrigation - Major & Minor 3 CADA (Command Area Development Authority) 4 Department of Agriculture 5 Kerala State Electricity Board	1 Survey 2 RRA 3 Mapping

#	Physical Factors	Data Sources	
		Secondary	Primary
18	Drinking water -Individual -Community Based -Large Scale Schemes -Industrial Purposes	1 Kerala Water Authority 2 Panchayat Office 3 KRWSA for Jalandhi, Swajaldhara 4 Kerala State Electricity Board 5 Industry Records	
19	Inland waterways	1 KSWTD 2 Panchayat Office 3 Tourism Department	

(iv) What necessary caution and criteria are required while collecting economic data?

- Primary data is essential for economic and social characterization
- Data on income is tricky with respect to all economic activities, respondents are hesitant to reveal
- Age of data is a prime criterion especially for secondary data, this is to ensure data consistency and uniformity
- Primary Data Collection Format Standardization is key to maintain data uniformity between panchayat, district and overall basin characterization
- Selection of Common Software is very essential for Primary Data collection, tabulation and analysis to ensure output stability. There are several software available for Integrated River Modeling.

(v) Data Validation

For economic characterization at LSGIs level, data collected should ensure the following:

- Maps of Floodplains and Floodplain Farming
- Maps of all Mining Sites both old and in use currently
- Maps of all Sand Mining Areas (*Kadavu*)
- Maps of all Major Industries
- Maps of all Tourism Facilities
- Maps of Effluent Outlets, Waste Dumping Sites
- Maps of Inland Waterways
- Table of Economic Features
- Table of Pesticides and Chemical Fertilizers used - crop wise
- Table of Industrial Products and raw materials used – industry wise
- Table of Chemical Effluents and Industrial Waste Generated – industry wise
- Table on Water Supply Schemes - category wise
- Textual History of Irrigation Facilities, Experiences
- Textual History of Waterways and uses

(vi) How do LSGIs collate the data?

Economic data represents direct human intervention in and along the basin. It also changes with change in economic activities and population along the basin area. Beginning from LSGIs to district and basin level, economic data will determine all present and future planning and implementation. When put together, the data would also provide the quantum of economic activities and money generated by the LSGI.

(vii) Data Tabulation

Primary data collection through socio- economic survey and also PRA and RRA methods are very important to gather economic data. The importance of maintaining dynamic data system is most visible with economic data as it may change from year to year. As always, the collection process should be clearly tabulated indicating whether the source is primary or secondary and also the date on which the data was published for secondary data. (Table 5.4).

Table 5.4: Particulars of Data Collection Method - LSGIs Level

#	Economic Factors	Secondary Data		Primary Data	
		Source	Date	Method	Date
1					
2					
Total					

(viii) LSGIs Level Status

Collecting and collating economic data can be a major activity in basin management plan. A socio-economic survey is strongly recommended with clear objective type questionnaire that shall reveal investments and earnings with minimum error. Economic data of major factors identified but specific to individual LSGI level is to be collected conscientiously. Homestead farming, fisheries, drinking water facilities etc could be common to all LSGIs. Sand mining also has become a common economic entity among the LSGIs. But other factors like industries, plantations etc could vary and their locations spread in other LSGIs. Based on their presence, economic data should be collated to arrive at the total of each factor. For example different land uses in the LSGI should be tabulated to have the land use grand total.

This primary level collation and tabulation shall thus provide the status of identified economic factors in the LSGI level. (Table 5.5).

Table 5.5: Economic Factors LSGIs Level

Distribution of Land				Homestead Farming				Fisheries Wild Catch				Sand Mining							
<25 cent	25 to 250 cent	250 to 500 cent	> 500 cent	Income Frarm Family	Income Dependents	Employment Total	Fertiliz-ers		Pesti-cides		Income Fishey Family	Income Dependents	Employment Total	Total Cash	Major Species	Sand Audit Reports	Dmployment & Income	Revenue LSGIs	River Managment Funds
							Type	Annual Use	Type	Annual Use									

(ix) District Level Status

The district level data represents LSGIs in the district and economic activities carried out. Presence of more factors shall now be represented as the number of LSGIs increase. Collating data from all LSGIs in the district shall provide the district level status of economic features. (Table 5.6).

Output Table 5.6: Economic Factors District Level

#	LSGI	Rice Farming	Homestead Farming	Fisheries	Plantations	Irrigation	Drinking Water	Tourism Facilities
1								
2								
Total								

(x) Basin Level Status

The basin level data represents all economic activities in its entirety. The data reveals the quantum money generated from the entire basin proving the significance of natural resources in human life. (Output Table 5.7).

Output Table 5.7: Economic Factors Basin Level

#	Districts	Rice Farming	Homestead Farming	Fisheries	Plantations	Irrigation	Drinking Water	Tourism Facilities	Floodplain Farming	Livestock Farming	Forest Produce	Inland Waterways	Industries
1													
2													
Total													

5.3.3 Conclusion

Economic factors identified here shall be a pointer to economic characterization of the basin that along with geographic and social characteristics shall form one of the major components of the BMP after the analysis. Later during the preparation of the action plan each of these factors will translated in prescribed matrices to suit LSGIs action. (Ref. Section II, for Sample Economic Factor- Sand Mining, detailing the Action Plan process).

Chapter 6

Social Characterization

- ▶ Key Terminologies
- ▶ Data Requirements
- ▶ Process: Descriptive & Tabular Representation

6.1 Key Terminologies

Listed below are terminologies that will be used during Social Characterization. Though some of them may be familiar and widely used, their definition or description is explained for the basin manual reader. (Table 6.1).

Table 6.1: Key Terminologies in Social Characterization

#	Key Terminologies	Description
1	Demography	Study of statistics of births, deaths, marriages, disease etc and changes that occur over a period of time in human populations.
2	Rain-fed Agriculture	Usually the term is used in agriculture to describe farming practices that rely on rainfall for water as against irrigated agricultural practices
3	Homestead farming	Farming carried out in the household compound for a single extended family, formally characterized by an all natural and earth friendly farming approach.
4	Floodplain farming	Farming taking place in river bottoms where annual floods deposit rich sediments and minerals on a regular basis allowing agriculture to thrive.
5	Animal husbandry	Farming and management of animals especially cattle in large scale
6	Plantations	Large, artificially-established farm or estate, where crops are grown for in large scale for commercial purpose (Coffee, tea, rubber estates or plantations)
7	Urban settlements	An urban settlement often has a large population size and high population density. An urban settlement engages predominantly in secondary and tertiary economic activities
8	Rural settlements	A rural settlement is where the population size is moderate and the community is involved predominantly in primary activities such as farming, cattle rising, artisanal activities etc

6.2 Data Requirements¹

In basin management, updating data is essential i.e. to keep data alive or dynamic. The term social characterization envelops several important factors and sub-factors that call for separate recording. All significant factors for social characterization are listed so that LSGIs and stakeholders have an informed participation during Basin Management Plan preparation. (Table 6.2).

Table 6.2: Data Requirements for Social Characterization

#	Social Factors	Data Requirements
1	Rice farming	1 Population and Demography 2 Education & Health status 3 Area under Rice Farming, 4 Rain- fed and Irrigated Area 5 Crop Varieties 6 Cropping Season and Pattern 7 Dependent Population
2	Homestead Farming & Animal Husbandry	1 Population and Demography 2 Education & Health status 3 Area 4 Crop Diversity 5 Seasonality 6 Type of Cattle & Number 7 Dependent Population
3	Flood Plain Farming	1 Population and Demography 2 Education & Health status 3 Farming Region(s) 4 Area 5 Seasonal Farming Methods

¹ Factors listed below are general but not exhaustive; individual basin may have its particularities that could be listed only during the characterization process

#	Social Factors	Data Requirements
		6 Cropping Pattern 7 Culture/Traditions 8 Dependent Population
4	Plantations	1 Population and Demography 2 Education & Health status 3 Area, size and name 4 Type of Agriculture Plantations within the basin– Tea, Coffee, Cardamom etc. 5 Infrastructure 6 Amenities for workers 7 Dependent Population
5	Fishing -Inland -Backwaters -Coast	1 Population & Demography 2 Education & Health status 3 Settlements & Locations 4 Fishing Regions 5 Type(s) of fishing 6 Culture/Traditions 7 Dependent Population
6	Tribes	1 Population and Demography 2 Education & Health status 3 Settlement Regions 4 River/Basin/Forest Dependence 5 Animal Husbandry 6 Livelihood 7 Culture/Traditions
7	Other Communities -Weavers -Potters -others	1 Population and Demography 2 Education & Health status 3 Settlement Region (s) 4 Dependence on Habitat 5 Livelihood 6 Culture/Traditions
8	Inhabited Areas	1 Villages 2 Towns 3 Cities 4 Urban Settlements
9	General Infrastructure -Road -Rail (if any) -Hydro power Stations -Dams -Water Supply Systems	General Information - Name, Location

Fig 10: Boat on River



6.3 Process: Descriptive & Tabular Representation

6.3.1 Introduction

To understand people, their relations to land and water, their livelihood and organizations etc denote the content in social characterization. Social and economic characteristics are often inter-twined and so is the analysis of one related to the other. Yet it is advisable to have these characteristics drawn separately for critical understanding.

6.3.2. Data Collection

(i) Why do LSGIs need social data in basin planning?

Social data is mainly to assess the population, historic use of land and water at basin level. The data obtained is critical to assess social development on the basin region and thereby its influence on the basin. This shall act as one of the key information along with economic characterization in pressure and impact assessment. From this assessed and analyzed data, the Basin Management Plan shall derive roles for LSGIs in the overall basin plan.

(ii) What all data is required ?

Data pertaining to population and its demographics, their education and health are important. Land use and agriculture practices and irrigation pattern, both historical and present, are significant. Equally important is the water dependency on the basin for agriculture and other human use. Apart from this, data on general infrastructure of the area should also be gathered and mapped.

(iii) Where do LSGIs gather the social data?

● Secondary data

- a) Secondary Data published by various government departments on land use and agricultural practices are available. LSGIs can refer to previous Census Reports on population and demographic data for comparison.
- b) Books published on farming systems, water and land use must be procured, especially those relating to the basin of interest to the LSGIs
- c) Satellite and Remote Sensing imageries
- d) Maps relating to cultivable and non-cultivable areas, land use and irrigation available are precious and must be procured.
- e) Search for old photographs could be made with possible date and age ascertained.

● Primary data

- a) Primary data to be generated through socio-economic surveys to assess the current status.
- b) Uniform questionnaire for all LSGIs along the basin for data consistency
- c) LSGIs can conduct Participatory Rural Appraisal (PRA) among the elderly and different community heads for historical practices, water dependency on the basin and cultural moorings.
- d) PRA or RRA methods can assess changes taken place and there by its affects and impacts.
- e) Maps of all present major social features, settlements etc are to be prepared.
- f) Maps of infrastructure in the area can be prepared.
- g) Seek service of photographers with keen interest and expertise in nature/wildlife to photo/video documentation of physical features.

Listed secondary data sources are agencies or sources that may possess data or maps in parts or full or none at all. But these are agencies that can be approached for generating required data or maps professionally eg: Dept of Agriculture, Tribal Welfare etc. Wherever blank, secondary sources are to be identified during the process of characterization. (Table 6.3).

Table 6.3: Listing of Social Factors & Data Sources

#	Physical Factors	Data Sources	
		Secondary	Primary
1	Rice Farming/paddy fields	1 Department of Agriculture 2 Village Records for Basic Tax Register (BTR)	1 Survey 2 RRA 3 Mapping
2	Homestead Farming & Animal Husbandry	1 Department of Agriculture 2 Panchayat Land Records 3 Census Reports	1 Survey 2 RRA 3 Mapping
3	Flood Plain Farming		1 Survey 2 RRA 3 Mapping
4	Plantations	1 Plantation Corporation 2 Department of Forests 3 Department of Agriculture 4 Panchayat Office for Land Records 5 Census Reports	1 Survey 2 RRA 3 Mapping
5	Fishing - Inland - Backwaters - Coast	1 Department of Fisheries 2 Panchayat Office 3 Census Reports	1 Survey 2 RRA
6	Tribes	1 Department of Tribal Welfare 2 Department of Forests 3 Panchayat Office 4 Census Reports	1 Survey 2 RRA
7	Other Communities -Weavers -Potters -others	1 Census Report 2 Panchayat Office 3 Kerala State Small Scale Industries Development Corporation	1 Survey 2 RRA
8	Inhabited Areas	1 Panchayat office for House Numbering Register 2 Corporation/Municipalities 3 Department of Town Planning	1 Survey 2 RRA 3 Mapping
9	General Infrastructure -Road -Rail (if any) -Hydro power Stations -Dams -Water Supply Systems	1 Panchayat Office for Resource Map 2 Department of Survey for Land Records 3 Respective Government Records 4 Google Maps	Survey Mapping

(iv) What necessary caution and criteria are required while collecting Social data?

- Age of data is a prime criterion especially for secondary data, this is to ensure data consistency and uniformity
- All available secondary data should be verified with onsite visits and comparisons
- Primary Data Collection Format Standardization is key to maintain data uniformity between panchayat, district and overall basin characterization
- Selection of Common Software is very essential for Primary Data collection, tabulation and analysis to ensure output stability. Integrated River Modeling Software is available for this.

(v) Data Validation

For social characterization at LSGIs level, data collected should ensure the following:

- Maps of all land uses like paddy fields, flood plains etc.

- b) Maps of all key infrastructure like roads and other public institutions
- c) Maps of all inhabited areas including urban settlements
- d) Table on population and demographic features
- e) Table on water supply schemes
- f) Textual history of land, water use
- g) Textual history of cultural practices

(vi) How do LSGIs collate the data?

Data on social factors is collected together with economic data. It would consist of all social factors collected through the questionnaire and information through PRA or RRA. The collating process involves the three different stages; first at LSGIs level followed by collation of all basin LSGIs at district level and finally at all basin districts put together to arrive at the basin level.

(vii) Data Tabulation

While collating data it is important to clearly specify the method opted to obtain the data. In case of primary data, it should specify the method; survey, RRA or through any other process. The collection process should be clearly tabulated indicating whether the source is primary or secondary and also the date on which the secondary data was published. (Table 6.4).

Table 6.4: Particulars of Data Collection Method - LSGIs Level

#	Social Factors	Secondary Data		Primary Data	
		Source	Date	Method	Date
1					
2					
Total					

(viii) LSGIs Level Status

Social factors like land use, fishery, infrastructure etc are in common to most LSGIs. Whereas industries, tourism projects etc could be LSGIs specific. All data collected based on major identified social factors at individual LSGI level should be collated to arrive at the total of each factor. For example, different land uses in the LSGI should be tabulated to have the land use grand total. This primary level collation and tabulation validated with relevant maps and also textual history shall provide the existing status of all physical factors of the basin under its jurisdiction.

Based on factors available, individual LSGI may tabulate and record relevant social factors as. (Table 6.5).

Table 6.5: Social Factors LSGIs Level

1						2						3								
Distribution of Land						Homestead Farming						Fishing/Inland/Backwaters/Coast								
Population and Demography	Education & Health status	Area under Rice Farming	Rain-fed and Irrigated	Crop Varieties	Cropping Season and Demography	Dependent Population	Population and Demography	Education & Health	Area	Crop Diversity	Seasonality	Type of Cattle and Number	Dependent Population	Population and Demography	Education & Health Status	Settlements & Locations	Fishing Regions	Type (s) of fishing	Culture/Traditions	Dependent Population

(ix) District Level Status

When collating data comprising all LSGIs in the district at district level, social factors become more pronounced. Sum of all factors represented by different LSGIs emerge at district level. Comparison between LSGIs on land use, population density, irrigation and water supply are possible at this stage. The status of social factors at district level thus reached can now move to the next level. (Table 6.6).

Table 6.6: Social Factors District Level

#	LSGI	Land Use (All Sources)	Crops (All Varieties)	Irrigation (All Sources)	Water Supply Schemes (All Types)	Tribes (All Categories)	Other Communities (All Categories)	General Infrastructure (All Categories)
1								
2								
Total								

(x) Basin Level Status

As collation of basin level data progresses, the district status of all social factors emerges. The status of all factors like land use, crop varieties, water distribution schemes and infrastructure etc and their grand totals are available at this point. Like in economic characterization where the basin dependent economy emerged in social characterization, the population dependency on land is made clear. (Table 6.7).

Table 6.7: Social Factors Basin Level

#	Districts	Land Use (All Sources)	Crops (All Varieties)	Irrigation (All Sources)	Water Supply Schemes (All Types)	Tribes (All Categories)	Other Communities (All Categories)	Population & Demography (Total)	Inhabitted Area	General infrastructure (All Categories)
1										
2										
Total										

6.3.3 Conclusion

The collated social data has great relevance in basin management. The pressure on land use, population and water consumption becomes apparent as the total data of all basin dependent districts emerges. Status of all infrastructures is also emerging during this phase. Later during the preparation of the action plan each of these factors will be translated in prescribed matrices to suit LSGIs action. (Ref. Section II, for Sample Social Factor- Rice Farming, detailing the Action Plan process).

Section II

Outcome & Action Plan

Chapter 7

**Characterization -
Outcome & Action Plan**

- ▶ **Sample 1 River Bank**
- ▶ **Sample 2 Watershed**
- ▶ **Sample 3 Pollution Load**
- ▶ **Sample 4 Sand Mining**
- ▶ **Sample 5 Rice Farming**

7 Characterization – Outcome & Action Plan¹

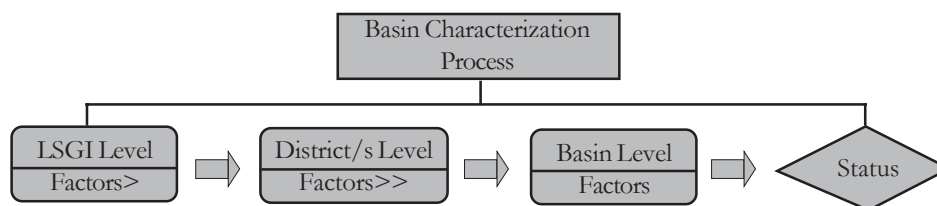
7.0 Introduction

The Manual in the previous section has detailed all indicative steps for basin characterization through data collection at different levels. Through Descriptive and Tabular Representation (DTR) these were further detailed step by step. The intent being that the LSGIs will be guided through while drawing the status of basin under their jurisdiction. The data thus collected and collated shall now lead to the next phase for analysis. The quantitative and qualitative analysis process and its outcome shall be the major content of the BMP representing the status of all characteristics. It will also provide an overall Action Plan. This section primarily focuses to interpret the Action Plan for LSGIs interventions. An attempt is also made to familiarize the LSGIs with key outcomes of the analysis process.

7.1 Outcome

The dynamic data provides status of each factor in the six identified characterization of the basin. It is also seen at the collation process that these are at three levels; (a) individual LSGI level (b) district level representing all LSGIs in the district, and (c) basin level representing all districts. It is based on these data that experts analyze to determine characterization of the basin in its entirety. The analysis shall provide the status and determine the criticality of the characteristics also at three levels; the threats at the Panchayat, district and overall basin level. (Fig.11).

Fig. 11: Characterization Process



7.1.1 Outcome of Analysis: Samples

➤ Calculation of Water Balance

The purpose is to present a feasible method for calculation of water balance in basins. Water balance is a relation of water inflow, outflow and accumulation (change of storage) in any basin in a given period (year, month, decade and other). The water balance analysis is critical for understanding the relationship between water availability and water use in the basin. This is drawn during hydrological characterization.

What this signifies to LSGIs ?

LSGIs have in the economic and social data collection process identified the water requirements and schemes. Once the calculation of water balance is available LSGIs can redraw their plans for water supply among different users and uses.

➤ Calculation of Aquifer Balance

Assessment of water balance for aquifers (underground layer of water) provides information on potential underground water resources in the river basin. Calculation helps to estimate long-term sustainable water yield to support economic development, as well as to implement optimal distribution of underground waters.

What this signifies to LSGIs ?

With technical support from experts, LSGIs can assess input and output of waters to and from the aquifer and set sustainable water yield.

➤ Setting Ecological flow

Ecological flow is the minimum level of river flows required to maintain the proper functions of the river network ecosystem under natural conditions. The significance of this is that river flow is not constant throughout the year but seasonality dependent; it decreases in summer and increases during rains.

What this signifies to LSGIs ?

For LSGIs, setting ecological flow is of utmost importance for its water requirements and more importantly for long term sustenance of the river.

¹ This section shall be post analysis and for the LSGIs implementation based on recommendations by the Basin Management Plan

➤ **Setting Environmental Objectives for Water Bodies**

Setting environmental objectives is primarily the analysis of anthropogenic (caused or produced by humans) pressures and environmental impacts on water bodies. The analysis focuses on how to measure future progress in improving water resources, in terms of water quality, flow management, and biological resources.

What this signifies to LSGIs ?

LSGIs have a significant short term and long term role to play in maintaining the environmental objective by regulating human activities and banning environmentally hazardous development activities.

➤ **Identification of Pressures and Measures**

Through analyses of various water uses, human activities and developments the pressure on water resources, its problems and the reasons become evident i.e. why water bodies are not achieving their environmental objectives. This analysis, if properly done, usually clarifies at a conceptual level, what types of solutions or measures are needed to resolve the water resource problems.

What this signifies to LSGIs ?

LSGIs are duty bound to address these issues beyond the conceptual recommendations. LSGIs have jurisdiction over several development and human induced pressures (license for setting up development projects, prevent pollution and hazardous activities in the basin etc). The status of our water bodies can be greatly improved if the LSGIs impart their duties to river basins sensibly.

➤ **Updating of River Basin Management Plans**

Key component of management plan provides guidance on updating the appropriate parts and data. The guideline identifies factors embedded in the different characterizations and also sets a time line for updating. For example, the hydrographical characteristics of watersheds once implemented, it is recommended to again implement monthly average flows of main watersheds once in five years whereas for the water withdrawal data collection, it is once a year. These are scientific and expert interventions that also set permanent mechanisms for monitoring.

What this signifies to LSGIs ?

Only through uninterrupted and continuous flow of data can the BMP be updated and kept as a live document. The power of dynamic data scheme and the LSGIs responsibility to maintain it uninterruptedly is significant to this key activity.

7.2 Action plan

This Manual is envisaged as an action oriented document for LSGIs to act individually as well as collectively. Their interventions will be guided by BMP, its findings, recommendations and guidelines. The Action Plan proposed in this Manual is designed to meet this purpose effortlessly for the LSGIs while not deviating from their systems. The Action Plan consists of (1) Interventions (2) Sectoral & Budget/Fund Integration and (3) Inter- Sub-matrix linkages. At LSGI level this makes sense since they are equipped with dynamic data on identified factors in their respective jurisdiction. While Interventions in the Action Plan creates space for remedial and corrective actions, and Sectoral & Budget Integration is founded on basic functional modes of the LSGIs. The Inter- Sub Matrix Linkages locates each factor within the overall basin for the LSGIs and for the managers to locate its significance while planning actions.²

7.2.1 Action Plan: Interventions

The Action Plan is founded on judicious actions based on the severity of problems. The approach is founded on 'precautionary principle' while dealing with natural resources. After locating an issue it is put forward through a series of actions with an intervention mode; Regulate, Restore, Protect, Ban and Educate. Regulative and corrective action will have precedence. Banning of an activity is considered giving first preference to the basin health. If no alternatives exist for an activity, in the worst case scenario, the activity can be banned. Prime importance is given to educate all involved, stakeholders and also the LSGIs as this can reap long-term benefits. (Table 7.1).

² See samples from different characteristics, dynamic data, action plan detailed in this section

Table 7.1: Action Plan - Interventions³

#	Action	Problem	Reason	Stakeholder(s) Involved
1	Regulate			
2	Restore			
3	Protect			
4	Ban			
5	Educate			

7.2.2 Action Plan: Sectoral & Budget Integration

LSGI plans and budgets are regulated through its own governance mechanisms. It is mandatory that all projects, interventions and actions are in sync with this. Put more simply, LSGI's budget allocation and implementation can only be through three sectors. They are; (a) Productive sector, (b) Service Sector and, (c) Infrastructure Sector. The identified issues in the Action Plan for Basin Management also have to be within the ambit of this. But this shall only be one part of the LSGIs regimen. While there are actions that individual LSGIs can handle in Basin Management, there are others that could be implemented only complementarily between Panchayat and also between upper tiers of LSGIs namely Block and District Panchayats. This is perfectly appropriate as the basin in its entirety is spread across districts that comprises of Grama Panchayats, Block Panchayats and District Panchayats. Such a milieu helps all three tiers to identify schemes and funds for vertical integration, for corrective interventions and for management of factors that cut across administrative boundaries. In cases where issues are critically critical, they can earmark mandatory fund allocation in their budgets too or can jointly seek direct government or funds from other sponsored schemes. (Table 7.2).

Table 7.2: Action Plan - Sectoral & Budget Integration⁴

#	Critical Physical Factor (s)	Scheme & Funds			
		Panchayat/s	Block	District	Other Schemes/ Funds
Productive					
1					
2					
Service					
1					
2					
Infrastructure					
1					
2					

7.3 Linkages with Overall Basin Character

For the purpose of our understanding and for ease of data collection and analysis, each characterization is separated from the overall basin characteristics. But in its natural function it has integral linkages with all others. For example in its natural function, physical characteristics has integral linkages with geographic–biological and hydrological characteristics of the basin. In the BMP, it has linkages with social and economic characteristics too since several human interventions can impact the physical characteristics of the basin. It is common sense that each human action impacts the overall basin function and intervenes with its natural self. It is therefore important that identified factors and their linkages with other sub matrices are properly documented with due priority (Table 7.3).

Table 7.3: Action Plan - Inter-Sub Matrix Linkages⁵

#	Factors	Sub Matrix Linkages	Role in Basin Management
1			
2			

³ See samples from different characteristics for completed Output Matrix for Interventions in this section

⁴ See samples from different characteristics for completed output matrix for sectoral & budget integration in this section.

⁵ See samples from different characteristics for completed output matrix for inter-sub matrix linkages in this section

7.4 Conclusion

As evident, all factors will not be present for all LSGIs, but are spread throughout the entirety of the basin – different LSGIs may have different factors. Even when there are common factors for many LSGIs the severity of the problem may not be uniform, as the status of data will indicate. It is however important that the LSGIs realize the inter-relationships and thereby plan each of their activities to support the overall health of the basin.

**Table 7.4: Physical Factor - River Bank¹
(Sample)**

Data, Source & Method					
#	Data Requirements	Secondary Data		Primary Data	
		Source	Date	Method	Date
1	River Bank under Panchayat	1 Panchayat Records		1 Survey 2 RRA 3 Mapping 4 Photographs	
2	Slope Stability	1 River -Management Cell 2 Photographs		1 Survey 2 Mapping 3 Photographs	
3	Erosion prone Areas	1 River Management Cell 2 Photographs		1 Survey 2 Mapping 3 RRA (History)	
4	Bank Reclamation	1 Panchayat Land - Records 2 Cadastral Map 3 Land Survey Records		1 Survey 2 RRA 3 Mapping 4 Photographs	
5	Bed Reclamation	1 Panchayat Land Records 2 Land Survey Records		1 Survey 2 RRA 3 Mapping 4 Photographs	
6	Extraction Areas -Sand -Gravel -Clay -Others	1 Panchayat Records		1 Survey 2 RRA 3 Mapping 4 Photographs	
7	Near Bank Land Use - Agriculture - Industries - Tourism - Housing	1 Panchayat Land Records 2 Panchayat Building Tax Records		1 Survey	

Table 7.5: River Bank - Data Summary

#	Length of Bank (Kms)	Slope Stability (Details)				Erosion prone Areas		Bank Reclamation		River Reclamation		Extraction Area				Near Bank Land Use (No & Area)									
		1	2	3	4	No	Name	No	Area	No	Area	Sand	Gravel	Clay	Others	Agri-culture		Indus-try		Tourism		Other			
																No	Area	No	Area	No	Area	No	Area		
1																									
2																									

¹ Sample considering River Bank Protection are important to LSGIs

Table 7.6: River Bank - List of Maps

#	Data Requirements	Particulars	Remarks
1	River Bank	Total Length Slope stability every Km Erosion prone locations, nature of erosion	
2	Reclamation	Bank Reclamation: location, extend & number River Reclamation:, location, extend & number	
3	Extraction	Sand extraction: location & number Gravel extraction: location & number Clay extraction: location & number	
4	Near bank Land Use	Agriculture: location, area & crop Industry: location, area & type Tourism: location & area Housing: Location, number & area	

Table 7.7: Action Plan - Interventions

#	Action	Problem	Reason	Stakeholder/s Involved
1	Regulate	Hard options for bank protection	Hard options (concrete, masonry) interfere with natural bank formations, flows, natural flooding	1 Panchayat 2 Households
2	Regulate	Constructions on reclaimed banks	1 Impacts the bank sensitivity 2 Loss of property in times of flood	Multiple
3	Regulate	1 Permanent agriculture activities on near bank or reclaimed land, bank & bed 2 Chemical fertilizers and pesticides	1 Obstructs natural flooding 2 Loss of property 3 Pollutes the river	1 Farmers 2 Households
4	Restore	Vegetation along Banks	1 Protects river bank against erosions 2 Many are of Medicinal Value	1 Panchayat 2 Farmers 3 Department of Soil - Conservation
5	Protect	Slope Stability	1 Avoid bank erosion 2 Avoid Sudden landslides during monsoon and heavy rains	Panchayat
6	Protect	100 mtr. set back zone for river banks as stipulated by CZMP	Salinity ingress areas in rivers and other freshwater bodies are ecologically sensitive regions	1 Panchayat 2 Department of Soil- Conservation
7	Ban	All types of Reclamations (Bank & Bed)	1 Serious impact on water flow pattern 2 Serious impact on riparian habitats	Panchayat
8	Ban	All types of Extractions	Serious impact on river bank systems & stability	1 Panchayat 2 Livelihood Dependent groups 3 Workers

¹ Assuming the General Trend in Kerala River Bank Threats

#	Action	Problem	Reason	Stakeholder/s Involved
9	Educate	Fallouts of bank and river reclamation	Floods Loss of property & livelihood	1 Panchayat 2 Farmers 3 Households 4 NGOs
10	Educate	Bank Strengthening Techniques	For Healthy & Productive River	5 Professionals 1 Panchayat 2 Farmers 3 Households 4 NGOs 5 Professionals

Table 7.8: Action Plan - Sectoral & Fund Integration

#	Sector in LSGIs Plan	Scheme & Funds			
		Panchayat/s	Block	District	Other Schemes/Funds
Productive					
1	Alternatives to near bank agriculture	Annual plans & Schemes			
2	River Bank Management	Annual Plan			
Service					
3	Conscien tize River Bank Protection Techniques	-Schemes -Three-tier -Integration	-Schemes -Three-tier- -Integraion	-Schemes -Three-tier- -Integration	
Infrastructure					
4	Soft Options for Bank Protection	-Schemes -Three-tier- -Integration	-Schemes -Three-tier- -Integration	-Schemes -Three-tier- -Integration	

Conscientize = to educate (someone) about, or raise awareness (in someone) of, an issue or idea

Table 7.9: Action Plan: Inter - Sub Matrix Linkages

#	River Bank	Sub Matrix Linkages	Role in Basin Management
1	Reclamations	Hydrological Characteristics Biological Characteristics	Assessing overall basin health & management
2	Near Bank Land use Agriculture	Social & Economic Characteristics	Total agriculture land use,Basin land management
3	Near Bank Land use Industries Tourism	Social & Economic Characteristics	Non-Agricultural Land Use,Water consumption, Pollution – pressures in Basin Management

**Table 7.10: Hydrological Factor - Watershed¹
(Sample)**

Data, Source & Method					
#	Data Requirements	Secondary Data		Primary Data	
		Source	Date	Method	Date
1	Watershed: Typology & Characteristics a Type b Area c Length d Slope e Seasonal f Perennial	1 Panchayat Records 2 Department of Irrigation 3 Farmers' Records		1 Survey 2 RRA 3 Mapping	
2	Rainfall	1 Department of Meteorology 2 Department of Irrigation		RRA	
3	Land Use in Watershed Area a Cultivable Land b Waste Land c Area of Habitation	1 Panchayat Records 2 Revenue Records		1 Survey 2 RRA 3 Mapping	
4	Land Ownership a Private Land Holdings b Revenue Land c Panchayat Land d Forest Land e Public/Common Land	1 Panchayat Records 2 Revenue Records 3 Department of Forests		1 Survey 2 RRA 3 Mapping	
5	Crop Varieties & Area in Watershed Area a Seasonal Crops b Annual Crops	1 Department of Agriculture 2 Panchayat Records		1 Survey 2 RRA 3 Mapping	
6	Cultivated Area & Water Dependency in Watershed Area a Irrigated Areas b Seasonal Irrigated Areas c Rain-fed Areas	1 Panchayat Records 2 Department of Irrigation 3. Farmers' Records		1 Survey 2 RRA 3 Mapping	

Table 7.11: Watershed Outside Forested Areas - Data Summary

#	Typology	Size (SqKm)	Length (Km)	Width (Average) (Km)	Gradient (m/m)	Seasonal (Months)	Perennial
1							
2							
Total							

Table 7.12: Watershed Outside Forested Areas - Data Summary

Land Use - Total				
#	Cultivable Land (Ha)	Waste Land (Ha)	Area of Habitation (Ha)	Total (Ha)
1				
2				
Total				

¹ Sample Considering River Bank Protection are Important to LSGIs

Table 7.13: Watershed Outside Forested Areas - Data Summary

Land Ownership - Total						
#	Private Holdings (Ha)	Panchayat Land (Ha)	Revenue Land (Ha)	Forested Land (Ha)	Public/Common Land (Ha)	Total
1						
2						
Total						

Table 7.14: Watershed Outside Forested Areas - Data Summary

Crop Varieties & Area in Watershed								
#	Type	Crop (Name)	Area (Ha)	Crop (Name)	Area (Ha)	Crop (Name)	Area (Ha)	Total
Seasonal Crops								
1								
2								
Annual Crops								
1								
2								
Total								

Table 7.15: Watershed Outside Forested Areas - Data Summary

Cultivated Area & Water Dependency		
#	Type	Area (Ha)
1	Irrigated	
2	Seasonal Irrigated	
3	Rain-Fed	
Total		

Table 7.16: Watershed Outside Forested Areas - List of Maps

1	Watershed	Sub & Micro Watersheds Number/s Area/Size
2	Land Use & Ownership	Types Emphasis on Wasteland Ownership pattern
3	Crop Varieties & Irrigation Pattern	Crops & Area Cultivated Irrigation Pattern
Total		

Table 7.17: Action Plan - Interventions²

#	Action	Problem	Reason	Stakeholder/s Involved
1	Regulate	Soil Erosion	<ul style="list-style-type: none"> - Rapid and unchecked erosion reduces the depth of fertile topsoil - Creates gullies in the land - Causes sedimentation of streams & chokes the water flow 	<ul style="list-style-type: none"> 1 Dept of Geology 2 Soil Conservation Agencies 3 Farmers & Planters 4 Panchayat 5 Department of Agriculture
2	Regulate	Construction of Roads and Pavements	<ul style="list-style-type: none"> - Hard construction removes vegetation, leaving the area susceptible to surface erosion - Road surfaces reduce or block water infiltration rates 	<ul style="list-style-type: none"> 1 Panchayat 2 Department of Public Works

² Watershed Protection is LSGIs key focus in Kerala

#	Action	Problem	Reason	Stakeholder/s Involved
			<ul style="list-style-type: none"> - Roads transport sediments in the stream system - Runoff that drains from roads can initiate landslides or gullies 	
3	Regulate	Non-Traditional - Water Intensive Farming Practices	<ul style="list-style-type: none"> - Diversion of streams for water-intensive agriculture - Overexploitation of ground water - Depletion of groundwater table 	<ol style="list-style-type: none"> 1 Department of Agriculture 2 Farmers & Planters 3 Panchayat
4	Restore		<ul style="list-style-type: none"> - drying up of streams - Prevents slope destabilization - Tree roots protect and stabilize steep watershed slopes - Enhances water storage ability & capacity - Many native plants are medicinal 	<ol style="list-style-type: none"> 1 Panchayat 2 Farmers 3 NGOs/Nature/Youth/Women/organizations
5	Protect	<ol style="list-style-type: none"> 1 Native Plants & Trees in Watershed 2 Water Quality in Watersheds 	<ul style="list-style-type: none"> - By preventing eroded soil through runoffs into watersheds - By preventing entry of pollution from chemical fertilizers and pesticides - By preventing untreated disposal of industrial & service sector wastes & effluents - By preventing untreated disposal of domestic and municipal waste 	<ol style="list-style-type: none"> 1 Basin Management Committees 2 Three-tier 3 LSGIs 4 Citizens 5 District Collector 6 Department of Agriculture 7 Department of Irrigation 8 Department of Industries 9 Department of Tourism 10 Pollution Control Board
6	Protect	Watersheds	<ul style="list-style-type: none"> - Watersheds are the life-line of freshwater repositories -Major support to agriculture & other domestic purposes especially in rural areas 	<ol style="list-style-type: none"> 1 Basin Management Committees 2 Three-tier 3 LSGIs 4 Citizens 5 NGOs/Nature/Youth/Women organizations
7	Protect Ban	Watersheds	<ul style="list-style-type: none"> - Through simple vegetative measures ensuring maximum soil cover - Moisture absorption, water recharge, biomass and biodiversity enhancement along with organic farming 	<ol style="list-style-type: none"> 1 Basin Management Committees 2 Panchayat 3 Farmers 4 Citizens 5 NGOs/Nature/Youth/Women organizations
8	Ban	Untreated Industrial & Municipal Effluents in Watersheds	<ul style="list-style-type: none"> - Degrade the watershed - untreated pollutants cause eutrophication - Create dead zones in river mouths - Severe impacts on economic activities like fishing, agriculture & drinking water 	<ol style="list-style-type: none"> 1 Pollution Control Board 2 Department of Industries 3 Panchayat
9	Educate	Organic Farming & Use of Organic	<ul style="list-style-type: none"> - Long-term gains & advantages of organic farming - Safe living environment 	<ol style="list-style-type: none"> 1 Panchayat 2 Farmers 3 Department of Agriculture

#	Action	Problem	Reason	Stakeholder/s Involved
		Fertilizers & Pesticides		4 NGOs/Nature/Youth/Women organizations 5 Professionals 6 Institutions
10	Educate	Key Watershed Linkages	- About integrated land & water management - About link between upstream land, water use & downstream impacts - About roles & responsibilities & multiplicity of stakeholders	1 Three-Tier Panchayats 2 Farmers & Planters 3 Department of Irrigation 4 Department of Agriculture
11	Educate	Farmers & Property Owners about Micro-watershed	- About appropriate farming practices - About site designs - About best management practices	1 Panchayat 2 Farmers 3 Property Owners
12	Educate	LSGIs about Sub-watershed	- Stream classification & its significance - About best management practices	Three-Tier Panchayats

Table 7.18: Action Plan - Sectoral & Fund Integration

#	Sector in LSGIs Plan	Schemes & Funds			
		Panchayat/s	Block	District	Other Schemes/Funds
Productive					
1	Organic Farming	Annual Plans & Schemes	Annual Plans & Schemes	Annual Plans & Schemes	
2	Watershed Protection & Management	Annual Plans & Schemes			
Service					
3	Conscientize Organic Farming	- Schemes - Three-tier - Integration	-Schemes -Three-tier Integration	- Schemes - Three-tier - Integration	
4	Conscientize Watershed Land-Water Linkages	- Schemes - Three-tier - Integration	-Schemes -Three-tier -Integration	-Schemes -Three-tier -Integration	
5	Conscientize Site Designs	- Schemes - Three-tier - Integration			
Infrastructure					
6	Water Treatment Plants	Annual Plans & Schemes			
7	Waste Management Plants	Annual Plans & Schemes	-Schemes -Three-tier- -Integration	-Schemes -Three-tier -Integration	

Conscientize = to educate (someone) about, or raise awareness (in someone) of, an issue or idea

Table 7.19: Action Plan - Inter-Sub Matrix Linkages

#	Watershed Outside Forested Areas	Sub Matrix Linkages	Role in Basin Management
1	Watershed: Typology & Characteristics	Physical Characteristics Water Yield	Basin Management Water Flow & Runoff Water Balance
2	Soil Erosion	Physical Characteristics Agriculture Economic Characteristics Education	Basin Management Water Flow & Runoff
3	Water Quality	Economic Characteristics Employment Water Uses Education	Basin Management Impact & Pressures Analysis Water Balance
4	Watershed Linkage	Physical Characteristics Land-Water Linkages Upstream-Downstream Linkages Education	Basin Management
5	Sub & Micro Watersheds	Physical Characteristics Economic Characteristics Education	Basin Management Impact & Pressures Analysis

**Table 7.20: Eco-Bio-Enviro Factor-Pollution Load ¹
(Sample)**

Data, Source & Method							
#	Data Requirements			Secondary Data		Primary Data	
	Source	Typology	Quantity	Source	Date	Method	Date
1	Agricultural	a Typology of Chemical Fertilizers b Typology of Chemical Pesticides		1 Department of Agriculture 2 Pollution Control Board 3 Traders 4 Farmers' & Planters' Records 5 Institutions for Scientific Studies/Reports 6 Panchayat Records		Survey RRA	
2	Livestock Farming	a Typology of Liquid Waste b Typology of Solid Waste		1 Department of Agriculture 2 Department of Dairy Development 3 Department of Industries 4 Farm Records 5 Panchayat Records		Survey RRA Mapping	
3	Industrial	a Typology of Industrial Chemicals Used b Typology of Effluents Discharged c Typology of Solid Waste		1 Department of Industries 2 Pollution Control Board 3 Traders 4 Industry Records 5 Panchayat Records		Survey RRA Mapping	
4	Service Industries	a Typology of Liquid Waste b Typology of Solid Waste		1 Department of Industries 2 Pollution Control Board 3 Industry Records 4 Panchayat Records		Survey RRA Mapping	
5	Municipal, Sanitary & Sewage	a Typology of Liquid Waste b Typology of Solid Waste		1 Town Planning Records 2 Panchayat Records 3 Records on Urban Settlements 4 Records on Slums		Survey RRA Mapping	

¹ Sample assuming the General Pollution Load Trends in Kerala Water Bodies

#	Data Requirements			Secondary Data		Primary Data	
	Source	Typology	Quantity	Source	Date	Method	Date
6	Impacts–Surface Water Sources			1 Kerala Water Authority 2 Department of Irrigation 3 Pollution Control Board 4 Panchayat Records		Survey RRA	
7	Impacts – Ground Water			1 Kerala Water Authority 2 Department of Irrigation 3 Pollution Control Board 4 Panchayat Records		Survey RRA	
8	Impacts - Habitats			1 Colleges & Universities 2 CMFRI 3 Department of Forests		Survey RRA	
9	Impacts - Wildlife			1 Department of Forests 2 KFRI		Survey RRA	
10	Impacts – Health			1 Department of Health 2 Hospital & Primary Health Centre Records 3 Records on Waterborne Diseases 4 Panchayat Record		Survey RRA	

Table 7.21 : Pollution Load - Data Summary

#	Source	Typologies										
		Type	Quantity (Ton)	Type	Quantity (Ton)	Type	Quantity (Ton)	Type	Quantity (Ton)	Type	Quantity (Ton)	Total (Ton)
1	Agriculture											
	a Chemical Fertilizers											
	b Chemical Pesticides											
2	Livestock Farming											
	a Liquid Waste											
	b Solid Waste											
3	Industry											
	a Chemical Raw Materials											
	b Effluent Discharge											
	c Solid Waste											
4	Service Industry											
	a Liquid Waste											
	b Solid Waste											
5	Municipal, Sanitary & sewage											
	a Liquid Waste											
	b Solid Waste											

Table 7.22: Pollution Load - Impacts

#	Source	Concerns				
		Surface Water	Ground Water	Habitats	Wildlife	Health
1	Agriculture					
	a Chemical Fertilizers					
	b Chemical Pesticides					
2	Livestock Farming					
	a Liquid Waste					
	b Solid Waste					
3	Industry					
	a Chemical Raw Materials					
	b Effluent Discharge					
	c Solid Waste					
4	Service Industry					
	a Liquid Waste					
	b Solid Waste					
5	Municipal, Sanitary & Sewage					
	a Liquid Waste					
	b Solid Waste					

Table 7.23: Pollution Load - List of Maps

#	Pollution Load	Maps
1	Effluent Discharge Points	Area Number(s) Type of Effluent Spread of effluent
2	Solid Waste Dump Yards/Sites	Area Number(s)
3	Drainage & Storm Water Runoff	Type(s) of Solid Wastes Location Numbers

Table 7.24: Action Plan - Interventions²

#	Action	Problem	Reason	Stakeholder(s) Involved
1	Regulate	Chemical Fertilizer and Pesticide Use	1 Hazardous agricultural practice 2 Regulation time required to roll back to organic farming & fertilizers	1 Department of Agriculture 2 Farmers & Planters 3 Panchayat
2	Regulate	Untreated Water Discharge of Industrial/Service Industries	1 Carry potential Pollutants 2 Could contain pathogens, which is harmful to humans or plants	1 Panchayat 2 Pollution Control Board 3 Industries
3	Regulate	Dumping of Non-degradable materials (eg: Plastic Carry Bags, wrappers & packing, etc.) in and around Waterbodies	1 Impacts water flow 2 Contaminates water 3 Affects plant and animal life	1 Panchayat 2 Domestic & Industrial Waste Management Experts 3 Citizens Basin 4 Management Committees
4	Restore	Organic Agricultural Practices	1 No chemical fertilizer inputs 2 Enhance soil fertility 3 Provide poison-free products	1 Department of Agriculture 2 Farmers & Planters 3 Panchayat

² Assuming the general pollution trend in Kerala Waterbodies

#	Action	Problem	Reason	Stakeholder(s) Involved
			4 Reduces pollution load on water bodies 5 Ensures cleaner and healthier water bodies	
5	Protect	River Basin & Other Waterbodies	1 There is only limited supply of fresh water on earth 2 Living organisms need fresh water 3 Most economic activities are dependent on river basins and waterbodies	1 Basin Management Committees 2 Three-tierLSGIs 3 Citizens 4 District Collector 5 Department of Agriculture 6 Department of Irrigation 7 Department of Industries 8 Department of Tourism 9 Pollution Control Board
6	Protect	Habitats & Wildlife from Effluents	1 Habitats co-ordinate different functions of the River Basin 2 Wildlife are integral part of the food-chain Habitats and wildlife possess 3 Immense scenic and aesthetic beauty	1 Basin Management Committees 2 Panchayat 3 Department of Forests 4 Educational Institutions 5 Nature Clubs & Wildlife Enthusiasts 6 Citizens
7	Ban	Industrial and other Effluent Discharge in Water Bodies	1 Contaminates water & waterbodies 2 Makes it unsafe for human & other animal use 3 Fatal to fish aquatic vertebrates & invertebrates 4 Potential health hazards	1 Pollution Control Board 2 Department of Industries 3 Panchayat 4 Peoples Forum & NGOs
8	Ban	Waste Dumping in and around Waterbodies	1 Pollutes waterbodies 2 Seepage to waterbodies 3 Seepage to groundwater	1 Panchayat 2 Industries 3 Farm Owners 4 Citizens
9	Ban	Chemical Fertilizer Use	1 Reduces soil fertility 2 Affects micro-organisms 3 Pollutes waterbodies 4 Adverse impacts on health	1 Department of Agriculture 2 Farmers & Planters 3 Panchayat
10	Ban	Chemical Pesticides	1 Pollutes air & water 2 Acute direct human health issues 3 Fatal impacts on animal & plant life	1 Department of Agriculture 2 Farmers & Planters 3 Panchayat
11	Educate	Use of Organic Fertilizers & Pesticides	1 Long-term gains & advantages of organic farming 2 Safe living environment	1 Panchayat 2 Farmers 3 Dept of Agriculture 4 NGOs, SHGs, Nature/ Youth Clubs 5 Professionals 6 Institutions
12	Educate	Domestic Waste Management systems	1 Clean & healthy homes 2 Prepare bio-manure for home gardens	1 Households 2 Panchayat 3 NGOs, SHGs, Nature/ Youth Clubs

#	Action	Problem	Reason	Stakeholder(s) Involved
13	Educate	Manufacture of Bio-degradable materials and Packing Materials	1 Alternative to non-degradable plastic carry bags 2 Income generation	1 Households 2 Panchayat 3 NGOs, SHGs, Nature/ Youth Clubs

Table 7.25: Action Plan - Sectoral & Fund Integration

Sector in LSGIs Plan		Schemes & Funds			
#		Panchayat/s	Block	District	Other Schemes/Funds
	Productive				
1	Agriculture Bio-Fertilizers	- Annual Plans - Integration	-Annual Plans - Integration	- Annual Plans - Integration	
2	Eco-friendly Industrial Products	Annual Plans			
3	Bio-Packing Manufacture	Annual Plans			
4	Degradable Waste Bins & Holders	Annual Plans			
5	Basin Management	Annual Plans			
	Service				
6	Educate Workers Health Issues	- Common Project			
7	Educate Industrial Best Practices	- Common Project			
8	Educate Agriculture Best Practices	- Common Project			
9	Educate Waste Management Best Practices	- Common Project			
	Infrastructure				
10	Water Treatment Plants	- Common Project - Integration	- Common - Project - Integration	- Common - Project - Integration	
11	Waste Management Plants	- Common Project - Integration	- Common - Project - Integration	- Common - Project - Integration	

Table 7.26: Action Plan - Inter-Sub Matrix Linkages

#	Pollution Load	Sub Matrix Linkages	Role in Basin Management
1	Pollution (All Types)	1 Physical Characteristics 2 Biological Characteristics 3 Hydrological Characteristics 4 Economic Characteristics 5 Social Characterization	1 Basin Management Impact & Pressures Analysis 2 Water Quality 3 Flora, Fauna Status 4 Environmental Standards
2	Agriculture Pollution	1 Basin Dependent Agriculture 2 Employment 3 Workers Health, Education	1 Basin Management Impact & Pressures Analysis 2 Analysis 3 Assessing overall Basin Dependent 4 Employment, Health
3	Industrial Pollution	1 Basin Dependent Industries 2 Employment 3 Workers Health 4 Education	1 Basin Management Impact & Pressures Analysis, 2 Analysis, 3 Assessing overall Basin Dependent 4 Employment, Health
4	Municipal, Sanitary & Sewage	Planning Education	1 Basin Management Impact & Pressures 2 Analysis, 3 Role of LSGIs

**Table 7.27: Economic Factor-Sand Mining¹
(Sample)**

Data, Source & Method					
#	Data Requirements	Secondary Data		Primary Data	
		Source	Date	Method	Date
1	Mining Area	1 Kerala Protection of River Banks and Regulation of Removal of Sand Act, 2001 2 Panchayat Records 3 Department of Geology 4 District Expert Committee Reports 5 Institutions for Scientific Studies/ Reports 6 Legal Records, Judgments, Objections		Survey Mining Area RRA (Mining timings, Unauthorized mining areas, local objections) Mapping Mining Area	
2	Sand Audit Reports	1 Panchayat Records 2 Institutions for Scientific Studies/ Reports			
3	Employment & Income	1 Panchayat Records 2 Employee Union Records		Survey RRA (Validation, verification purposes)	
4	Revenue from Sand Mining to LSGIs	1 Panchayat Revenue Records 2 Panchayat Check Post Records 3 Income & Expenditure Audit Reports			
5	River Management Funds	1 District Collector 2 Panchayat Records 3 Income & Expenditure Audit Reports			

Table 7.28: Sand Mining-Data Summary

#	Total Sand Mining Area		Sand Audit Report(s)		Total Employment & Wages (No. & Rs)				Revenue LSGIs		River Management Fund	
	No of Kadavu	Area	For Each Kadavu	Total	Male	Female	Total	Rs	Total sand mined/ auctioned	Rs	LSGIs Share (Rs)	Total (Rs)
1												
2												
Total												

Table 7.29: Sand Mining-List of Maps

#	Data Requirements	Particulars	Remarks
1	Mining Area(s)	Region Number of Kadavu with names	
2	Mining Area(s)	Approach Road(s) with names	
3	Mining Area (Unauthorized)	Region, Number, Name and approach Roads with Names	
Total			

¹ Sample considering sand mining related issues are important to LSGIs

Table 7.30: Action Plan-Interventions²

#	Action	Problem	Reason	Stakeholder/s Involved
1	Regulate	Overall Sand Mining Activities	1 Mining/Constructions lobbies and Thugs rule this 2 Total Unscientific Extraction Practices	1 District Collector 2 Police 3 Panchayat 4 Workers 5 Peoples' 6 Committees Local NGOs
2	Regulate	Revenue from Sand Mining	1 LSGI's Excessise & Effortless Dependency 2 Revenue Earned from Over exploitation of Natural Resource 3 LSGI's tendencies to move away from Genuine Productive & Environment Friendly Income Generation Sources	1 Government of Kerala 2 Panchayat 3 Peoples' Forums Women's & Youth Forums 4 Alternative Income Generation Advisors & Management Groups
3	Regulate	Mining	1 Absence of Audit/Scientific Study about Sand Deposits and Health of <i>Kadavu</i> 2 Absence of Basin Management Report	1 District Collector 2 Panchayat 3 Scientific Institutions/ Communities 4 River Management Committees
4	Restore	Sand Deposit River Bed	Based on Audit/Scientific Study about Sand Deposits and Health of <i>Kadavu</i> Based on Audit/Scientific Study about	1 District Collector 2 Panchayat 3 River Management Committees
5	Protect	River Bed <i>Kadavu</i>	Sand Deposits and Health of <i>Kadavu</i>	1 District Collector 2 Panchayat 3 River Management Committees
6	Protect	Employment & Workers	During Mining Regulation or Ban based on Basin Management Report	1 District Collector 2 Panchayat 3 River Management Committees 4 Workers Union 5 Workers Families
7	Protect	LSGIs Revenue	During Mining Regulation or Ban based on Basin Management Report	1 Government of Kerala 2 Panchayat all Tiers 3 River Management Committees
8	Ban	Mining Time Violations	1 Affects River Health 2 Accident Possibilities and threat to Workers Lives	1 District Collector 2 Panchayat 3 Police 4 River Management Committees
9	Ban	Sand Mining	1 Acute Basin Health issues 2 On Recommendation of Basin Management Report	1 Government of Kerala 2 District Collector 3 Panchayat 4 Police 5 River Management Committees Workers Unions

² Sample Assuming the general trend in Kerala Sand Mining

#	Action	Problem	Reason	Stakeholder/s Involved
10	Educate	About Natural Resources and Basins – Protection & Purpose	Callousness and Indifference towards Common Property Resources	1 Elected Representatives 2 Panchayat & Working Staff 3 River Protection Committees 4 Workers & Families 5 Youth 6 Local NGOs 7 Specialized Institutions

Table 7.31: Action Plan - Sectoral & Fund Integration

#	Sector in LSGIs Plan	Schemes & Funds			
		Panchayat/s	Block	District	Other Schemes/Funds
Productive					
1	Employment	Annual Plans			
2	Basin Management	Annual Plans	Common Project	Common Project	
Service					
3	Workers Health Issues	- Projects - Integration	- Projects - Integration	- Project - Integration	
4	Conscientiz-ation Basin Health	- Projects - Integration	- Projects - Integration	- Projects - Integration	
Infrastructure					
5	<i>Kadavu</i> Approach Roads Maintenance	Common Projects			

Table 7.32: Action Plan - Inter-Sub Matrix Linkages

#	Sand Mining	Sub Matrix Linkages	Role in Basin Management
1	Sand Mining	1 Physical Characteristics 2 Biological Characteristics 3 Hydrological Characteristics 4 Eco-Bio-Environmental Characteristics 5 Social Characteristics	Basin Management Impact & Pressures Analysis
2	Employment & Workers	1 Agricultural Workers, Industrial Workers, Mining Workers	Assessing Overall Basin Dependent Employment & Worker Pressure
3	Mining Revenue	1 LSGIs Revenue 2 Agriculture 3 Industry 4 Mining 5 Services	LSGIs Basin Dependent Overall Revenue

Table 7.33: Economic Factor - Rice Farming¹
(Sample)

Data, Source & Method					
#	Data Requirements	Secondary Data		Primary Data	
		Source	Date	Method	Date
1	Population and Demography	Census Report	2011	Survey	
2	Education	1 Census Report 2 Department of Education 3 Panchayat Records		Survey	
3	Health	1 Department of Health 2 Primary Health Centre 3 Panchayat Records		Survey	
4	Area under Rice Farming	1 Department of Agriculture 2 Panchayat Records, Maps		1 Survey 2 Mapping 3 RRA (History)	
5	Rain - fed and Irrigated Areas	Department of Agriculture		1 Survey 2 Mapping 3 RRA (History)	
6	Crop Varieties	Department of Agriculture		1 Survey 2 RRA (History)	
7	Cropping Season and Patterns	Department of Agriculture		1 Survey 2 RRA (History)	
8	Dependent Population (Agriculture Labourers)	Panchayat Records		Survey	

Table 7.34: Demography & Farming - Data Summary

#	Total Population (Rice Farming)			Demography (All Features)	Total Area under Rice Farming (In Ha)	Irrigation Type & Area				Crop Varieties & Area (In Ha)			Cropping Season & Pattern		Dependent Population			
	Male	Female	Total			Rain-fed	Well	Canal	Others	1	2	3	Months	Type	Male	Female	Total	
1																		
2																		

Table 7.35: Rice Farming - Data Summary

#	Farming Area	Data	Remarks
1	Area under Rice Farming	Region Number of Plots Crop Variety Season Cropping Pattern	
2	Rain- fed Area	Region Number of Plots Crop Variety Season Cropping Pattern	

¹ Sample Considering Rice Farming Related Issues are Important to LSGIs

#			Remarks
3	Irrigated Area	Region Number of plots Type – well, ponds, canals, others Crop Variety Season Cropping Pattern	
4	Settlement Pattern	Region Area Proximity to Basin	

Table 7.36: Action Plan - Interventions²

#	Action	Problem	Reason	Stakeholder/s Involved
1	Regulate	Paddy Land Conversion	Drastic fall in Paddy cultivation in the state	1 Panchayat 2 Paddy Land Owners
2	Regulate	Basin Water Dependency	Reduced flow in rivers	1 Farmers 2 Panchayat 3 Department of Irrigation
3	Restore	Watersheds Soil fertility	1 Land filling of watersheds 2 Land conversion 3 Soil erosion	1 Panchayat 2 Farmers 3 Department of Agriculture 4 Department of Soil Conservation
4	Protect	Local Crop Varieties	1 Local varieties have more adaptability 2 Less Water Intensive	1 Farmers 2 Department of Agriculture
5	Ban	Pesticides Chemical Fertilizers	1 Health hazards 2 Soil and water contamination 1 Better Economic Sense	1 Farmers 2 Panchayat 3 Traders
6	Educate	1 Optimum Yield without Pesticide Management 2 In situ Generation of Organic Manure 3 More Crop per Drop through Improved Water Use Efficiency	2 Better Watershed Management	1 Panchayat 2 Farmers 3 Department of Agriculture 4 NGOs 5 Professionals

² Assuming general trend in Kerala Rice Farming

Table 7.37: Action Plan - Sectoral & Fund Integration

#	Sector in LSGIs Plan	Project & Funds			
		Panchayat/s	Block	District	Other Schemes/ Funds
Productive					
1	Rice Farming	Annual Plan & Project			
2	Watershed Management	-Annual plan -Integration	-Projects -Integration	-Projects -Integration	
Service					
3	Conscientization on Rice Farming & Management Techniques	-Projects -Integration	-Projects -Integration	-Projects -Integration	
Infrastructure					
4	Measures to Prevent Land filling & Soft Options for Soil Erosion	-Projects			

Table 7.38: Action Plan - Inter-Sub Matrix Linkages

#	Rice Farming	Sub Matrix Linkages	Role in Basin Management
1	Population Including Dependent Population	Economic Characterization Geographic Characterization	Assessing overall basin population, pressure
2	Land use	Economic Characterization Geographic Characterization Other agricultural land use	Total Agricultural Land Use Basin Land Management
3	Watershed	Hydraulic Characterization Water use & irrigation	Total water availability, Water Balance and Basin Management

Section III
Governance

Chapter 8

Governance

- ▶ **Stakeholders**
- ▶ **Governance System**
- ▶ **Participatory Framework**
- ▶ **Monitoring**

8 Stakeholders

8.1 Introduction

Basin Management is the art of stakeholder participation and informed consensus. As water managers, LSGIs need to identify all stakeholders in the basin during pre management plan preparations and involve them in the BMP process. This shall help them realize the complexities of basin conservation and resources as they get hands-on experience of the overall status of the basin. Later, as basin management, resource use and conservation strategies are planned, this experience may come of good use.

8.1.1 Redefine Stakeholders?

People and institutions that have interest in the use of water and other resources come under the category of stakeholders. Communities that lived along the basin had enjoyed the resources uncontested in earlier times in the form of traditional or customary rights. But as new user groups emerge, there is severe erosion of rights to the local community in a gamut of resources. It is therefore strongly recommended to determine user right priorities. Traditional water and resource use groups such as farmers, fisher people, basin dependent tribal communities etc should be identified and bestowed with the first-right-user category.

Irrespective of the category, a critical point to drive home is that if stakeholders enjoy rights they also have responsibilities. Every user group is bound to shoulder responsibilities. Their commitment to the basin is not just in resource dependence or in resource exploitation but also in basin conservation. Based on resource exploitation and its impact, the BMP would provide measures for mitigation and responsibilities to the stakeholders.

8.1.2 Limiting Factor in the System of Resource Management

The practice of natural resource distribution prevalent today are; (a) Resource is allocated but without resource management, (b) There are licensing authorities but no resource managers. Natural resources especially water based resources are live illustrations of this practice. Licenses and permits for resource exploitation are issued irrespective of resource sustenance. Transparency and public consultation are also absent while flouting of rules and regulations are alarmingly high. Resource management is about rational distribution, regulation and corrective measures that custodians and authorities should insist upon.

8.1.3 Challenges to LSGIs

In managing a basin, the LSGIs are to face all disadvantages inherent to both Open Access Resources and also to Common Property Resources. Exploitation, especially that of fresh water resources, is at an all time high as the requirements of new generation service and infrastructure industry are mounting every day. Even the custodians (LSGIs and State Government) are unable to resist the temptation as in the case of increased sand mining permits granted to every Grama Panchayat and the revenue accrued. Our rivers and basins have increasing numbers of stakeholders and claims on its resources. The dynamic data generation provides the plethora of economic activities in and around the basin.

The LSGIs need to therefore critically contemplate resource claims. To distribute resources rationally while maintaining the optimum basin level and basin health, will be a tight rope walk to the LSGIs. They may have to consider regulating or even banning activities if the need arises. Managing common property resources or open access resources are diametrically opposite to ownership defined private property.

The six characterizations and their sub factors provide an in-depth scientific insight to what constitutes a basin. (Ref: Section I) What it signifies is that there are a whole range of scientists, experts, technicians and planners involved in translating it into the realm of action. Each

Box 2

Who is a stakeholder?

Can all Stakeholders be equal?

Can all stakeholders hold same rights?

Do stakeholders have responsibilities too?

Box 3

Property Regimes

Open-access resources are those that can be accessed by anyone at any time without restraint. When the resource is abundant relative to the demand for it, an open-access regime may not only be unproblematic, it may actually be the best management regime since it involves so little oversight.

However, when the resource is scarce, open-access resources may be subject to excessive use. Since the user's claim over the resource is only established by "the rule of capture", users have an incentive to harvest as much as they can as rapidly as they can. Instead of more conservative behavior preserving the resource in this circumstance, it could simply lead to resource degradation as other users simply increase their share.

Open-access resources should be distinguished from common-property resources. Common-property resources may allow many users to share the resource, but they may also do so in a way that restricts access (either formally or informally) to levels that are sustainable.

The Encyclopedia of Earth

stakeholder resource-demand would require the assistance of one or several of these expertises to gauge the impact on the resource and to the overall basin. The sub-matrix linkages of each factor justify this. (Ref: 3.2 in Section II)

LSGIs would require strong backing of experts to consult on different issues bound to arise in basin management. As shall be evidenced during preparation of the management plan, these issues could be related to basin health, its resources, environmental and conservation laws, best practices in agriculture, fisheries, service industries and water management etc. Decision making will have to be strictly through consultative process, acceptable to all. LSGIs are bound to adhere to this to make sure that their decisions are not challenged as unapprised and/or as out of ignorance.

8.2 Governance Structure

A new governance structure for basin management has to go hand in hand with the spirit of local governance prevalent in the state. Such a structure should also be capable of implementing the recommendations of the BMP effectively. Informed decision making, functional transparency and monitoring needs to be incorporated into the new governance structure. LSGIs have to take into consideration the demands of stakeholders, create new revenue generating models and simultaneously conserve the basin health, through consensus.

8.2.1 Seeds of New Resource Governance

Fresh water is a precious resource with significant pressures on its availability. There is only 0.3 percent (less than 1 per cent) surface water flowing through rivers and lakes on earth! (See Box 3) This scare resource is vital for the existence of all living beings; plants, animals, humans included. The threat to this precious resource is further magnified by the increasing number of stakeholders competing for the same resources. The resource management ought to reflect these complexities. Unless implemented scientifically, conceiving a viable governance system that addresses all interests including that of the basin for long-term sustenance will be an uphill task for water managers.

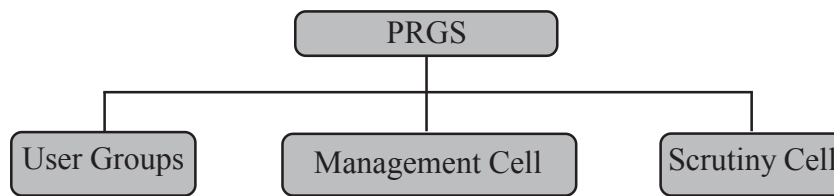
LSGIs while representing the management of basin and its resources should take into account all stakeholders involved their resource interests and stakes. They should rise to the level of resource managers willing to learn the nuances of the water body and of new management practices.

Stakeholders need to be thoroughly educated in areas other than in their interest of resource exploitation. They need to be apprised about their responsibilities, institutional and legal aspects of water and of resource management.

Taking these factors into consideration, the Manual proposes a Participatory Resource Governance System (PRGS) (Fig:12) with a three-tier representation to Basin Management: a User Group constituting all stakeholders, a Management Cell whose main representation shall be LSGIs through its elected representatives, and a Scrutiny Cell consisting of experts from various disciplines. It keeps the custodianship of the LSGI intact while accommodating representation for all beneficiary stakeholders.

Box 4
<p>Where is all of the Earth's water?</p> <p>The ocean holds 97 percent of the Earth's water!</p> <p>The remaining three percent (3%) is fresh water found in glaciers and ice, below the ground, or in rivers and lakes.</p> <p>Of the three percent of the water that is not in the ocean, about 69 percent is locked up in glaciers and icecaps. Ninety percent of that frozen water is in Antarctica and about nine percent covers Greenland.</p> <p>Of the remaining fresh water, 30 percent of it is groundwater, captured below our feet.</p> <p>About 0.3 percent is found in rivers and lakes.</p> <p>This means that the water source we are most familiar with in our everyday lives, rivers and lakes, accounts for less than one percent of all <i>freshwater</i> that exists on Earth.</p> <p>A very small percentage of water (0.1 percent of all water) is also found in the atmosphere.</p> <p style="text-align: right;"><i>National Ocean Service</i></p>

Fig 12: Constituents of PRGS



8.2.2 User Group

The user group will consist of members who, as a general rule, have an interest in the basin resources. But as stated earlier, such user groups have to be segregated as traditional rights and non-traditional user groups. Members of farming community, fisher folk, resource dependent tribal community etc, are users with traditional/customary rights. These traditional water users, with livelihood dependency on the basin, shall be given first-user priority. Industries, mining, water packaging services, tourism and a plethora of others shall constitute users with non-traditional/non-customary interests.

Table 8.1: User Group Membership¹

Traditional/Customary User Groups	Non Traditional/Non Customary User group
1. Farmers	1. Mining (Basin Specific)
2. Fisher folk	2. Industries (Basin Specific)
3. Tribes	3. Water Packaging and Soft drink Industry
4. Basket/Mat weavers	4. Distilleries
5. Potters	5. Tourism
6. Weavers	6. Water Theme Parks
7. Others	7. Hospitals
8.	8. Textiles
9.	9. Tanning
10.	10. Clay and Tiles Industries
11.	11. Agro Industries
12.	12. Others

8.2.3 Management Cell

The LSGIs shall head this cell as water bodies in the state have been transferred and vested in them². *(For a detailed account of LSGIs Rights & Responsibilities Ref: Annexure I)* It is suggested that each LSGI select/elect a team to their representation. Elected representatives from all basin wards must represent the team. LSGIs can also nominate officials/people with expertise, concern for basin health, resources and peoples' interests.

Apart from LSGIs, the cell will also consist of representatives from selected government departments such as the Department of irrigation, revenue, agriculture, fisheries etc. The representation of these departments in the management cell is due to the fact that these government bodies have traditionally been involved in the administration of the water resources.

Table 8.2: Management Cell Membership³

Traditional/Customary User Groups	Non Traditional/Non Customary User group
1 Elected Ward Representative	1 Revenue
2 Elected Ward Representative	2 Irrigation
3 Elected Ward Representative	3 Agriculture
4 Other Nominees	4 Fisheries
5	5 Others

¹ These are indicative; characterization process will list actual number of users in LSGI

² *'All public water courses the beds and Banks of river streams lakes, back waters and water courses and all standing and flowing water, springs, reservoirs, and also any adjacent land, not being private property appertaining there to shall stand transferred to and vest absolutely in the village panchayat/ the Municipality' [Panchayat Raj Act:218, 218(2) & Municipality Act: 208, 208(2)]*

³ This are indicative, characerization process shall list actual management cell members

8.2.4 Scrutiny Cell

Membership to this cell is considered voluntary. The members shall be selected based on the uses the basin is put into and also the conservation needs that the Basin Management Plan identifies. They shall be neutral, with allegiance only to the basin. Two sets of membership is considered in the scrutiny cell; the first consisting of different expertise and the second that shall bring in local interests and wisdom. Experts on river basin, women studies, environmental scientists, educationalists, legal experts, specialists in organic farming, sociologists, economists and experts required to tackle other identified issues shall represent the former. While members from nature clubs, women's groups, non-governmental organizations and community elders shall form the latter. In the interest of the basin, it is desirable that the scrutiny cell members are chosen in consensus with both User Groups and the Management Cell. The composition of this group and their terms in office etc can be worked out through consultative processes.

Table 8.3: Scrutiny Cell Membership⁴

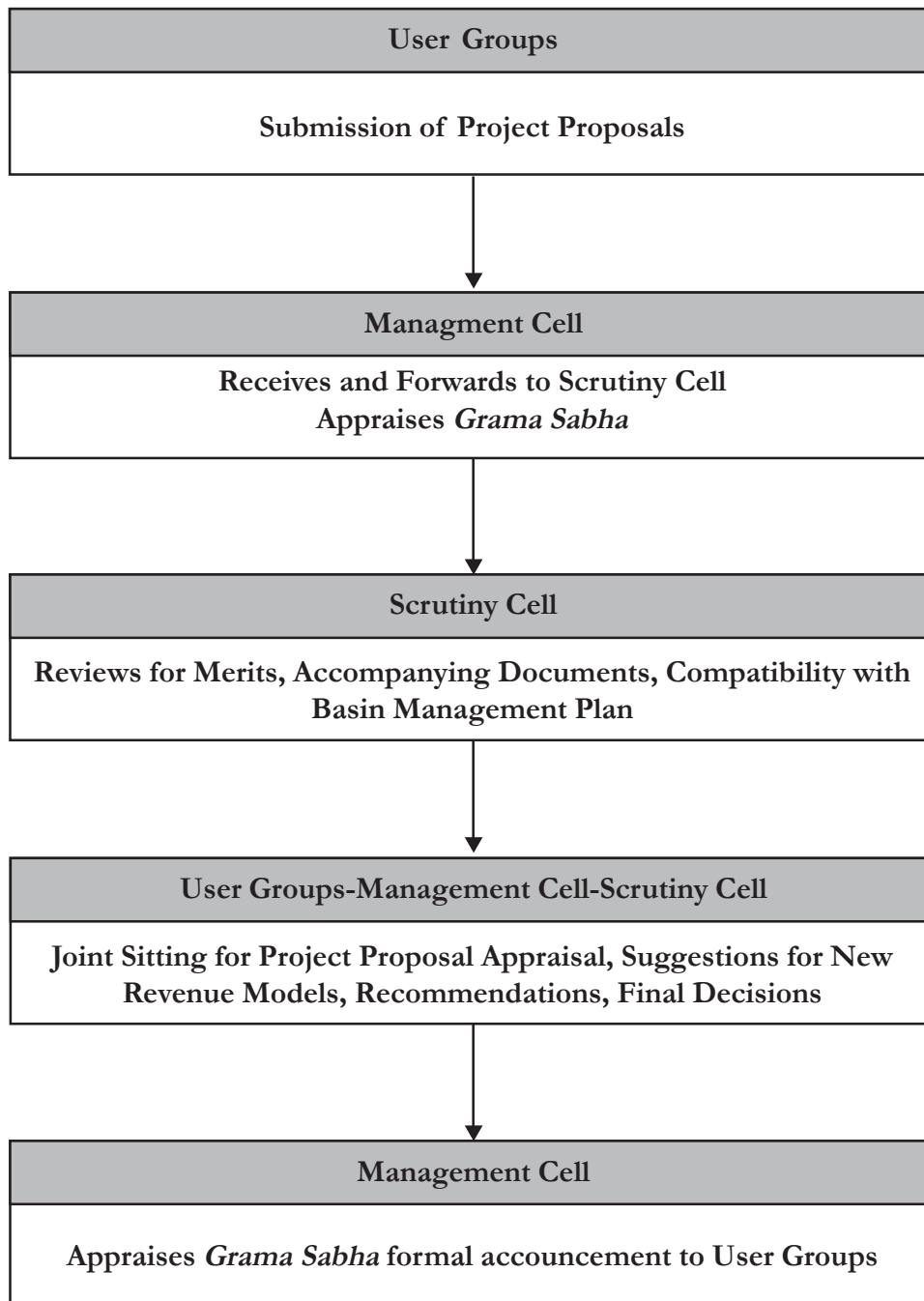
Expert Representatives	Local Representatives
1 Hydrologists	1 Nature Club
2 Economist	2 Youth Clubs
3 Environmental Scientist	3 Women's Group
4 Women studies	4 Local History and Tradition
5 Social Scientists	5 Non Governmental Organization
6 Medical Practionars	6 Others
7 Agriculture Experts	
8 Service industry Experts	
9 Legal & Environmental Law Experts	
10 Others	

8.3 Mode of Operations

User Group project proposals shall be submitted to the Management Cell. The management cell in turn shall forward this to the Scrutiny Cell members based on the type of projects. Simultaneously, the *Grama Sabha* shall be apprised about the proposals. The Scrutiny Cell members shall review the proposals, their merits, accompanying documents like environmental clearance and deliver their recommendations. It is based on their guidance that the Management Cell takes decisions. The process can be through a collective sitting of all three groups. The three-tier system can arrive at a consensus on the periodicity for sittings and for the review process. The *Grama Sabha* shall be apprised of the decisions on all approved projects along with the grounds for approval and conditionality, if any.

⁴ Invitation to Scrutiny cell Membership shall be issue based

Fig 13. PRGS Decision Making Process



8.3.1 Transparency

It is obligatory that the general public is aware of the status of the basin. The basin management plan, sections relevant to each LSGI are to be in public domain.

LSGIs have to ensure access to the status of ongoing projects and decisions on new projects. It is important that the rationale for acceptance or rejection is public knowledge. Make public the revenue generated through resource allocation to various stakeholders.

All activities related to basin conservation, regeneration and education should be announced. The budget allocations, contributions from stakeholders and user groups shall also be made public. Ensure local participation in conservation activities, especially that of the youth and women.

8.3.2 Conflict Resolution

Disputes are inevitable mainly between the User Groups and the Management Cell. It is also possible that the Management Cell circumvents recommendations of the Scrutiny Cell.

At times of conflict between Management Cell and User Groups, the role of the Scrutiny Cell becomes significant. Their recommendations are guided by informed, scientific methods and also by experiences and collective knowledge. The Management Cell can rely on their recommendations as a sound basis for decision making and to ease out conflicts.

Disagreements between Scrutiny Cell and the other two are more crucial to Basin Management. For the latter the objective is resource extraction while the former intervene to rationalize the resource use.

External interventions could be a way out as a worst case scenario. There are several scientific bodies and institutions that the basin PRGS can rely upon. Agencies such as STEC, River Management Cell, Environmental Protection Cell, Coastal Management Authority etc, can be approached for conflicts that do not get resolved within the ambit of PRGS.

8.4 Monitoring

Monitoring mechanisms have to consider the diverse resource demand, extraction and its pressures on the basin, as well as the methods and practices of extraction. Recommendations from the BMP, towards the well-being of the basin shall be the cornerstone for monitoring. The monitoring shall focus on easing competition for basin resources and on prevention of practices that are detrimental to the basin and life forms. Teams could be constituted for long term monitoring and also on a case by case basis at times of conflict of interests. PRGS can initiate monitoring teams in consultation and advice of the Scrutiny Cell.

8.4.1 Monitoring: Resource Extraction Status

The BMP would provide the status list of all resource demand and quantum of extraction. It would also have calculated resource availability in the basin for each resource. The apprehension is about the tendency to extract resources 'as much as they can and as rapidly as they can'. In the mad chase for profit, future is seldom kept in mind. The intervention therefore is to monitor the present use keeping focus on reserves for future use.

8.4.2 Monitoring: Methods and Practices

Almost all human activity in and around the basin will need radical reorientation. This is applicable to agricultural practices, fishing methods, industries and tourism projects etc. Chemical fertilizers and pesticides in agriculture, fishing gears and seasonality, industrial pollutants, solid and liquid waste disposal from tourism projects etc are common hazardous practices to pin point. The monitoring has to verify the best practices and the hazard free land and water use by stakeholders.

8.4.3 Monitoring: Permanent Mechanisms

Keeping human economic interest aside, the basin has to sustain for its natural self. One of the paramount benefits of a Basin Management Plan is that the

Box 5

Transparency Hoardings in Public Places

- Detailing basin protection schemes LSGI has initiated
- Funds allocated for conservation
- Stakeholder contributions to basin health & conservation
- Visible/measurable changes to basin and surrounds

News Letter on Basin

Support local nature/youth club to publish news and initiatives on the basin

Box 6

Monitoring

- **Short Term**
 - Issues arising out of flash floods
 - Erosion of banks
 - Monsoon flooding impacts
 - Diseases & threats to fish and other aquatic life
- **Long Term**
 - Rehabilitation of near-bank settlements and encroachments
 - Soft options for bank protection
 - Basin friendly agricultural practice promotion
 - Planting and regeneration of riparian vegetation

basin and its natural constituents – Physical, Hydrological, Eco-Bio-Environmental – are translated for water managers, stakeholders and general public for practical understanding. Maintaining the basin in its natural self demands a holistic approach. There are short-term and long-term interventions to be made for the basin sustenance. Short-term interventions are those seeking quick mitigations of sudden and unprecedented happenings. Long-term on the other hand calls for detailed and in-depth planning for a healthy and free flowing basin.

8.5 Conclusion

Participatory Resource Governance System (PRGS) is an informed and rational consensus-driven approach to basin management. It balances short-term and long-term interests on resources. Lays down a platform for LSGIs to take the lead in the process and demand an enhanced level of custodianship. In order to be effective, such a system requires the stakeholders involved to cross the critical threshold of understanding resources. They have to shift from a narrow one-dimensional functional perspective on resources to a multi-dimensional living entity with larger implications to existence of all live beings. To enable this, LSGIs and the user groups have the opportunity to transcend their knowledge base and advance their learning through productive engagement within the PRGS.

A black and white photograph of a riverbank. In the foreground, there is a sandy or rocky shore with some debris. The middle ground shows a calm body of water. In the background, there is a dense line of trees and a small, simple wooden structure with a flat roof, possibly a boat house or a small hut, situated on the bank. The sky is bright, and the overall scene is peaceful and natural.

Annexures

- I Powers on Panchayat/Municipalities**
- II Address of Departments for Data**
- III Legal Instruments - Policies, Act & Rules**

Annexure I

Powers on Panchayat/ Municipalities Relevant for (River) Basin Management in Kerala

#	Rights & Responsibilities of the LSGIs	Relevance to (River) Basin Management	Remarks / Other Act & Rules	Kerala Panchayat Raj Act/ Rule	Kerala Municipality Act / Rule
1	(1) All public water courses the beds and Banks of river streams lakes, back waters and water courses and all standing and flowing water, springs, reservoirs, and also any adjacent land, not being private property appertaining thereto shall stand transferred to and vest absolutely in the Village Panchayat/ the Municipality.	All rights and liabilities of the Government in relation to River – are now transferred and vested with Grama Panchayat & Municipality	<i>i) 2. Definitions. - In this Act, unless the context, otherwise requires – (xxviii) 'water course' includes any river, stream or channel whether natural or artificial;</i> <i>ii) Note.-There is no Gazette Notified Rivers in the State , excluding it from the Jurisdiction of any Village Panchayat/ Municipality.</i>	CHAPTER XX PUBLIC SAFETY, CONVENIENCE AND HEALTH S.218. Vesting of watercourse, springs, reservoirs, etc., in Village Panchayats	S.208A. Transfer of water courses, springs, reservoirs, etc, to Municipalities
2	(2) Subject to the provisions of this Act, all rights and liabilities of the Government in relation to the water courses, springs, reservoirs vested in the Village Panchayat under subsection (1) shall from the date of such vesting be the rights and liabilities of the Village Panchayat.			S.218 (2)	
3	(4) It shall not be lawful for any person to remove or appropriate for himself any tree, earth, sand, metal, laterite, limestone or such other articles of value as may be notified by the village panchayat from any land which is transferred to or vested in the Village Panchayat, under this Act whether a poramboke or not except under and in accordance with the terms and conditions of a permit issued by the village panchayat in this behalf and on payment of such fees and compensation at the rate determined by the village panchayat.	Regulating public activities by prescribing terms and conditions		S.218 (4)	

4	<p>Functions of Village Panchayats/ Municipality</p> <p>A. Mandatory Functions.</p> <ol style="list-style-type: none"> 2. Protection of public lands against encroachment 3. Maintenance of traditional drinking water sources. 4. Preservation of ponds and other water tanks 5. Maintenance of waterways and canals under the control of Village Panchayats. <p>Municipality</p> <ol style="list-style-type: none"> 6. Collection and disposal of solid waste and regulation of liquid waste disposal. 7. Storm water drainage. 8. Maintenance of environmental hygiene. 6. Issue of licenses to dangerous and offensive trades 21. Providing bathing and washing ghats. 22. Provision for ferries. 	Protection /Preservation / Maintenance & Providing for public usability of River and the River basin	<p>166. Powers, duties and functions of village panchayat.</p> <p>68 [Provided that it shall be the duty of the village panchayat to render services to the inhabitants of the village panchayat area in respect of the matters enumerated as mandatory functions in the Third Schedule].</p> <p>30. Powers, functions and responsibilities of Municipality.</p> <p>— Provided that, it shall be the duty of the Municipality to render necessary service to the inhabitants of the Municipal area in respect of the matters enumerated as mandatory functions in the First Schedule];</p>	<p>THIRD SCHEDULE</p> <p>A. Mandatory Functions</p>	<p>FIRST SCHEDULE</p> <p>[See Section 30(1)]</p> <p>FUNCTIONS OF THE MUNICIPALITY</p>
5	<ol style="list-style-type: none"> 3b. 1. Collection and updating of essential statistics. 2. Organise voluntary workers and make them participate in collective activities. 6. Organise relief activities during natural calamities. 7. Inculcating environmental awareness and motivating local action for environmental upgradation 	Management action plan preparation by the Village Panchayath / Municipality	<p>166. Powers, duties and functions of village panchayat. It shall be the duty of the Village Panchayat to meet the requirements of the village panchayat area in respect of the matters enumerated in the Third Schedule:</p>	<p>THIRD SCHEDULE</p> <p>B. General Functions</p>	<p>FIRST SCHEDULE</p> <p>B. General Functions</p> <p>FIRST SCHEDULE C.</p>
6	<ol style="list-style-type: none"> 4a. 1. Utilise Governmental-non-Governmental technical expertise at block level. 2. Provide technical assistance to Village Panchayats. 3. Prepare schemes taking into consideration the schemes of Village Panchayats in order to avoid duplication and to provide backward forward linkage. 	<p>Block Panchayats are responsible -to provide backward, forward linkage in the Management Plan</p>	<p>172. Powers, duties and functions of block panchayats. - (1) 103] [It shall be the duty of the Block Panchayat to meet the requirements of the Block Panchayat area in respect of the matters enumerated in the Fourth Schedule.</p>	<p>FOURTH SCHEDULE</p> <p>[See Sub-section (1) of section 172] functions of Block Panchayats</p> <p>A) General Functions</p>	

7	<p>5a.</p> <ol style="list-style-type: none"> 1. Mobilisation of the technical expertise available from Government-non-Government institutions. 2. Provide technical assistance to Block Panchayats, Village Panchayats and Municipalities. 3. Prepare schemes after taking into account the schemes of the Village Panchayat and the Block Panchayat to avoid duplication and to provide forward, backward linkage 	<p>District Panchayats are responsible –to provide back ward, forward linkage in the management plan.</p>	<p>[FIFTH SCHEDULE][See Sub section (1) of Section 175] Functions of District Panchayats A) General Functions</p>	
8	<p>4a.</p> <ol style="list-style-type: none"> 1. <i>Agriculture</i> 1.2. Soil protection III. <i>Minor Irrigation</i> 1. Maintenance and implementation of all minor irrigation projects within the area of a Village Panchayat. 2. Implementation and maintenance of all micro irrigation projects. 3. Put into practice water conservation. 4. Implementation of ground water resources development IV. <i>Fisheries</i> 1. Development of fisheries in ponds, pisciculture in fresh water and brackish water and mariculture. 2. Improvement of fish seed production and distribution of offsprings. 3. Distribution of fishing implements. 4. Provide assistance for fish marketing. 5. Provide minimum basic facilities for fisherman families. 6. Implementation of fisherman Welfare Schemes. 7. Development of traditional landing centres. 8. Administrative control of fisheries schools. 	<p>Management functions and responsibilities of the Village Panchayath/ Municipality</p>	<p>THIRD SCHEDULE C. Sector-wise functions.</p>	<p>Sector-wise functions.</p>

	<p>V. <i>Social Forestry</i></p> <ol style="list-style-type: none"> 1. Growing trees for cattle feed, fire wood and growing of fruit trees. 2. Organise campaigns for planting of trees and to build environmental awareness. 3. Afforestation of waste land <p>XV/III. <i>Natural calamities Relief</i></p> <ol style="list-style-type: none"> 2. Conduct works relating to natural calamity. The work to compensate damages caused to the assets should be done by the respective Panchayats. 		Sl.no. XVIII.-there is no parallel provision in the Municipalities Act.	
9	<p>4b.</p> <ol style="list-style-type: none"> 1. <i>Agriculture</i> 4. Management of watersheds falling within the Block Panchayat area. <p>III. <i>Minor Irrigation</i></p> <p>Implementation and maintenance of all Lift Irrigation Schemes and Minor Irrigation Schemes covering more than one village panchayats.</p> <p>IV. <i>Fisheries</i></p> <p>Development of traditional landing centres.</p>		FOURTH SCHEDULE [See Sub-section (1) of Section 172] Functions of Block Panchayats (B)	FIFTH SCHEDULE [See Sub section (1) of Section 175] functions of District Panchayats (B) Sector wise Functions
10	<p>5b.</p> <ol style="list-style-type: none"> I. <i>Agriculture</i> 2. Integrated water-shed management in water sheds covering more than one block panchayat area. <p>III. <i>Minor Irrigation</i></p> <ol style="list-style-type: none"> 1. Development of ground water resources. 229 Substituted by Act 13 of 1999. 2. Construction and maintenance of minor irrigation schemes covering more than one block panchayat. 3. Command area development. <p>IV. <i>Fisheries</i></p> <ol style="list-style-type: none"> 1. Arrangements for fish marketing 2. Management of fish farm development agency. 			

	<p>3. Management of district level pisci-culture centres, net making units, fish markets, feed mills, ice plants and cold storages.</p> <p>4. Management of fisheries schools.</p> <p>5. Introduction of new technologies.</p> <p>6. Provide implements required for fishermen.</p> <p>7. Promotion of fishermen's co-operative societies.</p> <p><i>VII. Water Supply</i></p> <p>1. Implementation of water supply schemes covering more than one Village Panchayat.</p> <p>2. Taking over of water supply schemes covering more than one Village Panchayat.</p> <p><i>VIII. Electricity & Energy</i></p> <p>1. Taking over of micro-hydel projects.</p>	<p>Relevance in Basin Management for economic activities, water use</p>		
11	<p>239. Power of Panchayat for carrying out their functions. - (1) A Panchayat shall exercise all the powers conferred on, and perform all the functions entrusted to that Panchayat by or under this Act or any other law and shall also exercise such other powers and perform such other functions as may be conferred on or entrusted to it by the Government for carrying out the provisions of this Act.</p> <p>(2) A Panchayat shall have power to do all acts necessary for and incidental to, carrying out the functions entrusted or delegated to it.</p> <p>(3) Without prejudice to the generality of the foregoing power, a Village Panchayat shall have power, -</p> <p>(c) to prohibit the use of the water of any stream, well, pond or any other excavation believed to be dangerous to public health; and</p>	<p>Grama Panchayats power over certain Water sources</p>	<p>Kerala Panchayat Raj Act Sec. 239</p>	

12	<p>(d) to regulate or prohibit the watering of cattle or bathing or washing in any stream, well, pond or other excavation reserved for drinking water.</p> <p>CONTROL OVER WATER etc;</p> <p>416. Prohibition of construction of wells, tanks, etc., without the permission of the Secretary.—</p> <p>(1) No new well, tank, pond, cistern, fountain or the like shall be dug or constructed without the permission of the Secretary.</p> <p>(2) The Secretary may grant permission subject to such conditions as he may deem necessary, or may, for reasons to be recorded in writing, refuse it.</p> <p>(3) Where any such work is begun or completed without such permission, the Secretary may either—</p> <p>(a) by notice, require the owner or other person who has done such work to fill up or demolish such work in such manner as the Secretary directs; or</p> <p>(b) grant permission to retain such work: Provided that such permission shall not exempt such owner from being proceeded against for contravening the provisions of sub-section (1).</p> <p>417. Filling in pools, etc., which are sources of nuisance.—</p> <p>(1) Where, in the opinion of the Secretary—</p> <p>(a) any pool, ditch, tank, well, pond, bog, swamp, quarry, hole, drain, cess pool, watercourse or any collection of water; or</p> <p>(b) any land on which water may at any time accumulate, is likely to become a breeding place of mosquitoes or in other</p>	Municipalities power over certain Water sources		Kerala Municipalities Act S.No. 416 to 425
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	<p>respect a source of nuisance, the Secretary may, by notice, require the owner or person having control thereof to fill in, cover over, demolish, weed and stock with larvicidal fish, petrolize, drain-off the same in such manner and with such materials as the Secretary directs and or make such order for removing or abating the nuisance.</p> <p>(2) Where a person on whom a requisition is made under sub-section</p> <p>(1) to fill in, cover over, or drain of a well, delivers to the Secretary, within the time specified for compliance therewith, written objections to such requisition, the Secretary shall report such objections to the Council, and shall make further inquiry in to the case, and he shall not institute any prosecution for failure to comply with such requisition except with the approval of the Council, but the Secretary may, nevertheless, if he deems the execution of the work called for by such requisition to be of urgent nature proceed in accordance with section 533 and pending the Council's disposal of the question whether the said well shall be permanently filled in, covered over or otherwise dealt with, may cause such well to be securely covered over so as to prevent the ingress of mosquitoes, and in every such case the Secretary shall determine with the approval of the Council whether the expenses of any work already done as aforesaid shall be paid by such owner or by the Secretary out of the municipal fund or shall be shared and if so, in what proportion.</p> <p>418. Regulation or prohibition of certain kinds of cultivations.—</p>
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	<p>A Municipality may, on a report of the Director of Health Services, the health officer of the Municipality or the local medical officer appointed by the Government that the cultivation of any description of crop or the use of any kind of manure or the irrigation of any land in any place within the municipal area is injurious to the public health, with the previous sanction of the Government, by public notice, regulate or prohibit the cultivation, the use of manure or irrigation of reported to be injurious:</p> <p>Provided that where such cultivation or irrigation has been practised during the five years preceding the date of such public notice with such continuity as the ordinary course of husbandry admits of, compensation shall be paid from the municipal fund to all persons affected for any damage caused to them by absolute prohibition.</p> <p>419. Cleaning of insanitary private tank or well, the water of which is used for drinking etc.—</p> <p>(1) The Secretary may, by notice, require the owner or person having control over any private water course, spring, tank, well or other place the water of which is used for drinking, bathing or washing clothes, to keep the same in good repair and to cleanse it of silt, refuse or vegetation and to protect it from pollution by surface drainage in such manner as he may think fit.</p> <p>(2) Where the water of any place which is used for drinking, bathing or washing clothes, as the case may be, is proved to the satisfaction of the Secretary to be unfit for</p>			
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	<p>the said purpose, the Secretary may, by notice, require the owner or person having control thereof to-</p> <ul style="list-style-type: none">(a) refrain from using or permitting the use of such water; or(b) close or fill in such place or enclose it with a substantial wall or fence. <p>420. Duty of Municipality in respect of public wells cess pools.— The Municipality shall keep and maintain in a clean condition all wells, ponds and reservoirs which are not in private property and operate it in a manner useful to the public.]</p> <p>423. (3) Where sufficient number of public wash houses or places are not maintained under sub-section (1), the Municipality may, without making any charge therefore, specify suitable places for the exercise by washer men of their calling.</p> <p>424. Prohibition of washing by washermen at unauthorised places.—</p> <ul style="list-style-type: none">(1) The Secretary may, by public notice, prohibit the washing of clothes by washermen in the exercise of their calling, within the municipal area, except at—<ul style="list-style-type: none">(a) public wash houses and places maintained or provided under section 423, or(b) such other places as it may specify for the purpose.(2) Where any such prohibition has been imposed, no person who is by calling, a washermen shall, in contravention of such prohibition, wash clothes except for himself or for personal and family service or for hire on and within the premises of the hirer at			
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	<p>any place within the municipal area other than a public wash house or place maintained, provided or specified under section 423. 20. [Section 420 substituted by Act 14 of 1999, w.e.f. 24-3-1999].</p> <p>425. Prohibition of defiling of water of tanks, etc., whether public or private.— It shall not be lawful for any person to- [(a) bathe in or in any other manner defile the water specially kept in any place by the Municipality for by any owner or drinking; or (aa) defile the water kept for bathing in any manner, or] (b) deposit any offensive or deleterious matter in the dry bed of any place set apart for drinking purposes; or (c) wash clothes in any place set apart for drinking or bathing; or (d) wash any animal or any cooking utensils or wool, skin or other foul or offensive substances or deposit any offensive or deleterious matter in any place set apart for bathing or washing clothes; or (e) cause or suffer to drain into or upon any place set apart as aforesaid for drinking bathing or washing clothes or cause or suffer anything to be brought there into or do anything whereby the water may be fouled or corrupted.</p>	<p>Activities to Regulate, Ban Action Plan</p>	<p><i>Act 31 / 2009 English not available</i></p>		
13	<p>Prohibition & Punishment on polluting river, etc</p>				
14	<p>184[234A. - Vesting of the existing water supply and sewerage services under the water authority with the Panchayat. - (1) Notwithstanding anything contained in the Kerala Water Supply and Sewerage Act, 1986 (14 of 1986) or in any other law from such date, on the Government may by notification in the gazette appoint, in respect of the Water Authority before such</p>				

				<p>date and intended for the benefit of the panchayat at any level and situated within its area,</p> <p>234B. Administrative powers of the Panchayat in respect of the existing water supply and sewerage schemes.</p> <p>(1) Notwithstanding anything contained in the Kerala Water Supply and Sewerage Act, 1986 (14 of 1986) or in any other law, the maintenance and administration of the water supply and sewerage schemes which cannot be vested in and transferred to the Panchayat under section 234A and is beneficial to the residents within the area of more than one Local Self Government Institutions shall vest in the committee to be constituted by the Government for the purpose.</p> <p>234 C. The power of the Panchayat in the preparation and execution of schemes related to water supply and sewerage works</p>
15	<p>(1) These rules may be called the Kerala Panchayat Raj (Regulation and Prohibition of Use of Public or Private Springs, Tanks, Wells and other Water Courses) Rules, 1996.</p> <p>(2) They shall come into force at once.</p>	<p>Clause (iii) of sub-section (2) of Section 254 of the Kerala Panchayat Raj Act, 1994 (13 of 1994) empowers the Government to make rules regarding the prohibition or regulation of use of any public spring, tank, well, watercourse or any private spring, tank, well, watercourse, with the consent, of the owner set apart for specific purpose. Government have decided to make rules for the purpose, Hence this Notification.</p>	<p>(Regulation and Prohibition of Use of Public or Private Springs, Tanks, Wells and other Water Courses) Rules 1996</p>	

16	<p>(1) These rules may be called the Kerala PanchayatRaj (Removal of encroachment and imposition and recovery of penalty for unauthorisedoccupation) Rules, 1996.(2) They shall come into force at once.</p>		<p>Clause (xxix) of sub-section (2) of Section 254 of the Kerala Panchayat Raj Act, 1994 (13 of 1994) empowers the Government to make Rules regarding the imposition and recovery of penalty for unauthorised occupation of anyland or public pathway belonging to or vested in any Grama Panchayat and the recovery of compensation for any losscaused due to such occupation. The Government have decided to make such rules. This notification is intended to achieve the above object.</p>	<p>(Removal of encroachment and recovery of penalty for unauthorised occupation) Rules 1996</p>	
17	<p>9. Providing of public urinals and bathing ghats. — (1) Public urinals and bathingghats shall be provided for the use of the public in densely populated places and the places whichPanchayat thinks fit. (2) The Panchayat may, take its own measures to keep the public urinals and bathingghats clean and to protect them or entrust such works with any person or establishment and levyfees from the public in the manner as may be decided by the Panchayat and the right to collectthe fee may be given by auction or licence:Provided that, no fees of any kind shall be levied from the public for bathing ghats providedwith the tanks, rivers and streams, owned by the Panchayat.(3) The Panchayat shall make available fresh water required in the public bathing ghatsand urinals and shall provide necessary drainage facility to drain the filthy water.</p> <p>19. Prohibition of improper disposal of carcasses, rubbish and filth. — (1) No</p>			<p>(Construction and Maintenance of Public Latrines, Urinals, Bathing Places and Sanitation ofPrivate Premises) Rules, 1998.</p>	

	<p>personshall, after due provision has been made under Rule 10 by the Panchayat for the deposit andremoval of rubbish, solid waste, carcasses and filth, deposit the same, —(a) in any street, or on the verandah of any building or on any unoccupied ground along theside of any street or in any public quay, jetty or landing place or on the bank of a watercourse or tank, or</p>			<p>18</p>
<p>109A. Rooftop Rain Water Harvesting Arrangements.-1) The municipality shall enforce workable artificial ground water recharging arrangements as an integral part of all new building constructions through collection of roof top rainwater.</p> <p>5) The component of workable artificial ground water recharging arrangements as stipulated in sub rule (1) above, shall include:</p> <ul style="list-style-type: none"> i) Roof catchment area ii) Roof gutters iii) Down pipe iv) Filter unit v) Recharge well/percolation pit 6) <p>Wherever rooftop rainwater harvesting arrangements as stipulated in sub rules (1) to (3) above are provided, additional arrangements for carrying the spill over water from storage tank to recharge well or percolation pit need only be provided</p> <p>4) The owner(s)/occupier(s) shall maintain the rooftop rainwater harvesting arrangements and artificial ground water recharge arrangements in healthy working condition</p> <p>8) The Municipality may, in exceptional cases such as water logging or impermeable subsoil conditions to considerable depths,</p>	<p>Kerala Panchayat Raj Building Rules, 2011. Chapter. X,VI,101,102</p>	<p>The Government of India has directed the State Governments to provide certain provisions in building rules, pertaining to incorporation of rooftop rainwater harvesting arrangements in building In the above context, the Government consider it necessary to make further amendments to the Kerala Municipality Building Rules, 1999</p>		<p>the Kerala Municipality Building (Amendment) Rules, 2004 “ Chapter XVI-A RAIN WATER HARVESTING” 109A, 109 B</p>

19	<p>exempt construction from The mandatory groundwater recharging arrangements.</p> <p>12. <i>General conditions for the sand removal operations in a Kadavu.</i>—(1) The Grama Panchayat or the Municipality concerned shall, before carrying out the sand removal operation obtain passes from the Geology Department which shall issue them on the recommendation of the District Expert Committee for a period of one month in advance, on payment of royalty as provided for in the law applicable for the payment of royalty.</p> <p>(2) No sand removal operation shall be carried out in a Kadavu before 6 a.m. and after 3 p.m.</p> <p>(3) The Grama Panchayat or Municipality concerned shall subject to the other provisions of this Act and the rules made thereunder, make necessary arrangements to carry out the sand removal operations</p> <p>15. <i>Obligation of the Local Authorities to maintain the Kadavu or river banks in safe condition.</i>—(1) Every Local Authority in the State having Kadavu or river bank for sand removal shall maintain such Kadavu or river bank in a safe condition and protect its bio-physical environment system by taking effective steps to control river bank sliding.</p> <p>(2) Every local authority shall erect concrete pillars at the Kadavu or river bank in such a way that no vehicle shall have direct access to the bank of the river.</p> <p>(3) The local authority shall establish a check post at each Kadavu or riverbank and maintain proper account of the sand removed from the Kadavu .</p> <p>(4) Bamboo and “Attuvanchi” may be</p>		<p>Kerala Protection of River Banks and Regulation of Removal of Sand Act, 2001</p> <p><i>Preamble.</i>—WHEREAS it has come to the notice of the Government that indiscriminate and uncontrolled removal of sand from the rivers cause large scale river bank sliding and loss of property;</p> <p>AND WHEREAS large scale dredging of river sand also disturb the biophysical environment system of the river in different degrees;</p> <p>AND WHEREAS due to the executive regulatory orders in force, complaints have been received regarding the hardship to the employees engaged in construction works;</p> <p>AND WHEREAS, in the public interest, it is expedient to provide for regulatory measures for the protection of river banks and removal of sand from rivers;</p>		
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	<p>planted on the river bank with the help of Forest Department to control river bank sliding.</p> <p>17. <i>River Management Fund and issue of Passes</i>—(1) The District Collector shall maintain a Fund called the “River Management Fund” from which all expenses towards management of the Kadavu or river bank shall be met.</p> <p>(2) Every Local Authority having a Kadavu or river bank shall contribute fifty per cent of the amount collected by the sale of sand towards the River Management Fund maintained by the District Collector: Provided that the cost of collection of sand and the Royalty paid shall not be included in the amount of collection.</p> <p><i>Explanation</i>.— For the purpose of this sub-section, “cost of collection” shall include the maintenance charges and the cost of erection of concrete pillars in the Kadavu.</p> <p>(3) The Department of Mining and Geology shall ensure that no pass is issued to the Local Authority without settling the accounts as provided in sub-section (5)</p> <p>(4) Every pass issued by the Department of Mining and Geology shall contain the signature of the authorised officer of that Department and his seal, which shall be countersigned by the Secretary of the Local Authority concerned before the sand removal operation.</p> <p>(5) The amount payable towards contribution to fund by a Local Authority shall be paid by means of cheque or demand draft to the District Collector or an officer authorised by him in this behalf, who shall countersign it in token of having received it. The account shall be settled before the 10th</p>			
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	<p>day of the succeeding month by remitting the balance amount due for payment</p> <p>16. Powers and functions of the Secretaries of Local Self Government Institutions.- The Secretaries of the Local Self Government Institutions shall be the Convener of the Kadavu committees and they have the following powers of functions, namely:-</p> <ul style="list-style-type: none"> (a) to implement the decisions of the Kadavu Committee; (b) to record his opinions on all issues coming up for consideration of the Kadavu Committee and place each item of agenda, with his specific opinions, before the meeting of Kadavu Committee; (c) to report the decisions of the Kadavu Committee to the District Collector; (d) to keep the income and expenditure accounts of the Kadavu accurately; (e) to deliver the amount payable towards River Management Fund by Cheque or Demand Draft to the District Collector at the appropriate time; (f) to take necessary steps to remove encroachment from River Banks or Kadavus at the right time; (g) to exercise all the powers and perform duties specifically entrusted on the Convener of the Kadavu Committee under the Act or these Rules; (h) to implement the ban imposed by Government or District Collector on sand mining; (i) to brought to the notice of the District Collector the disputes among Local Self Government Institutions regarding sand mining 			
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	<p>(i) to issue pass for each load of sand transported from the Kadavu.</p> <p>17. Powers and functions of the Local Self Government Institutions-</p> <p>Subject to the provisions of the Act and other provisions of these rules, the Local Self Government Institutions shall have the following powers and functions namely:-</p> <p>a) to ensure the compliance of restrictions imposed on sand mining in the Act and Rules made thereunder;</p> <p>(b) to follow and implement the instructions given by Government, District Expert Committee and District Collector from time to time;</p> <p>(c) to take steps to prevent the filling up of wet land or low land using river sand;</p> <p>(d) take steps to prevent the flow of filthiness to rivers;</p> <p>(e) take steps to prevent the flow of filthiness to water courses which extend to rivers;</p> <p>(f) to prevent all types of encroachment on river poramboke and to recommend the District Collector evict the existing encroachments;</p> <p>(g) to construct check dams to avoid loss by flow of rain water available during rainy season;</p> <p>(h) to prohibit or control bathing of animals, washing clothes and cleaning other things in the rivers considering public health;</p> <p>(i) to assist the Kadavu Committees to prepare River Bank Development Plan;</p> <p>(j) to publish the list of sand mining labourers working in the Kadavu under the control of Local Self Government Institutions;</p>			
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	<p>(k) to issue permits to country boats being used sand mining and publish its list;</p> <p>(l) to make all arrangements for sand mining operations in the Kadavu as decided by the District Expert Committee, Kadavu Committees and District Collector;</p> <p>(m) to erect concrete pillars in Kadavu or river bank in such a way not to get entry of vehicles directly to river banks;</p> <p>(n) to establish check posts to inspect the transportation of sand from Kadavu;</p> <p>(o) to remit the amount towards River Bank Management Fund at the appropriate time;</p> <p>(p) to assist the implementation of River Bank Development Plan.</p> <p>1[(q) to supervise the sale and auction of sand from all Kadavu;</p> <p>(r) to issue identification boards to the country boats used for sand removal;</p> <p>(s) to assist the collector in confiscating the implements and country boats used for the unauthorised sand removal and the lorries and other vehicles used for transporting such sand;</p> <p>(t) to issue identity cards to the sand removing workers of each Kadavu;</p> <p>(u) to assist the Police and Revenue Officials in taking action against the land owners and owners of unauthorised Kadavu, who facilitate unauthorised sand removal from rivers;</p> <p>(v) to set up check posts in the Kadavu having jungar service.</p> <p>18. Preparation of River Bank Development Plan. -</p> <p>(1) The District Expert Committee may prepare plan for comprehensive development of River Banks in the district and its catchment areas, for Protection of River</p>	<p style="text-align: center;">Kerala Protection of River Banks and Regulation of Removal of Sand Rules, 2002</p>		
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	<p>Banks, Construction of Kadavus on River Banks and up keep of bio-physical environment of River Banks, in consultation with the Kadavu Committee if necessary.</p> <p>(4) The District Expert Committee shall prepare River Bank Development Plan considering the proposal submitted by Local Self Government Institutions.</p> <p>[21. Implementation of scheme through Development Blocks, Public Works (Local Works), Department, and Local Authorities.-</p> <p>(1) Any work under the River Bank Development Scheme, for which administrative sanction is accorded by the Government under these rules, shall be caused to be executed by the District Collector, through Development Blocks in Village areas and Public Works (Local Works) Department in urban areas, by following the procedure being observed for the execution of relief works in connection with natural calamities.</p> <p>(2) The activities of planting saplings, implemented under the River Bank Development Scheme may be executed through Local Authorities.]</p>		<p>20</p> <p>22. Constitution of Biodiversity Management Committees</p> <p>(1) Every local body shall constitute a Biodiversity Management Committee (BMCs) within its area of jurisdiction.</p> <p>(2) The Biodiversity Management Committee as constituted under sub rule(1) shall consist of a Chairperson and not more than six persons nominated by the local body, of whom not less than one third</p>
			<p>Biological Diversity Rules, 2004</p>

	<p>should be women and not less than 18% should belong to the Scheduled Castes/ Scheduled Tribes.</p> <p>(3) The Chairperson of the Biodiversity Management Committee shall be elected from amongst the members of the committee in a meeting to be chaired by the Chairperson of the local body. The Chairperson of the local body shall have the casting votes in case of a tie.</p> <p>(4) The Chairperson of the Biodiversity Management Committee shall have a tenure of three years.</p> <p>(5) The local Member of Legislative Assembly / Member of Legislative Council and Member of Parliament would be special invitees to the meetings of the Committee.</p> <p>(6) The main function of the BMC is to prepare People's Biodiversity Register in consultation with local people. The Register shall contain comprehensive information on availability and knowledge of local biological resources, their medicinal or any other use or any other traditional knowledge associated with them.</p> <p>(7) The other functions of the BMC are to advise on any matter referred to it by the State Biodiversity Board or Authority for granting approval, to maintain data about the local vaid and practitioners using the biological resources.</p> <p>(8) The Authority shall take steps to specify the form of the People's Biodiversity Registers, and the particulars it shall contain and the format for electronic database.</p> <p>(9) The Authority and the State Biodiversity Boards shall provide</p>
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			<p>guidance and technical support to the Biodiversity Management Committees for preparing People's Biodiversity Registers.</p> <p>(10) The People's Biodiversity Registers shall be maintained and validated by the Biodiversity Management Committees.</p> <p>(11) The Committee shall also maintain a Register giving information about the details of the access to biological resources and traditional knowledge granted, details of the collection fee imposed and details of the benefits derived and the mode of their sharing.</p>
21		<p>10. Protection of Public drinking water sources:-</p> <p>(1) No notwithstanding anything contain in this Act, no person shall without the permission of Authority dig well for any purpose within thirty meters from any drinking water source from wherever is pumped for public purpose. Provided that the provision in sub-section (1) shall not apply to the digging of a well for any drinking water scheme implemented by the Government or local bodies.</p> <p>(2) Every application for permission under sub-section (1) shall be in such form as may be prescribed and shall be submitted to the Authority with such fees as may be fixed.</p> <p>(3) On receipt of an application under sub-section (2) and if it is satisfied that digging of well shall not adversely affect the public drinking water source, permission may, subject to such restrictions and conditions mentioned therein, be granted to dig the well for the purpose of drinking water or for agriculture:</p> <p>Provided that if the decision of the Authority is not communicated to the</p>	<p>THE KERALA GROUND WATER (CONTROL AND REGULATION) ACT, 2002</p> <p><i>An Act</i></p> <p><i>To provide for the conservation of ground water and for the regulation and control of its extraction and use in the State of Kerala.</i></p> <p><i>Preamble.</i> Whereas it is expedient to provide for the conservation of Ground Water and for the regulation and control of its extraction and use in the State of Kerala; And Whereas in certain areas of the State the tendency of indiscriminate extraction of Ground Water is continuing; And Whereas it is felt that the erratic extraction of ground water is found to result in undesired environmental problems in such areas; And Whereas the ground water is a critical resource of the State; And Whereas it is considered necessary in the public interest to regulate and control any form of development of ground water in State of Kerala;</p>

	<p>applicant within ninety days from the date of application permission shall be deemed to have been granted and the permission so deemed to have been granted shall be subject to the laws in this regard.</p>		<p>Water (Prevention and Control of Pollution) Act, 1974Sn.55 Chapter VII</p>		
22	<p>55. Local Authorities to assistAll local authorities shall render such help and assistance and furnish such information to the Board as it may require for the discharge of its functions, and shall make available to the Board for inspection and examination such records, maps, plans and other documents as may be necessary for the discharge of its functions.</p>		<p>Kerala State Biodiversity Board – Environment Department – State Environment Policy, 2009 - Approved – Orders issued. Environment Department G.O (MS) No.04/09/Envvt. dated, Thiruvananthapuram 31.12.2009</p>		
	<p>24-2. Grama Panchayats The Grama panchayats should take up the following responsibilities. Compared to all-India level, Kerala's Grama Panchayats are large, with about 20,000 people in each, and spreading over arbitrarily delineated territory. Therefore, it is necessary to organize at ward level and at even more primary collectives, people's organisations under the Panchayat umbrella. Such groupings shall be based on micro-watersheds, so that they are clearly defined from an ecologically meaningful view point. All programs for soil conservation and for preventing soil degradation, monitoring of soil fertility, encouragement of cropping systems in accordance with land capability classification, and other works in relation to agricultural lands will devolve on Village Panchayats. They shall arrange these works according to the identified micro-watersheds, and entrust the works to the multi-tiered people's organisations, to be formed as mentioned above.</p>				

	<p>24.3. Block and District Panchayats The Block and District Panchayat would undertake the responsibility for the following:</p> <p>24.3.3.1. Conduct training classes, bringing about attitudinal, and competence change to enable the people to be conscious of ecological imperatives, while seeking economic maximization goals.</p> <p>24.3.3.2. Co-ordinate and encourage programmes such as bio-gas plants, mini - and micro-hydel projects, wind energy farms, solar energy plants, and plantation of fuel wood species.</p> <p>24.3.3.3. Pioneer and encourage the production and spread of fodder planting material and the cultivation of these species by farmers so that self-sufficiency in fodder needs is approached / reached.</p> <p>24.3.3.4. Supplement, complete, and extend efforts undertaken by village Panchayats and grassroots organisations to maximize benefits.</p> <p>24.3.3.5. Ensure that public demand and profit-driven business in scarce material are harmonized with eco-specific requirements.</p> <p>24.3.3.6. Link and form 'associations of smaller levels, engaged in ecological conservation and enrichment activities, and businesses based on non-invasive land use, so that better economies and stronger bargaining for advantage are secured.</p>
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Annexure II

Address of Departments for Data

1. Agency For Development of Aquaculture (ADAK)
Thiruvananthapuram – 695014, Kerala.
Tel. 0471 2333059
e-mail: aquaculutrekerala@yahoo.co.in
Website: www.fishnetkerala.gov.in

2. Boomi Keralam Project Kerala Land Information Mission
State Project Office, Museum Bains Compound
Thiruvananthapuram
Tel. 0471 2313734
e-mail: bhoomikaeralam@gmail.com
Website: www.bhoomi.kerala.gov.in

3. Chairman
Central Water Commission
Ministry of Water Resources
Sewa Bhawan, RK Puram, New Delhi-110 066
Website: www.cwc.gov.in

4. The Chairman,
Kerala Dam Safety Authority
Legislature Complex
Thiruvananthapuram – 33
Tel: 0471-2302814, 2305160
e-mail: kdsatvpm@gmail.com

5. Commisionarate of Rural Development
4th Floor, Swaraj Bhavan
Nanthancode, Kowdiar – 695 003
Tel: 0471 2314526
e-mail: crdkerala@gmail.com
Website: www.rdd.kerala.gov.in

6. Department of Environment & Climate Change (Doecc)
Devikripa
Pallimukku, Pattah PO
Thiruvananthapuram- 695024
Tel: 0471 2742264, 274554
Website: www.envt_kerala.gov.in

7. Director,
Directorate of Mining & Geology
Keshavadasapuram, Pattam Palace P.O.
Thiruvananthapuram – 695 004
Tel: 0471-2556119
e-mail: director.dir.dmg@kerala.gov.in
Website: www.dmg.kerala.gov.in

8. Department of Town And Country Planning
Swaraj Bhavan, Nanthancode ,
Thiruvananthapuram-695 003
Tel: 0471-2721447
e-mail: ctpkerala@yahoo.co.in
Website: www.townplanning.kerala.gov.in

9. Directorate of Industries & Commerce
Vikas Bhavan
Thiruvananthapuram
Tel: 0471 2302774
e-mail: industriesdirectorate@gmail.com;
director.dic@kerala.gov.in
Website: www.kearalaindustry.org

10. Executive Director
Centre For Water Resources Development And Management
Kunnamangalam, Kozhikode-673 571, Kerala, India
Tel: 0495 2351800, 2351801, 2351804
e-mail: ed@cwrmd.org; npnb@cwrmd.org
Website: www.cwrmd.org

11. Geological Survey of India
Kendriya Bhavan Building
4th Floor, Airport Road, Csez Kakkanad,
Ernakulam – 682 037
Tel: 0484-2428938
e-mail: gsikochi@rediffmail.com
Website: www.gsi.gov.in

12. Jananidhi
Kerala Rural Water Supply And Sanitation Agency
TC Towers, SS Kovil Road, Thampanoor,
Thiruvananthapuram – 695 001
Tel: 0471-2337002, 2337003
e-mail: pmujanidhi@gmail.com
Website: www.jalanidhi.kerala.gov.in

Address of Departments for Data

13. Kerala State Biodiversity Board
L-14, Jai Nagar, Medical College P.O.
Thiruvananthapuram
Tel: 0471 2554740
e-mail: keralabiodiversity@gmail.com
Website: www.keralabiodiversity.org

14. Registrar,
Kerala Forest Research Institute
Peechi P.O., Thrissur District
Kerala, India. Pin – 680653
Tel: 0487-2690100; Fax: 0487-2690111
Website: www.kfri.res.in

15. Kerala State Council For Science Technology and
Environment
Sasthra Bhavan, Pattom
Thiruvananthapuram – 695004
Tel: 0471-2548200
e-mail: kscste@gmail.com
Website: www.kscste.kerala.gov.in

16. Kerala Rural Water Supply And Sanitation Agency
TC Towers, SS Kovil Road, Thampanoor,
Thiruvananthapuram – 695001
Tel: 0471-2337002, 2337003
e-mail: pmujalanidhi@gmail.com
Website: www.jalanidhi.kerala.gov.in

17. Kerala State Pollution Control Board,
Pattom P.O., Thiruvananthapuram – 695 004
Tel: 0471-2318153, 54, 56, 56, 2312910
Website: www.keralapcb.nic.in

18. Land Use Commissioner & Director
KSREC Vikas Bhavan P.O.
Thiruvananthapuram, Kerala – 695 .033
Phone No. +91 0471 2302231, 2307830
Fax: +91 0471 2300624
e-mail: alphoskj@hotmail.com

19. Member Secretary
Kerala Coastal Zone Management Authority
Sastra Bhavan, Pattom
Thiruvananthapuram – 695004,
Kerala – India
Tel: 0471-2548258, 2548316
Website: keralaczma.gov.in

20. Metrological Centre
Observatory Hills
Vikas Bhavan, Thiruvananthapuram-695033
Tel: 0471-2322894, 2322184
e-mail: mc.trv@imd.gov.in
Website: www.imtm.gov.in

21. National Centre for Earth Science Studies
Post Box No. 7250
Akkulam, Thiruvananthapuram – 695 011
Tel: +91 471-2511501
Fax: +91 471-2442280
Website: www.cess.res.in

22. Suchithwa Mission
Lekshmi Nivas
T.C. 24/2054, Panavila Junction, Thycad P.O. ,
695 014
Tel: 0471 12327730
e-mail: suchithwamission@gmail.com
Website: www.sanitation.kerala.gov.in

23. The Additional Surveyor General,
Indian Institute of Surveying & Mapping
Uppal, Hyderabad, Pin-500 039
Tel: 040-27201503
e-mail: iism.soi@gov.in
Website: www.soiisti.as.nic.in

24. The Director
Central Marine Fisheries Research Institute
Post Box No. 1603, Ernakulam North P.O.
Kochi-682 018
Tel: 0184 2394357
e-mail: contact@cmfri.org.in
Website: www.cmfri.org.in

Address of Departments for Data

25. Director

Directorate of Agriculture
Vikas Bhavan, Thiruvananthapuram – 695 003
Tel: 0471 2304480, 2303990
e-mail: krishidirector@gmail.com
Website: www.keralaagriculture.gov.in

26. Director

Directorate of Fisheries
Vikas Bhavan, Thiruvananthapuram – 33
Tel: 0471 2303160
e-mail: fisheriesdirector@gmail.com;
fishydirvkbnsancharnet.in
Website: www.fishnetkerala.gov.in

27. Director of Agriculture

(Soil Conservation Unit)
Directorate of Soil Conservation
Sree Sabari Building Chalai P.O.,
Thiruvananthapuram – 36
Tel: 0471-2479890, 2451433
Website: www.soilconsnetkeral.gov.in

28. The Director

Kerala State Remote Sensing Agency
Planning & Economic Affairs Department
5th Floor, Annexes Building , Secretariat,
Thiruvananthapuram
Tel: 0471-2326436, 2518695

29. Managing Director

Kerala Water Authority
Head Office
Jalabhavan, Vellayambalam
Thiruvananthapuram – 695033
Tel: 0471-2328654, 2328652, 2328652, 2333205
Website: www.kwa.kerala.gov.in

30. The Public Relations Officer Keral Agricultural University

Directorate of Extension, Mannuthy- 680 651
Thrissur, Kerala, India
Tel: 0487 2370051
e-mail: proWkau.in
Website: www.kau.edu

31. Vice Chairman

Kerala State Planning Board
Pattom, Thiruvananthapuram
Tel: 0471-2540707, 2540208
Website: www.spb.kerala.gov.in

Legal Instruments - Policies, Act & Rules

Listed below are legal instruments that have bearing on water resources and environment protection and regulation.

I State Laws and Acts

- 1 Kerala State Water Policy 2008
- 2 Act 18 of 2001 the Kerala Protection Of River Banks and Regulation of Removal of Sand Act, 2001 [1]
- 3 The Kerala Ground Water (Control and Regulation) Amendment Act, 2005 [1]
- 4 Act 19 of 2002 the Kerala Ground Water (Control and Regulation) Act, 2002 [1]
- 5 Act 8-2009 - Kerala Water Supply and Sewage (Amendment) Act
- 6 Kerala Water and Waste Water Ordinance, 1984 (Ordinance No. 102).
- 7 Kerala Water Supply And Waste Water Ordinance 1984
- 8 The Kerala Water Supply And Sewerage Act, 1986
- 9 The Kerala Water (Prevention and Control Of Pollution) Appellate Authority Rules 1977
- 10 Water (Prevention and Control Of Pollution) Rules, 1976
- 11 Water (Prevention and Control Of Pollution) Act, 1974 No. 6 of 1974
- 12 Municipal Waste Rules - PCB
- 13 Schedules-BMW-Bio Medical Waste – PCB
- 14 Water & Air Pollution - PCB
- 15 The Kerala Conservation of Paddy Land And Wetland 2008
- 16 Kerala State Environment Policy
- 17 Draft Land Policy
- 18 Industrial & Commercial Policy 2007
- 19 Urban policy – Govt. of Kerala

II State Departmental Laws

a) Forest

- 1 Forest Policy
- 2 Act 21 of 2005 the Kerala Forest (Vesting and Management of Ecologically Fragile Lands) Act, 2003
- 3 Act 32-2009- The Kerala Forest (Vesting And Management of Ecologically Fragile Lands (Amendment) Act
- 4 Ordinance 20-2009 the Kerala Forest (Vesting And Management of Ecologically Fragile Lands)

b) Fisheries

- 1 Fisheries Policy
- 2 Act15_2010 the Kerala Inland Fisheries and Aquaculture Act. 2010
- 3 Act 13 of 2007 The Kerala Monsoon Fishery (Pelagic)

c) Tourism

- 1 Tourism Policy
- 2 Ordinance No. 2 Of 2011 The Kerala Tourism (Conservation and Preservation of Areas) Amendment Ordinance, 2011
- 3 Ordinance No. 27 Of 2011 The Kerala Tourism (Conservation And Preservation Of Areas) Amendment Ordinance, 2011

III. Central Laws

- 1 Environment Protection Act 1986 Ministry Of Environment & Forests, Government Of India
- 2 Coastal Regulation Zone (CRZ) 1991 Notification
- 3 Biodiversity Act 2002
- 4 National Green Tribunal
- 5 S.O.583 (E) Water Quality Assessment Authority, Order, Dated 29 May, 2001
- 6 S.O.2151 Water Quality Monitoring Order 2005, Notification, Dated 17 June, 2005
- 7 Wetlands (Conservation & Management) Rules 2010