

Note on the approved Management Action Plans for Vembanad Kol and Ashtamudi Ramsar Wetlands  
by State Wetland Authority Kerala (SWAK)

Vembanad Kol Wetland

As part of the management of Vembanad Kol wetland, Management Action Plan was prepared by SWAK in 2017 and approved by MoEF &CC on 1<sup>st</sup> March 2018 under the Scheme 'National Plan for Conservation of Aquatic ecosystems (NPCA)' for five years.

**Major threats identified in the Management Action Plan**

**1. Shrinkage of wetland regime**

Vembanad-Kol wetland complex has been under consistent threat of modification and reclamation for agriculture. Nearly 550 km<sup>2</sup> of Vembanad estuary and floodplain marshes have been converted in Kuttanad region alone. Channelization of Kuttanad and Kol has altered the natural inundation regimes. In the last five decades, mangrove marshes on the shoreline of the estuary have been reclaimed for development of infrastructure for tourism. Remote sensing analysis of the Kuttanad region indicates increased instances of conversion of wetland paddies for non-wetland usages in the last three decades. The riparian habitats of inflowing rivers, particularly of Pamba and Muvattupuzha are being affected by unregulated sand mining.

**2. Changes in hydrological regimes**

The natural salinity gradient prevalent in the wetland complex has been altered to increase freshwater conditions in order to support agriculture. Circulation and mixing patterns have also been impeded by operation of Thaneermukom Barrage. Increased siltation from land use changes in the catchments has led to increased sedimentation of the estuary and a concomitant loss of water holding capacity.

**3. Ecological requirements for wetland functioning not addressed in water management planning and decision making**

Water management within the Vembanad- Kol wetland basin is mainly governed by the objectives of increasing agricultural productivity and operational requirements for Cochin port. Ecological requirements for maintaining wetland processes, for example species migration, control of invasives, and water circulation and mixing are very inadequately addressed, and are at best, incidental to human demands. Operation of Thottapally spillway and Thaneermukom Barrage are based on the needs of freshwater for sustaining agriculture in Kuttanad, and have led to several adverse impacts on the estuary, including proliferation of freshwater invasives, decline in fisheries and deterioration of water quality.

**4. Increasing anthropogenic pressure on waterbird habitats**

The floodplain marshes and the mangroves on the fringes of Vembanad estuary served as important habitats for waterbirds but have been gradually degraded and converted for alternate use. Clearing of mangroves has affected several herenories. Indiscriminate use of pesticides and conversion of floodplain marshes for brick kilns and construction purposes are major pressures on waterbird habitats in Kol lands.

## **5. Pollution**

Vembanad-Kol wetlands are the ultimate recipients of untreated sewage and sewerage from the industrial and manufacturing units and settlements which dot its periphery. With an increase in number of houseboats catering to backwater tourism, commensurate waste management facility is yet to be developed. Intensification of agriculture and use of high yielding varieties of rice has also led to increased use of fertilizers and pesticides. Coupled with changes in circulation and mixing pattern, excessive loading of nutrients is promoting growth of freshwater invasives in Kuttanad, clogging the channels and increasing waterlogging. The incidence of water borne diseases within the farming, fisher and clam collecting communities is high.

## **6. Declining wetland resources and increasing stakeholder conflicts**

Production of fisheries, clams as well as wetland agriculture has declined in recent periods stressing livelihoods of dependent communities and creating stakeholder conflicts. The operation of Thaneermukom Barrage is a perennial conflict between fishers (preferring natural salinity regime) and farmers (preferring freshwater conditions all the year round). Local clam collectors' societies are highly impacted by commercial clam trawling operations (major being Travancore Cements) which lead to considerable shifting of beds and harvesting of juveniles. Environmental groups which have for long rallied against increasing tourism operations in biodiversity hotspots as Kumarakom and Pathiramanal islands. Declining aesthetics due to spread of invasive and degrading water quality put tour operators in conflict with industrial operations in Udyogmandal region.

### **Action points on conservation**

The action plan is envisaged under three components namely institutional arrangements, ecosystem conservation and sustainable resource development and community livelihoods

## Component I: Institutional arrangements

### Expected Results

- An effective arrangement for cross sectoral coordination and multi-stakeholder engagement in wetland management established and operationalized
- Systematic wetland inventory, assessment and monitoring system established to support decision making management
- Capacity of concerned state government departments and agencies, civil society organizations and local communities for integrated wetland management developed and enhanced

### Activities

#### 1.1 Establishment of Vembanad Kol Wetland Authority

VKWA is proposed to be established as a nodal agency mandated for coordinating integrated management of Vembanad-Kol. The rationale, powers and functions, and governance structure have been discussed in Chapter 4 of the report. Specific activities to be undertaken include:

- Finalization of Memorandum of Association and governance structure
- Notification
- Registration under appropriate act ( eg. Societies Registration Act)

#### 1.2. Establishment of integrated wetland inventory, assessment and monitoring system

An integrated wetland inventory, assessment and monitoring system is proposed to be set up to address the overall information needs of wetland management and to provide robust decision support system for the same. Specific activities include:

- Establishment of a wetland monitoring and research centre (Given the state of infrastructure and human resource capabilities, it is recommended that CWRDM is designated as wetland monitoring and research centre for the state)
- Development of a database management system. This includes development of data quality and management plan specifying data collection objectives, sampling programme design, data and metadata documentation procedure, data quality control methods and performance audit procedures. A GIS based database management system should also be developed as an implementation platform.
- Wetland monitoring and evaluation as per agreed protocols (outlined in section 5.5) to be implemented.
- Assessment studies. Following studies are recommended to be commissioned to inform wetland management;
  - Environmental flows assessment to define water regime requirements for maintaining water circulation and mixing, species migration and other ecological processes

- Fish breeding and migration to assess interaction between riverine, estuarine and marine environments, presence and status of breeding grounds, strategies for improving habitat condition
- Ecological character risk and vulnerability to determine limits of acceptable change for critical ecosystem components, processes and services; sensitivity and adaptive capacity; and risk of adverse change
- Ecosystem service valuation to assess contribution made by wetland ecosystem services to local livelihoods and regional food and water security; thresholds and required conditions for delivery of ecosystem services; conservation – development tradeoffs and strategies for incentivizing ecosystem services stewardship
- Climate risks and vulnerability to assess degree of risks for priority ecological character elements; climate scenarios for wetland ; and risk management options

### **1.3.Capacity building**

Capacity building of VKWA, concerned state government departments, agencies and resource user groups (padashekharam committees, coir retting units, clam collectors units) needs to be undertaken through professional training in integrated wetland management, water management, biodiversity conservation, wetland inventory and assessment and sustainable livelihoods.

### **1.4.Communication and outreach Stakeholder engagement in wetland management will be promoted through creating awareness of values and functions of Vembanad-Kol, management strategies and opportunities for participation. Specific activities:**

- Workshops and public events on conservation and wise use of Vembanad-Kol involving media, research agencies, NGOs and CBOs
- Maintenance of an interactive web-site on Vembanad-Kol as a means of information dissemination
- Observation of World Wetlands Day and other environment related occasions
- Publication of newsletter and thematic brochures

## **Component II: Ecosystem Conservation**

### **Expected Results**

- Wetland regimes are maintained
- Hydrological regime requirements for maintenance of wetland processes and ecosystem services are integrated in water management planning and decision making
- Key biodiversity habitats and migratory pathways are restored and enhanced

- Water quality of wetland is improved to support biological diversity and reduce health impacts on communities living in and around

## Activities

### 2.1. Management zoning

GIS based delineation of Vembanad estuary; Kuttanad and Kol areas will be carried out. For each of the three physiographic zones, a zonal plan setting thresholds of various development activities with consideration of existing regulatory regimes (provisions of Kerala Conservation of Paddy Land and Wetland Act (2008), Wetland (Conservation and Management) Rules, 2010 and Coastal Regulation Zone Notification (2011)), ecological sensitivities and socio-economic requirements will be developed. These plans would be used as a basis for intersectoral coordination by KWMA.

### 2.2 Water management

#### 2.2.1 Improvement of hydrological regimes

Design and implementation of stakeholder endorsed policy for operation of Thaneermukom Barrage

Building on the assessments of IIT and CWRDM on upgradation of Thaneermukom Barrage to address salinity and flooding concerns, it is recommended that an improvised operation regime considering the ecological needs (as species migration, water circulation and flushing and maintenance of biodiversity habitats) is designed and implemented with participation of major stakeholders. Following steps are recommended:

- Set water management objectives to be achieved through reoperation of Thaneermukom Barrage
- Define water regime requirements for wetland agriculture in Kuttanad
- Define water regime requirements for wetland ecosystem processes and maintenance of biodiversity habitats
- Develop scenarios for barrage operation and assess outcomes for identified objectives
- Evaluate scenario outcomes based on agreed ecological and social indicators
- Identify required barrage operation schedule and monitoring mechanism
- Barrage reoperation and performance evaluation
- Review and adaptation of barrage operation rules Improved hydrological connectivity
- Comprehensive assessment of canal networks in Kuttanad and Kol to identify flow impediments and extent of siltation
- Improvement of canal network in Kuttanad and Kol by removing flow impediments, encroachments and selective desiltation

- Assessment of road networks ( particularly AC road) in terms of flow orientation
- Construction of culverts and bridges to ensure adequate water conveyance (C and D Blocks in Pulinkunnu panchayat and Rani and Chithira blocks in Kainakari and in the AC 11 canal flanking the AC road have been identified as priority intervention areas)
- Selective desilting of confluence of inflowing rivers with Vembanad Estuary
- Regulation of sand mining in river channels and floodplains based on Strategic Environmental Assessments (Periyar and Muvattupuzza to be taken on a priority)
- Maintenance of connectivity with the sea through management of freshwater inflows and selective dredging Reduce siltation
- Assessment of silt loading from rivers and identification of degraded watersheds
- Preparation of micro-watershed conservation plans
- Delineation and identification of critical watersheds using capability assessment
- Controlling deforestation and destruction of natural forest cover
- Afforestation, regeneration and activities to stabilize stream banks through small scale soil conservation measures.
- Creation of silt traps at high sedimentation locations

## 2.2.2 Water quality improvement

- Preventing discharge of untreated industrial waste from Udyogmandal Region
- Comprehensive sanitation coverage in villages around Vembanad-Kol wetland complex and banning direct discharge of household sewage
- Pilot projects for treating effluents of coir retting units (major concentration in Parur and Vaikom), upscaling based on ecological, economic and social efficiency
- Comprehensive coverage of waste collection and treatment for houseboats
- Expansion and upgradation of waste treatment facility at Kumarakom
- Upgradation of waste management facilities in major population centres as Kochi and Ernakulam
- Upgradation of waste management facilities at Sabarimala

## 2.3 Biodiversity conservation

### 2.3.1 Improving waterbird habitat

- Detailed waterbird habitat mapping for major congregation sites in Vembanad- Kol wetland complex
- Baseline assessment for creation of a community conservation reserve including KTDC Complex – Pathiramnal Island
- Community mobilization for controlling poaching and regulating use of pesticides in waterbird congregation areas in Kuttanad and Kol
- Improvement of habitats in Muhamma, River Kavanar, Kaipuzha muttu (Vaikom) (other sites to be identified based on detailed assessments) through construction of artificial nesting sites (floating platforms / earthen mounds, earthen mounds, marshes and trees near wetland area) with plantation by native species and watch towers
- Strengthening waterbird habitat assessment and monitoring network through specialized training, awareness and participation incentives

### **2.3.2 Mangrove restoration**

- Survey and demarcation of mangrove areas in and around wetland complex
- Promotion of incentive based mangrove restoration programmes in pilot sites around Kumarakom for private land owners
- Creation of community awareness on values and functions of mangrove ecosystems

## **Component III: Sustainable resource development and community livelihoods**

### Expected results

- Wetland based production systems sustained
- Community ownership of wetland resources is promoted
- Livelihoods diversified to reduce dependence on wetlands and provide additional income sources for wetland dependent communities
- Wetland based ecotourism developed as an incentive for communities to benefit from biodiversity conservation and maintenance of wetland habitat

### Activities

#### **3.1. Sustainable wetland agriculture**

- Pilot testing and upscaling of integrated farming models to diversify cropping patterns aligned with ecological conditions
- Improvizing polders through use stiff clay and materials which reduce environmental impacts on wetland and have lower maintenance costs

- Development and enforcement of crop calendar harmonized with ecology of estuary
- Polder reorganization and crop cycle management to improve ecological and economic efficiency
- Create incentives for organic farming, and reducing use of chemical fertilizers and pesticides
- Increase awareness on pokkali farming system, and mechanisms for enhancing area and economic viability, including branding as sustainable produce

### 3.2. Sustainable fisheries development

- Assessment and demarcation of breeding and spawning ground of fin and shell fish
- Tagging experiment on commercially important fish species to assess migratory pathways, distribution and growth rates
- Community mobilization to prevent fishing operations in breeding and spawning grounds near lake mouth and river confluence
- Regulation of use of fishing gears with small mesh size (priority for stake nets)
- Mapping clam beds and imposing cyclical closed periods for revival
- Promote use of aquaculture best practices in culture fisheries around wetland complex
- Promote culture of ornamental fish species as an alternate livelihood option for fisher

### 3.3. Ecotourism development

- Carrying capacity assessment of Vembanad backwaters for tourism
- Developing an action plan for regulating tourism below carrying capacity Creation of a wetland interpretation center at Kumarakom focused on biological diversity and ecosystem services of Vembanad-Kol
  - Development of signage on Vembanad-Kol wetlands at major tourist entry locations - Kumarakom, Alappuzza and Kochi
- Training of houseboats owners on ecological features and sensitivities
- Development of guidance on do's and don'ts for tourist

| Components                                     | Sub Components                                     | Budget (In Crore) | (In Sub Total (In Crore) | Remarks |
|--|--|-------------------|--------------------------|---------|
| <b>Component I: Institutional arrangements</b> |  |                   | 10                       |         |
| 1.1  | Establishment of KWMA                              | 0.3               |                          |         |
|  | Establishment of Wetland Inventory, Assessment and | 5                 |                          |         |

|  |                                     |     |              |  |
|--|-------------------------------------|-----|--------------|--|
|  | Monitoring System                   |     |              |  |
|  | Capacity building                   | 2   |              |  |
|  | Communication and outreach          | 2.7 |              |  |
| <b>Component II: Ecosystem Restoration</b>             |                                     |     | <b>145.5</b> |  |
| 2.1  | Management zoning                   | 0.5 |              |  |
| 2.2  | Catchment management                | 50  |              | Funding may be leveraged from Green India Mission                                    |
| 2.3  | Water management                    | 125 |              | Funding for water quality to be leveraged from Atal Mission for Urban Transformation |
| 2.4  | Biodiversity conservation           | 20  |              |  |
| <b>Component III: Sustainable resource development</b> |                                     |     | <b>200</b>   |  |
| 3.1  | Sustainable agriculture development | 100 |              | Funding to be leveraged from ongoing programmes of the Agriculture Department        |
| 3.2  | Sustainable fisheries development   | 50  |              |  |
| 3.3  | Ecotourism development              | 50  |              |  |
| <b>Grand Total</b>                                     |                                     |     | <b>355.5</b> |  |

The Management Action Plan of Vembanad Kol is being revised with the assistance of Wetlands International South Asia (WISA) and the Centre for Water Resource Development and Management (CWRDM), Kozhikode as per the new guidelines of the NPCA. The draft Integrated Management Plan (IMP) has been prepared and the budget and relevant activity components are being thoroughly reviewed in consultation with the stakeholders. The revised IMP of Vembanad Kol wetland will be finalized by the end of April 2023.

### Ashtamudi Wetland

The Management Plan of Ashtamudi wetland was also prepared in the year 2017 and approved by the MoEF&CC on 26<sup>th</sup> February 2018 under the Scheme 'National Plan for Conservation of Aquatic ecosystems (NPCA)' for five years.

#### Major threats identified in the Management Action Plan

| Threat   | Pressure  | Stressor   | Potential impact   |
|--|---|--|--|
| <p><b>Pollution</b></p> <p>Ashtamudi Estuary has pockets of low dissolved oxygen, high nutrient concentrations and pH. high quantity of iron, sulphate and calcium content and high levels of dissolved methane.</p> | <p>Insufficient waste treatment infrastructure for Kollam City.</p> <p>Environmentally degrading coir retting practices.</p> <p>Inadequate waste treatment facility within the houseboats.</p> <p>Inadequate waste treatment and management facilities in industrial units.</p> <p>Unsafe sanitation technologies in use for over half of the settlements around the estuary.</p> | <p>Elevated nutrient levels.</p> <p>Increased concentration of organic and inorganic pollutants.</p> <p>Increased concentration of pathogenic organisms.</p> | <p>Reduction in fisheries and aquaculture yields,</p> <p>Fish kills,</p> <p>Reduction in habitat and biodiversity.</p> <p>Reduced amenity value,</p> <p>Adverse impact on health of communities living in the immediate vicinity of the estuary.</p> |
| <p>Reduced freshwater inflow into Estuary from Kallada Basin</p> <p>Annual discharge of Kallada River into Ashtamudi Estuary during 2002-11 was only 57% of the discharge recorded during 1972-78 period.</p>        | <p>Increased freshwater storage within the basin.</p>   | <p>Altered hydrodynamics, leading to increased siltation from the sea</p> <p>Changed tidal limits and reduced salinity gradients.</p>                        | <p>Changes in community structure – predominance of brackish and marine forms.</p> <p>Reduced fisheries and aquaculture productivity.</p> <p>Altered sedimentation patterns.</p>   |

|  |  |  |   |
|--|--|--|---|
| <p><b>Conversion of intertidal habitats</b><br/>The natural shorelines of the estuary, consisting mangrove marshes and mudflats, have been extensively concretized. Area under mangroves has reduced from 146 ha to 950 ha during 1967-2016.</p> | <p>Reclamation and land use changes around intertidal habitats.</p>                      | <p>Intertidal habitat removal.</p>               | <p>Reduced fisheries and aquaculture productivity.<br/>Altered sediment deposition pattern.<br/>Increased pressure on habitats.<br/>Reduced biodiversity.</p> |
| <p><b>Reduced freshwater species</b><br/>Within fish and clam, there is a gradual reduction in freshwater dependant species, which have been replaced by high salinity tolerant species.</p>   | <p>Reduced freshwater inflows.</p>   | <p>Increased salinity regimes.</p>               | <p>Reduced ecological integrity.<br/>Reduced biodiversity.<br/>Reduced ecosystem productivity.</p>  |
| <p><b>Unsustainable clam harvesting</b><br/>The current annual production of clam <i>Paphia malabarica</i> is very close (96.7 %) of the estimated maximum sustainable yield level of this species in the estuary.</p>                           | <p>Increased harvest for livelihoods.<br/>Weak enforcement of regulation.</p>            | <p>Reduced stock.</p>                            | <p>Reduced harvest.<br/>Adverse impacts on livelihood systems dependant on clam resources.</p>  |
| <p><b>Use of destructive fishing practices</b><br/>There is rampant use of nets of low mesh sizes, and obstruction of migratory routes.</p>  | <p>Increased competition over limited resources.<br/>Weak enforcement of regulation.</p> | <p>Reduced biomass.<br/>Lower sizes of fish.</p> | <p>Reduced harvest.<br/>Adverse impacts on livelihood systems dependant on clam resources.</p>  |

|  |                                  |  |  |
|--|----------------------------------|--|--|
| <p>Reduced rainfall and increased rate of sea level rise<br/>The analysis of 100-year rainfall for IMD Kollam Station indicates a gradually declining rainfall during the south-west monsoon and as a result total rainfall. Comparing the long term average sea level rise during 1939-2007 with present data from the period 1992-2007, there has been an increase in sea level rise from 1.81 mm/year to 3.7 mm/year.</p> | <p>Altered climate patterns.</p> | <p>Altered hydrodynamics, leading to increased siltation from the sea<br/>Changed tidal limits and reduced salinity gradients.</p> | <p>Changes in community structure – predominance of brackish and marine forms. Altered sedimentation patterns.</p> |
|--|----------------------------------|--|--|

The management plan for Ashtamudi Estuary is proposed to be organized in five components, namely a) institutional development; b) water management; c) biodiversity conservation; d) sustainable fisheries; and, e) sustainable livelihoods. Specific objectives intended to be achieved within each of these components are as under:

#### Action points on conservation given in the Plans

#### Component 1: Institutions and governance

##### **1.1 Establishment of Ashtamudi Wetland Authority**

Ashtamudi Wetland Authority is proposed to be established as a nodal agency mandated for coordinating integrated management of Ashtamudi. The Authority may be registered as a government non-profit organization (under the Travancore-Kochi Literary Science Charitable Society Registration Act, 1955) to enable flexibility in raising financial resources from public and private sources.

As per the provisions of the Societies Registration Act, a Memorandum of Association defining the jurisdiction, aims and objectives and governance structure will need to be submitted to the Registrar of Authorities. Rules and Regulations detailing the membership, powers and functions of governing and executive bodies, accounting and audit procedures, and management of property of the authority will also need to be formulated and submitted to the Registrar.

A three-tier governance structure is proposed with the Governing Body at the apex, an Executive Committee, and an office of the Chief Executive to implement the programmes. Meeting atleast once in year, The Governing Body will approve the overall management framework, and ensure intersectoral coordination between line departments and agencies. The Executive Committee shall meet regularly to approve annual plans and projects. The Office of the Chief Executive shall be responsible for implementing the decisions of the Executive Committee, and report to the Committee on the overall ecosystem health.

Following specific activities are to be undertaken:

- Government approval of constitution of AWA and the governance structure
- Finalization of Memorandum of Association
- Registration under Societies Registration Act
- Staffing and work allocation as per the structure were suggested in the MAP
- Conducting business as per the Terms of Reference outlined in the MAP

### **1.2 Integrated wetland inventory, assessment and monitoring system**

An integrated wetland inventory, assessment and monitoring system is proposed to be set up to address the overall information needs of wetland management and to provide robust decision support system for the same. Specific objectives and a detailed framework have been outlined in Chapter 5 of the management plan. The following activities are proposed:

#### **1.2.1 *Establishment of wetland monitoring and research centre***

A state of the art wetland monitoring and centre is proposed to be established within the DTPC Complex premises for monitoring the ecological, hydrological and socio-economic features of Ashtamudi. The centre would function under the aegis of CWRDM which would coordinate all inventory, assessment and monitoring programmes. A list of necessary equipment to be procured for the centre is in Annex 11

### **1.2.2 *Development of database management system***

A database system for storing, retrieving and analysing the WIAMS is proposed to be set up in a GIS environment. This system would serve as a template for the CWRDM for the inventory, assessment and monitoring system.

Specific activities to be take up under this activity include:

- a) Development of data quality management and assurance plan including specification of data collection objectives, data quality objectives, sampling programme design, data and metadata documentation procedure, data quality control methods and performance auditprocedures;
- b) development of GIS based database management system;
- c) managing the database as per approved plan, alongwith periodic updation and reporting.

### **1.2.3 *Wetland monitoring and evaluation***

Wetland monitoring and inventory protocols at the Ashtamudi Estuary, associated wetlands and Kallada Basin and coastal zone level as detailed in Section 5.2 of the management plan will be implemented. Implementation would include following additional activities:]

### **1.2.4 *Ecosystem Health Report Card***

It is proposed to assess and publish an Ecosystem Health Report Card, every two years, to assess and communicate wetland monitoring information to decision-makers and stakeholders.

The health report card summarizes indicators along major indices (e.g. key water and sediment quality parameters; parameters indicating health of coastal zone; fish, prawn, crab and clam landings; waterbird counts; biodiversity status) which represent various elements of ecological character of Ashtamudi Estuary, evaluated against respective thresholds setin line with management goals. Such a report card is being biennially published for Lake Chilika and has been found to be highly effective in

communicating complex ecological, hydrological and socio-economic information in simple terms to decision-makers and stakeholders

### **1.3 Capacity development**

Capacity building of Ashtamudi Wetland Authority, concerned State Government departments, agencies and local communities is proposed to be undertaken through professional training in following:

- Integrated wetland management
- Wetlands and water management
- Wetlands and livelihoods
- Conserving wetlands biodiversity

Other needs based training, as recommended by training needs assessment Implementation of this component would be guided by a detailed capacityassessment of all management plan implementing agencies and departments,which will be conducted during the first year of management planimplementation. During the first two years, two training programmes for allconcerned institutions on integrated wetland management and wetlands andwater management are proposed. In addition, provision for exposure visits toChilika and other sites wherein management has been relatively successful hasalso been made. Interventions of infrastructure enhancement has been madewithin the monitoring and evaluation section of the action plan.

### **1.4 Monitoring compliance with existing laws and regulations**

Compliance with the provision of following rules and laws will be comprehensively monitored, and violations reported to concerned authority for ensuring remedial action:

- Provisions of Wetlands (Conservation and Management) Rules, 2010 – prohibiting conversion of wetlands into non-wetland usages, discharge of untreated sewage, soil waste dumping and activities likely to

adversely affect wetland ecosystem health.

- Provisions of the Coastal Regulation Zone Notification, 2011 – prohibiting discharge of untreated effluent within regulated zones, setting up and expansion of new industries (with exceptions), land reclamation and a range of construction activities.
- Provisions of the Kerala Conservation of Paddy Land and Wetland Act, 2008 barring reclamation of wetlands.
- Provisions of The Kerala Protection of River Banks and Regulation of Removal of Sand Act (2001) under which mining is banned in Kallada River.

### **1.5 Communication and outreach**

Stakeholder engagement in wetland management will be promoted through creating awareness on values and functions of Ashtamudi, management strategies adopted and opportunities for participation. Specific activities to be undertaken include:

#### ***Signage***

Signage proclaiming Ashtamudi as a Ramsar Site is proposed to be placed at all major entry points of the estuary, namely DTPC Kollam, Thoppikadavu, Kadavur, Thekumbhagam and Monruthuruthu. The AWA may work out arrangements with all major resort owners to prominently display the wetland's Ramsar Site status within their properties. Recommended format for signage is provided Annex 12.

#### ***Webpage***

It is proposed to create a dedicated webpage for Ashtamudi, as an electronic interface for stakeholders to connect with wetland managers. The page may be linked with the webpage of Department of Environment, and include information on various aspects of the Estuary, management plan implementation, outcomes of monitoring programme, research and development, news and career opportunities. The page will also host resources for wetland managers.

***Resource material***

Brochures, fact sheets and awareness material on Ashtamudi Estuary are proposed to be published in English and Malayalam for public distribution. A coffee table book is also proposed to be published for serious nature lovers.

***Newsletter***

A newsletter highlighting progress made in management plan implementation and key emerging issues related to Ashtamudi is proposed to be published annually in English and Malayalam, and disseminated to all stakeholders.

***Workshops and public events***

Public events are proposed to be organized on the eve of World Wetlands Day (Feb 2), World Environment Day (June 5) and International Day for Biological Diversity (May 22) as a means of reaching out to public on the issues of wetland conservation and wise use. Public events on specific issues, as water management and pollution abatement are also proposed to be organized, in cooperation with developmental programmes as Swacch Bharat Mission, as a means of engaging with stakeholders.

***Ashtamudi Rangers' Camp***

Camps, atleast once a year, are proposed to be organized for school and college students to make them aware of the significance of the lake. Students can be given an honorary Ashtamudi Rangers' badge on completion of the camp.

**1.6 Management plan review**

A mid-term and end-term review of management plan implementation is proposed to assess the extent to which stipulated objectives have been achieved with a high degree of resource efficiency and in participation with stakeholders. Evaluation would include assessment of management effectiveness. External agencies would be engaged for the purpose, who would report to AWA.

## Component 2: Water management

### 2.1 Allocating water for ecosystem functioning

A reduction of freshwater inflows into Ashtamudi has led to predominance of marine environments, inducing threats to its ecological integrity and resource productivity. An important element of management plan is to assess and implement environmental water requirements for the Estuary. Methods for assessment of environmental requirements can be broadly classed as follows (Adams, 2012):

- Conditions based which are set to maintain specific physical and habitat conditions in order to protect the estuarine ecosystem.
- Inflows-based deriving conditions for maintenance of freshwater inflows into the estuary based on hydrological analyses and modelling ( such as required percentage of stream flows required for estuary ecological components and processes)
- Resource-based focused on species and communities of economic importance (such as fisheries)
- Holistic methods considering the entire ecosystem and using a range of multi-disciplinary approaches

Steps to be taken are as follows:

- Establishing a decision-making framework (constitution of a committee with major stakeholders, empowered to review assessment outcomes and influence implementation)
- Scoping a terms of reference for environmental water requirements
- Assessing trends in human demands of water at basin scale
- Assessing ecosystem water requirements (quantity and quality)and linked sediment fluxes
- Identifying tradeoffs and possible options
- Recommending possible Kallada Barrage operation rules to address environmental water requirements needs
- Setting up a monitoring system to evaluate performance against agreed upon

indicators

- Implement environmental water requirement
- Review and adaptation

The assessment of environmental water requirements is proposed to be done by an external agency, working in collaboration with Kerala government research agencies as NCESS and CWRDM.

## **2.2. Water Quality Improvement**

### **2.2.1 Waste management system for Kollam City**

The absence of waste management infrastructure within Kollam City makes it one of the key pollution sources for Ashtamudi Estuary. As per the City Development Plan for Kollam, the projected sewage generation for the year 2031 and 2041 is 77 and 87 MLD respectively. For immediate requirement, STP (two units) of a cumulative capacity of 66 MLD and 305 km of branch sewers are required to be put in place. Provisions have already been made for this activity under the Atal Mission for Rejuvenation of Urban Transformation (AMRUT) of the Ministry of Urban Development.

The solid waste dumping site for Kollam City is located in Kureepuzha on the boundary of Ashtamudi estuary. The dump addresses only one-fourth of the waste generation, the rest invariably finding way into the estuary. In absence of treatment, leachate from the solid dump also becomes a source of pollution into the Estuary.

It is therefore proposed to treat the existing waste dump, and phase out these operations by locating an alternate site. Interventions for proper waste segregation at the household level, collection, and recycling through technologies as biomethanation and energy production need to be implemented, in collaboration with Kollam Municipal Corporation.

### **2.2.2 Management of Slaughterhouse Effluent**

The slaughter house located on the bank of Ashtamudi Estuary does not have adequate waste management facility and directly discharges waste into the Kollam Canal, and ultimately into the estuary. It is proposed to put in place effluent treatment facility in the slaughterhouse.

### **2.2.3 *Alternate Technology for Coir Retting***

It is proposed to establish closed coir retting facilities in all 25 retting units around Trikkaruva, Trikkadavur and Thekkumbhagam can be placed.

Closed coir retting technology has a biological leaching bed, which provides removal of bioextractables from coconut husk and thereby achieves anaerobic degradation of the bonding between the fibres and matrices. The pollutant is pumped to USAB high rate reactor leads to the formation of biogas which can be used as fuel. This is a quick process and takes around 30 days as compared with 10 months in the current practice. The coir pith produced in the process can be used as soil conditioner.

Implementation of this activity would involve engagement with the retting units on the adverse environmental as well as human health impacts of currently used retting practices. The unit owners would be trained in use of the alternate technology, and provided subsidies for adoption.

### **2.2.4 *Houseboat waste***

All houseboats would need to be fitted with a wastewater storage tank which can be emptied into a waste treatment facility located on the shorelines. Management plan implementation will also work with the Kerala Tourism Department to sensitize the boatowners on the implication of pollution on recreational values of the backwaters, and the extant regulatory measures in place prohibiting waste discharge in the waterbodies. Provisions are made within management plan to support adequate refurbishment of houseboats.

## **2.3 *Research studies***

Following specific research studies are proposed to be commissioned to

address the knowledge gaps in assessing status and trends in ecological character:

- Sediment flux in the estuary – to assess the degree and source of siltation, and implication for water holding capacity.
- Climate risk and vulnerability to assess perception of climate risks based on sensitivity and adaptive capacity of critical ecological character elements; climate scenarios with respect to ecological character; and risk management options.

These studies are proposed to be conducted by AWA by engaging external agencies, The outcomes would be taken on board while evaluation management effectiveness, and undertaking mid-term course correction.

## Component 3: Biodiversity conservation

### **3.1 Restoration of mangrove areas**

The management envisages to restore mangroves within the intertidal areas of the Estuary. Given that much of the shoreline is under private ownership, it is proposed to undertake restoration using an incentive based bio-rights framework.

Under this framework, the participating household is provided a grant for livelihood activities, subject to a condition that the restored mangroves achieve a certain height and density over a period of time, and is maintained in that condition for a period not less than eight years. In case the height and density of mangrove does not reach the stipulated conditions, the grant is converted into a loan, and is reclaimed with a stipulated rate of interest. Wetlands International has implemented mangrove restoration programmes using similar approach in Indonesia and several West African countries, with considerable success over cash for work based approaches, wherein communities are paid for labour. During field surveys, restoration appeared to be feasible in areas around Asramam, Islands near Sakthikulangara and Munroe Islands.

Steps to be taken include:

- Survey and mapping of areas wherein mangrove restoration is feasible. The feasibility can be assessed on the basis of existence of mangrove patches within near past, availability of required salinity regime, physical features of the landform and tidal regime.
- Identification of target communities, collaboratively with Panchayat.
- Conducting sensitization workshops with the concerned Panchayat on the values of mangroves within the context of estuarine ecosystem, and restoration method.
- Formulating biorights contracts, with clear specification of restoration targets and linked conditionality, and monitoring mechanisms.
- Restoration within the identified sites.
- Monitoring of regeneration, technical support and contract enforcement.

### **3.2 Mid-winter census**

Waterbird census conducted within the framework of Asian Waterbird Census provides a useful information base for assessing species-wise regional and global population. Ashtamudi Estuary is a habitat of over 60 of the known 216 species of migrating waterbirds recorded in India. While the census has been carried out for various years, the information remains patchy and disjointed.

It is proposed to conduct comprehensive mid-winter counts each year, in Ashtamudi Estuary and adjoining wetlands. The census can be led by the existing team at Kerala Agriculture University which has been conducting comprehensive census for Vembanad Kol wetlands since over a decade. Waterbird census also provides an opportunity to promote awareness of wetlands, and therefore it is recommended to involve interested Panchayat members and volunteers in this operation. Action to be taken are as follows:

**a) *Training on bird identification and counting***

It is proposed to train interested village community members and volunteers on identification and counting of birds so as to enable them being enumerators of census programme.

To support capacity development, it is proposed to publish a bird identification guide of Ashtamudi Estuary region in English and Malayalam.

**b) *Census***

The census would be conducted as per the guidelines laid by the Asian Waterbird Census Programme and reported in standardized formats to State Coordinator for validation and onward compilation at national level.

**3.3 Breeding waterbirds investigation**

An assessment of distribution and breeding concentrations of all waterbird species in Ashtamudi Estuary and adjoining wetlands

(Sasthamcotta Lake, Karali marshes, Chittumala, Veliyapadam marshes and Chellurpola kayal) is proposed to be undertaken to determine the current baseline population of breeding birds. Studies of the habitat preferences, precise requirements, ecology of key waterbird species and determination of current threats is proposed to enable planning and execution of measures to manage and improve existing habitats, to identify potential breeding areas and restore degraded areas to increase breeding habitats and address increased prey requirements. The services of Bombay Natural History Society or Salim Ali Center for Ornithology may be sought for implementing this study.

#### **3.4 Animal disease surveillance**

Knowledge of health of resident and migratory waterbird species is critical for assessing the risk and potential threat of avifaunal diseases. Knowledge of the health of these species that inhabit the wetland is critical to understand the risk and potential threat of transmission of avifauna diseases. It is proposed to train the Ashtamudi Wetland Authority in general identification of traits of common diseases as well as avian influenza. The authority will also be networked with surveillance teams of State Animal Husbandry Department to enable timely response.

#### **3.5 Biodiversity Register for Ashtamudi**

It is proposed to develop a Biodiversity Register for Ashtamudi Estuary and associated wetland habitats. This register would be compiled by the Biodiversity Management Committees constituted within the Panchayat surrounding the estuary. Implementation of this activity may be supported by Kerala Biodiversity Board, Zoological Survey of India, Kerala Forest Research Institute, and Central Marine Fisheries Research Institute.

#### **3.6 Ecotourism development**

### **3.6.1 Master Plan Development**

A community managed ecotourism master plan for Ashtamudi would be drawn up by engaging experts. The plan would establish the tourism potential by:

- Carrying capacity assessment of estuary for tourism. The assessment should inter alia establish the optimal number of houseboats that can be permitted with due consideration of the ecological character of the wetland.
- Identifying areas and features of ecotourism potential
- Identifying infrastructure development needs (eg. interpretation centre, boardwalk and nature trails and others)
- Analysis of regulatory environment in the context of ecotourism
- Institutional development needs
- Strength, Weakness, Opportunities and Threat analysis for ecotourism development
- Development of Regional Ecotourism Plan

### **3.6.2 Interpretation Center**

It is proposed to establish an Ashtamudi Interpretation Center at KRTC, which is one of the significant entrypoints to the estuary. The Center is proposed to be a two storeyed 2,000 square feet construction with following facilities:

**Viewing gallery** – the gallery would display panels on the ecological, socio-economic and cultural significance of Ashtamudi Estuary;

**Exhibits** – life-size models estuary hydrology, fish migration, and waterbirds and their habitat;

**Auditorium** – as an audiovisual platform for screening of documentaries, holding talks, and workshops;

**Monitoring laboratory** – with equipment for ecological monitoring and GIS;

**Conference hall** – as a designated place for holding meetings, trainings and workshops.

**Information kiosk** – for public information through pamphlets, posters, maps and other references on key features of the wetland.

### **3.6.3 *Capacity development programme for houseboat operators***

A designated capacity development programme is proposed to be conducted for houseboat owners to train them in conducting tourists within an ecologically fragile area. Training would include introduction to various ecological features of the estuary, key biodiversity habitats and management needs and dos and don'ts for the operators as well as tourists. The training is proposed to be conducted at least once every year to take into account staff turnover.

## **Components 4: Fisheries management**

### **4.1 Code of conduct for responsible fisheries**

The Food and Agriculture Organization's Code of Conduct for Responsible Fisheries provides a validated reference framework for long-term conservation and sustainable use of fisheries resources. This voluntary framework emerged from a call from the International Conference on Responsible Fishing (1992) to strengthen the international legal framework for more effective conservation, management and sustainable exploitation and production of living aquatic resources, and was adopted by the FAO in 1995. After two decades since its adoption, the Code continues to be a reference framework for national and international efforts, including in the formulation of policies and other legal and institutional frameworks and instruments, to ensure sustainable fishing and production of aquatic living resources in harmony with the environment.

The management plan aims to create awareness on the needs of sustainable fishing, and mobilize local collective action by disseminating the code of conduct amongst the Ashtamudi

Estuary fishers. The code will be translated into Malayalam, and would be disseminated to all member fishers through outreach workshops. An important outcome to be targeted through the Code is regulation of use of small mesh sizes, and removing barriers to migratory routes.

#### **4.2 Value addition in clam fisheries**

Clams are traded in two forms: a) whole clam (fresh frozen or boiled frozen) and

b) as clam meat (frozen blocks). Analysis of certified clam fisheries by CMFRI (reported in Muhamed et al, 2016) indicates that higher revenues can be generated if the trade is targeted at European markets, which have a preference for whole clams. The management plan aims to support this transition by promoting an alternate means of whole clam processing (rather than shucking clam meat) by depuration, prototypes for which are available with CMFRI.

Following steps are proposed:

- Conducting technology dissemination workshop with clam fisheries
- Establishing a demonstration project on whole clam processing
- Upscaling based on evaluation of outcomes of demonstration project

#### **4.3 Maintenance of Marine Stewardship Council standard for certified clam fishery**

Ashtamudi clam fisheries are famed to be the first Marine Stewardship Council certified fisheries of the country. The certification enables clam fishers to generate higher revenues and access new export markets. However, maintenance of certification requires meeting conditionality such as wilful forfeiture of clam catch due to enforcement of ban, cost of re-auditing (after 5 years), and cost of experts involved in auditing process.

Management plan entails efforts for maintenance of MSC

certification through covering the cost of experts, providing alternate livelihoods for ban period, and training and outreach to the clam fisher community on sustainable clam fisheries.

#### **4.4 Improving landing center infrastructure**

It is proposed to provide landing platforms, storage area, weighing units, toilets and drinking water supply at all 20 landing center locations around the Estuary. These infrastructure would be managed by fisher cooperatives.

#### **4.5 Cage culture of Pearl-spot**

In convergence with Department of Fisheries' initiative "Matsyasamrudhi", a project for cage culture of state fish Karimeen (*Etroplus Suretensis*) is proposed to be undertaken with technical support of the Regional Agriculture Research Station, Kumarakom. The project would involve two sites, with two groups of beneficiaries (20 fishers each), and would be replicated based on the evaluation of outcomes. Specific activities are as follows:

- Site and beneficiary selection: Site selection require specific consideration of water level fluctuation; adequate water circulation; availability of sheltered, weed free, shallow bays; and operational accessibility.
- Training: The target fisher will be trained in use of cage culture technology, harvest & post-harvest management, and fish marketing. Training on the cage installation, species selection, stock maintenance and feeding operation and harvest will be imparted to the beneficiaries.
- Cage preparation and installation: Standard cages of 1 m<sup>3</sup> (1m x 1m x 1m) are proposed to be installed in a battery of six cages per unit.
- Productivity from cages would be monitored for four fishing cycles, and based on outcomes further dissemination would be done.

#### 4.6 Monitoring and research

Following monitoring and research activities are proposed to support management of Ashtamudi Estuary Fisheries:

##### a) *Stock and yield assessment*

A systematic yield assessment protocol would be designed in consultation with CMFRI, and would be implemented to assess stocks and establish maximum sustainable yields for different fisheries. Provisions will be made for implementation of the assessment protocol and dissemination of outcomes.

##### b) *Mapping migration pathways*

Tagging experiment on commercially important fish species to assess migratory pathway, distribution and growth rates.

### Component 5: Sustainable livelihoods

#### 5.1 Improved sanitation services

Nearly half of the toilets around the shoreline have single pits and have inadequate sealing of faecal matter. It is proposed to replace nearly 20,000 such toilets with double pits to prevent water contamination with faecal matter.

#### 5.2 Additional / alternate livelihoods

Additional / alternate livelihood options listed below would be provided to communities having direct livelihood dependence on Ashtamudi Estuary with an objective of reducing resource use pressure as well as incentivize resource stewardship.

- Dry fish unit for 6 fisher groups near Koduvila, Thekkumbhagam and Panayam with support of Fisheries Department. The dried and processed products can be market under the brand name “Drish Kerala” by Kerala State Coastal Area Development Corporation (KSCADC) in Sakthikulangara
- Vermi composting unit for 50 groups, using poultry waste and

household waste. Arrangements would be made with Panchayat for sale of compost through Kudumbasree units.

- Coir based handicrafts for 5 self-help groups with support of Kerala State Coir Corporation Limited to promote ropes, mats, baskets, wall hangings etc. in national and international market
- Promote culture of ornamental fish species (such as the clownfish Amphiprion chrysogaster, A. percula, A. frenatus, A. ocellaris and one spot damselfish Chrysiptera unimaculata, Dascyllus aruanus and D. trimaculatus) for 5 fisher group with support of CMFRI.

### Budget

| Management Plan Components                                       | Budget    | Convergence Scheme | Concerned Department / Agency / Organization | Convergence Budget |
|--|-----------|--------------------|--|--------------------|
| 1 Institutions and Governance                                    | 1,045.25  |                    |  |                    |
| 1.1 Establishment of Ashtamudi Management Authority              | 125.00    |                    |  |                    |
| 1.2 Integrated wetland inventory, assessment & monitoring system | 688.00    |                    |  |                    |
| 1.3 Capacity development   | 99.50     |                    |  |                    |
| 1.4 Monitoring compliance with existing laws & regulation        | 10.00     |                    | DoE  | 10.00              |
| 1.5 Communication & outreach                                     | 87.75     |                    |  |                    |
| 1.6 Management Plan Review                                       | 35.00     |                    |  |                    |
| 2 Water Management   | 12,242.20 |                    |  |                    |
| 2.1 Environmental water requirement                              | 51.00     |                    |  |                    |
| 2.2 Enhancement of water quality                                 |           |                    |  |                    |
| Improvement of sewage management in Kollam                       | 9,319.20  | AMRUT              | KSUDP  | 9,319.20           |

|          |   |          |                 |         |       |          |
|----------|---|----------|-----------------|---------|-------|----------|
|          | city  |          |                 |         |       |          |
|          | Improvement of solid waste management               | 2,572.00 |                 | AMRUT   | KSUDP | 2,572.00 |
|          | Management of slaughterhouse effluent               |          |                 | AMRUT   |       |          |
|          | Alternate coir retting method                       | 75.00    |                 |         |       |          |
|          | Upgradation of houseboats in Ashtamudi              | 125.00   |                 |         |       |          |
|          | 2.3 Research studies                                | 100.00   |                 |         |       |          |
| <b>3</b> | <b>Biodiversity Conservation</b>                    |          | <b>876.50</b>   |         |       |          |
|          | 3.1 Mangrove restoration                            | 429.00   |                 |         |       |          |
|          | 3.2 Annual water birdscensus                        | 27.50    |                 |         |       |          |
|          | 3.3 Water bird disease surveillance                 | 10.00    |                 |         |       |          |
|          | 3.4 Breeding waterbirds investigation               | 25.00    |                 |         |       |          |
|          | 3.5 Biodiversity Register                           | 35.00    |                 |         |       |          |
|          | 3.6 Eco-Tourism Development                         | 350.00   |                 |         |       |          |
| <b>4</b> | <b>Sustainable fisheries</b>                        |          | <b>572.50</b>   |         |       |          |
|          | 4.1 Code of Conduct forsustainable fisheries        | 15.00    |                 |         |       |          |
|          | 4.2 Value added in clamfisheries                    | 317.50   |                 |         |       |          |
|          | 4.3 Marine Stewardship Council Standard Maintenance | 30.00    |                 |         |       |          |
|          | 4.4 Improving landing center infrastructure         | 100.00   |                 |         |       |          |
|          | 4.5 Cage culture                                    | 50.00    |                 | NFDB    | DoF   | 50.00    |
|          | 4.6 Monitoring andResearch                          | 60.00    |                 |         |       |          |
| <b>5</b> | <b>Livelihoods</b>                                  |          | <b>2,617.50</b> |         |       |          |
|          | 5.1 Safe sanitation                                 | 2,500.00 |                 | Suchitw |       | 2,500.00 |
|          |   |          |                 | a       |       |          |

|     |                        |        |           |                               |     |           |
|-----|------------------------|--------|-----------|-------------------------------|-----|-----------|
|     |                        |        |           | Mission                       |     |           |
| 5.2 | Additional Livelihoods | 117.50 |           | Matsya<br>Samridh<br>iProject | DoF | 40.00     |
|     |                        |        | 17,353.95 | -                             | -   | 14,491.20 |

The Management Action Plan of Ashtamudi wetland is being initiated and will be revised as per NPCA guidelines by August 2023.

The approved management action plans of Ashtamudi and Vembanad are placed in the following link

<https://swak.kerala.gov.in/index.php/informations/downloads/action-plans>