

# Project Preparation Technical Assistance

ADB TA 7954-IND



## FINAL REPORT

*for the*

### Karnataka Integrated and Sustainable Water Resources Management Investment Program

#### Volume 3: Annexure - 1 Environmental Assessment Review Framework

Prepared for the State Government of Karnataka  
and the Asian Development Bank

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By

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## Abbreviations

AC-IWRM	Advanced Centre - Integrated Water Resource Management
ADB	Asian Development Bank
AEE	Assistant Executive Engineer
CADA	Command Area Development Authority
CE	Chief Engineer
CPCB	Central Pollution Control Board
DoEF	Department of Environment and Forests, Government of Karnataka
EARF	Environmental Assessment and Review Framework
EE	Executive Engineer
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPA, 1986	Environmental Protection Act, 1986
Gol	Government of India
GoK	Government of Karnataka
ha	Hectors
HWHAMA	Hampi World Heritage Area Management Authority
IEE	Initial Environmental Evaluation
IWRM	Integrated Water Resources Management
KISWRMIP	Karnataka Integrated and Sustainable Water Resources Management Investment Program
KSPCB	Karnataka State Pollution Control Board
MAB	Man and Biosphere
MFF	Multitranch Financing Facility
MoEF	Ministry of Environment and Forests, India
MW	Megawatts
NABET	National Accreditation Board of Education and Training
O&M	Operation and Management
PMU	Project Management Unit
RSPM	Respiratable Suspended Particulate Matter
SE	Superintending Engineer
TA	Technical Assistance
QCI	Quality Council of India
UNESCO	United Nations Educational, Scientific and Cultural Organisation

## EXECUTIVE SUMMARY

1. The Environmental Assessment Review Framework (EARF) is a document that is to be used to guide the environment related actions for the overall project. It is to help guide the development of the IEE or EIA, whatever the case might be for each subproject in the various tranches of the project. Apart from the guidance of possible impacts and their management plan, the EARF also has discussed possible legislations that are applicable for the project – both the ADB and Indian legislation and regulations. These can help guide the development of subsequent environmental assessments identify permissions and procedures that may be required. This document has also provided an overall institutional framework and capacity building guideline for environmental actions. However, if during the project implementation alternate and better arrangements are identified those could be considered instead. Finally, the document has identified a list of activities/subprojects which should be undertaken during design/detailed planning, construction, and operation and maintenance in order to minimise their potential environmental impact. This must be referred at the time of identification of subproject and its activities.

## 1. INTRODUCTION

1. The SGOK, Government of India (GOI) and ADB have agreed on technical assistance for preparing the Karnataka Integrated and Sustainable Water Resources Management Investment Program (KISWRMIP) and this will be financed through a Multi-tranche Financing Facilities (MFF). The MFF will be implemented in 3 overlapping Tranches over a period of 10 years.

2. The Environmental Assessment and Review Framework (EARF) which is required by the ADB SPS June 2009 is to guide subproject selection, screening and categorization, environmental assessment, and preparation and implementation of safeguard plans of subprojects to facilitate compliance with the ADB requirements<sup>1</sup>. As a part of this EARF, potential environmental impacts and a general environmental management plan has also been developed and this will help guide the environmental process in the subsequent tranches of the MFF.

3. The EARF is intended for use and reference primarily by the Program's key stakeholders and particularly the Project Management Unit (PMU), Karnataka Neeravari Nigam Limited (KNNL), CADA, and WUCS. The Framework will be translated into Kannada language and disseminated accordingly. The English version will be posted on the ADB website.

### 1.1 Project Overview

4. The SGOK, Government of India (GOI) and ADB have agreed on technical assistance for preparing the Karnataka Integrated and Sustainable Water Resources Management Investment Program (KISWRMIP).

5. **Program Impact:** The impact of the Program will be enhanced security of water resources in Karnataka river basins. Indicator targets from the Design and Monitoring Framework (DMF) for this are, by 2028:

- i. River basin management arrangements established in at least 3 sub-basins
- ii. Water quality in at least 90 % of river reaches maintained at or better than class for intended use in selected sub-basins
- iii. State gross value (2012 INR) of annual agricultural production increases from INR 62,057 crore (USD 11.28b) to INR 141,455 crore (USD 25.72b)

6. **Program Outcome:** The Outcome of the Program would be improved water resources management in the selected river basins in Karnataka. The indicator targets for this are:

- i. By 2020 the State IWRM strategy will be under implementation
- ii. By 2023 annual water resources monitoring and assessments in program sub-basins and corresponding water allocations to users are being implemented
- iii. By 2023 Infrastructure and management systems on 55,000 ha of irrigation is modernized (FAO 1996) within the K8 sub-basin

7. **Program Outputs:** The KISWRMIP comprises 3 Program Level Outputs, each with performance indicators, and these are:

- i. State and basin institutions strengthened for IWRM
- ii. Irrigation system infrastructure and management modernised
- iii. Program management systems operational

8. The KISWRMIP will be financed through a Multi-tranche Financing Facility (MFF) to enable flexibility in investment decisions and timing based on the needs and constraints of the project. The

<sup>1</sup> ADB (March 2011) Draft Sourcebook for Safeguard Requirement 1: Environment. paragraph 241. pp 173.

MFF will allow ADB and GOK to develop a long-term partnership for supporting the goals of the KISWRMIP in a realistic timeframe. Procurement would be carried out according to the ADB's Procurement Guidelines.

9. As indicated above the proposed program has three major Outputs which will support GOK agencies:

**1. State and basin institutions strengthened for IWRM**

10. The overarching IWRM component would provide continuous support and introduce international leading practice to the GOK through the Advanced Centre – IWRM (AC-IWRM) in building IWRM approaches suited to Karnataka. It would support the Centre in becoming an international centre of excellence. This component would conduct (i) IWRM policy studies and preparation of a State IWRM Strategy, (ii) developing and utilising a Water Information Knowledge Management system, (iii) preparing a State wide inventory of river basins capacity building and human resource development, (iv) river basin planning and advising on river basin organization arrangements initially for the Tungabhadra sub-basin, (v) trialing community based Land and Water Management Plans including local environmental sustainability issues such as water quality and waste management, water table and groundwater control, biodiversity conservation; (vi) assessments of water use efficiency and water productivity at scales from river basin to irrigation system and field levels, (vii) stakeholder awareness raising and participation, (viii) developing partnerships with international organisations and governments responsible for the management of severe water scarcity in river basins and with an interstate water sharing context. This will be supported by IWRM capacity building and training, and, investigations of approaches internationally, regionally and nationally.

**2. Irrigation system infrastructure and management modernised**

11. This component would improve irrigation service delivery and sustainability using an IWRM approach. This would include integrated planning and management for selected command areas and involve: (i) achieving a sustainable water balance; (ii) infrastructure modernization for Bhadra and Gondhi for Tranche 1 and throughout the Tungabhadra River sub basin in subsequent Tranches. It would include flow measurement, telemetry and related control systems; canal rehabilitation and lining; and command areas development; (iii) agriculture development including raising water use efficiency and water productivity and improving the environmental functioning of irrigation (eg. use of IPM, soil health, use of agrichemicals); (iv) improving farmer livelihoods and living conditions; (v) management of water logging, salinity and return flows and their quality, and, (vi) institutional and human strengthening including for Nigam, Command Area Development Authorities (CADA), Water User Cooperative Societies (WUCS) and farmers via extension services to promote necessary changes.

12. This Output would improve irrigation service delivery and sustainability using an IWRM approach. This would include integrated planning and management for selected command areas and involve:

- (i) Developing an improved understanding of water availability and usage within the Tungabhadra sub-basin through provision of a flow measurement network and associated information system
- (ii) Supporting improved operation of the Bhadra irrigation system to provide more equitable distribution and reduced wastage
- (iii) Modernisation of the selected canal systems and command areas to improve water use efficiency and equity (Gondhi in Tranche 1, Vijayanagara and Tungabhadra left bank in Tranche 2, and, Tungabhadra left bank in Tranche 3)
- (iv) Capacity building of system operations staff, water user organisations and agricultural staff to support the objective of increased crop value concurrent with reduced water consumption.

### 3. Program management systems operational

13. This output concerns the overall management of the program including the direct oversight of the implementation of Output 2.

14. KNNL is proposed as the program Executing Agency. The SGOK IWRM Steering Committee, chaired by the Chief Secretary, will be responsible for overall review of the program and to facilitate inter-departmental coordination, especially for IWRM activities and the GOI Central Water Commission (CWC) will be invited as a member. The Implementing Agency for Output 1 will be the AC-IWRM; Output 2, KNNL; and, for Output 3, the KNNL through its Irrigation Zones (Field Units) and the concerned CADAs. A skills-based expert advisory panel is proposed for Output 1. It would comprise international, national (CWC) and SGOK representatives.

15. A Program Management Unit (PMU) will be established in the Tungabhadra Basin, under the KNL Chief Engineer, Central Irrigation Zone, Munirabad, who is designated as the Program Director. The PMU will have overall responsibility for Output 3. The PMU will be responsible for overall program management, coordination, monitoring and reporting. Communications will be managed consistent with GOI and ADB requirements for transparency. The PMU will be supported by a Program Support Consultancy (PSC) team in its work. The PSC will consist of international and domestic specialists in the areas of irrigation management, irrigation operation, water institutions, PIM, agriculture, social, gender and the environment.

16. The program will be monitored according to the Program Design and Monitoring Framework and a Program MIS will be established in the commencement phase of the project.

17. Program coordination at Headquarters will be the responsibility of the Program Director. For interagency coordination, the Program Director will have the support of the KNNL / WRD and the IWRM Steering Committee.

18. Transparent and effective external relations and disclosure of information will be undertaken consistent with the ADB, Public Communications Policy 2011 and the Government of India, Rights to Information Act, 2005. The PMU will establish a specific communication strategy consistent with these policies.

#### The EARF

19. This EARF is for Output 2, *Irrigation system infrastructure and management modernised*. The preliminary investment roadmap comprises a range of projects as follows:

- Provision of a flow measurement and information system for the whole Tungabhadra sub-basin (Tranche 1)
- Modernisation of Gondhi Canals and command area (Tranche 1)
- Modernisation of Vijaynagara Canals and part of the Tungabhadra left bank canal system and the respective command areas (Tranche 2)
- Modernisation of part of the Tungabhadra left bank canal system and relevant command areas (Tranche 3)
- Training of Irrigation Water Supply Service Providers in Organisation and System Management (all tranches)
- Water User Cooperative Societies and Training of Water Users (all tranches)
- Capacity building in agriculture to encourage crop production providing increased household income while using less water (all tranches)

## 2. POLICY AND LEGISLATIVE SET-UP

There are a number of acts and rules of the State and National Government that may be of important to the project. While some of these could define activities to be done and location of the project, there are others that may be supported by project activities. This section discusses these regulations and their implications.

### 2.1 National and State Legislation

*Environmental (Protection) Act, 1986, Environmental Impact Assessment Notification, 2006 with amendments and rules*

20. This act vests power to the Central Government to take necessary action to protect the environment and prevention of environmental pollution. Under this act standards for discharge of effluents and pollution standards, as specified under the various pollution control acts are made. Under this act procedures and safeguard for handling of hazardous substances are also laid down. All projects and activities are broadly categorized in to two - Category A and Category B, based on the spatial extent of potential impacts and potential impacts on human health and natural and man made resources. Clearances for category A projects are from the central government and processed through the Ministry of Environment and Forests. Category B projects require clearance at the state level and will go through the State Environment Impact Assessment Authority (SEIAA).

21. According to notification of 2006 under sub-rule (3) of rule 5 of the EPA, 1986, powers conferred by sub-section (1) and clause (v) of sub-section (2) of section 3 of the Environment (Protection) Act, 1986, read with clause (d) of sub-rule (3) of rule 5 of the Environment (Protection) Rules, 1986 construction of new projects or activities or the expansion or modernization of existing projects or activities listed in the Schedule to the notification entailing capacity addition with change in process and or technology will only be undertaken after the prior environmental clearance from the Central Government or as the case may be, by the State Level Environment Impact Assessment Authority as the case might be.

22. The Schedule includes in 1 (c) River valley projects, including irrigation projects. The table 1 below gives details of what is mentioned under 1 (c) of the Schedule.

**Table 1: Categorisation according to EPA, 2006 for River Valley Projects**

Project or Activity		Category with threshold limit		Conditions if any
		A	B	
1(c)	River Valley projects	(i) 50 MW hydroelectric power generation; (ii) 10,000 ha. of culturable command area	(i) < 50 MW to 25 MW hydroelectric power generation; (ii) < 10,000 ha. of culturable command area	General Condition shall apply

General Conditions: Any project or activity specified in category 'B' will be treated as category 'A', if located in whole or in part within 10 km from the boundary of: (i) Protected Areas notified under the Wild Life (Protection) Act, 1972, (ii) Critically Polluted areas as identified by the Central Pollution Control Board from time to time, (iii) Notified Eco-sensitive areas, and (iv) inter-State boundaries.

23. This project will therefore need to look at, based upon the activities planned and finalized under the MFF the implication of this act. According to the activities finalized there may be a need to take environmental clearance for the project by the Government of India.

24. As can be seen from the General Conditions of the notification certain projects which are category B, may be considered as category A if they fulfil any of the conditions listed above. Both Bhadra and Gondi are near protected areas, with part of the Bhadra Canal system passing through forest land. Also, the Bhadra Tiger Reserve is close to the project area. VNC may also be impacted by this project due to its proximity to Daroji Bear Sanctuary. Therefore, there is a need to clearly identify the distance from

protected areas as notified under the Wildlife Protection Act, 1972 and obtain the required clearances. This should also be done for TLBC as a part of project preparation as there are forest lands in the area that may be protected under the act. Also, it is understood that the stretch of River Bhadra at Bhadrawati has been identified by the Central Pollution Control Board as critically polluted. Condition (ii) applies if the subprojects are within 10 km of critically notified area. An accredited consultant registered under Government of India's EPA, 1986 is to be hired for clearances required under the law. Projects must also be examined for possible concern under condition (iii) and (iv). While condition four would not be applicable to Bhadra or Gondi, it may be applicable to TLBC or VNC as part of the canal network could be within 10 km of the border with Andhra Pradesh.

25. For any project that requires an environmental clearance under the Government of India's EPA, 1986 there will be a need for an accredited consultant registered with the Ministry of Environment and Forests to undertake the EIA and obtain a clearance from it, as has been stated in the Office Memorandum: Accreditation of the EIA Consultants with Quality Council of India (QCI)/ National Accreditation Board of Education and Training (NABET) Dated 9th December, 2009 and available at the ministry's website.

### ***The Biological Diversity Act, 2002***

26. According to this act, where the Central Government has reasons to believe that an area rich in biological diversity, biological resources and their habitats is threatened by overuse, abuse or neglect, it could issue directives to the concerned State Government to take immediate ameliorative measures. The Central Government, as seen appropriate, integrate the conservation, promotion and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programmes and policies. The State Government, under this act, can also declare areas of biological importance as heritage sites.

27. Based on this acts recommendations, the state has started to create Biodiversity Management Committees in Karnataka. The purpose of these committees is promoting conservation, sustainable use and documentation of biological diversity including preservation of habitats, conservation of land races, folk varieties and cultivars, domesticated stocks and breeds of animals and micro-organism.

28. Considering that the project area is close to the UNESCO Man and Biosphere (MAB) site – the Nilgiri Biosphere reserve, a tip of which is the Bhadra Wildlife Sanctuary, and there are other wildlife areas such as the Daroji Bear Sanctuary in Bellary, near the identified project area, there could also be important biodiversity, animal corridors or other sensitive areas in and around the catchment area. Therefore, while planning activities of the different Tranches of the MFF there will be a need to look carefully at possible biodiversity concern. As an example, discussions with the State Biodiversity Board highlighted concerns if changes to irrigated agriculture resulted in changes to the bear sanctuary ecosystem. This would particularly be the case where there is irrigation expansion or encroachment onto neighbouring areas. Another concern highlighted by the State Biodiversity Board has been the change of the agro-ecosystems due to increased emphasis on high yielding variety crops and other more economically attractive crops, which may result in the areas agro-ecological land races depleting. However, it is yet to be understood if there will be any impact, and the possible type of impact, on the Gram Panchayat (GP) level biodiversity committees and registers underway at present. Appendix 5 of this document provides a list of some biodiversity hotspots as identified by the State Biodiversity Action Plan which in or around the project command area or could be in the areas of influence of the catchment and command areas. All subproject assessments must review these hotspots, and if required take appropriate actions minimise any adverse impacts from project activities to them. Biodiversity hotspots identified by the Karnataka Biodiversity Action Plan are given in Appendix 1.

### ***Karnataka Forest Act, 1963, Karnataka Forest Rules, 1969, Karnataka Preservation of Tree Act, 1976***

29. The Karnataka Forest Act defines the use and management of Reserved Forests, District Forests, Village Forests and Private Forests, the control of forest products – both timber and other forest products. It also defines 'reserved trees' or trees that cannot be cut without permission from the Forest Department and the cutting of 'Government Trees' from private lands. According to the Tree Act the

felling of any tree; even on private lands, requires permission from the appropriate authority for the area, as specified in the legislation. A few exceptions to the legislation have been given in chapter 5 of the document. The legislation also mentions that there is a need to plant trees of the same or different species in lieu of the felled trees, as directed by the Tree Officer.

30. It is likely that any construction activity will result in the removal of some trees, whether to access identified intervention areas, create infrastructure or even use of wood as fuel wood by the construction labour or other uses. Therefore, this legislation is expected to be relevant to the project and as required trees to be removed should be identified, permission taken and required compensation made.

#### ***Karnataka Groundwater (Regulation for Protection of Sources of Drinking Water) Act, 1999***

31. This bill defines the procedures for sinking of wells near public drinking water sources, declarations of watersheds as over exploited and the prohibition of sinking wells in such watersheds and the abstraction of water from wells in the watersheds.

32. Considering existing climate change predictions for the basin there is likely to increased aridity and therefore project watersheds may face increasing degradation and perhaps could also result in increasing periods of drought. In such a scenario, there is likely to be temporary restrictions on the use of groundwater for all purposes other than drinking. This is likely to have an impact on any conjunctive water use plans developed for irrigated agriculture.

#### ***Karnataka Act No. 25 of 2011. The Karnataka Groundwater (Regulation and Control of Development and Management) Act 2011***

33. This act further strengthens the Karnataka Groundwater (Regulation for Protection of Sources of Drinking Water) Act, 1999 as it to bring a general legislation to control in-discriminatory exploitation of ground water especially in the notified areas in the State. This act also provides for declaration of areas as drought hit, restriction and regulation of use of groundwater in notified areas and specifying minimum distance between irrigation bore wells.

34. This legislation could become relevant as some of the project areas such as in Raichur are drought prone and therefore any conjunctive use plan would be dependent upon existing restrictions. Similarly, with the minimum distance between irrigation wells, there would also be a restriction on the number of wells that can be dug for irrigation purpose.

35. If any conjunctive water use plan is to be developed, this legislation must be considered and required permissions taken while developing the plan.

#### ***Insecticide Act, 1968***

36. This act provides a list of pesticides which are restricted or banned for use in India. There is a list of 34 pesticides and formulations banned for use in India. There are another seven withdrawn pesticide, eighteen refused registration and thirteen for restricted use in India.

37. Discussions in the field identified the use of pesticides restricted in India like endosulphan and monocrotophos. The major reason for this use is that they are considered extremely effective in comparison to other known formulations by the farmers. The project would therefore need to undertaken concentrated efforts to ensure that such formulations are not used and appropriate alternate pest management techniques are known and understood by the farmers. The environmental assessments will therefore need to identify appropriate actions to ensure this.

#### ***Noise Pollution (Regulation and Control) Rules, 2000***

38. This legislation defines the levels of noise permitted in each area, including from vehicular traffic, generators, construction activities and mechanical devices. This rule would be important especially during the construction period of the project. The ambient air quality standards under this rule are given in the table below (Table 2). These levels need to be adhered to for all project activities.

**Table 2: Noise Pollution Standards for Various Locations**

Area Code	Category of Area/Zone	Limits in dB(A) Leq *	
		Day Time	Night Time
(A)	Industrial area	75	70
(B)	Commercial area	65	55
(C)	Residential area	55	45
(D)	Silence Zone	50	40

***Air (Prevention and Control of Pollution) Act, 1981, its Rules and amendments***

39. Under this Act, Boards (Central and State) for the prevention and control of air pollution have been set up to monitor and manage activities that would lead to air pollution in India, declare air pollution control areas. The act also sets ambient air quality standards for industrial, residential and ecologically sensitive areas.

40. This will be important during the construction phase, where there is likely to be use of diesel generators for provision of energy and other activities that may result in air pollution. Also, based upon the area the project activities are underway, the standards, as defined by the Act are to be adhered to. These standards are given in the Appendix 2.

***Water (Prevention and Control of Pollution) Act, 1974, its Rules and amendments***

41. This law is to control and prevent water pollution. This legislation also defines discharge standards and permit needs for any effluent/wastewater discharged. It includes surface and ground water and marine discharges. The Act also discusses possible water pollution, prevention and control areas for the application of this act.

42. Presently the project does not envisage undertaking any activity that would result in effluent discharges and therefore permission under this act is not required. Nonetheless, at the construction phase of the project, there may be a need to look at possible discharge from various activities to ensure that discharges do not result in the change in the quality of water bodies, whether temporarily or permanently. Water quality standards for different uses have been defined by the Central Pollution Control Board, Government of India.

***Manufacturing, Storage and Transportation of Hazardous Chemicals Rules, 1989 and Amendments***

43. This Rule is for the management and transportation hazardous chemicals and substances – that include toxic and flammable substances, their use, processing and storage. Schedule 1 to 4 of this rule describes what is categorized as hazardous, their quantities and level’s of toxicity. These include a number of pesticides, and liquid and gaseous fuels. According to the rule, the agency needs to identify possible accidents and risk from the chemical during transport, storage or usage, ensure ways to avoid any hazard to take place and in case of an accident, ensuring clean up and reporting of the accident to appropriate authority. The rule also states that no industrial activity is to start till a safety report is filed to the concerned authority according to Schedule 8 of the rule, which needs to be adhered to and no changes in activities undertaken without updating of the report with another 90 days notice. Equally, any hazardous chemicals stored or transported need to be labelled as specified in the rules and an updated safety data sheet to be kept.

44. This could be relevant to the project as there would be certain chemicals and fuel likely to be stored for various project needs. Some of these could be flammable or toxic. Prior to starting any activity the project would need to identify if there are any chemicals as identified in Schedule 3 of the project. If so, appropriate handling procedures and safety permits etc would need to be developed and submitted to the concerned authority.

### ***Wetlands (Management and Conservation) Rules, 2010***

45. This rule defines a wetland – which according to the rule is ‘an area of marsh, fen, peat land or water; natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water, the depth of which at low tide does not exceed six meters and includes all inland waters such as lakes, reservoirs, tanks, backwaters, lagoons, creeks, estuaries and manmade wetlands and zones of direct influence of wetlands that is to say drainage areas or catchment areas of the wetlands as determined by the authority, but does not include main river channels, paddy fields and the coastal wetlands covered under the notification of the Government of India in the Ministry of Environment and Forests, S.O. 114 (E) dated 19 February, 1991 published in the Gazette of India Extraordinary, Section 3, Sub-Section (ii) of dated the 20<sup>th</sup> of February, 1991. The rules also identifies various types of wetlands including those in UNESCO World Heritage sites, ecologically sensitive areas, below 2500 mts with an area of at least 500 ha, or other notified wetlands or those identified by the Wetland Authority.

46. Activities not permitted in such areas are identified and include reclamation, setting up of new or expansion of existing industries, dumping of waste or discharge of effluents, any activity that adversely impacts the wetland ecosystem, amongst others.

47. Any activity that is to impact either of the dams – Bhadra or Tungabhadra may be of concerns as the reservoirs of these dams are defined as wetlands by the Wetland Rules. Also, any activity that could have an adverse impact on wetlands in the project area must be carefully redesigned to ensure that they are according to this legislation.

### ***Draft Guidelines for Integrated Water Resource Development and Management, 2010, Central Water Commission***

48. The Guidelines mention the need to consider ecological needs of water and therefore the maintenance of appropriate minimum flows of rivers for ecological needs, aesthetics and other requirements. The guidelines go further and mention the need for catchment treatment, integrated watershed projects, restoration of ecological balance. No thumb rules or calculations to assessing minimum flows are given in the guidelines.

49. At present, it is understood that minimum flows downstream of the Tungabhadra Dam are not maintained, resulting in many months when the river flows are mainly constituted of sewage discharged. Considering the IWRM approach, and the suggestions of the draft guidelines this project should include environmental flows for the Tungabhadra as a part of the modernization activities. The CDTA report suggests a minimum 10% as environmental flows for the river. Therefore, at least this should be considered for the river.

### ***The Ancient Monuments and Archaeological Sites and Remains Act, 1958, The Ancient Monuments and Archaeological Sites and Remains (Amendment and Validation) Act, 2010 and their rules and amendments, and The Karnataka Ancient and Historical Monuments and Archaeological Sites and Remains Act, 1961***

50. This act identifies limits of prohibited and regulated areas and the activities that can be carried out in them and the required permissions. According to this Act, areas within a 100 meters radius of notified monuments are prohibited and another 200 meters regulated. However, if required this area can be extended to protect the monuments and archaeological site. Any work in the prohibited area needs to be carried out by the archaeological officer and if work is carried out in a regulated area by persons other than the archaeological officer then there is a need for permission to undertake the work as defined in the regulation. Also, for any work in either the prohibited or regulated area permission is required to carry out any work. However, this Act also defines the sort of work that can be carried out within areas notified under this act. Furthermore, any construction, mining or other activity in the vicinity of a protected or regulated area would also need permission from the competent authority.

Also, these regulations prohibit cultivation within protected areas if it involves digging of more than 1 foot of soil.

51. These Acts and their associated regulations and other legislation are important for the project both as there are a number of notified monuments in the project area and that there is a possibility of a chance finding while carrying out various project activities. In the case of Hampi, and its core, buffer and peripheral area the Hampi World Heritage Management Authority and its associated Act must be followed. This is briefly discussed below.

### ***The Hampi World Heritage Area Management Authority Act, 2002***

52. This Act is for the protection and preservation of the Hampi World Heritage site and its cultural identity. It defines the core, peripheral and buffer zones for Hampi. Based upon this act a development plan for the heritage area has been developed. This Act also specifies that any development activity needs prior written permission from the authorities identified in the Act prior to starting the activity. The act also identifies a special authority the Hampi World Heritage Area Management Authority (HWHAMA) for the protection and management of the area.

53. This act is extremely relevant for all project areas that will be within the core, buffer and peripheral area of the Hampi Heritage area. This is therefore specifically relevant to the Vijayanagara Channel system. Any project activities within zone identified under this Act must be undertaken after consultation with the HWHAMA.

## **2.2 Asian Development Bank**

54. From ADB's perspective there is the 2009 Safeguard Policy Statement (SPS). The SPS is a set of operational policies that seek to avoid, minimize, or mitigate adverse environmental impacts of development activities where ADB is involved. To ensure this, impacts of project activities on the environment are to be identified early in the project cycle so that appropriate mitigation and management actions are undertaken. The SPS also states that the implementation of the identified safeguards is the responsibility of the client/borrower, while the ADB is to monitor compliance.

55. In the case of a Multitranche Financing Facility (MFF) an Environmental Assessment and Review Framework (EARF) is also to be developed. The EARF will provide guidance to the assessments of the subprojects of the subsequent tranches which are prepared after Board approval.

56. The ADB has also developed categorisation of all projects according to the level and type of impacts and type of investments. ADB uses a classification system to reflect the significance of a project's potential environmental impacts. Projects can be categorised into four depending upon their impacts. These are,

- Category A. A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment is required.
- Category B. A proposed project is classified as category B if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination is required.
- Category C. A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. No environmental assessment is required although environmental implications need to be reviewed.
- Category FI. A proposed project is classified as category FI if it involves investment of ADB funds to or through a FI (Financial Intermediary).

57. To ensure that people's concerns and needs are included in project design consultation with those impacted by the project need to be undertaken early in the project design cycle. Furthermore, there is a need for the client to identify an appropriate grievance redress system for project impacted stakeholders and to ensure transparency. Appendix 3 further describes conditions that need to be met

vis-à-vis to the environment for ADB financing. The appendix also suggests formats and structures for various environment reports.

58. Each tranche will be categorized once interventions and their locations are identified. If the identified project is categorised as a Category B project, an IEE will be undertaken and if it is a Category A, an EIA.

## 2.3 Other Relevant Policies and Principles

### Wildlife and Biodiversity

59. There are a number of different international conventions that discuss concerns of wildlife, biodiversity and their conservation and management. These also have complementary legislation developed by the national and state governments, of which the relevant ones are discussed in the section on Indian legislation.

60. Ramsar Convention: India is a signatory of the Ramsar Convention. In support to this the Indian government has also recently brought out wetland conservation and management rules in 2010. At present India has a total of 25 wetland sites identified for conservation under the Ramsar Convention in India. None of these are in or near the project site. However, if any wetlands are identified subsequently actions are required in the Ramsar Convention need to be reviewed in terms of the project activities.

61. Convention on Biodiversity: This convention discusses the need for countries to conserve and manage their biodiversity through development of national strategies, programmes and projects. The conventions also talks of integration and conservation of biodiversity in relevant sector and cross-sectoral plans, policies and programmes.

62. This, in the Indian context is covered through the Biodiversity Act, 2002 which is discussed in the section on Indian legislation. Based upon this Act a number of biodiversity hotspots have been identified under the project. Upon finalisation of activities under this project it will be possible to understand the proximity of the biodiversity hotspots to project locations.

63. Convention on Migratory Species: Concerned about the wildlife habitat at the global level of migratory species, this convention is also known as the Bonn Convention. The Convention aims to conserve migratory species throughout their range. So far no migratory species has been identified in the project area. However, if any species are identified appropriate management actions will be undertaken.

64. Conservation and protection of Siberian Crane, MoU: This MoU is to conserve and protect the Siberian Crane, which is also an endangered species listed in Schedule 1 of the Wildlife (Protection) Act, 1972. Also, it is listed as critically endangered species according to the MoEF's 2011 list of critically endangered species. Based on current knowledge, this species is not found in the project area.

### Other Conventions

65. UN Convention to Combat Desertification: According to this convention, signatory countries are to develop and carry out national, regional and sub-regional plans to combat desertification. To this effect the Government of India has developed a desertification cell in the Ministry of Environment and Forests which undertakes all activities for combating desertification. Discussions so far have not identified any activities under this convention in the project area. In fact, the project provides an opportunity, through its IWRM perspective to provide a combination of more rational irrigation and agricultural practices and watershed management activities and land and water management improvement and overall land management, all of which can also ensure a reduction in land degradation and resultant desertification.

66. UNFCCC and Kyoto Protocol: The Government of India is a signatory to the Kyoto Protocol which is to address climate change and reduction of greenhouse gases. Perhaps, the increase in the area under/more intensive cultivation of paddy would result in an increase in the emission of methane. While the project is likely to result in larger areas under paddy cultivation, paddy is not being introduced in the area. It is already a major crop in the area. Furthermore, discussions with farmers also indicate in many areas, due to existing agricultural and soil conditions converting to other crops may not be that easy at present. Some other direct impacts, at a much small scale likely are i) use of energy for construction and

any irrigation activity, ii) use of fertilizer and other agrochemicals, iii) clearance of vegetation and trees for construction and other activities. Indirectly, the increase in commercial farming leading to increase in various processing and packaging activities exist, however this would be beyond the influence of the project.

67. The project also provides opportunities to provide in the long term improved agricultural practices and crop diversification that includes millets and other traditionally grown crops may in the long run also have a positive impact on GHG emissions.

## 2.4 Major Environmental Compliance Requirements

68. Given below (Table 3) are the major Indian legislations that are applicable to this project along with the actions that would need to be undertaken for each of these regulations. These must be followed as a part of the environmental compliance activities for the subprojects under this project.

**Table 3: Environmental Compliance Requirements Legislative Needs**

Component	Applicable Legislation	Action Required
All irrigation project modernization activities	Environmental (Protection) Act, 1986	Requires environmental clearance – as discussed in the Schedule of the act
Any component where there is a need to acquire forest land or access any produce from forest produce Any trees cut by project activities	Karnataka Forest Act 1969, Wildlife Act, 1972 and Karnataka Preservation of Tree Act, 1976	Apply for permission and undertake any action as directed by the Forest Department Apply for permission and undertake any action as directed under this act – e.g. undertake compensatory plantation activities.
Any impact on biodiversity hotspots or sensitive areas due to project activities	Biodiversity Act, 2002	Consult with the Biodiversity Board to identify any sensitive areas and appropriate actions to minimize impact from project activities
For conjunctive water plans where groundwater is to be used	Karnataka Groundwater (Regulation for Protection of Source of Drinking Water) Act, 1999 and Karnataka Groundwater (regulation and Control of Development and Management) Act 2011	Taking permission for sinking of borewells, ensuring minimum distance between irrigation wells and follow directions of legislation if area declared drought hit.
Especially during construction period	Noise Pollution (Regulation and Control) Rules, 2000	Ensure all activities adhere to the existing noise limits
Pollution due to vehicle and construction activities	Water (Prevention and Control of Pollution) Act, 1974	Ensure any activity undertaken is within the existing discharge standards, based upon the designated use of a waterbody.
At time of construction especially when there is likely to be use of diesel generators for energy and the various vehicles and machinery at the site and for transportation. Also at various quarry and other sites resulting in atmospheric dust	Air (Prevention and Control of Pollution) Act, 1981	Ensure that all activities comply with the existing air quality levels. Vehicles have required pollution under control certification from appropriate authorities

Component	Applicable Legislation	Action Required
Waste dumping at construction or in the O&M phase Change in wetland due to project intervention	Wetland (Management and Conservation) Rules, 2010	Ensure compliance to the rules by ensuring identified waste disposal is in water bodies and wetlands. Ensure that no important wetland is degraded

### 3. INSTITUTIONAL ARRANGEMENTS AND SYSTEMS

69. Given below are the national and state level government agencies focusing on environmental management and regulation. The state level agencies are directly functioning below their national level agencies.

#### 3.1 National Level

##### Ministry of Environment and Forests

70. The Ministry of Environment & Forests (MoEF) is the nodal agency in India for planning, promoting, co-coordinating and overseeing the implementation of environmental and forestry programme. The principal activities undertaken by Ministry of Environment & Forests consist of conservation & survey of flora, fauna, forests and wildlife, prevention & control of pollution, afforestation & regeneration of degraded areas and protection of environment, in the frame work of legislations.

71. It is located at the national level and has regional offices for 4 regions and works in coordination with the national office to undertake any work and clearance and other consultation related activities. This includes one for the South region for which the office is located in Bangalore. This Ministry is also in-charge of any forest related clearances as identified under the forest acts and to be undertaken by the central ministry.

##### Central Pollution Control Board

72. Central Pollution Control Board (CPCB) is the statutory organisation constituted in 1974. The board provides field information and technical services to MoEF. The Board also monitors and oversees the implementation of the Environmental Protection, Air and Water acts. The functions of the board are,

- Advise the Central Government on any matter concerning prevention and control of water and air pollution and improvement of the quality of air
- Plan and cause to be executed a nation-wide program for the prevention, control or abatement of water and air pollution
- Co-ordinate the activities of the State Board and resolve disputes among them
- Provide technical assistance and guidance to the State Boards, carry out and sponsor investigation and research relating to problems of water and air pollution, and for their prevention, control or abatement
- Prepare manuals, codes and guidelines relating to treatment and disposal of sewage and trade effluents as well as for stack gas cleaning devices, stacks and ducts
- Perform such other function as may be prescribed by the Government of India

#### 3.2 State Level

73. At the state level in Karnataka, there are 3 major government agencies working on the environment. These are the Forest Department, Department of Ecology and Environment and the State Pollution Control Board (KSPCB).

##### Department of Ecology, Environment and Forests, GoK

74. Department of Ecology, Environment and Forests (DoEF) is the apex body in the state of Karnataka with administrative control of environmental management in the state. The department through KSPCB administers the enforcement of various laws and regulations of Government of India. The department formulates environmental management and policy guide lines for Karnataka and grants clearances for projects under its purview. The Department of Ecology and Environment looks at the enforcement of Category B projects under the EIA notification while the Category A projects are directly handled by the central Ministry of Environment and Forests. In order for the Department to provide advice for clearance of Category B projects, it has a State Environmental Impact Assessment Authority and the State Expert Appraisal Committee to support this Authority. The Department also evaluates the

effectiveness of government agencies to assess the impact of their activities on the environment and aims at strengthening local institutes to address environment problems. This Department is also provides policy advice on climate change and at present is also undertaking studies through the Environmental Management Policy Research Institute on climate change.

75. The department is headed by a Principle Secretary to Government and Supported by Secretary (Ecology and Environment). The Secretary (Ecology and Environment) is supported by two Under Secretaries and a Director (Technical).

#### **Forest Department**

76. The Forest Department looks at the implementation of the wildlife and forest acts and the management of forests, national parks and sanctuaries. Any clearance for working in forest areas requires consultations and clearance from them. If within their mandate, the department will give the clearance otherwise it will be referred to the regional office of the MoEF and/or the Central office of MoEF.

#### **Karnataka State Pollution Control Board**

77. KSPCB is the regulatory body in the state of Karnataka for enforcing various environmental legislations of the Government of India. The KSPCB looks at the implementation of the national Environmental (Protection) Act 1986, and the Air and Water pollution abatement acts and the provision of licenses under these acts. While the regulatory powers are delegated to KSPCB from CPCB, the administrative control of the board rests with DoEF. More specifically, the functions of the board are listed below.

- Implementing the provisions of EPA 1986, Water and Air Acts
- Advise State Government in respect of suitability of particular area for industrial development
- Assess the quality of environment in terms of ambient air and water quality through monitoring
- Issue and enforce the consent orders issued for industrial pollution control
- Oversee, supervise and regulate water, air, solid, bio-medical and hazardous waste management in urban areas

78. The board is headed by a Chairperson who is supported by a Member Secretary and a Chief Environmental Officer. The Chief Environmental Officer is supported by Regional Environmental Officers and the District Environmental Officers in each of the district of the state. The Board has its Central Office at Bangalore. The enforcement of the Acts and Rules are being implemented through thirty three Regional Offices spread throughout the state. The Central laboratory of the Board is located at Bangalore. Regional laboratories have been set up along with Regional Offices.

79. Depending upon the needs of the project, for any clearances these agencies will need to be contacted as directed under the relevant acts discussed in the legislation section.

#### **Karnataka Neeravari Nigam Limited and Environment**

80. The Karnataka Neeravari Nigam Limited (KNNL) does not have any specific environment unit or specific environment related activities. Environmental clearance is taken for projects with Central Government funding. From this funding an accredited consultant is hired. The consultant is responsible for doing the environmental assessment, public consultation and liaising with the Ministry of Environment and Forests for getting clearances from the ministry. Any monitoring activities identified under the EIA are also outsourced to a consultant qualified to undertake the activities.

81. Project's where an environmental clearance and required follow up activities are to be undertaken, KNNL supervises the overall implementation of activities. The officer in-charge, the Chief Engineer (CE) or the Superintending Engineer (SE), is to ensure any environment activity required – is

implemented. In case of larger projects there is a CE in charge. Otherwise an SE oversees the implementation of the Environmental Assessment.

82. At the field level the Executive Engineer (EE) of KNNL oversees all construction and implementation actions. The EE will be supported by the Assistant Executive Engineer (AEE). Therefore, any supervision of actions identified in the Environment Report to be carried out at the field level is to be undertaken by the EE and AEE.

83. At present any grievance that may occur at the time of project implementation is first referred to the EE. If the EE is unable to handle the problem, the concerns are to be handled by the SE/CE. Usually grievances are adequately redressed through this system.

#### 4. Anticipated Impacts of Subprojects

84. This section briefly discusses possible impacts from project activities. This can be used as a guideline, along with its supporting appendix for identifying probable subproject impacts. The second subsection of this section lists types of activities not to be taken up as a part of project activities. In case any identified subproject or activity is likely to result any of the concerns listed in the following subsection without appropriate mitigation measures such as design changes to ensure that no such impact occurs, the activity should not be undertaken.

##### 4.1 Probable Impacts from Subproject Activities

85. Details of possible environmental impacts from project activities are given in Appendix 4. These are the most likely impacts and could be used to guide the assessment process for the future tranches of the MFF. However, an assessment for activities and subprojects as planned for each tranche must be undertaken to ensure all relevant environmental impacts are identified and the Environmental Management Plan is developed for the project according to its needs. This section can be used as guidelines alongside with the impact assessment for each subproject. Appendix 5 gives possible mitigation actions and suggests authorities responsible for each action. This could guide the development of the EMP for the activities and subprojects for subsequent tranches. The table 4 below briefly outlines possible areas of impacts from project activities. In case there is a secondary or a minor impact it is not highlighted here, but will be discussed in appendix 4 that details project related impacts.

86. As for Tranche 1, which will be conducted for the Gondhi Anicut area, Tranche 2 and 3 are likely to consist of modernisation of part of the Tunghabhadra Left Bank canal, modernisation of Vijayanagara Channels, putting in place flow measures and telemetry, working on WUCS and agricultural development and strengthening of the Nigam and CADA.

**Table 4: Probable impacts from project activities**

Impact category	Impact	Project phase		
		Design	Construction	O&M
River system & environmental flows	<ul style="list-style-type: none"> <li>▪ Change in water availability</li> <li>▪ Competition among users</li> <li>▪ Change in river course</li> </ul>	X	X	
Wetlands & water bodies	<ul style="list-style-type: none"> <li>▪ Degradation and eutrophication</li> <li>▪ Waste dumping and silting</li> <li>▪ Improvement due to better catchment management</li> </ul>	X	X	X
Groundwater	<ul style="list-style-type: none"> <li>▪ Contamination</li> <li>▪ Rise in water table and waterlogging</li> <li>▪ Excessive withdrawal and aquifer level decline</li> </ul>	X	X	X
Water quality	<ul style="list-style-type: none"> <li>▪ Improved due to better catchment management</li> <li>▪ Degradation of quality</li> </ul>	X	X	X
Air and Noise	<ul style="list-style-type: none"> <li>▪ Vehicular pollution</li> <li>▪ Dust and high SPM</li> <li>▪ High level of noise from machines</li> </ul>	X	X	
Soil degradation	<ul style="list-style-type: none"> <li>▪ Increased salinity or alkalinity and contamination due to poor drainage or improper soil</li> </ul>	X	X	X

Impact category	Impact	Project phase		
		Design	Construction	O&M
	management <ul style="list-style-type: none"> <li>▪ Soil degradation and toxicity due to excessive agrichemical use</li> <li>▪ Soil exhaustion</li> <li>▪ Compaction or erosion</li> <li>▪ Disposal of silt from canals to fields</li> </ul>			
Biodiversity	<ul style="list-style-type: none"> <li>▪ Disruption of migratory routes</li> <li>▪ Degradation of ecosystems</li> <li>▪ Competition with invasive species</li> <li>▪ Expansion of agriculture, habitat loss for existing biodiversity, or conflicts</li> <li>▪ Material procurement creating habitat loss or degradation</li> <li>▪ Poor management of agrochemical and other waste degrading ecosystems</li> <li>▪ Loss of agro-biodiversity</li> </ul>	X	X	X
Infrastructure and economic activities	<ul style="list-style-type: none"> <li>▪ Temporary disruption of routes etc due to construction activities</li> <li>▪ Increased competition for water between different users</li> <li>▪ Poor agro practices leading to reduced agriculture yields</li> <li>▪ Quarrying impacting aquifers</li> <li>▪ Degradation of local fisheries</li> <li>▪ Reduced pastures and grazing lands and other uses of common lands</li> <li>▪ Disruption, breakage and degradation of local infrastructure – such as energy, navigation and WSS</li> </ul>	X	X	X
Social	<ul style="list-style-type: none"> <li>▪ Possible increase in vector habitats</li> <li>▪ Increase in water borne diseases</li> <li>▪ Conflict with local population during construction</li> </ul>	X	X	X

#### 4.2 Environmental Procedures to be used for MFF subprojects

87. In order to ensure that there is minimum adverse impact due to project activities it is suggested that certain activities which are likely to cause major adverse impacts are not taken up as a part of the project. Considering this, given below (Table 5) is a list of possible criteria to be used while identifying subprojects or activities for subsequent tranches of the TA. In case any of these issues are identified, the project must be carefully reconsidered and designed as required.

Table 5: Environmental Criteria for Sub-project Selection

Criteria
<ul style="list-style-type: none"><li>• Project or its activities not to destroy, encroach or damage any protected areas, including reserved forests or biodiversity conservation hotspots (identified in the State Biodiversity Strategy and Action Plans), Wildlife Sanctuaries or National Parks.</li><li>• Project or its activities should not destroy, encroach upon or damage any wildlife migratory routes, corridors or fly paths.</li><li>• Activities not to destroy/disturb any historical and cultural places/values, including archaeological sites.</li><li>• The project should not result in social conflicts, and should minimize resettlement issues.</li><li>• The project is not to result in environmental degradation such as watershed degradation, increased water resource degradation or the destruction of private or government owned forested lands.</li><li>• Project design should not result in conjunctive use plans that create unsustainable groundwater withdrawal.</li><li>• Any project that goes against the country's or ADB's regulations</li></ul>

## 5. ENVIRONMENTAL ASSESSMENT PROCEDURES

88. In order to ensure that identified project activities follow required legal procedures and regulatory procedures of ADB, GoI and the State Government, and ensure the proper implementation of the identified EMP a set of environmental procedures have been identified. Given below (Table 6) are these environmental procedures and actions that are to be undertaken at each stage of the project. These have been categorised according to responsibilities of different agencies - GoI/GoK and ADB and project stage and can be used as guidelines for activities to be planned under subsequent tranches and their subprojects and activities.

**Table 6: ADB and GoI Environmental Procedures and Actions during Subproject Processing**

Project Stage	ADB Procedures	GoI and State Government Procedures
Subproject Identification	<ul style="list-style-type: none"> <li>▪ REA Checklist</li> <li>▪ Identification of project category A/B/C, F1</li> <li>▪ ADB SPS 2009</li> </ul>	<ul style="list-style-type: none"> <li>▪ Categorization (A or B) according to Schedule and General/Specific Conditions in GoI EPA, 1986 and amendment 2006</li> <li>▪ Application for Environmental Clearance (EC) after the identification of the prospective site as a part of the project preparation activities.</li> <li>▪ Clearance criteria given in the Schedule of EPA, 1986 revision 2006, and discussed in section 2 above.</li> <li>▪ In case of Category A clearance to be taken from MoEF. For Category B clearance from SEIAA.</li> <li>▪ Ancient Monuments and Archaeological Sites and Remains Act, 1958 and HWHAMA Act, 2002</li> </ul>
Feasibility study and Detailed Design	<ul style="list-style-type: none"> <li>▪ EIA/IEE (EMP for Category A and B) Based upon project category environmental assessment undertaken for project on ADB processes, as outlined in Appendix 3</li> <li>▪ If special surveys etc are required given specific project location – by SPS 2009 they need to be commissioned. All identified issues from these studies should be incorporated in the environmental assessment and identified issues incorporated in the project design and EMP.</li> <li>▪ Submit EIA/IEE for ADB’s review and obtain clearance</li> </ul>	<ul style="list-style-type: none"> <li>▪ As required, undertake environmental assessment – and get clearance from required authority.</li> <li>▪ As required, take permission, clearance and design modification to ensure sensitive cultural and archaeological sites sanctity is preserved.</li> <li>▪ Include any identified actions in the project design.</li> </ul>
Construction	<ul style="list-style-type: none"> <li>▪ Include EMP in contract documents and ensure compliance through contractor clauses, training activities etc in place and appropriate monitoring system in place and monitoring is undertaken by</li> </ul>	<ul style="list-style-type: none"> <li>▪ Ensure compliance to EMP, make clauses in contractor’s agreement</li> <li>▪ In case required work with other government agencies for ensuring all required regulations are complied to and any concern/issue that may come up during the construction phase is also sorted upon</li> </ul>

Project Stage	ADB Procedures	Gol and State Government Procedures
	<p>identified agency</p> <ul style="list-style-type: none"> <li>▪ Suggest changes in implementation if any new issue, not identified in the assessment is found at the implementation stage</li> <li>▪ Update EMP as required</li> <li>▪ Environmental monitoring reports to be uploaded to ADB's website</li> </ul>	<p>being identified. An example of this could be possible archaeological chance findings.</p>
O&M	<ul style="list-style-type: none"> <li>▪ IEE/EIA and EMP and monitoring reports to be uploaded on website</li> <li>▪ Suggest changes in implementation if any new issue, not identified in the assessment is found at the implementation stage</li> </ul>	<ul style="list-style-type: none"> <li>▪ Monitor implementation of environmental assessment needs, as identified through the project assessment and those agreed through ADB IEE/EIA. IEE/EIA and EMP and monitoring reports to be uploaded on website.</li> <li>▪ Suggest changes in implementation if any new issue, not identified in the assessment is found at the implementation stage</li> </ul>

89. Appendix 3 outlines the Table of Contents of the ADB environment report.

## 6. CONSULTATION, INFORMATION DISCLOSURE AND GRIEVANCE REDRESSAL MECHANISM

90. Consultation and information disclosure would be needed at various stages of the project. These are outlined below.

- At time of identification of project undertake consultation to ensure all concerns of project stakeholders are incorporated in the project design. Consultations should help inform project design and therefore there is a need to ensure consultations are undertaken at the time of identification of project feasibility and before the finalization of design
- Depending upon the assessment needs of the project, such as whether it is a Category A, B, C or F1 under ADB guidelines or GoI Category A or B under EPA, 1986 EPA guidelines consultations must be undertaken.
- Consultations must be documented and made a part of the final environment report.
- Any issues identified during the consultations should be considered during the final project design.
- Environment Assessment documents will be available on KNNL and ADB websites with executive summaries available in Kannada, the local language. Hard copies for reference will be made available with local language executive summary translations at the Executive Engineer in charge of the scheme and the Superintending Engineer's offices and in the District Commissioner's office in each of the project districts. There will also be a notice on the website displaying the documents stating where the hard copies are available.

91. Grievance redressal needs to be considered to ensure any unintended consequences, or violations of planned actions and activities is brought to the notice of the authorities to ensure compliance and resolution of problems and issues faced by the local population. The grievance redressal mechanism must,

- Be accessible to the local population and therefore should be present close to the area where project activities are under implementation.
- Ensure fairness and transparency in any grievance system planned. This could include making information on project activities available at the impacted areas itself, keeping a register of complaints and a system to identify progress of complaint and resolution taken, providing for a higher level authority for any problem resolution that has not be solved at the local level, ensure that contact information on the existing grievance redressal mechanism is available at the project implementation/construction sites.
- Ensure there are time limits set for solving all issues at each level of the system and is adhered to.
- Also, if any adverse impact is identified by the local population, they need to be immediately addressed and the grievance redressal system should be able to include any such complaints into project design.
- Records on how grievances are addressed should be maintained at a central place where the public could access these records
- It must be a dynamic process that is able to help correct any adverse impact that project activities occur

92. The grievance redressal system as developed in the PMU will be used for the management of all identified grievances. The PMU will formulate and make operational a grievance reporting mechanism to the program's vigilance officer, project managers and the Program Director. The mechanism will lay down the procedure for affected/concerned stakeholders to register complaints/grievance regarding the program and the action to be taken by the concerned officers. The PMU and PIOs will organize awareness campaigns on the grievance reporting mechanism for the WUCS and other stakeholders;

93. Appendix 7 of this document gives an outline of the format to be used for consultations during the project.

## 7. INSTITUTIONAL RESPONSIBILITIES

94. This section looks at the possible institutional responsibilities of various agencies for the implementation of activities under it and the capacity building needs.

### 7.1 Institutional responsibilities

95. The implementation arrangements for the environmental sections will involve various actors, depending upon activities planned under the project and possible impacts. The major responsible authorities for various activities are identified below (Table 7).

**Table 7: Institutional Roles and Responsibilities**

KNNL/PMU Environmental Specialist	ADB
<b>Subproject Identification stage</b>	
Environmental safeguard specialists in PMU environmental specialist –will ensure that identified environmental impacts are addressed in the project design. The specialist can refer to the EARF to identify possible impacts.	Ensure required environmental actions for ADB are in place and required assessment is taken.
Ensure project gets required clearances in time - KNNL	Ensure all ADB procedures are being followed and required environmental actions are in place. Follow required disclosure process of ADB
Ensure inclusion of Environmental Management Plan in overall project design and use of the Environmental Sub-project design criteria is used to ensure only appropriate projects are taken up – PMU environmental specialist	Review documents for environmental compliance and provide guidance, as required.
Identification and development of contractor agreement – include identified clauses for construction stage are in contract	Review and discuss clauses with EA/IA included for their appropriateness Disclose IEE/EIAs on website
<b>Construction stage</b>	
Ensure contractor understands project environmental needs, has adequate capacity to implement the required actions and has required equipment for the activity and has an appropriate site plan – PMU Environmental Specialist	Ensure that the identified contracting agreements have required contractor clauses to cover environmental concerns as identified in the environmental assessment of the sub-project
Monitoring overall implementation, advising on additional actions required, support for mitigation of any impacts identified later – PMU Environmental Specialist Where required, also include other government departments for the monitoring activities, such as the HWHAMA for Hampi World Heritage site. PMU Environmental Specialist	Joint monitoring with KNNL to ensure field level compliance and support, and review of implementation reports for any further action required
Ground level monitoring of contractor – PMU Environmental Specialist	Undertake due diligence monitoring.
Monitor project for any unforeseen impacts or issues and ensure required actions are undertaken - PMU Environmental Specialist Grievance redressal - ensure that any grievances from any stakeholders are adequately responded to and	Undertake joint monitoring with government to ensure any unforeseen impacts are adequately addressed and if required, request for changes in implementation/construction process Joint monitoring with KNNL to ensure field level

KNNL/PMU Environmental Specialist	ADB
required amelioration actions undertaken - PMU Environmental Specialist and KNNL Submit periodic monitoring reports to GoI and ADB	compliance and support. Ensure all grievances reported are adequately addressed Review monitoring reports and disclose in ADB website
<b>Operations Stage</b>	
Overall safeguard implementation - PMU Environmental Specialist	Joint monitoring with KNNL and implementation support and advisory Undertake due diligence monitoring
Monitor project for any unforeseen impacts or issues and ensure required actions are undertaken – PMU Environmental Specialist	Undertake joint monitoring with government to ensure any unforeseen impacts are adequately addressed

## 7.2 Training and Capacity Building

96. Training and Capacity Building of various stakeholders involved in the implementation and monitoring of project activities is essential and would need to be undertaken to ensure all identified environmental concerns are properly implemented and adequately monitored. Given below is the suggested training and capacity building plan for the project. Based upon this, project personnel who may need to be trained should be identified and trained for activities. This must be built in the environmental assessment’s management plan. The training and capacity building activities will be provided by the specialists of the PMU. The PMU Capacity Building specialist with support from the Environmental Specialist and the Agricultural Specialist will be involved with the training activities.

Capacity Building Activity	Frequency	Type of training	Who will be trained
Awareness on ADB environmental procedures, monitoring and EMP needs and compliance to ADB	Once – project start	Half day workshop	All key stakeholders involved in project design & implementation such as the KNNL
Refreshers programme awareness training – on ADB environmental procedures and compliance needs	Annually	Half day workshop	All key stakeholders involved in project design & implementation such as the KNNL
On farm management for improved agricultural practices, IPNM, soil management etc.	Annually once	Half day workshop and various locations	Farmers, CADA, KNNL officials

## 8. MONITORING, ENVIRONMENTAL PERFORMANCE AND REPORTING

97. Since it is planned to have a PMU housed with the KNNL in place at the time of project implementation, most monitoring and guiding activities would be undertaken by the PMU itself. The PMU would support the implementation agency – the KNNL with required implementation of environmental safeguards as required. Therefore, the PMU would have an environmental specialist who would specifically look at these issues. Monitoring needs and agencies responsible are given in Appendix 6.

98. In order to ensure that ADB environmental management needs are fulfilled, as required, appropriate training and capacity building activities must be undertaken. A capacity building and training plan is suggested in section 7.2. All monitoring and reporting costs must be included in the EMP of the environmental assessment of the project as a part of the capacity building activities.

99. Monitoring to be undertaken,

- There is a need for six monthly reporting for subprojects requiring either an EIA or IEE. This is to be submitted along with the semi-annual report on project progress.
- Monitoring needs and activities for project activities for each phase of the project must be identified and undertaken separately. Therefore, the feasibility and design stage activities, the construction and post construction activities should have clearly defined and identified monitoring actions and indicators which must be reported separately with the relevant project progress reports for the overall subproject.
- Monitoring activities must be used for ensuring the project is following the identified guidelines in the EMP and also ensuring that any issue identified subsequently during project implementation is addressed. Therefore, if any environmental issue identified subsequent to the IEE it must be included in the implementing action with clearly identified activities to be undertaken and not just flagged and left without further action.

## 9. Appendix

### Appendix 1 – Biodiversity Hotspots as Identified by the Karnataka Biodiversity Action Plan

100. Given below are hotspots identified by the Karnataka Biodiversity Action Plan. While at present there does not seem to be any issue that needs to be flagged specifically about most of these hotspots, these must be reconsidered while developing projects for the subsequent tranches of the MFF. The only concern identified is on the possible concerns of loss of Agr-biodiversity.

#### Hotspots of Hope (Source: Karnataka Biodiversity Action Plan)

Ecosystem	Plants	Animals	Habitat	Management Regime	Geographic Location	Taluk	District
Evergreen Forests	<i>Rhynchosyris</i> , <i>Catlea</i> , <i>Luisia</i>		Evergreen Forests	Reserve Forest	Kemmannagundi	Tariker	Chikamagalur
Dry deciduous forests	<i>Anogeisus latifolia</i> , <i>Terminalia sp.</i> , <i>Tectona grandis</i> , <i>Dyospyros melanoxylon</i>	<i>Tiger</i> , <i>Leopard</i> , <i>Sambar</i> , <i>Dhole</i>	Forests	Tiger Reserve	Bhadra		Chikamagalur
Evergreen Forests	<i>Poeciloneuron indicum</i>	<i>Lion-tailed Macaque</i>	<i>Poeciloneuron Indicum</i> Forests	National Park	Bhagavati Valley		Dakshina Kannada, Chikamagalur, Udupi
Grasslands	<i>Grasses</i> , <i>ground orchids</i> and <i>other herbs</i>		Montane Grasslands	National Park	Kudremukh National Park		Dakshina Kannada, Chikamagalur, Udupi
Reservoir/Lakes		<i>Water Fowl</i>	Reservoir/Lakes	Irrigation Department	Nidige		Shimoga
Reservoir/Lakes		<i>Water Fowl</i>	Reservoir/Lakes	Irrigation Department	Soolekere	Channagiri	Davangere
River	<i>Members of Podostemaceae</i>	<i>Freshwater Fishes</i>	Streams/Rivers	Irrigation Department	Sringeri	Sringeri	Chikamagalur

#### Hotspots of Despair (Source: Karnataka Biodiversity Action Plan)

Ecosystem	Plants	Animals	Habitat	Management Regime	Geographic Location	Causal factor	Taluk	District
Agro ecosystem	Crop Diversity		Agro-ecosystems		All taluks			All districts
Evergreen Forests	<i>Canarium strictum</i> , <i>Garcinia gummi-gutta</i> , <i>Syzygium</i>	Amphibians	All	National Park	Kudremukh National Park	Mining		Chikamagalur, Udupi, Dakshina Kannada

Ecosystem	Plants	Animals	Habitat	Management Regime	Geographic Location	Causal factor	Taluk	District
	gardnerii, Depterocarpus indicus,							
Evergreen Forests	Canarium strictum, Garcinia gummi-gutta, Syzygium gardnerii, Depterocarpus indicus,	Lion-tailed Macaque	Evergreen Forests	National Park	Kudremukh National Park	Mining		Chikamagalur, Udupi, Dakshina Kannada
River	Members of Podostemaceae	Freshwater Fishes	Streams/Rivers	Irrigation Department	Sharavati River	Monoculture, Encroachment	Sagar, Honavar	Uttara Kannada/Shimoga
River		Freshwater Fishes	Streams/Rivers	Irrigation Department	Tunga	Flow of untreated sewage, dumping of wastes, washing of vehicles	Harihar	Davanagere
River		Freshwater Fishes	Streams/Rivers	Irrigation Department	Bhadra	Flow of untreated sewage, dumping of wastes, washing of vehicles	Bhadravathi	Shimoga
River		Freshwater Fishes	Streams/Rivers	Irrigation Department	Tungabhadra	Pollution in river	Harihar	Davanagere
River		Freshwater Fishes	Streams/Rivers	Irrigation Department	Bhadra	Pollution in river	Bhadravathi	Shimoga

**Appendix 2: Standards as defined in the Air (Prevention and Control of Pollution) Act, 1981.**

Pollutant	Time Weighed Average	Concentration of Ambient Air		Methods of measurement
		Industrial, Residential, Rural and other areas	Ecologically Sensitive Areas (notified by central government)	
Sulphur Dioxide (SO <sub>2</sub> ), µ/m <sup>3</sup>	Annual* 24 hrs#	50 0	20 80	- improved West and Gaeke - Ultraviolet fluorescence
Nitrogen dioxide (NO <sub>2</sub> ), µ/m <sup>3</sup>	Annual* 24 hrs#	40 80	30 80	- Modified Jacob & Hochheiser (Nat-Arsenite) - Chemiluminescence
Particulate Matter (size less than 10 µm) or PM <sub>10</sub> µg/m <sup>3</sup>	Annual* 24 hrs#	60 100	60 100	- Gravimetric - TOEM - Beta attenuation
Particulate Matter (size less than 2.5 µm) or PM <sub>2.5</sub> µg/m <sup>3</sup>	Annual* 24 hrs#	40 60	40 60	- Gravimetric - TOEM - Beta attenuation
Ozone (O <sub>3</sub> ) µg/m <sup>3</sup>	8 hrs* 1 hr#	100 180	100 180	- UV photometric - Chemiluminescence Chemical Method
Lead (Pb) µg/m <sup>3</sup>	Annual* 24 hrs#	0.50 1.0	0.50 1.0	- AAS/ICP method after sampling on EPM 2000 or equivalent filter paper - ED-XRF using Teflon filter
Carbon monoxide (CO)	8 hrs# 1 hrs#	02 04	02 04	- Non Dispersive Infra Red (NDIR) spectroscopy
Ammonia (NH <sub>3</sub> ) µg/m <sup>3</sup>	Annual* 24 hrs#	100 400	100 400	- Chemiluminescence - Indophenol blue method
Benzene (C <sub>6</sub> H <sub>6</sub> ) µg/m <sup>3</sup>	Annual*	05	05	- Gas chromatography based continuous analysis - Absorption and Desorption followed by GC analysis
Benzo (a) Pyrene (BaP) – particulate phase only, ng/m <sup>3</sup>	Annual*	01	01	- Solvent extraction followed by HPLC/GC analysis
Arsenic (As) ng/m <sup>3</sup>	Annual*	06	06	AAs/ICP method after sampling on EPM 2000 or equivalent filter paper
Nickel (Nk), ng/m <sup>3</sup>	Annual*	20	20	- AAS/ICP method after sampling on EPM 2000 or equivalent filter paper

\* Annual arithmetic mean of minimum of 104 measurements in a year at a particular site, taken twice a week 24 hourly at uniform intervals.

# 24, 8 or 1 hourly monitoring values, as applicable, shall be complied with 98% of the year. 2% of the time, they may exceed the limits, but not on two consecutive days of monitoring.

### Appendix 3: IEE and EIA Format for ADB projects

101. This outline is part of the Safeguard Requirements 1. An environmental assessment report is required for all environment category A and B projects. Its level of detail and comprehensiveness is commensurate with the significance of potential environmental impacts and risks. A typical EIA report contains the following major elements, and an IEE may have a narrower scope depending on the nature of the project. The substantive aspects of this outline will guide the preparation of environmental impact assessment reports, although not necessarily in the order shown.

#### A. Executive Summary

102. This section describes concisely the critical facts, significant findings, and recommended actions.

#### B. Policy, Legal, and Administrative Framework

103. This section discusses the national and local legal and institutional framework within which the environmental assessment is carried out. It also identifies project-relevant international environmental agreements to which the country is a party.

#### C. Description of the Project

104. This section describes the proposed project; its major components; and its geographic, ecological, social, and temporal context, including any associated facility required by and for the project (for example, access roads, power plants, water supply, quarries and borrow pits, and spoil disposal). It normally includes drawings and maps showing the project's layout and components, the project site, and the project's area of influence.

#### D. Description of the Environment (Baseline Data)

105. This section describes relevant physical, biological, and socioeconomic conditions within the study area. It also looks at current and proposed development activities within the project's area of influence, including those not directly connected to the project. It indicates the accuracy, reliability, and sources of the data.

#### E. Anticipated Environmental Impacts and Mitigation Measures

106. This section predicts and assesses the project's likely positive and negative direct and indirect impacts to physical, biological, socioeconomic (including occupational health and safety, community health and safety, vulnerable groups and gender issues, and impacts on livelihoods through environmental media [Appendix 2, para. 6]), and physical cultural resources in the project's area of influence, in quantitative terms to the extent possible; identifies mitigation measures and any residual negative impacts that cannot be mitigated; explores opportunities for enhancement; identifies and estimates the extent and quality of available data, key data gaps, and uncertainties associated with predictions and specifies topics that do not require further attention; and examines global, trans-boundary, and cumulative impacts as appropriate.

#### F. Analysis of Alternatives

107. This section examines alternatives to the proposed project site, technology, design, and operation—including the no project alternative—in terms of their potential environmental suitability under local conditions; and their institutional, training, and monitoring requirements. It also states the basis for selecting the particular project design proposed and, justifies recommended emission levels and approaches to pollution prevention and abatement.

#### G. Information Disclosure, Consultation, and Participation

108. This section:

- (i) describes the process undertaken during project design and preparation for engaging stakeholders, including information disclosure and consultation with affected people and other stakeholders;

- (ii) summarizes comments and concerns received from affected people and other stakeholders and how these comments have been addressed in project design and mitigation measures, with special attention paid to the needs and concerns of vulnerable groups, including women, the poor, and Indigenous Peoples; and
- (iii) describes the planned information disclosure measures (including the type of information to be disseminated and the method of dissemination) and the process for carrying out consultation with affected people and facilitating their participation during project implementation.

#### **H. Grievance Redress Mechanism**

109. This section describes the grievance redress framework (both informal and formal channels), setting out the time frame and mechanisms for resolving complaints about environmental performance.

#### **I. Environmental Management Plan**

110. This section deals with the set of mitigation and management measures to be taken during project implementation to avoid, reduce, mitigate, or compensate for adverse environmental impacts (in that order of priority). It may include multiple management plans and actions. It includes the following key components (with the level of detail commensurate with the project's impacts and risks):

##### *(i) Mitigation:*

- (a) identifies and summarizes anticipated significant adverse environmental impacts and risks;
- (b) describes each mitigation measure with technical details, including the type of impact to which it relates and the conditions under which it is required (for instance, continuously or in the event of contingencies), together with designs, equipment descriptions, and operating procedures, as appropriate; and
- (c) provides links to any other mitigation plans (for example, for involuntary resettlement, Indigenous Peoples, or emergency response) required for the project.

##### *(ii) Monitoring:*

- (a) describes monitoring measures with technical details, including parameters to be measured, methods to be used, sampling locations, frequency of measurements, detection limits and definition of thresholds that will signal the need for corrective actions; and
- (b) describes monitoring and reporting procedures to ensure early detection of conditions that necessitate particular mitigation measures and document the progress and results of mitigation.

##### *(iii) Implementation arrangements:*

- (a) specifies the implementation schedule showing phasing and coordination with overall project implementation;
- (b) describes institutional or organizational arrangements, namely, who is responsible for carrying out the mitigation and monitoring measures, which may include one or more of the following additional topics to strengthen environmental management capability: technical assistance programs, training programs, procurement of equipment and supplies related to environmental management and monitoring, and organizational changes; and
- (c) estimates capital and recurrent costs and describes sources of funds for implementing the environmental management plan.

(iv) *Performance indicators:*

- (a) describes the desired outcomes as measurable events to the extent possible, such as performance indicators, targets, or acceptance criteria that can be tracked over defined time periods.

**J. Conclusion and Recommendation**

111. This section provides the conclusions drawn from the assessment and provides recommendations.

**Appendix 4: Expected Impacts at Different Project Stages**

DESIGN IMPACT			
Environmental Issue	Positive Impact	Adverse Impact	Possible Management Actions
River system and environmental flows		Increased efficiencies in agriculture and better systems management, resulting in reduced environmental flows	Overall assessment of appropriate water allocation needs for each sector, including environmental flows
Wetlands & local water bodies	Better agriculture practices may result in improved health of local water bodies	<p>Increase in area under agriculture – impact adversely increase agrochemicals and waste leading to increased toxicity and eutrophication</p> <p>The design could have an adverse impact on water quality, if appropriate measures are not designed to ensure that waterlogging does not take place.</p> <p>Possible waterlogging with drainage blocking if more areas are brought under agriculture without adequate drainage provisions</p> <p>Improved irrigation practices may reduce waterlogging in areas where practiced</p> <p>Due to change in characteristic of certain water bodies – such as making them perennial from ephemeral may result in localised flood situation during floods or the monsoon/rains and may also locally cause waterlogging in other seasons due to reduced drainage to the site from surrounding areas</p>	<p>Education to farmers on improved agricultural practices, on-farm land management practices</p> <p>Development of appropriate drainage structures and management measures, on-farm land management</p> <p>Work with farmers to identify appropriate cropping pattern given existing soils and drainage conditions</p>
Groundwater	Improved irrigation practices may reduce waterlogging in areas where practiced, improving aquifer quality	<p>Increase area under agriculture – especially paddy and other high water consuming crops, or flood irrigation would lead to increased waterlogging and a rise in the water table</p> <p>Increased contamination of groundwater –</p>	<p>Education to farmers on improved agricultural practices, on-farm land management practices</p> <p>Development of appropriate drainage structures and management measures, on-farm land management</p> <p>Work with farmers to identify appropriate cropping</p>

DESIGN IMPACT			
Environmental Issue	Positive Impact	Adverse Impact	Possible Management Actions
		<p>sanitation coverage is low and therefore with waterlogging contamination can occur</p> <p>Decrease in water table due to excessive demand irrigation due to agricultural expansion</p> <p>Conjunctive use plans increase pressure on aquifers, depleting them</p> <p>Increased efficiency of agriculture water use, reducing unnecessary pumping of groundwater</p> <p>Reduced return flows in river resulting in lower recharge of connecting aquifers dependent on them</p>	<p>pattern given existing soils and drainage conditions</p> <p>Develop appropriate conjunctive water use plans, identify appropriate groundwater management activities and identify, where possible, groundwater</p> <p>Overall assessment of appropriate water allocation needs for each sector, including environmental flows</p>
Water quality	<p>Improved on-farm practices may result improve water quality</p> <p>Improved irrigation practices may reduce waterlogging and pollution</p> <p>SRI and other agricultural practices that reduce water consumption could result in reduced agricultural return flows and have a positive impact on overall water quality</p>	<p>The design could have an adverse impact on water quality, if appropriate measures are not designed to ensure that waterlogging does not take place</p> <p>Increased area under agriculture and agricultural intensification, certain interventions like horticulture and floriculture may result in increased use of agro-chemicals resulting in water quality deterioration.</p> <p>Leaching return flows and increased chemicals in surface water system</p>	<p>Education to farmers on improved agricultural practices, on-farm land management practices</p> <p>Development of appropriate drainage structures and management measures, on-farm land management</p> <p>Work with farmers to identify appropriate cropping pattern given existing soils and drainage conditions</p>
<b>Land resources</b>			
Soil quality	<p>Less water intensive crops are used, resulting in reduced water waterlogging and improved soils</p> <p>Improved knowledge from extension activities in project resulting in improved</p>	<p>Deterioration of soil quality may occur if congestion of water resulting in waterlogging takes place due to poor drainage planning</p> <p>Excessive application of water – water intensive crops resulting in waterlogging and water</p>	<p>Education to farmers on improved agricultural practices, on-farm land management practices</p> <p>Development of appropriate drainage structures and management measures, on-farm land management</p> <p>Work with farmers to identify appropriate cropping</p>

DESIGN IMPACT			
Environmental Issue	Positive Impact	Adverse Impact	Possible Management Actions
	soil management and health	quality deterioration Soil salinisation and toxicity due to agrochemical usage	pattern given existing soils and drainage conditions
Erosion/ compaction	Opportunities for improved soil management with improved agricultural extension systems put in place	Inadequate agricultural extension resulting in intensive agriculture, poor soil management and erosion	Education to farmers on improved agricultural practices, on-farm land management practices
Salinity, alkalinity	Proper soil and water management would improve soil health	Poor drainage or excessive water usage due to poor cropping practices, excess use of fertilizers	Education to farmers on improved agricultural practices, on-farm land management practices Development of appropriate drainage structures and management measures, on-farm land management Work with farmers to identify appropriate cropping pattern given existing soils and drainage conditions
<b>Natural and Biological environment</b>			
<i>Terrestrial</i>			
Fauna	Reduced toxicity in the environment with better on-farm management practices	Possible loss of habitat at sites due to increase in irrigated agriculture, or change in ephemeral water bodies to perennial ones – especially dry land birds and animals. Some possible species include the sloth bear (the Doroji Bear Sanctuary is near Gangawati), and also some highly endangered bird species such as the Great Indian Bustard and Lesser Florican have been sighted in some of the project districts. Similarly change in habitat may result in migratory routes being disturbed disturbing species Increase in the area under agriculture would	All plantation activities should consist of appropriate species for the area to be planted, in consultation with the FD and also after understanding the local ecological needs. Ensure all plantation activities are based upon the local fauna and flora needs, with no alien and invasive species planted Identify areas which are important habitats for all species – both sensitive and reserve areas and those outside (including corridors and fly paths), and ensure that they have appropriate actions and measures taken to reduce any adverse impact on them Identify an appropriate land management plan for the

DESIGN IMPACT			
Environmental Issue	Positive Impact	Adverse Impact	Possible Management Actions
		<p>reduce habitats for wild species, resulting in animal-man conflict and also impact species numbers</p> <p>Alien species and habitat loss - Non-native and alien species planted as a part of the plantation activities through project plantation activities, displacing native species which in turn would result in a loss of habitat for species.</p> <p>Increased animal – human conflict, either due to reduced habitat or due to change in cropping pattern such as increased area under sugarcane and paddy resulting in raiding of fields by elephants.</p> <p>Expansion of agriculture on what was considered wasteland earlier, and was used by wild animals for grazing etc resulting in increasing conflicts and raiding of crops</p> <p>Construction of structures in migratory routes or animal corridors may result in disruption of migratory patterns and also human-wildlife conflicts.</p>	<p>basin on the whole including areas for wildlife – fauna and flora, conservation in consultation with local authorities and people with appropriate management plans identified alongside</p> <p>Identify appropriate grazing areas, cultivation of fodder grasses etc. which are appropriate for the area to reduce degradation by overgrazing and the increased pressure on existing grazing lands, as areas previously used for open grazing is brought under cultivation</p> <p>Identify appropriate cropping pattern for an area, considering possible animal raid issues. Discuss with forest department in case required</p> <p>Avoid any activity in corridors, and fly paths. In case of an elephant corridor, do not undertake any permanent construction activity to obstruct it.</p>
Flora		<p>Some trees are likely to be cut along with other vegetation.</p> <p>Alien species introduced competing with local species</p> <p>Increase in area under irrigated agriculture, increase in HYV, monoculture and other crops and introduction of alien species with a corresponding loss of local agro-biodiversity</p> <p>Non-native and alien species planted as a part</p>	<p>For all trees cut/removed, plantation should be at the ratio of for every 1 cut planting of 3 trees.</p> <p>All plantation activities should consist of appropriate species for the area to be planted, in consultation with the FD and also after understanding the local ecological needs. Ensure all plantation activities are based upon the local fauna and flora needs, with no alien and invasive species planted</p> <p>Identify an appropriate land management plan for the</p>

DESIGN IMPACT			
Environmental Issue	Positive Impact	Adverse Impact	Possible Management Actions
		<p>of the plantation activities through project plantation activities, displacing native species and resulting in a loss of habitat</p> <p>Planting of non-native species in areas of local animal corridors resulting in damage to local forest areas that are habitats of the animals using the corridors</p> <p>Change in habitat for species due to increase in irrigated agriculture and change from ephemeral to perennial water bodies resulting in some species adapted for prior less water conditions unable to survive area</p>	<p>basin on the whole including areas for wildlife – fauna and flora, conservation in consultation with local authorities and people with appropriate management plans identified alongside</p> <p>Identify appropriate cropping pattern for an area, considering possible animal raid issues. Discuss with forest department in case required</p>
<i>Aquatic</i>			
Fauna	Improved irrigation, agriculture and on-farm practices resulting in improved aquatic habitats for fish	<p>Reduced environmental flows can decrease the availability of aquatic fauna habitats</p> <p>Increased agrochemicals usage resulting in degradation of the aquatic environment and toxicity of species</p>	<p>Overall assessment of appropriate water allocation needs for each sector, including environmental flows</p> <p>Education to farmers on improved agricultural practices, on-farm land management practices</p>
Flora	Improved aquatic habitat with improved on-farm practices	<p>Depending upon location of various activities and possible changes in river flows, aquatic flora may be impacted adversely.</p> <p>Increase in growth of aquatic weeds due to eutrophication of water</p>	<p>Overall assessment of appropriate water allocation needs for each sector, including environmental flows</p> <p>Education to farmers on improved agricultural practices, on-farm land management practices</p>
Sensitive areas		There are a number of notified sensitive areas such as the Doroji Bear Sanctuary, the BhadraTiger Reserve, and reserve, protected and other forest areas. While at present there are no activities identified that may impact	<p>Ensure all plantation activities are based upon the local fauna and flora needs, with no alien and invasive species planted</p> <p>Identify areas which are important habitats for all species – both sensitive and reserve areas and those</p>

DESIGN IMPACT			
Environmental Issue	Positive Impact	Adverse Impact	Possible Management Actions
		<p>these areas, it is possible change in land use pattern, agriculture intensification etc may have an impact such as change in local ecosystem from a semi-arid to irrigated paddy or sugarcane. This could impact local flora the area and species.</p> <p>Possible area of special concern which have not yet been properly identified. These are likely to include arid, semi-arid and grass and grazing lands, where species such as the Great Indian Bustard and the Lesser Florican are found. Recent sighting of the Long Billed Vultures and Egyptian Vultures in the Raichur – Bellary area have also been made. All these species are categorised as either endangered or critically endangered according to the IUCN Red List of Endangered Species. With increased water availability, more area may be bought under agriculture, or there could be a reduction in fallow land. Apart from expansion of land under agriculture, animal grazing in the more marginalised lands, and may be the home to some of these species.</p>	<p>outside (including corridors and fly paths), and ensure that appropriate actions and measures taken to reduce any adverse impact on them</p> <p>Identify an appropriate land management plan for the basin on the whole including areas for wildlife – fauna and flora, conservation in consultation with local authorities and people with appropriate management plans identified alongside</p> <p>Identify appropriate grazing areas, cultivation of fodder grasses etc. which are appropriate for the area to reduce degradation by overgrazing and the increased pressure on existing grazing lands, as areas previously used for open grazing is brought under cultivation</p> <p>Identify areas which are specifically for grazing in the area and through community management ensure that they are not encroached upon</p>
Corridors, fly paths etc.		Change in land use, flora species changes, or other habitats resulting in disruption and destruction of corridors and fly paths	<p>Ensure any plantation activities are according to discussions with the FD and understanding of local ecological needs</p> <p>Ensure that alien species or those inappropriate for the area are not planted in any animal corridor or fly path area</p>

DESIGN IMPACT			
Environmental Issue	Positive Impact	Adverse Impact	Possible Management Actions
<b>Economic and Infrastructure</b>			
Agriculture	<p>There is likely to be a positive impact on agriculture due to increased availability of water in some reaches.</p> <p>Improved agricultural practices – yield increased</p> <p>Improved livelihood opportunities in agriculture and better returns</p>	<p>Possible loss of agro-biodiversity due to introduction of other species and HYVs</p>	<p>Identify methods of preserving and cultivating local agricultural species.</p> <p>Work towards breed improvement of local agricultural species and possible methods to improve income from the sale of produce of local agro-biodiversity</p>
Industries	<p>Improved water quality due to improved on-farm management</p>	<p>Competition in water use, ground water or pumping from rivers</p> <p>Impact from industries due to reduced water availability and quality</p>	<p>Develop appropriate conjunctive water use plans, identify appropriate groundwater management activities and identify, where possible, groundwater management systems and local level regulation systems based upon local aquifer needs.</p>
Mining and quarrying		<p>Quarrying, borrow and sediment disposal activities could affect local vegetation, biodiversity, cause erosion, dust and noise, and affect communities</p>	<p>Identify specific borrow, quarry and sediment disposal sites, make impact assessments and prepare necessary operational guidelines for construction phase.</p>
Fisheries	<p>Improved on-farm practices result in better water quality and fisheries</p>	<p>Some waterlogged areas have been reclaimed for fisheries, a programme encouraged by the state Fisheries Department. Therefore, drainage plans could adversely impact fisheries</p> <p>Expansion of area under agriculture result in loss of habitat or contamination by agrochemicals</p>	<p>To the extent possible do not undertake any structure construction in areas where local population fish. In case unavoidable, identify methods to reduce impact after discussion with local population and also consider ways to compensate for loss</p>
Forestry		<p>Vegetation clearance for structures</p> <p>Alien species plantation and niche take over</p>	<p>Avoid cutting more trees than needed</p> <p>If possible, consider transplanting of tree to be removed</p> <p>For all trees cut/removed, plantation should be at the</p>

DESIGN IMPACT			
Environmental Issue	Positive Impact	Adverse Impact	Possible Management Actions
			ratio of for every 1 cut planting of 3 trees. All plantation activities should consist of appropriate species for the area to be planted, in consultation with the FD and also after understanding the local ecological needs. Ensure all procedures as required under the Tree Act are followed.
Fodder and grazing lands		Expansion of agriculture area may result in less areas for open grazing as grazing lands get taken over, reducing fodder availability in the project area Stocks of rice and other agriculture produce are used in TLBC as fodder, this would need to be considered while planning crops	Identify areas which are specifically for grazing in the area and through community management ensure that they are not encroached upon Identify appropriate agencies, such as the Animal Husbandry Department to help with improving fodder availability and reduction in open grazing
Natural Resource usage and access	If waterlogging reduced and improved agricultural practices, positive impact	In case an areas identified for compensatory plantation or other activities is at present common land where all people have rights and also use for various purposes such as threshing, use of such lands for compensatory plantation, increased area under agriculture, used for procuring raw material such as murrum, may reduce access to such materials and resources that these lands may have provided for before	Identify water needs for different users and in consultation with them develop appropriate design changes to ensure access to identified groups
WSS infrastructure	Improved groundwater quality due to better agricultural practices and reduced waterlogging Improved on-farm practices result in improved water quality	Due to poor groundwater quality and availability many areas are dependent upon the canal water for domestic, livestock and other purposes by storing in local tanks dug for the purpose. Inadequate consideration of this issue could deny them access to water Contamination of groundwater due to	Identify water needs for different users and in consultation with stakeholders and develop appropriate design changes to ensure access to identified groups Education to farmers on improved agricultural practices, on-farm land management practices Development of appropriate drainage structures and management measures, on-farm land management

DESIGN IMPACT			
Environmental Issue	Positive Impact	Adverse Impact	Possible Management Actions
		<p>waterlogging in new areas under agriculture or more water available, more intensive irrigation and inadequate drainage</p> <p>Contamination of groundwater due to agricultural intensification and extension of irrigation to rainfed agriculture areas</p>	<p>Work with farmers to identify appropriate cropping pattern given existing soils and drainage conditions</p>
Settlements	Unlikely to have any impact from project related activities	Poor routing of traffic and heavy traffic loads may damage roads	Identify most appropriate route for construction vehicles
Navigation, roads and other transport infrastructure		Some disruption may occur if sighting of infrastructure in river – such as water flow measures does not take into account local boat routes and landing sites	<p>Identify any landing and other sites along the planned infrastructure site. Where possible consider design changes to ensure there are no problems faced by the local population.</p> <p>Where not possible in consultation with the local population create alternate facilities.</p>
Energy		Possible increased demand and competition for energy due to micro-irrigation	
Waste		<p>Agrochemical waste as more areas and more intense agriculture takes place</p> <p>Depending upon crops various waste products may occur especially due to agro-industries, e.g. palm oil and sugar factories requiring proper disposal and use</p> <p>Poor quality pipes used for irrigation/micro-irrigation requiring regular changing and waste dumping in the fields</p> <p>Increased use of diesel and other energy for assuring irrigation water or for micro-irrigation</p>	<p>Need for identification of better waste management and more efficient industrial processes</p> <p>Undertake on-farm management education for farmers to ensure that they know how to dispose agro-chemical waste in most appropriate way</p> <p>Explore with KVK's, Agriculture Department, local agro-chemical shops and agro-chemical companies possibilities of buy back</p>

DESIGN IMPACT			
Environmental Issue	Positive Impact	Adverse Impact	Possible Management Actions
		as cropping patterns shift, and resultant spilling of the fuel and disposal of other waste from regular maintenance of generators and other energy systems	
<b>Social</b>			
Population and livelihoods	Overall improvement in livelihood opportunities due to increase in irrigation area, improved information on agriculture		
Vector borne diseases		Due to increased area under irrigated agriculture, or poor drainage management may result in increased habitats for various vectors both due to increased humidity and waterlogging. Number of vector diseases exist in the project districts and include malaria, dengue, chikungunya, Japanese encephalitis and filarial.	Ensure adequate drainage needs are identified, designed and there maintenance is also identified If required, develop extra drainage plans for various structures to ensure there is no waterlogging
Water borne diseases		Waterlogging, waste management and increased water availability increasing contamination of both surface and groundwater resulting in contamination of groundwater	If required, develop extra drainage plans for various structures to ensure there is no waterlogging
Nutrition and other health problems	District Raichur has been identified as an area where there are major malnutrition concerns. The increased availability of assured agriculture outputs may have a positive impact on the areas	Organophosphate poisoning has been an issue and is of concern among the health officials of Raichur district where organophosphates are used as agrochemicals. An increase in agriculture could result in a higher usage of these chemicals, creating greater access to them and also a higher level of agrochemicals	Undertake on-farm management education for farmers to ensure that they know how to dispose agro-chemical waste in most appropriate way. Identify any landing and other sites along the planned infrastructure site. Where possible consider design changes to ensure no problems are faced by the local

DESIGN IMPACT			
Environmental Issue	Positive Impact	Adverse Impact	Possible Management Actions
		<p>in the environment.</p> <p>Wetlands and drainage of some waterlogged areas where there is fishing at present. These may be sources of nutritional supplement for the local population, adversely impacting them</p> <p>Sand mining destroying local fishing areas</p> <p>Expansion of land for agriculture and into what was earlier considered wasteland. This 'wasteland' may have been used for fodder, pasture lands or even nutritional supplements. This is a possible secondary impact as increased employment opportunities attract labour, which in turn clears up areas for their own agricultural needs.</p>	<p>population.</p> <p>Where not possible in consultation with the local population create alternate facilities.</p> <p>Identify water needs for different users and in consultation with them develop appropriate design changes to ensure access to identified groups</p> <p>Identify an appropriate land management plan for the basin on the whole including areas for wildlife – fauna and flora, conservation in consultation with local authorities and people with appropriate management plans identified alongside</p> <p>Identify appropriate grazing areas, cultivation of fodder grasses etc. which are appropriate for the area to reduce degradation by overgrazing and the increased pressure on existing grazing lands, as areas previously used for open grazing is brought under cultivation</p> <p>Identify areas specifically for grazing and through community management ensure that they are not encroached upon</p>
Archaeological, cultural sites, paleontological sites and aesthetics		<p>Archeologically important sites such as Hampi from the Vijayanagara Empire exist within the project area. Their integrity, aesthetics and cultural and heritage value could decrease due to poor planning, changes in the overall aesthetics of the area or design inputs for either the irrigation or agricultural systems that results in a damage to the structures.</p>	<p>Ensure that any important archaeological area is well identified and demarcated and required actions are demarcated in a detailed management and mitigation plan so that no damage takes place to it. Follow procedures laid out in legislation related to archaeological findings</p> <p>Rehabilitation of all sites must be undertaken once work is completed and plans developed well in advance of construction activities and should be in the construction company contract to ensure it is taken up and appropriate budget should be made for the activity</p>

DESIGN IMPACT			
Environmental Issue	Positive Impact	Adverse Impact	Possible Management Actions
			Avoid identifying any quarrying work in an aesthetically important/significant place For material used in important places such as Humpi ensure it blends with local design and style to the extent possible

CONSTRUCTION RELATED IMPACTS			
Environmental Issue	Positive impacts	Adverse Impacts	Possible mitigation measures
<b>Physical Environment</b>			
<i>Water resources</i>			
River system and environmental flows		Sand mining resulting in changing of river course and river scouring	<p>Identify appropriate areas for taking river sand, based upon existing regulations, but also ensuring that there is no excess sand taken.</p> <p>Rehabilitate land after work is finished to ensure least damage to area. In case of any damage consult with experts from the WRD, Forest Department and NGOs working on the issue to develop appropriate rehabilitation of area and compensation.</p> <p>Plan mining and procurement sites before starting work to keep in mind any erosion issues that may occur</p>
Wetlands & local water bodies		<p>Dumping of waste in water bodies, contaminating them</p> <p>Washing of vehicles and other activities leading to pollution of water bodies and wetlands</p>	<p>Ensure proper site planning takes place and site management is adequate – to be put into construction contractor’s clauses</p> <p>Proper storage and disposal of hazardous material to avoid contamination, spills and accidents.</p> <p>If there are no waste disposal systems in the area, the material should be sent to a pre-identified disposal site.</p> <p>No dumping in river, or labour camps/temporary or material storage sites on river bed.</p> <p>Vehicles properly maintained and serviced – and not washed or serviced, at water bodies/wetlands.</p> <p>Sites restored after work completed.</p> <p>No quarry work in running water of rivers, and minimize need to work or drive through water.</p>

CONSTRUCTION RELATED IMPACTS			
Environmental Issue	Positive impacts	Adverse Impacts	Possible mitigation measures
			<p>Fence off in-stream work to reduce disturbance.</p> <p>Avoid refuelling at project site. For refilling at site, demarcate site, ensure surface made impermeable.</p>
Groundwater		<p>In areas where vehicles are kept, parked or at the quarry site, there may be spills of grease and oil – which could contaminate the groundwater, especially in areas with a high water table</p> <p>Poorly managed sites or waste disposal resulting in waterlogging and a rise in the water table.</p>	<p>Proper storage and disposal of material, including hazardous material, to avoid contamination, spills and accidents.</p> <p>If there are no waste disposal systems in the area, the material should be sent to a pre-identified disposal site.</p> <p>No dumping in river, or labour camps/temporary or material storage sites on river bed.</p> <p>Vehicles properly maintained and serviced – and not washed or serviced, at site.</p> <p>No driving in river water.</p> <p>Proper waste storage and disposal.</p> <p>Sites restored after work completed.</p> <p>No quarry work in running water of rivers, and minimize need to work in water.</p> <p>Fence off in-stream work to reduce disturbance.</p> <p>Avoid refuelling at project site. For refilling at site, demarcate site, ensure surface made impermeable.</p>
Water quality		<p>Construction activities – like sand mining in river bed will impact the river quality, resulting in localized turbidity to spill of grease and oil from heavy machinery and trucks excavating material</p> <p>Washing vehicles etc in river polluting them</p>	<p>Proper storage and disposal of hazardous material, to avoid contamination, spills and accidents.</p> <p>If there are no waste disposal systems in the area, the material should be sent to a pre-identified disposal site.</p> <p>No dumping in river, or labour camps/temporary or material storage sites on river bed.</p>

CONSTRUCTION RELATED IMPACTS			
Environmental Issue	Positive impacts	Adverse Impacts	Possible mitigation measures
			<p>Vehicles properly maintained and serviced – and not washed or serviced, at site. No driving/washing in river.</p> <p>Sites restored after work completed.</p> <p>No quarry work in running water of rivers, and minimize need to work in water and fence off in-stream work to reduce disturbance.</p> <p>Avoid refuelling at project site. For refilling at site, demarcate site, ensure surface made impermeable.</p>
<b>Atmospheric Parameters</b>			
Air		<p>Vehicular pollution is likely, as it is noted that many of the vehicles – especially trucks, are old and poorly maintained</p> <p>Dust during excavation – at construction sites and sourcing of raw material such as aggregate, sand and murrum, and transportation of these materials to construction site</p> <p>Diesel pump sets for provision of energy during construction – leading to air pollution</p>	<p>Use silt fences around excavation and storage for earth, as required.</p> <p>Ensure vehicles carrying earth are covered.</p> <p>Avoid work in high wind condition.</p> <p>As far as possible use already identified roads and routes to access various sites</p> <p>Ensure all equipment is properly maintained</p> <p>Use sprinklers etc to settle dust where needed</p>
Noise		<p>During construction there is likely to be a relatively high level of noise – given the present quiet environment. However, as construction activities requiring machinery will be limited – it is expected that the noise levels may not rise too high.</p>	<p>Ensure all equipment and vehicles are properly maintained</p> <p>Discuss with local population before starting any construction activity to identify possible concerns to ensure minimum disturbance</p>

CONSTRUCTION RELATED IMPACTS			
Environmental Issue	Positive impacts	Adverse Impacts	Possible mitigation measures
<b>Land resources</b>			
Soil quality		<p>Localized pollution due to oil and grease spill and waste is likely.</p> <p>Labour camps, for some of the construction activities will create pollution through increased waste or poor management and disposal of waste created due to construction activities</p>	<p>Ensure proper site planning takes place and site management is adequate</p> <p>Rehabilitate site after finishing work, as appropriate</p> <p>Ensure all equipment and vehicles are properly maintained</p> <p>Proper storage and disposal of material, including hazardous material, to avoid contamination, spills and accidents.</p> <p>If there are no waste disposal systems in the area, the material should be sent to a pre-identified disposal site.</p>
Erosion/ compaction		<p>From procurement sites for material – quarries etc, sheet and gully erosion possible</p> <p>Vehicular movement, construction sites and labour sites causing soil compaction</p>	<p>Plan mining and procurement sites before starting work to keep in mind any erosion issues that may occur</p> <p>Rehabilitate all sites after construction/quarrying activities are completed such as ploughing and plantation.</p> <p>Plan site prior to starting excavation activities, including slope stabilization, identify and developing appropriate slope aspect during excavation and contouring to ensure slope stability after earth borrowing activities are completed.</p> <p>Only vegetation that must be cleared for construction purposes or site access should be removed</p> <p>As far as possible use already identified roads and routes to access various sites</p>

CONSTRUCTION RELATED IMPACTS			
Environmental Issue	Positive impacts	Adverse Impacts	Possible mitigation measures
Salinity, alkalinity		Poor drainage due to poorly managed construction and labour campsites	<p>Plan site prior to starting excavation activities, including slope stabilization, identify and developing appropriate slope aspect during excavation and contouring to ensure slope stability after earth borrowing activities are completed.</p> <p>Only vegetation that must be cleared for construction purposes or site access must be removed</p> <p>As far as possible use already identified roads and routes to access various sites</p>
<b>Natural and Biological environment</b>			
<i>Terrestrial</i>			
Fauna		<p>Depending upon area for procurement of raw material, location of labour camp, transport routes and other activities disturbance to local avian and other species due to construction noise and human movement possible.</p> <p>Introduction of alien species for plantation activities resulting in loss of habitat</p> <p>Construction in migratory routes at time of migration on inadequate post construction cleaning up of site, could impact species such as the butterfly migration in and around the Western Ghats</p> <p>Habitat loss due to cutting of trees and other vegetation and plantation of alien species as replacement or for fulfilling local fuel wood needs at the time of construction, which are not appropriate habitat for the local species such as <i>prosopis glandulosa</i></p>	<p>Undertake plantation activities as required, and ensure plantation activities include species that are endemic to the area, in consultation with Forest Department.</p> <p>Rehabilitate all sites after construction/quarrying activities are completed including plantation.</p> <p>Discuss with local population before starting any construction activity to identify possible concerns to ensure minimum disturbance</p> <p>Only take up work in day hours</p> <p>In case of local animal movement or migrations, ensure that work does not take place when the migration is underway, or avoid migratory routes</p> <p>Do not create blockages by storage, labour camps etc in animal corridors</p> <p>Near sensitive areas ensure that work adheres to local regulations and also use least destructive methods, and rehabilitate area after finishing work</p>

CONSTRUCTION RELATED IMPACTS			
Environmental Issue	Positive impacts	Adverse Impacts	Possible mitigation measures
Flora		<p>Some impacts – and are likely at the different sites identified for storage of material may require clearance of vegetation.</p> <p>Access to the quarries and borrow pits and clearance of vegetation for removing material</p> <p>Use of alien species resulting in competition invading local flora areas – such as plantation of alien species as replacement or for fulfilling local fuel wood needs at the time of construction, which are not appropriate habitat for the local species such as <i>prosopis glandulosa</i></p>	<p>Undertake plantation activities as required, and ensure plantation activities include species that are endemic to the area, in consultation with Forest Department.</p> <p>For compensatory plantation, try and plant the same species as those removed.</p> <p>Rehabilitate all sites after construction/quarrying activities are completed such as plantation.</p> <p>Discuss with local population before starting any construction activity to identify possible concerns to ensure minimum disturbance</p> <p>Near sensitive areas ensure that work adheres to local regulations and also use least destructive methods, and rehabilitate area after finishing work</p>
<i>Aquatic</i>			
Fauna		<p>Depending upon the area, there is a possibility of an increased turbidity or disturbance or degradation of the habitat. This could be due to sand quarrying, disposal of waste or washing of vehicles in the area, or even construction of structures in the aquatic system.</p>	<p>Discuss with local population before starting any construction activity to identify possible concerns to ensure minimum disturbance</p> <p>Do not undertake any construction/ quarrying activity during the spawning period of the different fish species.</p> <p>Ensure there is a proper waste management plan in place for all sites</p> <p>Do not wash vehicles in rivers</p>
Flora		<p>Depending upon the area, there is a possibility of an increased turbidity or disturbance or degradation of the habitat. This could be due</p>	<p>Discuss with local population before starting any construction activity to identify possible concerns to ensure minimum disturbance</p>

CONSTRUCTION RELATED IMPACTS			
Environmental Issue	Positive impacts	Adverse Impacts	Possible mitigation measures
		to sand quarrying, disposal of waste or washing of vehicles in the area, or even construction of structures in the aquatic system.	Ensure there is a proper waste management plan in place for all sites Do not wash vehicles in rivers
Sensitive areas		Depending upon sourcing of material and transportation routes sensitive areas can be impacted due to noise, light, vibrations, and destruction of habitat.	Rehabilitate all sites after construction/quarrying activities are completed including plantation. Discuss with local population before starting any construction activity to identify possible concerns to ensure minimum disturbance Only take up work in day hours In case of local animal movement or migrations, ensure that work does not take place when the migration is underway, or avoid migratory routes Near sensitive areas ensure that work adheres to local regulations and also use least destructive methods, and rehabilitate area after finishing work
Corridors, fly paths etc.		Disruption and destruction of corridors and fly paths Disruption of migration of species due to construction and other construction related activities	Do not create blockages by storage, labour camps etc in animal corridors Only take up work in day hours
Economic and Infrastructure			
Agriculture		There could be some disturbance accessing various sites Labour camps, construction and storage sites. Vehicle parking area. Most of this is likely to be temporary, but poor management of sites may result in higher impacts	Identify appropriate access routes, speed limits, timings and site plans with community. Identify appropriate material storage areas to ensure least possible disturbance.
Industries			

CONSTRUCTION RELATED IMPACTS			
Environmental Issue	Positive impacts	Adverse Impacts	Possible mitigation measures
Mining and quarrying		Impact from quarries and mines due to reduced water availability and quality, dewatering and change in aquifers or surface water systems	<p>Insure appropriate waste management plan is in place and adhered to.</p> <p>Ensure proper site planning in place and rehabilitation of site after work is over.</p> <p>Ensure appropriate site drainage.</p>
Fisheries		<p>Disturbance to local habitats during construction – such as sand mining from riverbeds.</p> <p>Waste dumping and washing and cleaning of vehicles, machinery etc in water bodies or near them</p>	<p>Do not undertake any construction/ quarrying activity during the spawning period of the different fish species.</p> <p>Plan sites to ensure that there is no, or if this not possible, not excessive river bed mining impacting river flows or fish habitats</p> <p>Ensure waste is not dumped in the river</p> <p>Ensure appropriate waste management at all construction sites</p>
Forestry		<p>Vegetation clearance for access to construction sites, quarries etc</p> <p>Use of fire wood at labour camps and other construction activities</p>	<p>Only undertake plantation clearance where needed</p> <p>Undertake rehabilitation and re-plantation with appropriate species once work is over</p> <p>Develop firewood plantation for labour with appropriate species</p>
Fodder and grazing lands		Use of grazing areas for storage of construction material etc.	Discuss with local population prior to identifying sites for construction camps etc
Natural Resource usage and access		<p>There could be some disturbance accessing various sites</p> <p>Labour camps, construction and storage sites.</p> <p>Vehicle parking area</p>	Discuss with local population prior to identifying sites for construction camps etc
WSS infrastructure		<p>Damage to infrastructure at construction time –during sourcing of material or at various sites and facilities or during transport</p> <p>Labour lack of sanitation facilities leading to</p>	Identify possible infrastructure in the area prior to starting work to ensure that they are not damaged due to any construction work.

CONSTRUCTION RELATED IMPACTS			
Environmental Issue	Positive impacts	Adverse Impacts	Possible mitigation measures
		contamination of existing resources Labour lack of sufficient water supplies leading to competition for existing resources Contamination of water sources due to construction activities – both at construction sites and in areas raw material is sourced from the river could lead to reduced water quality – impacting availability of potable water.	In case of damage repair them immediately Ensure appropriate waste management at all sites during construction and rehabilitate sites once work is over In case of accidental spillage, ensure immediate clean-up
Settlements		Disruptions and disturbance due to labour camps, construction activities and transportation of goods. But this is likely to be temporary	Identify appropriate access routes, speed limits and timings with community. Identify appropriate material storage areas to ensure least possible disturbance. Provide signage, demarcate and cordoning of areas to reduce access to construction site and to avoid accidents. Ensure appropriate site drainage. Restore areas after work is over. Minimize transportation of material through heavily populated areas. Only use road worthy vehicles.
Navigation, roads and other transport infrastructure		During construction time, there is likely to be higher traffic to and from the various sites – traffic disruptions Poorly identified borrow pits and river sand quarries could lead to a long term damage to both river based and land based infrastructure as landing sites may be disrupted and river courses could shift or lead to erosion downstream, undermining infrastructure on or next to the river Damage to infrastructure due to heavy	Identify appropriate access routes, speed limits and timings with community. Vehicles should take pre-identified routes. Do not allow vehicles to move with loads higher than what they can take. Ensure all sites are rehabilitated once construction or quarrying is over Avoid landing sites, navigation routes for sand quarrying

CONSTRUCTION RELATED IMPACTS			
Environmental Issue	Positive impacts	Adverse Impacts	Possible mitigation measures
		transport vehicles	
Energy		Labour camps will require energy and resultant conflict with the local population or destruction of local vegetation	Undertake adequate energy plantations and ensure appropriate species are planted that do not damage local environment
Waste		Increased waste from labour camps, silt, raw material procurement site, construction waste Malfunctioning vehicles and onsite maintenance Waste from areas dug for infrastructure construction – such as for water flow measurement and lining.	Proper storage and disposal of material, including hazardous material, to avoid contamination, spills and accidents.  If there are no waste disposal systems in the area, the material should be sent to a pre-identified disposal site.  No dumping in river, or labour camps/temporary or material storage sites on river bed.  Vehicles properly maintained and serviced – and not washed or serviced, at site.  No driving in river water.  Proper waste storage and disposal.  Sites restored after work completed.  No quarry work in running water of rivers, and minimize need to work in water.  Fence off in-stream work to reduce disturbance.  Avoid refuelling at project site. For refilling at site, demarcate site, ensure surface made impermeable.
Telecommunication		Possible damage to telecommunication lines during construction possible – near material procurement sites and during transportation. Though considering the rural setting, the possibilities are limited and mainly along the	Identify possible telecommunication lines in the area prior to starting work to ensure that they are not damaged due to any construction work.  In case of damage repair them immediately

CONSTRUCTION RELATED IMPACTS			
Environmental Issue	Positive impacts	Adverse Impacts	Possible mitigation measures
		small towns such as Maski and Hospet through which either the canal system passes or are on transport routes.	
<b>Social</b>			
Population and livelihoods		Disturbance to local population due to construction activity, sites and labour camps	Identify appropriate access routes, speed limits and timings with community. Identify appropriate material storage areas to ensure least possible disturbance. Provide signage, demarcate and cordoning of areas to reduce access to construction site and to avoid accidents. Ensure appropriate site drainage. Restore areas after work is over. Minimize transportation of material through heavily populated areas. Only use road worthy vehicles.
Vector borne diseases		Disruption of drainage, borrow pits and sand mining areas resulting in an increase in vector habitats	Ensure appropriate drainage and waste management at all sites, including sanitation for workers Rehabilitate sites after work is completed
Water borne diseases		May increase if waste management, sanitation and drainage systems for the labour camps are not adequately addressed	Ensure appropriate drainage and waste management at all sites, including sanitation for workers Rehabilitate sites after work is completed
Health and safety of workers		Possible risk of accidents to workers during construction	Need for emergency procedures in place with first aid available at site. Trained staff to ensure first aid and immediate medical attention is made available till worker reaches hospital Ensure that all safety equipment for workers is available and in place, and workers are trained to use it and are using it Any site which may pose a risk to workers – such as

CONSTRUCTION RELATED IMPACTS			
Environmental Issue	Positive impacts	Adverse Impacts	Possible mitigation measures
			<p>areas where hazardous material are stored must have restricted entry with workers at the facility equipped to handle any accidents, if they may happen</p> <p>All required safety equipment and signage must be in place to ensure that there is a minimum risk of accidents</p>
Nutrition and other health problems		<p>There may be a loss of local fishing grounds/access to areas where local fishing activities are undertaken, resulting in less fish in the diet, temporarily – especially for areas where construction is taking place along the river or areas near fishing sights.</p> <p>Accidents due to the proximity of the construction sites to the residential area</p> <p>Accidents at the construction sites resulting in injury to the labour or local population.</p> <p>HIV/AIDS – some villages in the project area have a high incidence already which is attributed to temporary migration of local population, similarly labour into the area may also result in a spread of the disease</p>	<p>Consult with local population prior to starting work for all site planning</p> <p>Ensure all requirements of the labour camps are identified prior to starting work and appropriate arrangements made</p> <p>Ensure first aid is available at site and required arrangements to take injured to the hospital is there</p> <p>Minimise transportation through heavily populated areas</p> <p>Ensure appropriate fencing off and signage at all sites, allowing only authorised personal to be there</p> <p>Undertake appropriate awareness on AIDS etc</p> <p>Ensure that labour at sites has required safety equipment which is in good condition, knows how to use it and uses it</p>
Archaeological, cultural sites, paleontological sites and aesthetics		<p>This area has a rich cultural heritage and a number of historical places, archaeological sites could be found in the project area. The Vijayanagara empire and other sites that predate it exist. The greatest concern is of the work on the VNC. However, there also exist possibility of chance finds in other project areas</p> <p>Riverbed quarries will impact the aesthetics of the area, through the impact is expected to be</p>	<p>In case of chance finding of any archaeological sites, Stop all work that may be underway or planned in the area and discuss with District Commissioner for further action</p> <p>Ensure that the construction company and supervising consultants have an understanding of archaeological concerns in the area</p> <p>Ensure that any important archaeological area is well identified and demarcated and required actions are demarcated in a detailed management and mitigation</p>

CONSTRUCTION RELATED IMPACTS			
Environmental Issue	Positive impacts	Adverse Impacts	Possible mitigation measures
		low Quarries in hills have an impact on local aesthetics Much of the area consists of hard rock hills especially in the Tunghabhadra area, and forests in the case of the Bhadra. Procurement of material therefore would be an issue that could have an adverse impact on local aesthetics, such as the destruction of the craggy hills for raw material or cutting of trees for use for firewood.	plan so that no damage takes place to it

OPERATION RELATED IMPACTS			
Environmental Issue	Positive Impact	Adverse Impact	Possible Mitigation Actions
<b>Physical Environment</b>			
<i>Water resources</i>			
River system and environmental flows		<p>Increased areas being bought under irrigation resulting in possible return flows no longer reaching the river, adversely impacting environmental flows</p> <p>In areas where some water returns to the river, reuse and higher level of agrochemical with agricultural expansion would result in increased toxics in river system and more aquatic weeds</p>	<p>Through the IWRM plan as identified by the AC_IWRM work towards ensuring that there are sufficient environmental flows in the river and its tributaries</p> <p>Farmers education on proper use and management of agrochemicals, including their waste</p> <p>Ensuring a farmer’s friendly method for disposal of agrochemical waste, as identified during project design</p>
Wetlands & local water bodies	<p>Improved agriculture practices resulting in lowering agrochemical usage, reducing contamination reaching waterbody</p> <p>Improved irrigation practices may reduce waterlogging in areas where practiced</p>	<p>Agricultural waste dumped in local water bodies especially agrochemical and their used containers deteriorating local water bodies and their wetland values</p> <p>Increased waterlogging due to poor maintenance of drainage system.</p>	<p>Farmers education on proper use and management of agrochemicals, including their waste</p> <p>Ensuring a farmer’s friendly method for disposal of agrochemical waste, as identified during project design</p> <p>Ensure through farmer’s education that waste is not disposed in water bodies and appropriate waste disposal systems are found and used</p>
Groundwater	<p>Improved agriculture practices resulting in lowering agrochemical usage, reducing contamination reaching aquifers</p> <p>Improved irrigation practices may reduce waterlogging in areas where practiced, improving aquifer quality</p>	<p>Insufficient funds or management of system – especially drainage management leading to silting up and choking, resulting in rising water table and waterlogging</p> <p>Poor agricultural practices – such as excessive water used for irrigation leading to rising water table and waterlogging</p> <p>Agrochemical used leaching into groundwater, contaminating aquifers</p>	<p>Farmers education on proper use and management of agrochemicals, including their waste</p> <p>Ensuring a farmer’s friendly method for disposal of agrochemical waste, as identified during project design</p> <p>Ensure through farmer’s education that waste is not disposed in water bodies and appropriate waste disposal systems are found and used</p> <p>Identify appropriate cleaning and maintenance of drainage system, including disposal of waste</p>

OPERATION RELATED IMPACTS			
Environmental Issue	Positive Impact	Adverse Impact	Possible Mitigation Actions
			removed. Improved agriculture practices – understanding plant needs and use of irrigation water as required through improved understanding of the system Ensure there is a budget for the management of drains and the budget is spent on it
Water quality		Return flows, drainage into canal system (silt and water quality – agrochemicals) deteriorating water quality of both surface and ground water systems	Farmers education on proper use and management of agrochemicals, including their waste Ensuring a farmer's friendly method for disposal of agrochemical waste, as identified during project design Ensure through farmer's education that waste is not disposed in water bodies and appropriate waste disposal systems are found and used
<b>Land resources</b>			
Soil quality	Improved agriculture knowledge resulting in improved soil health	Excessive use of agrochemicals, poor soil and land management practices leading to soil exhaustion, toxicity and degradation, due to poor agricultural extension	Farmers education on proper use and management of agrochemicals, including their waste Ensuring a farmer's friendly method for disposal of agrochemical waste, as identified during project design Identify appropriate soil management and soil testing systems and educate farmers on it. Ensure that farmers remember through repeated information sharing on good agriculture and soil management practices
Erosion/ compaction		Agriculture intensification and poor farmland management resulting in soil erosion	Identify appropriate soil management and soil testing systems and educate farmers on it. Ensure that farmers remember through repeated information sharing on good agriculture and soil

OPERATION RELATED IMPACTS			
Environmental Issue	Positive Impact	Adverse Impact	Possible Mitigation Actions
			management practices
Salinity, alkalinity	Improved soil and water management will ensure soil salinity and alkalinity is reduced/ does not take place	Inadequate extension service to support agricultural expansion resulting in poor land and irrigation management practices	<p>Farmers education on proper use and management of agrochemicals, including their waste</p> <p>Ensuring a farmer’s friendly method for disposal of agrochemical waste, as identified during project design</p> <p>Identify appropriate cleaning and maintenance of drainage system, including disposal of waste removed.</p> <p>Improved agriculture practices – understanding plant needs and use of irrigation water as required through improved understanding of the system</p> <p>Ensure there is a budget for the management of drains and the budget is spent on it</p>
<b>Natural and Biological environment</b>			
<i>Terrestrial</i>			
Fauna		<p>Poor management of agriculture waste – especially agrochemical waste, contaminating the area and impacting local species</p> <p>Draining of wetlands and local water bodies for expansion of agriculture resulting in loss of local habitats</p> <p>Reduced toxicity in the environment with better on-farm management practices</p> <p>Assured irrigation can result in higher use of agrochemicals, HYV &amp; GMOs resulting in reduced habitat of pollinators or increased</p>	<p>Through the IWRM activities identify appropriate land management and conservation methods, and work with farmers to educate and ensure that wetlands are not drained</p> <p>Work with farmers to identify appropriate land management systems at the village level</p> <p>Work through agricultural extension, KVKs etc for breed improvement and improved agriculture market and prices for local crops and varieties</p> <p>Farmers education on proper use and management of agriculture and agrochemicals, including their waste</p>

OPERATION RELATED IMPACTS			
Environmental Issue	Positive Impact	Adverse Impact	Possible Mitigation Actions
		toxicity to them, having a an impact on both the pollinators and various flowering plant species, including both wild species and cultivated species like fruit trees.	Ensuring a farmer’s friendly method for disposal of agrochemical waste, as identified during project design Identify appropriate cleaning and maintenance of drainage system, including disposal of waste removed
Flora		Increased area brought under agriculture due to expansion of agriculture Increased areas under HYV, monoculture or other crops resulting in loss of local biodiversity	Work with local community to ensure that cultivation extension into grasslands, and other scrub areas is not undertaken Work through a community system to identify wetlands and their protection Educate community on management of soil and agrochemical usage Demarcate all areas though an IWRM plan for conservation and limitation of areas for agriculture. Thereby, lands considered barren or wasteland and perhaps containing important ecosystems are not encroached upon either by agriculture or converted to grazing areas with increased pressure on existing grazing lands, encroaching upon scrub forest land
<i>Aquatic</i>			
Fauna	Improved irrigation, agriculture and on-farm practices resulting in improved aquatic habitats for fish	Agrochemical waste and increased toxicity of the local aquatic environment Reduced environmental flows due to agriculture intensification and reduced return flows resulting in decreased habitats Draining of wetlands and local water bodies for expansion of agriculture resulting in loss of local habitats	Through the IWRM plan as identified by the AC_IWRM work towards ensuring that there are sufficient environmental flows in the river and its tributaries Through the IWRM activities identify appropriate land management and conservation methods, and work with farmers to educate and ensure that wetlands are not drained Work with farmers to identify appropriate land management systems at the village level

OPERATION RELATED IMPACTS			
Environmental Issue	Positive Impact	Adverse Impact	Possible Mitigation Actions
			<p>Farmers education on proper use and management of agriculture and agrochemicals, including their waste</p> <p>Ensuring a farmer’s friendly method for disposal of agrochemical waste, as identified during project design</p>
Flora		<p>Agrochemical waste and increased toxicity and degradation of local aquatic habitat, and increase in aquatic weeds</p> <p>Draining of wetlands and local water bodies for expansion of agriculture resulting in loss of local habitats</p>	<p>Through the IWRM activities identify appropriate land management and conservation methods, and work with farmers to educate and ensure that wetlands are not drained</p> <p>Work with farmers to identify appropriate land management systems at the village level</p> <p>Farmers education on proper use and management of agriculture and agrochemicals, including their waste</p> <p>Ensuring a farmer’s friendly method for disposal of agrochemical waste, as identified during project design</p>
Sensitive areas		<p>Agriculture intensification, irrigation intensification and use of new species may have an impact on area of influence of sensitive area</p>	<p>Through the IWRM activities identify appropriate land management and conservation methods, and work with farmers to educate and ensure wetlands and other conservation areas are not degraded</p> <p>Work with farmers to identify appropriate land management systems at the village level</p> <p>Farmers education on proper use and management of agriculture and agrochemicals, including their waste</p> <p>Ensuring a farmer’s friendly method for disposal of agrochemical waste, as identified during project design</p>

OPERATION RELATED IMPACTS			
Environmental Issue	Positive Impact	Adverse Impact	Possible Mitigation Actions
Corridors, fly paths etc.		<p>Draining of wetlands and local water bodies for expansion of agriculture resulting in loss of local habitats</p> <p>Expansion of area under grazing or other anthropogenic activities resulting in destruction of habitats</p>	<p>Through the IWRM activities identify appropriate land management and conservation methods, and work with farmers to educate and ensure wetlands and other conservation areas are not degraded</p> <p>Work with farmers to identify appropriate land management systems at the village level</p> <p>Work with animal husbandry and other departments to identify ways to ensure appropriate fodder grasses are grown and to identify ways to reduce grazing pressure</p>
<b>Economic and Infrastructure</b>			
Agriculture	Improvement in yields and productivity with improved agriculture extension/agricultural practices, more reliable irrigation availability and reduced waterlogging.	In areas where water is now available due to saving in other areas, poor drainage may result in water logging decreased agricultural productivity.	<p>Identify appropriate cleaning and maintenance of drainage system, including disposal of waste removed.</p> <p>Improved agriculture practices – understanding plant needs and use of irrigation water as required through improved understanding of the system</p>
Fisheries	Improved on-farm practices resulting in better fisheries	<p>Expansion of agriculture into wetlands and water bodies by draining them</p> <p>Agrochemical and other waste dumping degrading water quality</p>	<p>Through the IWRM activities identify appropriate land management and conservation methods, and work with farmers to educate and ensure that wetlands are not drained</p> <p>Work with farmers to identify appropriate land management systems at the village level</p> <p>Farmers education on proper use and management of agriculture and agrochemicals, including their waste</p> <p>Ensuring a farmer’s friendly method for disposal of agrochemical waste, as identified during project design</p>

OPERATION RELATED IMPACTS			
Environmental Issue	Positive Impact	Adverse Impact	Possible Mitigation Actions
Fodder and grazing lands		Less open land in fields for grazing	Demarcate all areas through an IWRM plan for conservation and limitation of areas for agriculture
WSS infrastructure		<p>Poor management of agriculture waste leading to pollution of groundwater reducing availability of potable water</p> <p>Groundwater contamination due to poor drainage management</p> <p>Increasing irrigation intensity raises water tables resulting in waterlogging and in areas where soak pits and septic tanks are used it may reduce their lifespan and reduce effectiveness.</p> <p>Increased usage of agrochemicals resulting in higher pollution loads in water bodies</p>	<p>Farmers education on proper use and management of agriculture and agrochemicals, including their waste</p> <p>Ensuring a farmer's friendly method for disposal of agrochemical waste, as identified during project design</p> <p>Identify appropriate cleaning and maintenance of drainage system, including disposal of waste removed.</p> <p>Improved agriculture practices – understanding plant needs and use of irrigation water as required through improved understanding of the system</p>
Settlements		Poor maintenance leading to waste dumping and nuisance in and around settlements	<p>Ensuring a farmer's friendly method for disposal of agrochemical waste, as identified during project design</p> <p>Identify appropriate cleaning and maintenance of drainage system, including disposal of waste removed.</p>
Waste		<p>Silt management – desilting, other waste, disposal sites</p> <p>Increased weeds in water bodies due to eutrophication resulting in increased need for disposal of weeds</p>	<p>Identify appropriate waste management system for drain cleaning</p> <p>Weeds can be used, in consultation with farmers, for manure. Therefore, if farmers are interested a system for their use and disposal on farmlands at the time that drains are cleaned should be</p>

OPERATION RELATED IMPACTS			
Environmental Issue	Positive Impact	Adverse Impact	Possible Mitigation Actions
			<p>undertaken</p> <p>Ensure appropriate drainage management to keep the area silt free and not allowing the disposal of any waste</p> <p>Work with farmers through farmer’s education system to ensure appropriate application of agrochemicals, including fertilizers</p> <p>Educate farmers on proper soil management and testing</p>
<b>Social</b>			
Population and livelihoods			
Vector borne diseases		<p>Poor waste management – dumping of waste in natural drainage systems, or those developed for draining excess water from project area increasing vector habitats</p> <p>Poor drainage management resulting in silting chocking and weed growth in water bodies</p>	<p>Farmers education on proper use and management of agrochemicals, including their waste</p> <p>Ensuring a farmer’s friendly method for disposal of agriculture, agrochemical and other waste, as identified during project design</p> <p>Identify appropriate cleaning and maintenance of drainage system, including disposal of waste removed</p> <p>Identify appropriate cleaning and maintenance of drainage system, including disposal of waste removed.</p> <p>Improved agriculture practices – understanding plant needs and use of irrigation water as required through improved understanding of the system</p>

OPERATION RELATED IMPACTS			
Environmental Issue	Positive Impact	Adverse Impact	Possible Mitigation Actions
Water borne diseases		Poor drainage and waste management	<p>Farmers education on proper use and management of agrochemicals, including their waste</p> <p>Ensuring a farmer’s friendly method for disposal of agriculture, agrochemical and other waste, as identified during project design</p> <p>Identify appropriate cleaning and maintenance of drainage system, including disposal of waste removed</p> <p>Identify appropriate cleaning and maintenance of drainage system, including disposal of waste removed.</p> <p>Improved agriculture practices – understanding plant needs and use of irrigation water as required through improved understanding of the system</p>
Nutrition and other health problems		<p>Toxicity and other health risks due to use of agrochemicals without adequate protection</p> <p>Reuse of agrochemical packages for food and other storage purposes</p> <p>Burning of agrochemical plastic packaging</p> <p>Increased agro-industry waste disposal without adequate treatment and management resulting in contamination of land and water in the area, impacting health</p>	<p>Farmers education on proper use and management of agrochemicals, including their waste</p> <p>Ensuring a farmer’s friendly method for disposal of agriculture, agrochemical and other waste, as identified during project design</p>
Archaeological, cultural sites, paleontological sites and aesthetics		<p>Increase or decrease in availability of water may have an impact on the foundation of local monuments</p> <p>Expansion of agriculture into areas which were earlier not under agriculture due to insufficient irrigation water, given the existing history of the area may result in some chance findings when clearing sites.</p>	<p>Local material not to be sourced from ruins or archaeological area</p> <p>Ensure agriculture does not extend up to important monuments</p> <p>If during cultivation activities something is found, it needs to be reported to the local District Collector (DC) and the site left undisturbed till required action from the DC is completed</p>

OPERATION RELATED IMPACTS			
Environmental Issue	Positive Impact	Adverse Impact	Possible Mitigation Actions
		<p>These could be adversely impacted due to the clearing process</p> <p>During regular maintenance of their system or for some new activity either to improve their agriculture or increase access (such as across a distributory or field channel) may use stones, pillars from the archaeological sites, as has been noted in the field.</p>	<p>Ensure waste is not disposed in or near any archaeological site or there is excess irrigation or crops cultivated that could destabilise local structures</p>

**Appendix 5: Possible Mitigation Actions for Adverse Environmental Impacts and Suggested Responsible Authorities**

Environmental Issue	Mitigation Action	Responsible Authorities
<b><i>Project Design and Location</i></b>		
Reduced environmental flows due to increased efficiency	Overall assessment of appropriate water allocation needs for each sector, including environmental flows	AC-IWRM's IWRM plans
Encroachment upon local wetlands and water bodies	Identification of water bodies and wetlands in an area and educate the local population not to dump in them or encroached upon them Develop land allocation plans for each land use, including wetlands and water bodies	PMU – Environmental Expert AC-IWRM IWRM plans
Waterlogging due to project interventions	Development of appropriate drainage structures and management measures, on-farm land management Work with farmers to identify appropriate cropping pattern given existing soils and drainage conditions	Overall responsibility of PMU Environmental Expert
Water quality degradation due to existing agricultural practices – agrochemicals and land management practices	Education to farmers on improved agricultural practices, on-farm land management practices	PMU – Institutional & Capacity Development and Environment Experts
Increased soil toxicity and reduction in soil quality due to excess use of agrochemicals and poor soil management	Education to farmers on improved agricultural practices, on-farm land management practices	PMU – Institutional & Capacity Development and Environment Experts
Soil exhaustion, erosion and degradation due to poor agricultural practices and soil management practices	Education to farmers on improved agricultural practice and soil management	PMU – Institutional & Capacity Development and Environment Experts
Lowering groundwater table	Develop appropriate conjunctive water use plans, identify appropriate groundwater management activities and identify, where possible, groundwater management systems and local level regulation systems based upon local aquifer needs.	AC-IWRM's IWRM plans PMU – Environment Experts
Cutting of trees	Avoid cutting more trees than needed If possible, consider transplanting of tree to be removed For all trees cut/removed, plantation should be at the ratio of for every 1 cut	PMU Environment Expert Need to include in the construction contractor's contract

Environmental Issue	Mitigation Action	Responsible Authorities
	planting of 3 trees. All plantation activities should consist of appropriate species for the area to be planted, in consultation with the FD and also after understanding the local ecological needs.	
Accidents among local population due to faulty design and improper construction practices	Ensure design has safety measures to reduce accidental falling in of children or adults in canal or their getting trapped in Ensure all cut areas or working areas have safety barricades to prevent local population from accessing work areas	PMU experts
Reduction in habitat for local fauna and flora	Ensure all plantation activities are based upon the local fauna and flora needs, with no alien and invasive species planted Identify areas which are important habitats for all species – both sensitive and reserve areas and those outside (including corridors and fly paths), and ensure that they have appropriate actions and measures taken to reduce any adverse impact on them Identify an appropriate land management plan for the basin on the whole including areas for wildlife – fauna and flora, conservation in consultation with local authorities and people with appropriate management plans identified alongside Identify appropriate grazing areas, cultivation of fodder grasses etc. which are appropriate for the area to reduce degradation by overgrazing and the increased pressure on existing grazing lands, as areas previously used for open grazing is brought under cultivation	PMU Environment Expert All construction activities should be included in the construction contractor's contract clauses
Human – animal conflict	Identify appropriate cropping pattern for an area, considering possible animal raid issues. Discuss with forest department in case required Avoid any activity in corridors, and fly paths. In case of an elephant corridor, do not undertake any permanent construction activity to obstruct it. Ensure design is such that animal's – wild or domestic, do not accidentally fall in and get trapped in the canal	PMU experts
Reduced fodder and grazing lands	Identify areas which are specifically for grazing in the area and through community management ensure that they are not encroached upon Identify appropriate agencies, such as the Animal Husbandry Department to help with improving fodder availability and reduction in open grazing	AC-IWRM's IWRM plan Implementation of locally identified issues through guidance from PMU
Introduction of alien species of flora through	Ensure any plantation activities are according to discussions with the FD and	PMU Environment Expert, all

Environmental Issue	Mitigation Action	Responsible Authorities
plantation activities.	<p>understanding of local ecological needs</p> <p>Ensure that alien species or those inappropriate for the area are not planted in any animal corridor or fly path area</p> <p>Identify appropriate local species for any firewood plantation to be taken up</p>	plantation activities to be included in the construction consultant's contract
Chance finding of an archeologically or culturally important site.	<p>Clearly identify all required actions – such as stopping work in case of a chance finding and who to contact are clearly understood by the construction consultants</p> <p>Ensure that the construction company and supervising consultants have an understanding of archaeological concerns in the area</p>	Construction consultants and supervisory PMU Environment specialist
Important archaeological areas - such as Hampi	<p>Ensure that any important archaeological area is well identified and demarcated and required actions are demarcated in a detailed management and mitigation plan so that no damage takes place to it</p>	Construction consultant contract clauses would be needed – overall supervisory by PMU Environmental specialist
Reduced aesthetics due to quarries on river bed, hills etc.	<p>Rehabilitation of all sites must be undertaken once work is completed and plans developed well in advance of construction activities and should be in the construction company contract to ensure it is taken up and appropriate budget should be made for the activity</p> <p>Avoid identifying any quarrying work in an aesthetically important/significant place</p> <p>For material used in important places such as Hampi ensure it blends with local design and style to the extent possible</p>	Supervision by PMU Environmental Specialist All construction related activities should be included in the construction consultant's contract as clauses, including material procurement.
Loss of local agro-biodiversity	<p>Identify methods of preserving and cultivating local agricultural species.</p> <p>Work towards breed improvement of local agricultural species and possible methods to improve income from the sale of produce of local agro-biodiversity</p>	Environmental specialist of PMU
Quarries resulting in degradation of local aquifer or surface water quality	<p>Identify and manage quarries such that they are likely to cause minimum if any damage to surface and ground water systems, and ensure that during quarrying there is minimum if any damage to aquifers and surface water systems</p>	PMU Environment Consultant and construction contractor contract clauses at implementation
Conflict with local fisheries	<p>To the extent possible do not undertake any structure construction in areas where local population fish. In case unavoidable, identify methods to reduce impact after discussion with local population and also consider ways to compensate for loss</p>	PMU environmental and gender and social specialists
Vegetation clearance for structures	<p>Ensure minimum damage to site during detailed design stage itself</p>	PMU environment specialist

Environmental Issue	Mitigation Action	Responsible Authorities
	Where possible identify appropriate re-plantation activities with appropriate species	
Reduced access of water for domestic, livestock and other purposes from canal system due to design changes and increased water use efficiencies	Identify water needs for different users and in consultation with them develop appropriate design changes to ensure access to identified groups	PMU environment and gender and social specialists
Disruption of traffic routes – especially navigation due to sighting of infrastructure	Identify any landing and other sites along the planned infrastructure site. Where possible consider design changes to ensure there are no problems faced by the local population. Where not possible in consultation with the local population create alternate facilities.	PMU environment and gender and social specialists
Increase in agricultural waste such as agro-chemical waste	Undertake on-farm management education for farmers to ensure that they know how to dispose agro-chemical waste in most appropriate way  Explore with KVK's, Agriculture Department, local agro-chemical shops and agro-chemical companies possibilities of buy back system for agrochemical containers etc	PMU Environmental specialist with support/suggestions from other members of PMU
Increase waste from fields due to micro-irrigation system and other systems – such as diesel pump sets	Educate farmers on best management of systems to be used, where to get good quality material that does not break down and spoil fast, its maintenance and proper disposal of waste	PMU Institutional and Capacity Building and Environment specialists
Increased vector habitats and diseases	Ensure adequate drainage needs are identified, designed and there maintenance is also identified  If required, develop extra drainage plans for various structures to ensure there is no waterlogging	PMU Environment specialist
Reduction in food supplements – fish and wild berries etc	Identify any use of lands where structure is planned, or fishing areas and consider how best to take into account people's needs  Through a proper IWRM approach identify various needs of lands not presently occupied by agriculture and ensure that these uses are accounted for any land use and management plan developed for the area	PMU Environment expert

Environmental Issue	Mitigation Action	Responsible Authorities
Increase in agro-industrial waste	Need for identification of better waste management and more efficient industrial processes	Beyond project objective, but discussion by PMU Environmental specialist with State Pollution Control Board AC-IWRM may identify possible actions
<b>Project Construction</b>		
Sand mining and possible change in river course and river scouring	Identify appropriate areas for taking river sand, based upon existing regulations, but also ensuring that there is no excess sand taken.  Rehabilitate land after work is finished to ensure least damage to area	Through appropriate contract clauses of construction agency under supervision of PMU Environmental specialist
Waterlogging from poor site planning and management	Ensure proper site planning takes place and site management is adequate – to be put into construction contractor's clauses	Contractor clauses of construction agency under supervision of PMU Environmental specialist
Increased particulate matter on transport route of raw material and at quarries	Ensure vehicles are properly maintained Ensure vehicles are covered when carrying raw material Reduce blasting and other similar activities that may create dust to the extent possible Use sprinklers etc to settle dust where needed	Contractor clauses of construction agency under supervision of PMU Environmental specialist
Erosion due to sand and murrum mining and material procurement methods	Plan mining and procurement sites before starting work to keep in mind any erosion issues that may occur  Rehabilitate site after finishing work, as appropriate	To be ensured by construction company through contract clauses from agency providing raw material, monitoring PMU environmental specialist
Disturbance to wildlife species due to construction and material procurement activities, including in fly paths and corridors	Discuss with local population before starting any construction activity to identify possible concerns to ensure minimum disturbance  Only take up work in day hours	To be ensured by construction company through contract clauses both for work carried out by them and for any procurement from other

Environmental Issue	Mitigation Action	Responsible Authorities
	<p>In case of local animal movement or migrations, ensure that work does not take place when the migration is underway</p> <p>Do not create blockages by storage, labour camps etc in animal corridors</p> <p>Near sensitive areas ensure that work adheres to local regulations and also use least destructive methods, and rehabilitate area after finishing work</p>	<p>agencies, monitoring PMU environmental specialist</p>
<p>Occupational Safety and construction hazards.</p>	<p>Provision of protective gear and safety equipment as required.</p> <p>Signage, site plan, lighting and restricted entry.</p> <p>Vaccination and preventive health measures as required, and first aid at site.</p> <p>Facilities for handling emergencies at site.</p> <p>Restricted access to hazardous materials.</p> <p>Personnel handling hazardous material properly trained, licensed and with sufficient experience.</p> <p>As needed have toilet and drinking water infrastructure, at construction sites.</p>	<p>To be ensured by construction company through contract clauses both for work carried out by them and for any procurement from other agencies, monitoring PMU environmental specialist</p>
<p>Pollution from construction activities</p>	<p>Proper storage and disposal of material, including hazardous material, to avoid contamination, spills and accidents.</p> <p>If there are no waste disposal systems in the area, the material should be sent to a pre-identified disposal site.</p> <p>No dumping in river, or labour camps/temporary or material storage sites on river bed.</p> <p>Vehicles properly maintained and serviced – and not washed or serviced, at site.</p> <p>No driving in river water.</p> <p>Proper waste storage and disposal.</p> <p>Sites restored after work completed.</p> <p>No quarry work in running water of rivers, and minimize need to work in water.</p>	<p>To be ensured by construction company through contract clauses both for work carried out by them and for any procurement from other agencies, monitoring PMU environmental specialist</p>

Environmental Issue	Mitigation Action	Responsible Authorities
	Fence off in-stream work to reduce disturbance. Avoid refuelling at project site. For refilling at site, demarcate site, ensure surface made impermeable.	
Accidents and health concerns of local population	Ensure that all construction sites are cordoned off and only permitted people enter Ensure appropriate signage is there are construction, mining sites Ensure that where blasting takes place, such as at mines, timings are known and adhered to In case of accident ensure required first aid etc is given immediately and till the person has not been reached to the required medical facility	To be ensured by construction company through contract clauses both for work carried out by them and for any procurement from other agencies, monitoring PMU environmental specialist
Compaction of soil/soil erosion for access to various sites and to quarries – such as metal quarries for aggregates, murrum quarries and sand mining areas	Rehabilitate all sites after construction/quarrying activities are completed such as ploughing and plantation. Plan site prior to starting excavation activities, including slope stabilization, identify and developing appropriate slope aspect during excavation and contouring to ensure slope stability after earth borrowing activities are completed. Only clear vegetation that must be removed As far as possible use already identified roads and routes to access various sites	To be ensured by construction company through contract clauses both for work carried out by them and for any procurement from other agencies, monitoring PMU environmental specialist
Sediment runoff and deposition near sites or during transportation.	Use silt fences around excavation and storage for earth, as required. Ensure vehicles carrying earth are covered. Avoid work in high wind condition. During soil excavation ensure slope aspect is maintained	To be ensured by construction company through contract clauses both for work carried out by them and for any procurement from other agencies, monitoring PMU environmental specialist
Plantation activities – including alien species introduction.	Undertake plantation activities as required, and ensure plantation activities include species that are endemic to the area, in consultation with Forest Department. For compensatory plantation, try and plant the same species as those removed.	To be ensured by construction company through contract clauses both for work carried out by them and for any procurement from other

Environmental Issue	Mitigation Action	Responsible Authorities
		agencies, monitoring PMU environmental specialist
Impact on local fisheries and fish spawning and aquatic fauna.	Do not undertake any construction/ quarrying activity during the spawning period of the different fish species.  Discuss with local population before starting any construction activity to ensure minimum disturbance	To be ensured by construction company through contract clauses both for work carried out by them and for any procurement from other agencies, monitoring PMU environmental specialist
Disturbance to local population.	Identify appropriate access routes, speed limits and timings with community.  Identify appropriate material storage areas to ensure least possible disturbance. Provide signage, demarcate and cordoning of areas to reduce access to construction site and to avoid accidents. Ensure appropriate site drainage. Restore areas after work is over. Minimize transportation of material through heavily populated areas.  Only use road worthy vehicles.	To be ensured by construction company through contract clauses both for work carried out by them and for any procurement from other agencies, monitoring PMU environmental specialist
Damage to telecommunication lines	Identify possible telecommunication lines in the area prior to starting work to ensure that they are not damaged due to any construction work.  In case of damage repair them immediately	To be ensured by construction company through contract clauses, monitoring PMU environmental specialist
Reduced access to sites for local population, construction sites or material procurement sites	Identify alternate routes for project construction activities where possible  If not possible, in consultation with the local population identify appropriate alternatives for them and provide required facilities	To be ensured by construction company through contract clauses both for work carried out by them and for any procurement from other agencies, monitoring PMU environmental specialist
Human animal conflict	Do not undertake any work at migration period in the area	To be ensured by construction company through contract clauses

Environmental Issue	Mitigation Action	Responsible Authorities
	Avoid animal corridors etc for any activity	both for work carried out by them and for any procurement from other agencies, monitoring PMU environmental specialist
Damage to infrastructure.	Vehicles should take pre-identified routes. Do not put drive vehicles with loads higher than what they can take. If damage to infrastructure occurs, plan for any maintenance that maybe required.	To be ensured by construction company through contract clauses, monitoring PMU environmental specialist
Workers/labour camps and facilities.	Provide appropriate shelter and other facility for any labour brought from outside. Do not use hazardous materials like asbestos for construction of shelters or temporary housing. Ensure no conflict with local population due to labour camp.	To be ensured by construction company through contract clauses both for work carried out by them and for any procurement from other agencies, monitoring PMU environmental specialist
Conflict with labour camps on resources.	Select labour camp sites to ensure least possible conflict with local population – e.g., at a distance from where population density is high. Ensure labour camps have required infrastructure like water supply, sanitation facilities and energy. Develop appropriate waste management system, and rehabilitate the site after construction is over Do not develop any construction site – material storage, labour camps etc without consultation with the local population. Also, where possible do not use grazing lands etc for labour and material storage	To be ensured by construction company through contract clauses both for work carried out by them, monitoring PMU environmental specialist
Chance findings – archaeological sites.	Stop all work that may be underway or planned in the area and discuss with District Commissioner for further action Ensure that the construction company and supervising consultants have an understanding of archaeological concerns in the area	To be ensured by construction company through contract clauses, monitoring PMU environmental specialist

Environmental Issue	Mitigation Action	Responsible Authorities
	Ensure that any important archaeological area is well identified and demarcated and required actions are demarcated in a detailed management and mitigation plan so that no damage takes place to it	
<b>Project Operation</b>		
Reduced environmental flows as more water is used for agriculture with increasing efficiencies and better irrigation systems in place	Through the IWRM plan as identified by the AC_IWRM work towards ensuring that there are sufficient environmental flows in the river and its tributaries	AC-IWRM's IWRM plan
Increased agricultural waste in water and water bodies	Ensure through farmer's education that waste is not disposed in water bodies and appropriate waste disposal systems are found and used	PMU environmental specialist
Increased agrochemicals in surface and ground water systems, and reduced quality of return flows	Farmers education on proper use and management of agrochemicals, including their waste Ensuring a farmer's friendly method for disposal of agrochemical waste, as identified during project design	PMU environmental specialist, capacity building and institutional specialist
Waterlogging	Identify appropriate cleaning and maintenance of drainage system, including disposal of waste removed. Improved agriculture practices – understanding plant needs and use of irrigation water as required through improved understanding of the system	PMU environmental specialist along with support from other team members
Poor management of drainage system leading to silting and choking	Identify appropriate systems for the management of drains and disposal of silt Ensure there is a budget for the management of drains and the budget is spent on it	PMU environmental specialist along with support from other team members
Soil degradation due to poor on-farm management, intensive agriculture, soil exhaustion and soil toxicity due to chemical usage and lack of knowledge among farmers	Identify appropriate soil management and soil testing systems and educate farmers on it. Ensure that farmers remember through repeated information sharing on good agriculture and soil management practices	PMU environmental specialist along with support from other team members
Drainage of wetlands for conversion to agricultural lands	Through the IWRM activities identify appropriate land management and conservation methods, and work with farmers to educate and ensure that wetlands are not drained Work with farmers to identify appropriate land management systems at the village	PMU environmental and institutional and capacity building specialists

Environmental Issue	Mitigation Action	Responsible Authorities
	level	
Loss of local agro-biodiversity with introduction of HYV	Work through agricultural extension, KVKs etc for breed improvement and improved agriculture market and prices for local crops and varieties	Maybe beyond the project scope and would need to be handled at a policy level
Reduced and degradation of habitats for species – both aquatic and terrestrial species	Work with local community to ensure that cultivation extension into grasslands, and other scrub areas is not undertaken Work through a community system to identify wetlands and their protection Educate community on management of soil and agrochemical usage Demarcate all areas through an IWRM plan for conservation and limitation of areas for agriculture. Thereby, lands considered barren or wasteland and perhaps containing important ecosystems are not encroached upon either by agriculture or converted to grazing areas with increased pressure on existing grazing lands, encroaching upon scrub forest land	PMU environmental and institutional and capacity building specialists AC-IWRM’s IWRM plan
Increased aquatic weeds	Ensure appropriate drainage management to keep the area silt free and not allowing the disposal of any waste Work with farmers through farmer’s education system to ensure appropriate application of agrochemicals, including fertilizers Educate farmers on proper soil management and testing	PMU environmental and institutional and capacity building specialists
O&M waste – spoils from drainage system and canals	Identify appropriate waste management system for drain cleaning Weeds can be used, in consultation with farmers, for manure. Therefore, if farmers are interested a system for their use and disposal on farmlands at the time that drains are cleaned should be undertaken.	PMU environmental and institutional and capacity building specialists
Increased toxicity in environment and for people with more agrochemical packages being reused	Farmer education on appropriate management of agrochemical packaging. Where possible consider a buy-back system for agrochemical packages by the agrochemical companies	PMU environmental and institutional and capacity building specialists for improvement disposal
Impact on local monuments and archaeological sites	Local material not to be sourced from ruins or archaeological area Ensure agriculture does not extend up to important monuments If during cultivation activities something is found, it needs to be reported to the local District Collector (DC) and the site left undisturbed till required action from the DC is completed	PMU environmental specialist

### Appendix 6: Monitoring Activities

112. Given below are suggested monitoring actions for the subprojects. These can be adjusted according to required subproject design and therefore monitoring needs.

113. Prior to developing a monitoring plan there is a need for the development of a baseline for some activities. This would help with the monitoring activities. The baseline is described below along with monitoring needs and responsibilities

Project Phase	Parameter	Frequency to monitor	Action	Responsible authority
Pre-Construction phase	Air Quality	To be done once and included in the DPR for the baseline.	Measurement of SPM and RSPM, at selected locations in all construction sites for the time identified for construction and project related activities	The actual measures should be available in the DPR for those areas where actions have been identified  Could also be done prior to commencing of the construction activities,
	Noise	To be done once and included in the DPR for the baseline	Measurement for time of construction activity. Since all activities are expected to be done in the day time  If not possible to identify schedule – should be done for 3 different times: peak traffic, day quite hours and late evening at sensitive sites	The actual measures should be available in the DPR for those areas where actions have been identified  Could also be done prior to commencing of the construction activities, but before the construction starts
	Site for quarries and borrow pits	Before work baseline and end of work prior to making final payment for work to contractor.	Photographic baseline for restoration of site after the construction activity is completed	Prior to commencing the activity, will require to be done by the construction company or PMU, as appropriate. All records are to be with the PMU for future reference
Construction phase	Removal of vegetative cover and trees	Prior to starting work and before making the final payment to the agency identified for undertaking all plantation activities.	Vegetative survey to identify type and amount of vegetation that requires to be replaced  Tree surveys where trees are to be cut to estimate the amount that has to be replanted	Prior to commencing the activity. However, for costs needs to be included in the DPR too.
	Transport route – to avoid sensitive areas	At random on routes as a continuous	Identification if transport routes are	Identification of final transport routes should be done in the

Project Phase	Parameter	Frequency to monitor	Action	Responsible authority
	need for specific routes	process for the duration of work	being used or not	IEE/DPR.
	Waste management at sites	Monthly inspection At random at sites,	To review if the waste management plan is in place and being followed properly.	The actual measures should be available in the DPR for those areas where actions have been identified
	Site management	Monthly for the duration of the work	To ensure that all required facilities are available – like safety equipment, workers sanitation facilities and domestic needs, water for workers and their families etc. as defined in the EMP	To be identified as a list of actions in the construction contractor’s contract.
	Site restoration	Once prior to work commencing and then before final payment of the construction company in-charge of the area	To ensure that restoration is undertaken appropriately. Photographic baseline to be maintained.	To be done by the contractor or the PMU with all records available with the PMU.
Project Operation	IPMN implementation	Six monthly	Review progress of knowledge and use of IPNM by farmers and access to required facilities.	Based upon the activities identified by the agriculture and environment specialist of the PMU and in the subproject documents

Appendix 7: Consultation format

Serial No	Date	Place	Topic & issues raised	Outcomes	Broad support obtained? Y/N (Annexure-List of Participants)	Total Participants	Stakeholder Group (Number Involved in the Consultation)							
							State Govt	Villagers Ilagers	Local Govt/ Gram Panchayat/ WUCs /anganwadi	SOE (KNNL, CADA)	CSO	Female	Consultants	