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Annex 1

ANNEXURE 1: PROJECT COMPONENT

Component details	Component objective	Sub component objectives and activities
Component A: Enabling Agri Enterprise Development	To enable the establishment, operations and growth of agri enterprises by creating a congenial investment climate and linking them with the much needed access to finance and technology.	<p>A.1. Enhancing state capacity to attract private investments: Assam Bureau of Investment Promotion (ABIP)</p> <p>Objective: To strengthen the newly established Assam Bureau of Investment Promotion to anchor the private sector investment promotion and facilitation.</p> <p>Activities:</p> <ul style="list-style-type: none"> • Setting up and operationalizing ABIP to play a proactive role in promoting select priority sectors (including agribusiness) where the state has competitive advantages. • Strengthening of DICCs in project districts by upgrading the physical infrastructure and also building the capacities of staff through trainings, exposure to best practices, etc. • Sector scan for prioritization of competitive sectors, • Developing and communicating the investment opportunities in the state of Assam, • Conducting market outreach through road shows, investor summits, etc. • Developing a platform to provide investor aftercare services to the firms which are operational and/or in expansion/ diversification stage.
		<p>A.2. Setting up of Agribusiness SME Fund</p> <p>Objective: To support the establishment and management of an Investment Fund that would provide risk capital (equity/quasi-equity financing) and technical assistance to small and medium enterprises (SMEs) in the agribusiness sector.</p> <p>Activities:</p> <ul style="list-style-type: none"> • Setting up of Agribusiness incubator. • Developing a robust mentoring program. • Evaluating the business plans of FPOs and incubates. • Providing Agribusiness incubation services to the needy startups. • Outreach programs like Seminars, Technology Awareness and Sensitization programs, Agribusiness investors meet, Agribusiness incubation conference, etc. • Training and capacity building – Entrepreneurship Development Programs (EDPs), Agri Business Incubator (AAI) staff training and exposure visits. • Engaging with funders. • Formation of policy dialogue group – a think tank to track relevant regulatory measures in agri-entrepreneurship sector
		<p>A.3. Establishing stewardship councils</p> <p>Objective: To support the setting up, and establishment of stewardship councils in select value chains. The stewardship council will act as the platform for engaging industry leaders and stakeholders of the given value chain to act in concert to develop and implement sustainable strategies for their value chain.</p> <p>Activities:</p> <ul style="list-style-type: none"> • Identification of policy and regulatory level constraints in the sector. • Preparation of Detailed Action Plans and Feasibility Studies. • Technical assistance to undertake long term planning of these groups
		<p>A.4. Setting up of an Enterprise Fund (EF)</p> <p>Objectives:</p> <ul style="list-style-type: none"> • Providing risk capital (equity/quasi-equity) for high growth Agribusiness SMEs in Assam • Unlock the agricultural potential of Assam to focus on risk capital to agribusiness SMEs. <p>Activities:</p> <ul style="list-style-type: none"> • Setting up of a seed capital fund. • Setting up of an Impact investment Fund • Engaging fund management agency

Component details	Component objective	Sub component objectives and activities
<p>Component B: Facilitate Agro Cluster Development</p>	<p>To establish a modern supply chain from farm to market that will enable farmers and other value chain participants to access new markets.</p>	<p>B.1 Support establishment of Cluster Level Industry Associations (IAs)</p> <p>Objectives: To enhance competitiveness of agri-enterprises in specific geographic locations.</p> <p>Activities:</p> <ul style="list-style-type: none"> • Mobilizing existing enterprises into Industries Associations (IA) at the cluster level. • Strengthening the capacity of such IAs to develop an Agro Industrial Development Plans (AIDP) laying out an action plan for addressing cluster-level obstacles to enterprise growth over the project period. • Enhancing access of agri-enterprises to needed technical and Business Development Services. • Provide partial financing for AIDPs, with partial financing coming in the form of user fees and contributions made by agri-enterprises. • Enhancing availability of a skilled labor pool through skills training initiatives. • Increasing efficiencies and reducing business costs through developing and sharing of business functions such as research and development, information networks, common infrastructure, and joint marketing and branding efforts. • Increasing efficiencies through linkages to specialized technical and BDS services such as assistance with developing business plans, introduction of improved technologies, fostering linkages to input suppliers and linkages to debt and investment financing.
		<p>B.2 Supply chain support</p> <p>Objective: To establish a modern supply chain, which prevents wastage and value erosion and allows farmers and agro-entrepreneurs to access to more distant markets.</p> <p>Activities:</p> <ul style="list-style-type: none"> • Improving rural access roads that are connected to the clusters. • Modernizing and upgrading the warehouses, including issuing of warehouse receipts • Upgrading and modernizing of regulated wholesale markets. • Introduction of e-marketing platforms.
<p>Component C: Fostering Market-led Production and Resilience Enhancement</p>	<p>To enable farmers in the targeted districts to take advantage of the rapidly changing consumer demand and enhance resilience of agricultural production systems for increasing production and managing risks associated with climate change.</p>	<p>C.1 Promoting climate resilient technologies and their adoption</p> <p>Objectives: To enable farmers in the targeted districts to take advantage of the rapidly changing consumer demand and ensuring resilience of agriculture production systems in order to better manage increasing production and risks associated with climate change.</p> <p>Activities:</p> <ul style="list-style-type: none"> • Development of climate resilient production clusters of the selected commodities in the project districts. • Increasing productivity of the commodity in the identified blocks by technological inputs. • Improved post-harvest management, value addition and marketing of produce by setting up farmer common service centers (CSCs). • Hiring of Service providers for mobilizing village level farmer commodity groups and federating them into larger farmer producer organizations (FPOs). • Farmer producer organizations will be the focal points for dissemination of improved technologies.
		<p>C.1.A: Crop and horticulture value chains.</p> <p>Objective:</p> <ul style="list-style-type: none"> • increasing productivity of field and horticultural crops, • promoting diversification to pulses, oilseeds, maize, banana and vegetables, • improving quality of produce. <p>Activities:</p> <ul style="list-style-type: none"> • promote climate-resilient and sustainable crop-horticulture production systems. • pilot remote sensing – GIS tools and agro-meteorology - to improve climate

Component details	Component objective	Sub component objectives and activities
		<p>resilience.</p> <ul style="list-style-type: none"> • Crop diversification • promotion of high yielding varieties/hybrids seeds, production of disease-free seedlings and improved agronomic practices. • Integrated crop management (ICM) demonstrations and farmer trainings VCAPs. • Post-harvest management demonstrations to promote farm level drying, cleaning, grading, packing and value addition. • promotion of improved farm implements like seed-cum-fertilizer drills, zero tillage seed drills, tillers, sprayers and machinery for cleaning and processing of agricultural produce. • exposure visits, trainings and capacity building activities covering various aspects of production, post-harvest management and marketing crops for farmers by AAU and KVKs. • Strengthening of Agricultural Technology Management Agencies (ATMAs) to deliver market driven and climate resilient agricultural support services to the farming communities, covering production, post-harvest management and marketing of the identified commodities
		<p>C.1.B: Silk value chain</p> <p>Seed to raw silk: Objectives</p> <ul style="list-style-type: none"> • to increase production of raw silk • to increase area under plantation • to increase cocoon yield and reeling efficiency, and quality of silk • create employment opportunities across the value chain. <p>Activities:</p> <ul style="list-style-type: none"> • organizing producer-entrepreneurs into Producer Groups and Producer Companies • establish community-run Common Services Center (CSCs) to facilitate collective actions and provide extension services and handholding support • create cluster level infrastructure such as community jali houses, nurseries, cocoon houses, eri rearing houses, cocoon drying chambers, grainage houses. • develop key partnerships with research and technical institutions for disease management of silk worms and plants, climate resilient plantation technologies, vegetative propagation, tissue culture protocols, seed certification mechanisms (esp. for commercialization), spinning, reeling and weaving technologies. <p>Raw silk to fabric: Objectives</p> <ul style="list-style-type: none"> • to increase production of hand-woven silk • to increase visibility of Assam's silk brands and expand presence in national and overseas markets. <p>Activities:</p> <ul style="list-style-type: none"> • organizing weaver-entrepreneurs into Producer Groups (PGs) and Producer Companies (PCs), and providing them skill and design development support • developing demonstration units for propagating new technologies at the field level, • provide investment packages that help communities acquire upgraded looms and accessories, and facilitate the creation of community weaver workspaces • establishing centralized handloom marketing complex at Guwahati • developing market channels and launching branding campaigns

Component details	Component objective	Sub component objectives and activities
		<p>C.1.C: Fisheries value chain:</p> <p>Objectives</p> <ul style="list-style-type: none"> • improving the quality of the inputs such as fish seed and feed for aquaculture. • increasing the fish productivity and production from the pond/tank aquaculture systems, through culture-cum-capture fisheries activities in the beels. • promoting diversification of fish species – particularly genetically improved strains - in combination with Indian major carps in the culture systems. • improved post-harvest management, value addition and marketing of produce by setting up fish farmer common service centres (CSCs). <p>Activities:</p> <ul style="list-style-type: none"> • promote development of climate resilient fish production clusters in the project districts. • establishment of seed multiplication centres, new hatcheries , etc. • novel polyculture technology demonstration in pond fisheries for market demand based fish species • technology demonstration in beel fisheries by combining indigenous small fishes (e.g. mola) with Indian carps supported with stock enhancement, stock improvement, habitat management/improvement • pen culture on pilot basis in one beel fisheries as practiced elsewhere to demonstrate community involvement in productivity enhancement, • integrated farming of fish with piggery and climate resilient paddy-cum-fish integration • creating adequate post-harvest and market infrastructure facilities, • capacity building, training, extension and exposure visits of farmers, awareness programmes, on climate resilient aquaculture and fisheries and developing and implementing supporting policies and programmes.
		<p>C.1.D: Milk and pork value chains:</p> <p>Objectives</p> <ul style="list-style-type: none"> • production - organizing small scattered farmers into producer groups and increasing productivity. • market access – through enterprise development and addressing aggregation and processing, with a particular focus on food safety and human health risks, and increasing consumer awareness • capacity building – farmer training, building AHVD and Dairy Department capacity, developing & equipping a service delivery network; building state capacity to implement the Food Safety Standard Act for Indian(FSSAI); and training and certification of small scale market actors (like milk traders and sweet makers).
		<p>Milk Value Chain</p> <p>Activities:</p> <ul style="list-style-type: none"> • organize farmers into DCS. • upgrading low producing non-descript cows using AI. • Demonstration of Fodder. • vaccination campaigns • installation of BMC to improve market access and enhance quality. • Installation of Solar powered automated milk collection units at each DCS to enable transparent milk payment. • Provision of hygienic basic milking equipment (cans, pails). • Training of Traders and informal market actors like cottage processors, sweet makers, etc. in clean milk practices, monitored and certified, • Expansion of WAMULs capacity and product line to include value added products like curd, paneer and UHT. • market assessment including of health risks and consumer awareness campaign focussing on food safety and human health risks. • utilizing WAMUL micro-training centers on farm to build skills of farmers;
		<p>Pig Value Chain</p> <p>Activities:</p> <ul style="list-style-type: none"> • Formation of FIGs and then further form FPO.

Component details	Component objective	Sub component objectives and activities
		<ul style="list-style-type: none"> • Productivity enhancement through vaccination, cross-bred • Hiring of local resource people/lead farmers as ‘pig bandhus’ to support services delivery on fee for service. • Housing demos would improve productivity, hygiene, and reduce human health risk • Upgradation of existing market areas to facilitate aggregation for large volume traders, • construction of small -scale slaughter facilities in each cluster and training of butchers and local vendors by NRC in humane, hygienic, slaughtering methods. • Monitoring and certification of vendors and butchers under the FSSAI. • market assessment including of health risks and consumer awareness campaign developed focused on food safety and human health risks also from zoonotic diseases. • Demos of hygienic vendor booths would also be carried out in prominent local markets • training and extension – targeting farmers and developing service network.
		<p>C.2 Facilitating market linkages through market intelligence and product aggregation</p> <p>Objectives:</p> <ul style="list-style-type: none"> • To organize the producers into FPOs, develop their capacity and skills for marketing, for accessing wider markets, & investment support to these FPOs for establishing CSCs, as small scale aggregation places owned, managed & operated by FPOs. • Setting up of a Market Intelligence Unit to increase information transparency, productivity, profitability and market access to the forming community. <p>Activities:</p> <ul style="list-style-type: none"> • Selection of Service Providers. • Formation of FPOs. • Establishment of CSC • Preparation of b-plan and market linkage.
		<p>C.3 Facilitating access and responsible use of financial services</p> <p>Objectives: To facilitate access to broad set of financial services, and their responsible use by farmers and their organizations supported by the project.</p> <p>Activities :</p> <ul style="list-style-type: none"> • Data collection and diagnostics work including a demand-side survey that will aim to estimate the level of access, use and quality of financial services received by the target clients as also their financial capability, and a supply-side assessment to assess the constraints to delivery of high-quality financial services to these clients. • Based on the findings of the data and diagnostics activity, sub-projects will be developed and implemented, that help test innovations and scale-up tested innovations in collaboration with financial service providers. • Provide financial education and counselling based on the findings of the survey. • All of these activities will be implemented with a focus on the project’s target value chains and target districts.
<p>Component D: Project Management, Monitoring and Learning</p>	<p>To ensure effective implementation of the project activities, and monitor and evaluate project implementation progress, outputs and outcomes.</p>	<p>Activities:</p> <ul style="list-style-type: none"> • Establishment and operations of PCU to oversee & co-ordinate activities of the implementing agencies of the project. • Establishment and operations of PIUs in the respective implementing agencies. • Setting up a M&E system including PMIS.

Source: APART, Guwahati

Annex 2

ANNEXURE 2: ENVIRONMENTAL RULES AND REGULATIONS (GOVT. OF ASSAM AND GOVT. OF INDIA)

1. ENVIRONMENTAL LAWS AND REGULATIONS (CENTRAL)

1.1 The Environment (Protection) Act, 1986

The Environment (Protection) Act, popularly known as EP Act, is an umbrella legislation that supplements existing environmental regulations. Empowered by the EP Act, the Ministry of Environment & Forests (MoEF), Government of India has issued the following notifications regulating siting of industry and operations, procuring clearance to establish industries and development of projects with appropriate EIA studies, coastal zone regulations and other aspects of environment are :

- Empowers the Government of India (section 6) to make rules to regulate environmental pollution by stipulating standards and maximum allowable limits to prevent air, water, noise, soil and other environmental pollutants.
- Prohibits operations that emit pollutants in excess of standards (section 7).
- Regulates handling of hazardous substances and identifies persons responsible for discharges and pollution prevention (section 9).
- Section 17 deals with offences committed by Government Departments.
- Formulated Environmental (Protection) Rules, 1986, Hazardous Wastes (Management and Handling) Rules, 1989 and Manufacture, Storage & Import of Hazardous Chemical Rules, 1989 in accordance with the sections 6, 8 and 25 of EP Act.

The act has been supplemented with EIA notification 2006.

1.2 Water (Prevention and Control of Pollution) Act 1974, Amended in 1988

Water Act is the first environmental regulation that was brought at the state and centre levels, pollution control boards to control / regulate environmental pollution in India. Amended twice in 1978 and 1988, the Act vests regulatory authority to the State Pollution Control Board and empowers them to establish and enforce effluent standards for industries and local authorities discharging effluents.

The act vests regulatory authority on the State Pollution Control Boards and empowers them to enforce effluent discharge standards to prevent water pollution (both for industries and local authorities)

- *Section 24* of the act prohibits use of stream / well or on land disposal for polluting substances that violate disposal standards laid down by the board
- *Section 25* of the act requires an application to be made to the state board to establish any treatment and disposal system that is likely to discharge sewage or trade effluent in to a stream or well or sewer or on land. (Refer **Annexure 2**)
- *Sections 41 and 44* details the penalties for not complying with the various provisions or directives of the board.
- *Section 48* deals with offences committed by Government Departments
- *Section 55* asserts that all local authorities shall render help & assistance and furnish information to the board as required for discharge of functions, and shall make available to the board, for inspection and examination, such records, maps, plans and other documents as may be necessary

The act empowers the board to levy and collect cess on water consumed by the industry or local authority and to utilise and augment resources for the Pollution Control Board. In line with this provision, The Water (Prevention & Control of Pollution) Rules, 1975 were formulated.

1.3 Air (Prevention and Control of Pollution) Act 1981

Similar to Water Act, the Air Act vests regulatory authority on the State Pollution Control Boards and empowers them to enforce air quality standards to prevent air pollution in the country. **Section 21** of the act requires an application to be made to the state board to establish or operate any industrial unit.

1.4 Wetland (Conservation and Management) Rule 2010

The wetlands were defined as the vital part of the hydrological cycle, which are highly productive, supports exceptionally large biological diversity and provide a wide range of ecosystem services such as assimilation, water purification, flood mitigation, erosion control, ground water recharge, micro climate regulation, aesthetic enhancement of the landscape while simultaneously supporting many significant recreational, social and cultural activities besides being part of cultural heritage. But many wetlands are seriously threatened by reclamation through drainage and landfill, pollution, hydrological alteration and overexploitation of natural resources. Thus for the purpose of conservation and wise use of wetlands, this rule was established by Govt. of India in the year 2010 which are:

- *Section 4 (1)* of this rule restricts the activities within wetland like, reclamation, setting and expansion of industries, manufacture, storage or disposal of hazardous substances, dumping of solid wastes, discharge of untreated waste, or any activity which has adverse impact on the ecosystem.
- *Section 4 (2)* of this rule requires prior approval from the State Government for activities like, withdrawal of water, harvesting of living and nonliving resources, grazing, effluent discharge, piling of motorized boat, dredging, aquaculture or any other activity identified by the authority.

1.5 The National Green Tribunal Act, 2010

Section 3 of this act says for the establishment of Tribunal, known as the National Green Tribunal to exercise the jurisdiction, powers and authority conferred on such Tribunal by or under this Act.

Section 15 of this act says that the Tribunal may, by an order, provide relief and compensation to the victims of pollution and other environmental damage arising under the, enactments specified in the Schedule I (including accident occurring while handling any hazardous substance), for restitution of damaged property and for restitution of the environment for such area or areas, as the Tribunal may think fit which is in addition to the relief paid or payable under the Public Liability Insurance Act, 1991 (6 of 1991).

1.6 Disaster Management Act, 2005

On 23 December 2005, the Government of India enacted the Disaster Management Act, which envisaged the creation of National Disaster Management Authority (NDMA), headed by the Prime Minister, and State Disaster Management Authorities (SDMAs) headed by respective Chief Minister's, to spearhead and implement a holistic and integrated approach to Disaster Management in India.

- *Section 22 (2)*, states that the state executive committee of the State NDMA should examine the construction, in any local area in the State and, if it is of the opinion that the standards laid for such construction for the prevention of disaster is not being or has not been followed, may direct the District Authority or the local authority, as the case may be, to take such action as may be necessary to secure compliance of such standards.

- *Section 23 (3)*, states that the State Plan of NDMA includes the manner in which the mitigation measures shall be integrated with the development plans and projects.

1.7 Energy Conservation Act, 2001

With the background of high energy saving potential and its benefits, bridging the gap between demand and supply, reducing environmental emissions through energy saving, and to effectively overcome the barrier, the Government of India has enacted the Energy Conservation Act – 2001. The Act provides the much-needed legal framework and institutional arrangement for embarking on an energy efficiency drive.

Under the provisions of the Act, Bureau of Energy Efficiency has been established with effect from 1st March 2002 by merging erstwhile Energy Management Centre of Ministry of Power. The Bureau would be responsible for implementation of policy programmes and for coordination of implementation of energy conservation activities.

Section 15 of this act says that direction will be provided to every owner or occupier of a building or building complex being a designated consumer to comply with the provisions of the energy conservation building codes, and to get energy audit conducted by an accredited energy auditor in such manner and at such intervals of time as may be specified by regulations.

1.8 Forest (Conservation) Act, 1980, (as Amended In 1988)

As per *Section 26* of Indian Forest Act, 1927 a number of activities are prohibited in forest areas and prior approval is required from the Central Government to use forest land for non-forest purposes.

The Forest (Conservation) Act, 1980 prohibits large-scale diversion of forestland for non-forest use. As amended in 1988, no State Government or authority shall make such diversions except with the prior approval of the Central Government. Salient features of the act are summarised below.

- The Indian Forest Act, 1927: *Section 5* states that after declaring a particular land as reserved forest, no fresh clearings for any purpose shall be made, except in accordance with such rules as made by the state government.
- *Section 26* states the acts prohibited in such forests, in addition to section 5.
- *Sections 30, 32* furnish power to the State government to regulate certain acts (clearing for cultivation, building or any other purpose) in such forests as specified in the section
- *Section 35* furnishes power to the State government to prohibit certain acts (clearing of vegetation etc) in lands not being the property of the government.
- The Forest (Conservation) Act, 1980: *Section 2* of the Act restricts the state government on the de-reservation of forests or use of forestland for non-forest purposes
- The Forest (Conservation) Rules, 1981: *Rule 4* states that the procedure for state government's to make a proposal seeking prior approval to de-reserve a forest for non-forest purposes (section 2 of Forest Act, 1980), provided all proposals involving clearing of naturally grown trees in forest land or portion thereof, for the purpose of using it for afforestation, shall be sent in the form of a working plan / management plan.

1.9 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between governments. Its aim is to ensure that international trade of specimens

of wild animals and plants does not threaten their survival. CITES was drafted as a result of a resolution adopted in 1963 at a meeting of members of IUCN (The World Conservation Union). The text of the Convention was finally agreed at a meeting of representatives of 80 countries in Washington, D.C., the United States of America, on 3 March 1973, and on 1 July 1975 CITES entered in force.

The *Article II* of CITES states the Fundamental Principles of it which are:

- Appendix I shall include all species threatened with extinction which are or may be affected by trade. Trade in specimens of these species must be subject to particularly strict regulation in order not to endanger further their survival and must only be authorized in exceptional circumstances.
- Appendix II shall include:
 - (a) all species which although not necessarily now threatened with extinction may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with their survival; and
 - (b) Other species which must be subject to regulation in order that trade in specimen of certain species referred to in sub-paragraph (a) of this paragraph may be brought under effective control.
- Appendix III shall include all species which any Party identifies as being subject to regulation within its jurisdiction for the purpose of preventing or restricting exploitation, and as needing the co-operation of other Parties in the control of trade.
- The Parties shall not allow trade in specimen of species included in Appendices I, II and III except in accordance with the provisions of the present Convention.

1.10 The Biological Diversity Act, 2002

An Act to provide for conservation of biological diversity, sustainable use of its components and fair and equitable sharing of the benefits arising out of the use of biological resources, knowledge and for matters connected therewith or incidental thereto. The Act includes:

- Section 3, Certain persons not to undertake Biodiversity related activities without approval of National Biodiversity Authority.
- Section 4, Results of research not to be transferred to certain persons without approval of National Biodiversity Authority.
- Section 7, Prior intimation to State Biodiversity Board for obtaining biological resource for certain purposes.

1.11 Hazardous Wastes (Management, Handling and Transboundary Movement) Fourth Amendment Rules, 2010.

Hazardous waste is waste that poses substantial or potential threats to public health or the environment.

Section 4 of this Rule states the responsibilities of the occupier for management of hazardous and other wastes.-

- For the management of hazardous and other wastes, an occupier shall follow the following steps, namely, prevention, minimization, reuse, recycling, recovery, utilization including co-processing, safe disposal.
- The occupier shall be responsible for safe and environmentally sound management of hazardous and other wastes.
- The hazardous and other wastes generated in the establishment of an occupier shall be sent or sold to an authorized actual user or shall be disposed of in an authorized disposal facility.
- The occupier shall take all the steps while managing hazardous and other wastes to

- (a) Contain contaminants and prevent accidents and limit their consequences on human beings and the environment; and
- (b) Provide persons working in the site with appropriate training, equipment and the information necessary to ensure their safety.

Section 5 says about the grant of authorisation for managing hazardous and other wastes.-

- Every person who is engaged in generation, treatment, processing, package, storage, transportation, use, collection, destruction, conversion, recycling, offering for sale, import, export, transfer or the like of the hazardous and other wastes shall be required to obtain an authorization from the State Pollution Control Board.
- The hazardous and other wastes shall be collected, treated, re-cycled, re-processed, stored or disposed of only in such facilities as may be authorized by the State Pollution Control Board
- Every person engaged in generation, treatment, processing, package, storage, transportation, use, collection, destruction, conversion, recycling, offering for sale, import, export, transfer or the like of the hazardous and other wastes or occupier of the facility shall make an application for the grant or renewal of authorization.

1.12 Solid Waste Management Rules, 2016 and Construction and Demolition Waste Management Rules, 2016

These rules shall apply to every urban local body, outgrowths in urban agglomerations, census towns as declared by the Registrar General and Census Commissioner of India, notified areas, notified industrial townships, areas under the control of Indian Railways, airports, airbases, Ports and harbours, defence establishments, special economic zones, State and Central government organisations, places of pilgrims, religious and historical importance as may be notified by respective State government from time to time and to every domestic, institutional, commercial and any other nonresidential solid waste generator situated in the areas except industrial waste, hazardous waste, hazardous chemicals, bio medical wastes, e-waste, lead acid batteries and radio-active waste, that are covered under separate rules framed under the Environment (Protection) Act, 1986.

In *Section 4* this rule says about the Duties of waste generators which are:

- **Every waste generator shall have:**
 - a) Segregate and store the waste generated by them in three separate streams namely bio-degradable, non-biodegradable and domestic hazardous wastes in suitable bins and handover segregated wastes to authorised waste pickers or waste collectors as per the direction or notification by the local authorities from time to time.
 - b) Store separately construction and demolition waste, as and when generated, in his own premises and shall dispose off as per the Construction and Demolition Waste Management Rules, 2016.
 - c) Store horticulture waste and garden waste generated from his premises separately in his own premises and dispose of as per the directions of the local body from time to time.
- No waste generator shall throw, burn or bury the solid waste generated by him, on streets, open public spaces outside his premises or in the drain or water bodies.
- All waste generators shall pay such user fee for solid waste management, as specified in the bye-laws of the local bodies.
- No person shall organise an event or gathering of more than one hundred persons at any unlicensed place without intimating the local body, at least three working days in advance and such person or the organiser of such event shall ensure segregation of waste at source and handing over of segregated waste to waste collector or agency as specified by the local body.
- Every street vendor shall keep suitable containers for storage of waste generated during the course of his activity such as food waste, disposable plates, cups, cans, wrappers, coconut shells, leftover food, vegetables, fruits, etc., and shall deposit such waste at waste storage depot or container or vehicle as notified by the local body.
- All resident welfare and market associations shall, within one year from the date of notification of these rules and in partnership with the local body ensure segregation of waste at source by the generators as prescribed in these

rules, facilitate collection of segregated waste in separate streams, handover recyclable material to either the authorised waste pickers or the authorised recyclers. The bio-degradable waste shall be processed, treated and disposed off through composting or bio-methanation within the premises as far as possible. The residual waste shall be given to the waste collectors or agency as directed by the local body.

- All gated communities and institutions with more than 5,000 sqm area shall, within one year from the date of notification of these rules and in partnership with the local body, ensure segregation of waste at source by the generators as prescribed in these rules, facilitate collection of segregated waste in separate streams, handover recyclable material to either the authorised waste pickers or the authorized recyclers. The bio-degradable waste shall be processed, treated and disposed off through composting or bio-methanation within the premises as far as possible. The residual waste shall be given to the waste collectors or agency as directed by the local body.

Section 15 states about the duties and responsibilities of local authorities and village Panchayats of census towns and urban agglomerations like: The local authorities and Panchayats shall,-

- Prepare a solid waste management plan.
- Arrange for door to door collection of segregated solid waste from all households including slums and informal settlements, commercial, institutional and other nonresidential premises. From multi-storage buildings, large commercial complexes, malls, housing complexes, etc., this may be collected from the entry gate or any other designated location;
- Facilitate formation of Self Help Groups, provide identity cards and thereafter encourage integration in solidwaste management including door to door collection of waste.
- Setup material recovery facilities or secondary storage facilities with sufficient space for sorting of recyclable materials to enable informal or authorised waste pickers and waste collectors to separate recyclables from the waste and provide easy access to waste pickers and recyclers for collection of segregated recyclable waste such as paper, plastic, metal, glass, textile from the source of generation or from material recovery facilities; Bins for storage of bio-degradable wastes shall be painted green, those for storage of recyclable wastes shall be printed white and those for storage of other wastes shall be printed black;
- Ensure safe storage and transportation of the domestic hazardous waste to the hazardous waste disposal facility or as may be directed by the State Pollution Control Board or the Pollution Control Committee;
- Collect waste from vegetable, fruit, flower, meat, poultry and fish market on day to day basis and promote setting up of decentralised compost plant or bio-methanation plant at suitable locations in the markets or in the vicinity of markets ensuring hygienic conditions;
- Collect horticulture, parks and garden waste separately and process in the parks and gardens, as far as possible;
- Transport non-bio-degradable waste to the respective processing facility or material recovery facilities or secondary storage facility;
- Transport construction and demolition waste as per the provisions of the Construction and Demolition Waste management Rules, 2016
- Involve communities in waste management and promotion of home composting, bio-gas generation, decentralised processing of waste at community level subject to control of odour and maintenance of hygienic conditions around the facility;
- Facilitate construction, operation and maintenance of solid waste processing facilities and associated infrastructure on their own or with private sector participation or through any agency for optimum utilisation of various components of solid waste adopting suitable technology including the following technologies and adhering to the guidelines issued by the Ministry of Urban Development from time to time and standards prescribed by the Central Pollution Control Board. Preference shall be given to decentralised processing to minimize transportation cost and environmental impacts such as
 - a) bio-methanation, microbial composting, vermi-composting, anaerobic digestion or any other appropriate processing for bio-stabilisation of biodegradable wastes;
 - b) waste to energy processes including refused derived fuel for combustible fraction of waste or supply as feedstock to solid waste based power plants or cement kilns;

- Make an application in Form-I for grant of authorisation for setting up waste processing, treatment or disposal facility, if the volume of waste is exceeding five metric tones per day including sanitary landfills from the State Pollution Control Board or the Pollution Control Committee, as the case may be;
- Submit application for renewal of authorisation at least sixty days before the expiry of the validity of authorisation;
- Ensure that the operator of a facility provides personal protection equipment including uniform, fluorescent jacket, hand gloves, raincoats, appropriate foot wear and masks to all workers handling solid waste and the same are used by the workforce;
- Ensure that provisions for setting up of centers for collection, segregation and storage of segregated wastes, are incorporated in building plan while granting approval of building plan of a group housing society or market complex; and frame bye-laws and prescribe criteria for levying of spot fine for persons who litters or fails to comply with the provisions of these rules and delegate powers to officers or local bodies to levy spot fines as per the bye laws framed; and create public awareness through information, education and communication campaign and educate the waste generators on the following; namely:-
 - (i) not to litter;
 - (ii) minimise generation of waste;
 - (iii) reuse the waste to the extent possible;
 - (iv) practice segregation of waste into bio-degradable, non-biodegradable (recyclable and combustible), sanitary waste and domestic hazardous wastes at source;

1.13 Insecticide Act 1968 & Rules 1971

Section 10 of this Act says about prohibition against sale or storage of insecticides in certain places:

- Where no person shall manufacture, store or expose for sale or permit the sale or storage of any insecticide in the same building where any articles consumable by human beings or animals are manufactured, stored or exposed for sale.

Section 39 of this Act says about Protective clothing where:

1. Persons handling insecticides during its manufacture, formulation, transport, distribution or application, shall be adequately protected with appropriate clothing.
2. The protective clothing shall be used wherever necessary, in conjunction with respiratory devices.
3. The protective clothing shall be made of materials, which prevent or resist the penetration of any form of insecticides formulations. The materials shall also be washable so that the toxic elements may be removed after each use.
4. A complete suit of protective clothing shall consist of the following dresses, namely:
 - a. Protective outer garment / overalls / hood / hat;
 - b. Rubber gloves or such other protective gloves extending half way up to the fore-arm, made of materials impermeable to liquids;
 - c. Dust-proof goggles
 - d. Boots

Section 40 of this Act says about the respiratory devices for preventing inhalation of toxic dusts, vapours or gases the workers shall use namely:

1. Chemical cartridge respirator
2. Supplied air respirator
3. Demand flow, type respirator
4. Full face or half face gas masks with canister

In no case shall the concentrates of insecticides in the air where the insecticides are mixed exceed the maximum permissible values.

Section 42 says about the training of Workers that the manufacturers and distributors of insecticides and operators shall arrange for suitable training in observing safety precautions and handling safety equipment provided to them.

1.14 Fertilizer Control Order 1985

Fertilizer (Control) Order, 1985 which is administered by Department of Agriculture Cooperation, Govt. of India has been issued under the Essential Commodities Act, 1955. The FCO lays down as to what substances qualify for use as fertilizers in the soil, product-wise specifications, methods for sampling and analysis of fertilizers, procedure for obtaining license/registration as manufacture/dealer in fertilizers and conditions to be fulfilled for trading thereof, etc.

- Section 3 of this Order says about the fixation of prices of fertilisers, that no dealer, manufacturer, importer or pool handling agency shall sell or offer for sale any fertiliser at a price exceeding the maximum price or rate fixed under this clause.
- Section 4 says about the display of stock position and price list of fertilisers that every dealer, who makes or offers to make a retail sale of any fertilisers, shall prominently display in his place of business:-
 - a. the quantities of opening stock of different fertilisers held by him on each day;
 - b. a list of prices or rates of such fertilisers fixed under clause 3 and for the time being in force.
- The Specification of different types of fertilizers are provided in Schedules of this Order which should be followed:
 - Schedule I: Specification of Fertilizers
 - Schedule III: Specification of Bio-Fertilizers
 - Schedule IV: Specification of Organic-Fertilizers

1.15 Prevention of Food Adulteration Act, 1954

Section 5 of this Act, says about the prohibition of import of certain articles of food that no person shall import into India—

- (i) any adulterated food;
- (ii) any misbranded food;
- (iii) any article of food for the import of which a licence is prescribed, except in accordance with the conditions of the licence; and
- (iv) any article of food in contravention of any other provision of this Act or of any rule made thereunder.

Section 7 of this act says about the prohibitions of manufacture, sale, etc., of certain articles of food.— No person shall himself or by any person on his behalf manufacture for sale, or store, sell or distribute any adulterated food, any misbranded food, any article of food for the sale of which a licence is prescribed, except in accordance with the conditions of the licence, any article of food the sale of which is for the time being prohibited by the Food (Health) Authority, any article of food in contravention of any other provision of this Act or of any rule made thereunder.

Section 16 of this Act talks about the Penalties which will be imposed if any person whether by himself or by any other person on his behalf, imports into India or manufactures for sales or stores, sells or distributes any article of food—

- (i) Which is adulterated.
- (ii) Prevents a food inspector from taking a sample as authorised by this Act.

- (iii) Prevents a food inspector from exercising any other power conferred on him by or under this Act
- (iv) Whether by himself or by any other person on his behalf, gives to the vendor a false warranty in writing in respect of any article of food sold by him.

1.16 Fruit Products Order (FPO), 1955

Fruit Products Order -1955, promulgated under Section 3 of the Essential Commodities Act - 1955, with an objective to manufacture fruit & vegetable products maintaining sanitary and hygienic conditions in the premises and quality standards laid down in the Order. It is mandatory for all manufacturers of fruit and vegetable products including some non-fruit products like non fruit vinegar, syrup and sweetened aerated water to obtain a license under this Order. Following minimum requirements are laid down in the Fruit Product Order for hygienic production and quality standards:

- (i) Location and surroundings of the factory
- (ii) Sanitary and hygienic conditions of premises
- (iii) Personnel hygiene
- (iv) Portability of water
- (v) Machinery & Equipment with installed capacity
- (vi) Quality control facility & Technical staff
- (vii) Product Standards
- (viii) Limits for preservatives & other additives

1.17 Food Safety and Standards (Food Products Standards and Food Additives) Regulations, 2011 and subsequent amendment.

The Food Safety and Standards Authority of India (FSSAI) has been established under the Food Safety and Standards Act, 2006 as a statutory body for laying down science based standards for articles of food and regulating manufacturing, processing, distribution, sale and import of food so as to ensure safe and wholesome food for human consumption. Chapter 2 of this Regulations talks about the Food Product Standards which are to be followed as per this regulation.

1.18 Milk and Milk Products Order 1992

Whereas the Central Government is of opinion that for maintaining and increasing the supply of liquid milk of the desired quality in interest of the general public, it is necessary to provide for regulating the production, supply and distribution of milk and milk product. Now, therefore, in exercise of the powers conferred by Section 3 of the Essential Commodities Act, 1955 (10 of 1955), the Central Government hereby makes the order.

- Section 5 of the Order says about the registration that no person or manufacturer shall set up a new plant or expand the capacity of the existing plant without obtaining registration/permission as the case may be from the concerned Registering Authority. For this purpose, such person may make an application in the form specified in the first Schedule along with the prescribed fee to the Registering Authority for obtaining registration certificate.
- Section 5(B) says that the plant set up shall not be allowed to be commissioned unless an inspection has been carried out to ascertain sanitary and hygienic condition as specified in the Fifth Schedule and as per the instructions issued by the Central Government from time to time.
- Every holder of registration certificate shall endeavor to maintain a cold chain from the place of milk procurement up to the final stage of sale of the milk or milk product to the end consumer and every holder of the registration certificate shall observe such procedures and practices that may be approved by the Advisory Board for clean milk production, collection, transportation and distribution of milk and milk product.

- The Fifth Schedule talks about the conditions for registration of Dairy establishments which should be followed.

1.19 Meat Food Products Order, 1973 under Essential Commodities Act, 1955 (10 of 1955)

- Section 4 of this Order says about the Licence that no person shall carry on business as a manufacturer except under and in accordance with the terms and conditions of a licence granted to him under this Order.
- The Second Schedule of the Order speaks about the sanitary and other requirements that are to be complied with by a licensee. The factory of the licensee shall, in the opinion of the licensing authority, be fit for manufacturing the class or classes of meat food products for which the licence is granted to him.
- The Third Schedule speaks about the hygienic and other requirements to be complied with by a licensee who also slaughters animals in his factory.
- The Fourth Schedule talks about the requirements to be complied with in regard to packing, marking, and labelling containers of meat food products.

1.20 Prevention of Cruelty to Animals (Slaughter House) Rules, 2001

- **Section 3 of this rule speaks that the animals should not to be slaughtered except in recognized or licensed houses.**
- **Section 4 speaks about the reception area or resting grounds that the slaughter house shall have a reception area of adequate size sufficient for livestock subject to veterinary inspection.**
- **Section 5 speaks about the lairages that every animal after it has been subjected to veterinary inspection shall be passed on to a lairage for resting for 24 hours before slaughter.**
- **Section 6 says about the slaughter that no animal shall be slaughtered in a slaughter house in sight of other animals nor shall be administered any chemical, drug or hormone before slaughter except drug for its treatment for any specific disease or ailment.**
- **Section 7 speaks about the slaughter house building of different construction that should be built and maintained by its owner in the manner as specified under this rule.**
- **Section 8 speaks about the engagement in slaughter house that no owner or occupier of a slaughter house shall engage a person for slaughtering animals unless he possesses a valid license or authorization issued by the municipal or other local authority.**
- **Section 9 speaks about the inspection of slaughter house that the Animal Welfare Board of India or any person or Animal Welfare Organisation authorised by it may inspect any slaughter house without notice to its owner or the person in charge of it at any time during the working hours to ensure that the provisions of these rules are being complied with.**

1.21 Central Silk Board Silkworm Seed Regulations, 2010

- Section 8 of this Regulations talks about the quality standards for the kind or variety of silkworm seed that should conform to the breed characters with respect to fecundity, hatchability, survival and cocoon yield.
- Section 9 speaks about the conditions to be complied by the seed cocoon producer that he/she should possess a mulberry garden, disinfestable rearing house or rearing space and rearing appliances such as chawki rearing appliances, rearing trays, cleaning nets, shoot rearing racks or rearing stands and mountages.
- Section 10 says about the conditions for registration of producer that a mulberry silkworm seed producer shall possess a matriculate pass certificate and a certificate course in sericulture from a recognized institution for having undergone training in Silkworm seed production for not less than three months in a sericulture institution under State or Central Silk Board or any other recognized institution.

Provided that mulberry silkworm seed producer operating the seed production centre before the commencement of these regulations shall not be required to possess the prescribed qualifications, but he shall undergo a refresher course training in silkworm seed production for a period of not less than one month.

- Section 11 mentions the quality standards for production of mulberry silkworm seeds that the seed producer shall clean, wash and disinfect the grainage rooms, premises and appliances before initiating the grainage operations.
- Section 13 and 14 mentions the quality standards for production of Muga and Eri silkworm seed that the grainage rooms and appliances shall be thoroughly cleaned, washed and disinfected.
- Section 25 speaks about the production, supply, distribution, trade and commerce in silkworm seed.

1.22 The Seeds Act, 1966

Section 7 of this Act says about the regulation of sale of seeds of notified kinds or varieties that no person shall, himself or by any other person on his behalf, carry on the business of selling, keeping for sale, offering to sell, bartering or otherwise supplying any seed of any notified kind or variety, unless-

- such seed is identifiable as to its kind or variety;
- such seed conforms to the minimum limits of germination and purity specified under clause (a) of section 6;
- the container of such seed bears in the prescribed manner, the mark or label containing the correct particulars thereof, specified under clause (b) of section 6; and
- he complies with such other requirements as may be prescribed.

Section 17 Restricts on export and import of seeds of notified kinds or varieties.

No person shall, for the purpose of sowing or planting by any person (including himself), export or import or cause to be exported or imported any seed of any notified kind or variety, unless-

- it conforms to the minimum limits of germination and purity specified for that seed under clause (a) of section 6; and
- Its container bears, in the prescribed manner, the mark or label with the correct particulars thereof specified for that seed under clause (b) of section 6.

Section 19 of this act speaks about the Penalty that if any person-

- contravenes any provision of this Act or any rule made thereunder; or
- prevents a Seed Inspector from taking sample under this Act or
- prevents a Seed Inspector from exercising any other power conferred on him by or under this Act; he shall, on conviction, be punishable-
 - for the first offence with fine which may extend to five hundred rupees,
 - in the event of such person having been previously convicted of an offence under this section, with imprisonment for a term which may extend to six months, or with fine which may extend to one thousand rupees, or with both.

1.23 Agricultural Produce (Grading and Marking) Act, 1937 (Act No. 1 of 1937) (as amended up to 1986)

Section 3 of this Act says about the prescription of grade designations which are:

- fixing grade designations to indicate the quality of any scheduled article ;
- defining the quality indicated by every grade designation ;
- specifying grade designation marks to represent particular grade designations ;
- authorising a person or a body of persons, subject to any prescribed conditions, to mark with a grade designation mark any article in respect of which such mark has been prescribed or any covering containing or label attached to any such article ;

- e) specifying the conditions referred to in clause (d) including in respect of any article conditions as to the manner of marking, the manner in which the article shall be packed, the type of covering to be used, and the quantity by weight, number or otherwise to be included in each covering;
- f) providing for the payment of any expenses incurred in connection with the manufacture or use of any implement necessary for the reproduction of a grade designation mark or with the manufacture or use of any covering or label marked with a grade designation mark 4[or with measures for the control of the quality of articles marked with grade designation marks including testing of samples and inspection of such articles or with any publicity work carried out to promote the sale of any class of such articles] ; and
- g) providing for the confiscation and disposal of produce marked otherwise than in accordance with the prescribed conditions with a grade designation mark.

1.24 National seed Policy 2002

The National Seed Policy was launched to provide intellectual protection to new varieties, usher this sector into planned development, protect the interest of farmers and encourage conservation of agro biodiversity. This policy had ten thrust areas which are:

1. Varietal development and plant varieties protection.
2. Seed production
3. Quality assurance
4. Seed distribution and marketing
5. Infrastructure facilities
6. Transgenic plant varieties
7. Import of seeds and planting material
8. Export of seeds
9. Promotion of domestic seed
10. Strengthening of monitoring system.

1.25 Rural Producers Companies Act, 2002

The Companies (Amendment) Act 2002 vides notification no. S.O. 135 (E) inserted part IX – A of the Companies Act, 1956 (hereinafter referred to as “the Act”) and introduced the concept of **Producer Company**. In the year 2002 an expert committee led by noted economist Y.K Alagh framed legislation for incorporation of a producer company, and conversion of inter- state cooperative society into a producer company and its reconversion into cooperative society.

It aims at upliftment of rural producers for following reasons:

- Rural producers have been at a potential disadvantage given their limited assets, resources, educational and access to advanced technology.
- In Indian context the farmers disposes of his produce in unprocessed form there is no plough back of surpluses from value addition to the farm.
- Agribusiness enterprises are therefore increasingly looking for direct tie up with the farmers to source the agricultural produce required by them.

OBJECTS OF PRODUCER COMPANY

- A producer company means a body corporate, having objects specified in section 581 B and registered as a Producer Company. The object of a producer company shall relate to all are any of the following namely:

Production , harvesting , procurement, grading , pooling ,handling marketing, selling, export of primary produce of members or import of goods or services for their benefit: *Provided that the producer company may carry on any of the activities specified in this clause either by itself or through other institution;*

- Processing including preserving drying, distilling , brewing , venting canning and packing of produce of farmers;
- Manufacture, sale or supply of machinery, equipment or consumables mainly to its members;
- providing education on mutual assistance principles to its members and others;
- rendering technical services , consultancy services , training , research and development and all other activities for the promotion of interests of its members;
- generation , transmission and distribution of power , revitalisation of land and water resources their use , conversion and communications relatable to primary produce;
- insurance of producers on their primary producer;
- promoting techniques of mutuality and mutual assistance ;
- welfare measures or facilities for the benefit of members as may be decided by the board;
- Any other activity, ancillary or incidental to any of the activity referred to in clauses (a) to (i) which include extending of credit facilities or any other financial services to its members.
- Producer Company shall deal primarily with the producer of its active member.
- Under Clause (a) sec 581A – An Active Member means a person who fulfils the quantum and period of patronage of company as specified by the article of Producer Company.

1.26 Forest Right Act - 2006, The Scheduled Tribe and Other Traditional Forest Dwellers (Recognition of Forest Right) Act, 2006

The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, is a key piece of forest legislation passed in India on 18 December 2006. It has also been called the Forest Rights Act, the Tribal Rights Act, the Tribal Bill, and the Tribal Land Act. The law concerns the rights of forest-dwelling communities to land and other resources, denied to them over decades as a result of the continuance of colonial forest laws in India.

The rights which are included in section 3(1) of the Act are:

1. Right to hold and live in the forest land under the individual or common occupation for habitation or for self-cultivation for livelihood by a member or members of a forest dwelling Scheduled Tribe or other traditional forest dwellers;
2. Community rights such as *nistar*, by whatever name called, including those used in erstwhile Princely states, Zamindari or such intermediary regimes;
3. Right of ownership, access to collect, use, and dispose of minor forest produce(includes all non-timber forest produce of plant origin) which has been traditionally collected within or outside village boundaries;
4. Other community rights of uses of entitlements such as fish and other products of water bodies, grazing (both settled or transhumant) and traditional seasonal resource access of nomadic or pastoralist communities;
5. Rights including community tenures of habitat and habitation for primitive tribal groups and pre-agriculture communities;
6. Rights in or over disputed lands under any nomenclature in any State where claims are disputed;
7. Rights for conversion of Pattas or leases or grants issued by any local council or any State Govt. on forest lands to titles;
8. Rights of settlement and conversion of all forest villages, old habitation, unsurveyed villages and other villages in forest, whether recorded, notified or not into revenue villages;
9. Right to protect, regenerate or conserve or manage any community forest resource which they have been traditionally protecting and conserving for sustainable use;
10. Rights which are recognised under any State law or laws of any Autonomous Dist. Council or Autonomous Regional Council or which are accepted as rights of tribals under any traditional or customary law of the concerned tribes of any State;
11. Right of access to biodiversity and community right to intellectual property and traditional knowledge related to biodiversity and cultural diversity;

12. Any other traditional right customarily enjoyed by the forest dwelling Scheduled Tribes or other traditional forest dwellers, as the case may be, which are not mentioned in clauses-1 to 11, but excluding the traditional right of hunting or trapping extracting a part of the body of any species of wild animal

2. ENVIRONMENTAL LAWS AND REGULATIONS (State)

2.1 Assam Forest Regulation (Amendment) Act, 1995

This act is a regulation to amend the law relating to forest, forest produce and the duty liveable on timber in Assam (similar to Forest (Conservation) Act, 1980).

2.2 Assam Forest Policy, 2004

Government of Assam has decided to adopt an environment and people's friendly State Forest Policy of Assam to focus on preservation, enhancements, maintenance, and evolution of management strategies for improved productivity, sustainable utilisation and overall quantitative improvement of stand composition and structure for enrichment of the environment. The key objectives of the policy are:

- Maintenance of environmental stability through preservation and where necessary, restoration of ecological balance that has been adversely disturbed by serious depletion of forests in the State.
- Conserving natural heritage of the state by preserving the natural forests and wetlands with vast variety of flora and fauna which represent the unique biodiversity and genetic resources of the State.
- Checking the denudation of forests and soil erosion in catchments areas of rivers and reservoirs for soil and water conservation; reducing the fury of floods and droughts; recharging of water bodies, aquifers and arresting siltation of the reservoirs.
- Promoting non-consumptive use of Protected Areas for the purpose of providing livelihood support to the fringe dwellers by encouraging sustainable eco-tourism and eco development.
- Enhancing the quality of forests/tree cover in the denuded and degraded land of the State through the involvement of people and symbiosis of traditional knowledge and modern technology.
- Increasing the forest/tree cover in forest deficient areas of State like chars, chapories permanently established along the course of the river Brahmaputra, through community afforestation and suitable agro-forestry and farm forestry models.
- Increasing forest productivity through shift of accent from major to minor forest produces; from top canopy to lower canopies and from flagship species to smaller denizens of the forest.
- Encouraging efficient utilisation of forest produce and maximising value addition to the timber and non-timber forest produce in the State. The use of non-durable secondary species as constructional timber is to be encouraged after inducing durability through wood preservation techniques.
- Encouraging conservation of genetic resources and development of traditional ethnic knowledge repository of Assam.

2.3 The Assam State Agriculture Policy

The objectives of the policy were:

1. The Agriculture and allied sector grows at the rate of 4 p.c. per annum for the next decade to provide food security and to improve nutritional intake of the people of the State as well as significantly decrease the population below the poverty line.
2. To increase the productivity of all major crops, particularly that of rice, wheat, pulses and oilseeds.

3. To increase the cropping intensity in the sector through an increase in irrigation facilities as well as giving a boost to mechanization in the State, to make it at par with the rest of the country by the end of the 10th Plan.
4. As the bulk of the population in the State lives in the rural area and most of the people are dependent on agriculture and allied sectors for their livelihood, the Government sees this sector as the engine for growth of the economy in the long run and wishes to treat the agriculture sector as an area of maximum employment generation in the State.
5. The bulk of the population in the State lives in the rural area and most of the people are dependent on agriculture and allied sectors for their livelihood, the Government sees this sector as the engine for growth of the economy in the long run and wishes to treat the agriculture sector as an area of maximum employment generation in the State.
6. It should be recognized that increased cropping intensity and improvements in productivity and production for the market can only be sustained if the links of the farmers to the market are good, the market infrastructure well developed and the farmers gets a remunerative price for their produce. It will be the endeavour of the State to develop marketing and processing infrastructure by focusing on development of rural roads, terminal markets, and district level markets for agricultural produce as well as to focus on value addition of agricultural produce in the State essentially through facilitating private enterprise in the food processing sector. The development of a marketing infrastructure and value addition has tremendous potential for developing the economy of the State, considering the strategic location of the State and the potential markets, which exist for our produce in neighbouring countries like Bangladesh and in parts of South East Asia.
7. Since the resources at the disposal of the State are limited, the endeavour will be to converge the resources available under various government schemes like JGSY and PMGSY, etc. to ensure that funds are spent keeping in view of the long term growth of the agriculture and allied sector in the State.
8. The State has a remarkable human resource in Field Management Committee, which have been functioning as an Extension Wing of the Agriculture Department. They shall be further strengthened and developed to function as a SHGs to further strengthen the extension activities in agriculture. They shall also function as focal points for disbursal of agricultural credit and as entry points for extension activities of other allied sectors like livestock and fisheries.

2.4 Assam Biodiversity Rules 2010

Section 18 of this act talks about the procedure for access to/collection of biological resources for certain purposes:

- Any citizen of India or a body corporate, association or organization registered in India seeking permission of the Board for access to/collection of biological resource for commercial utilization or bio-survey and bio-utilization for commercial utilization shall make an application as per Format – I to the Board. Every application shall be accompanied by a fee as may be fixed and notified by the Board in the form of Demand Draft drawn in favour of the Chairperson and payable at the head office of the Board.

Section 20 talks about the restriction on Activities related to access to Biological resources

The Board, if it deems necessary and appropriate, shall take steps to restrict or prohibit the, request for access to biological resources for the following reasons, namely -

- a) the request for access is for any endangered taxa;
- b) the request for access is for any endemic and rare species;
- c) the request for access may likely to result in adverse effect on the livelihood of Local people,
- d) the request for access may result in adverse environmental impact which may be difficult to control and mitigate;
- e) the request for access may cause genetic erosion or affect the ecosystem functions,
- f) use of resources for purposes contrary to national interest, other related international agreements.

2.5 The Assam Irrigation Act 1983

Section 8 of this act says about the contents of an irrigation scheme. On receipt of a direction under the preceding section, the Divisional Irrigation Officer shall prepare a scheme containing the following particulars namely:

- i. existing irrigation works to be included in the irrigation scheme;
- ii. additional items of works proposed to be constructed and the extent of reconstructions, additions or alternations of existing works proposed, if any.
- iii. the area of land proposed to be irrigated;
- iv. conditions and limitations of supply of water, if any;
- v. volume of water proposed to be supplied, calculated either on area or volumetric basis;
- vi. period and time during which the water is proposed to be supplied;
- vii. authority competent to direct supply of water for purposes other than irrigation;
- viii. estimated costs of constructions, additional constructions, re-constructions, additions or alternations proposed to be made;
- ix. cost of constructions, additional constructions, reconstructions, additions or alternations proposed to be levied as betterment contribution;
- x. Period during which and the yearly rate at which the betterment contribution is proposed to be levied;
- xi. Whether it will be necessary to control the construction of wells for any purpose other than exclusively for domestic use, either on personal or community basis, in any area or areas within the culturable command such area of the irrigation work and, if so, the area or areas where such control is necessary, the limitations and conditions under which such control is proposed to be exercised;
- xii. Whether it will be necessary to regulate the operation of the existing wells for any purpose other than exclusively domestic use, either on personal or community basis, in any area or areas within the culturable commanded area of the irrigation work and, if so, the area or areas in which regulation is necessary, the limitations and conditions under which such control is proposed to be made;
- xiii. Whether any land or block of land is to transferred to any other area covered by another irrigation scheme and, if, so the land or block of land and the irrigation scheme to which the same is proposed to be transferred;
- xiv. Whether any land or block of land will require temporal submersion and if so, the land or block of land which will require such submersion and the period for which such submersion is proposed to be made;
- xv. Any other particulars as may be prescribed.

2.6 Assam Fish Seed Rule, 2010

Section 11 of this act mentions the matter on which monthly report to be submitted under section 15 (iv). The District Fishery Development Officer or any other officer authorised by the State Government to act as Fish Seed Regulator under section 15 of the Act shall furnish monthly report to the respective Zonal Deputy Director under section 15(iv) of the Act on or before 10th of every subsequent month as per Annexure "D" in respect of following matters, namely:

- i. particulars of inspected person, farm, Associations;
- ii. particulars of fish seed sample collected ;
- iii. item seized, if any;
- iv. persons arrested, if any.

Annex 3

ANNEXURE 3: FACT SHEET - ENVIRONMENT BASE LINE REPORT

1. Barpeta

BARPETA													
	<p>Topography</p> <ul style="list-style-type: none"> The district is situated in the lower Brahmaputra valley of Assam between 26°5'N and 26°51 'N latitudes and 90°38'E and 91°20'E longitudes. The district is characterized by almost plain topography. 												
	<p>Geology and Soil</p> <ul style="list-style-type: none"> The district has soil cover of younger and older alluvial soil which has undergone diversified pedagogical changes. The soils are characterized by medium to high organic carbon and low to medium phosphorous and potash contents. Deep red coloured soil is developed in forested and foothill areas in the extreme northern region and the texture of these soils ranges from clay to sandy loam. The alluvial soils are light yellow to light grey in colour of recent age. The texture of the soil ranges from sandy loam to silty loan in nature. <p>Agro climatic zone</p> <ul style="list-style-type: none"> The district falls under the Lower Brahmaputra valley zone (NARP¹). Rice, Wheat, Maize, Rapeseed, Mustard, Niger, Linseed, Sesame, Black gram, Green gram, Lentil, Pea, Jute, are the major field crops grown here. 												
<table border="1"> <thead> <tr> <th>Parameters</th> <th>Values/Remarks</th> </tr> </thead> <tbody> <tr> <td>Electrical Conductivity</td> <td>Within permissible limit</td> </tr> <tr> <td>Fluoride</td> <td>Within Permissible Limit</td> </tr> <tr> <td>Iron</td> <td>Beyond Permissible Limit</td> </tr> <tr> <td>Arsenic</td> <td>Within permissible limit</td> </tr> <tr> <td>Type of water</td> <td>Fresh and potable</td> </tr> </tbody> </table>	Parameters	Values/Remarks	Electrical Conductivity	Within permissible limit	Fluoride	Within Permissible Limit	Iron	Beyond Permissible Limit	Arsenic	Within permissible limit	Type of water	Fresh and potable	<p>Surface Water</p> <ul style="list-style-type: none"> Major drainage pattern of the district falls under Brahmaputra, Manas, Kaldia, Pahumara River. <p>Groundwater</p> <ul style="list-style-type: none"> As per Central Ground Water Board, the present stage of ground water development is only 41 per cent and district is still under 'safe' category
Parameters	Values/Remarks												
Electrical Conductivity	Within permissible limit												
Fluoride	Within Permissible Limit												
Iron	Beyond Permissible Limit												
Arsenic	Within permissible limit												
Type of water	Fresh and potable												

¹ National Agricultural Research Project

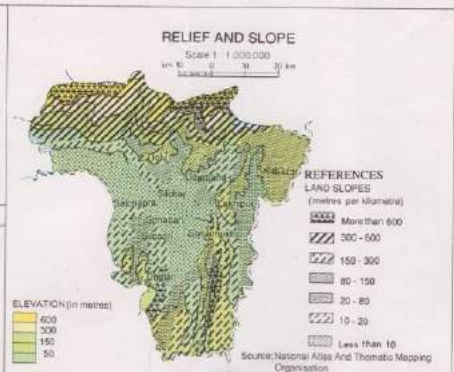
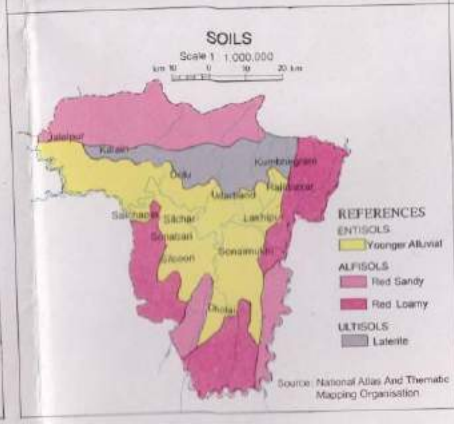
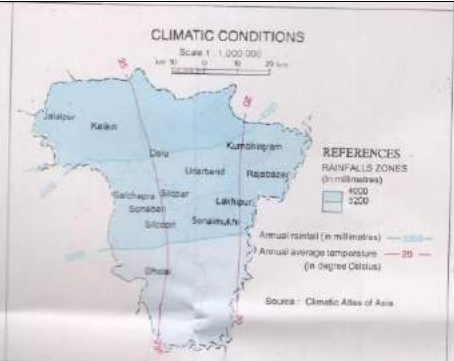
BARPETA	
	<h3>Climate and Meteorology</h3> <ul style="list-style-type: none"> The climate of the district is sub-tropical and humid. The average temperature ranges from 15° to 30°C. The winter season starts by November and continues till February. December/January is the coldest and July/August is the hottest period. The air is highly humid throughout the year and during rainy season; the relative humidity is about 90 percent. The area receives heavy rainfall every year and out of 2,051 mm of annual normal rainfall, 60 to 65% is received during June to September from south west monsoon. The district also receives rainfall during pre-monsoon period from March/April to May in the form of thunder showers and hail storms.
	<h3>Biodiversity and Forest</h3> <p><u>Forest</u></p> <ul style="list-style-type: none"> The district covers a forest land of 397 square kilometers. Open forest and moderately dense forest dominates the region covering 46.09% and 45.08% of the total forest land respectively. Whereas very dense forest covers only 8.81%². <p><u>Flora and Fauna</u></p> <ul style="list-style-type: none"> The district is rich in flora and fauna. Manas National park, a World Heritage Site, with a prominent Tiger project situated at a distance of 52 km towards North West from Barpeta town is ornamented with rare and diversified wildlife. There are 543 species of plants, 60 species of mammals, 312 species of birds, 42 species of reptiles, 7 species of fishes and 100 species of insects in the park³.
<h3>Natural Hazard and Calamities</h3> <ul style="list-style-type: none"> The most common vulnerability to the all over state is flood and Seismicity⁴. Barpeta district is also vulnerable to flood which occur almost in every monsoon. 	

²Indian State Forest Report, 2011.

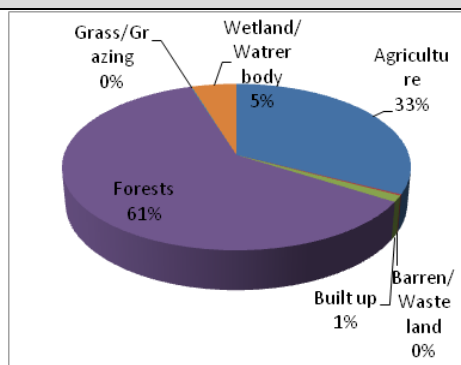
³<http://barpetazp.com/barpeta.htm>

⁴ All over state is coming under seismic zone V, i.e. very high damage zone

2. Cachar

CACHAR											
	<p>Topography</p> <ul style="list-style-type: none"> The district is located on the Barak Valley of Assam between, 24°22'N and 25°8 'N latitudes and 92°24'E and 93°15'E longitudes. The district is mostly made up of plains, but there are a number of hills spread across the district. 										
	<p>Geology and Soil</p> <ul style="list-style-type: none"> The soil of the district varies from alluvial to lateritic in nature. Texture is generally clayey loam to clay. The pH ranges from 4.5 to 6.0. The river line tracts are found to be loamy to sandy loamy in nature. The hilly tracts are covered by lateritic soil. <p>Agro climatic zone</p> <ul style="list-style-type: none"> The district falls under the Barak valley zone (NARP⁵). Rice, Maize, Wheat, Sugarcane, Jute, Black gram, Gram, Mung, Pea, Lentil, Lathyrus, Other rabi crops, Rapeseed & mustard Sesumum, Linseed, Nizer are the major field crops grown here. 										
<table border="1"> <thead> <tr> <th>Parameters</th> <th>Values/Remakes</th> </tr> </thead> <tbody> <tr> <td>Electrical Conductivity</td> <td>Within permissible limit</td> </tr> <tr> <td>Fluoride</td> <td>Within Permissible Limit</td> </tr> <tr> <td>Iron</td> <td>ranges from 0.24 to 4.19</td> </tr> <tr> <td>Arsenic</td> <td>Not determined</td> </tr> </tbody> </table>	Parameters	Values/Remakes	Electrical Conductivity	Within permissible limit	Fluoride	Within Permissible Limit	Iron	ranges from 0.24 to 4.19	Arsenic	Not determined	<p>Surface Water</p> <ul style="list-style-type: none"> Major drainage pattern of the district falls under Barak River and its tributaries. <p>Groundwater</p> <ul style="list-style-type: none"> From the quality point of view, ground water attains its suitability for drinking as well as irrigation purposes.
Parameters	Values/Remakes										
Electrical Conductivity	Within permissible limit										
Fluoride	Within Permissible Limit										
Iron	ranges from 0.24 to 4.19										
Arsenic	Not determined										
	<p>Climate and Meteorology</p> <ul style="list-style-type: none"> The district receives heavy annual rainfall of the tune of 3,874.5 mm. The maximum rainfall occurs during monsoon period between May to August. The district experiences a sub -tropical and humid climate . The temperature varies from 12 °C in winter to 35 °C in summer. The humidity varies from 32% to maximum of 98% during July and October. 										

⁵ National Agricultural Research Project

CACHAR**Biodiversity and Forest**Forest

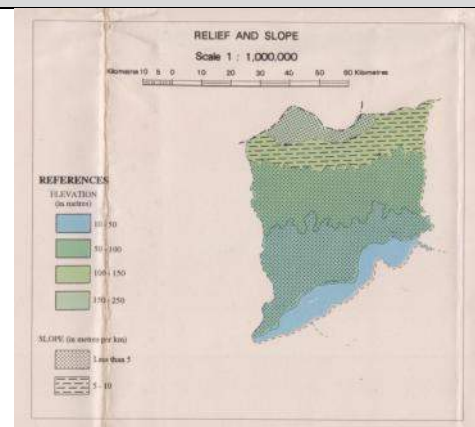
- The district covers a forest land of 2236 square kilometers. Open forest and moderately dense forest dominates the region covering 52.77% and 43.60% of the total forest land respectively. Whereas very dense forest covers only 3.62%⁶.

Flora and Fauna

- The flora is mainly Tropical evergreen as well as there are huge tracts of the Rainforests within northern as well as southern parts in the district that are home of Tigers, Hoolock Gibbons, Asian Elephants, Gaurs etc. Unusual species found include Pig-tailed Macaques, Hoolock Gibbons, Phayre's leaf Monkeys, Masked Finfoots, Stump-tailed Macaques and White-armed Wood Ducks etc. Its southern division was known as the Dhaleswari Wildlife Sanctuary. The Barail is lone wildlife sanctuary in this district and in the Barak valley area.⁷

Natural Hazard and Calamities

- The most common vulnerability to the all over state is flood and Seismicity⁸. Barak district is also vulnerable to flood which occur almost in every monsoon.

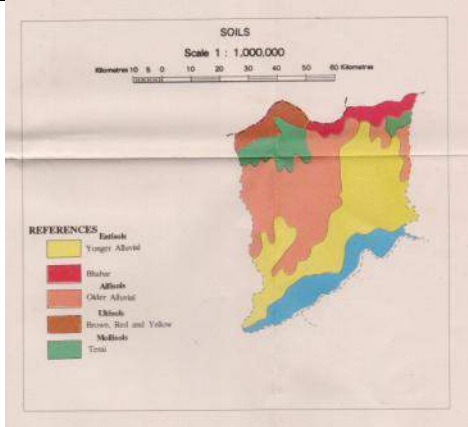
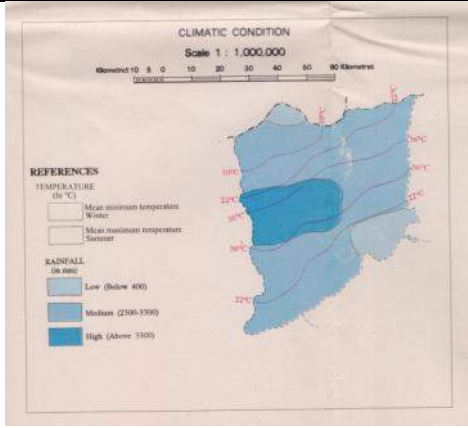
3. Darrang**DARRANG****Topography**

- The district is situated in the central part of Assam and on the Northern side of the river Brahmaputra, between, 20°9'N and 26°95'N latitudes and 91°45'E and 92°22'E longitudes.
- The district is mostly made up of plains.

⁶Indian State Forest Report, 2011.

⁷ <http://www.cachar.nic.in>

⁸ All over state is coming under seismic zone V, i.e. very high damage zone

DARRANG								
	<p>Geology and Soil</p> <ul style="list-style-type: none"> The district has soil cover of younger alluvium and older alluvium which have undergone diversified pedagogical changes. The soils are characterized by medium to high organic carbon, low to medium phosphate and potash contents. The alluvial soils are light yellow to light grey in colour of recent age. The texture of the soil ranges from sandy loam to silty loam in nature. The soil is suitable for cultivation of rice crops. <p>Agro climatic zone</p> <ul style="list-style-type: none"> The district falls under the North Bank Plain Zone (NARP⁹). Rice, Toria, Jute, Black gram, Wheat, Sugarcane are the major field crops grown here. 							
<table border="1" style="width: 100%;"> <thead> <tr> <th style="width: 20%;">Parameters</th> <th>Values/Remakes</th> </tr> </thead> <tbody> <tr> <td>Electrical Conductivity</td> <td rowspan="4">Sporadic occurrence of high concentration of Fe in few pockets in shallow and deeper aquifer.</td> </tr> <tr> <td>Fluoride</td> </tr> <tr> <td>Iron</td> </tr> <tr> <td>Arsenic</td> </tr> </tbody> </table>	Parameters	Values/Remakes	Electrical Conductivity	Sporadic occurrence of high concentration of Fe in few pockets in shallow and deeper aquifer.	Fluoride	Iron	Arsenic	<p>Surface Water</p> <ul style="list-style-type: none"> Major drainage pattern of the district falls under Brahmaputra, Dhansiri, Bega, Mangaldoi and Noa rivers. <p>Groundwater</p> <ul style="list-style-type: none"> From the quality point of view, ground water attains its suitability for drinking as well as irrigation purposes.
Parameters	Values/Remakes							
Electrical Conductivity	Sporadic occurrence of high concentration of Fe in few pockets in shallow and deeper aquifer.							
Fluoride								
Iron								
Arsenic								
	<p>Climate and Meteorology</p> <ul style="list-style-type: none"> The climate of the district is sun-tropical and humid. The winter season starts by November and continues till February. December/January is the coldest month and the temperature comes down to almost 150 C. The temperature starts rising from the month of February/March and July/August is the hottest month and it reaches up to about 400 C. The air is highly humid throughout the year and during rainy season; the relative humidity is about 90 percent. The area receives heavy rainfall every year and out of 1,951 mm of annual normal rainfall, 60 to 65% is received during June to September from south-west monsoon. The district also receives about 501 mm of rainfall during pre-monsoon period from March to May in the form of thunder showers and hail storms. 							

⁹ National Agricultural Research Project

DARRANG	
<p>A 3D pie chart illustrating the land use distribution in Darrang. The largest portion is Agriculture at 55%, followed by Forests at 25%, Wetland/Water body at 14%, Grass/Grazing at 3%, Barren/Waste land at 2%, and Built up at 1%.</p>	<p>Biodiversity and Forest</p> <p><u>Forest</u></p> <ul style="list-style-type: none"> The district covers a forest land of 470 square kilometers. Open forest and moderately dense forest dominates the region covering 78% and 19.36% of the total forest land respectively. Whereas very dense forest covers only 2.55%¹⁰. <p><u>Flora and Fauna</u></p> <ul style="list-style-type: none"> In 1990 Darrang district became home to Manas National Park, which has an area of 500 km² (193.1 sq mi). It shares the park with four other districts. It is also home to Orang National Park, which it shares with Sonitpur district. Orang was established in 1999 and has an area of 79 km² (30.5 sq mi). Apart from the two national parks, it's also home to a wildlife sanctuary: the Bornadi.¹¹
<p>Natural Hazard and Calamities</p> <ul style="list-style-type: none"> The most common vulnerability to the all over state is flood and Seismicity¹². Darrang district is also vulnerable to flood which occur almost in every monsoon. 	

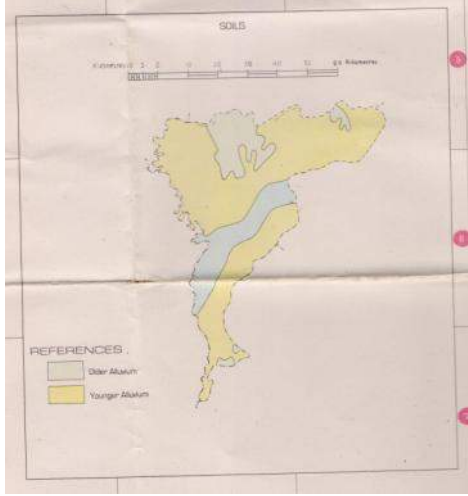
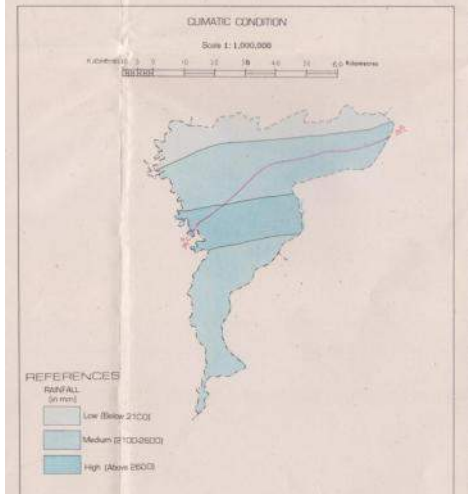
4. Dhubri

DHUBRI	
<p>A relief and slope map of Dhubri district. The map shows the district's location relative to the Brahmaputra river. A legend indicates elevation in meters (less than 40, 40-60, 60-230, 230-400) and slope in meters per km (less than 10, 10-20, 20-30). A scale bar shows 0 to 40 kilometers.</p>	<p>Topography</p> <ul style="list-style-type: none"> This district is located on the globe between 26.22° and 25.28° 'N latitudes and 89.42°E and 90.12°E longitudes and the Mighty River Brahmaputra is flowing through this district from east to west. The district is characterized by almost plain topography with patches of small hillocks like Tokorabandha, Dudhnath, Chandardinga, Boukumari, Boropahar, Chakrasila etc.

¹⁰Indian State Forest Report, 2011.

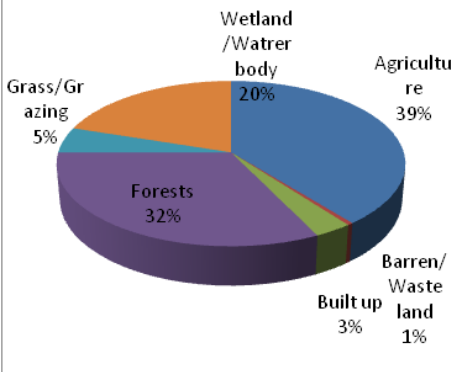
¹¹https://en.wikipedia.org/wiki/Darrang_district#Flora_and_fauna

¹²All over state is coming under seismic zone V, i.e. very high damage zone

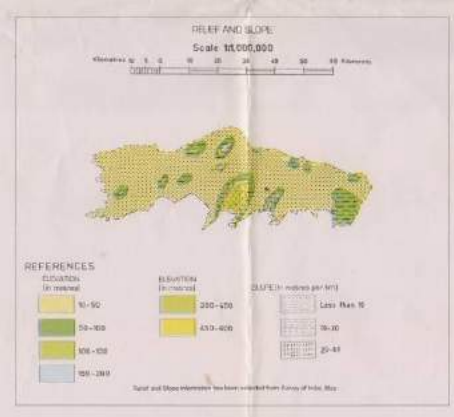
DHUBRI	
	<p>Geology and Soil</p> <ul style="list-style-type: none"> • Soils in greater part of the district are sandy and silty loam, or clayey loam. It is found to be highly acidic to slightly alkaline in nature and is moderately permeable and characterized by the presence of low organic carbon and low soluble salts. Soils restricted to inselberg areas are more clayey, lateritic and less permeable and are highly acidic in nature. From agriculture point of view, the soils in major part of the area are suitable for all sorts of crops cultivation. <p>Agro climatic zone</p> <ul style="list-style-type: none"> • The district falls under the Lower Brahmaputra valley zone (NARP¹³). Summer Paddy, Winter Paddy, Autumn Paddy, Rapseed & Mustard, Wheat, Black gram, Nizer, Sesamum, Lentil, Linseed Pea, Groundnut, Green gram are the major field crops grown here.
<p>Surface Water</p> <ul style="list-style-type: none"> • Major drainage pattern of the district falls under Brahmaputra, Gadadhar, Sankosh, Silai, Gouranga Rivers. <p>Groundwater</p> <ul style="list-style-type: none"> • The concentration of major, minor and trace element in the district is generally within the limited range except iron. The iron distribution is abruptly high in and around Tamarhat and Chapar area where it has exceeded the permissible limit of drinking. The ground water is suitable for agricultural and industrial usages.¹⁴ 	
	<p>Climate and Meteorology</p> <ul style="list-style-type: none"> • The district enjoys a subtropical humid climate with temperature ranging between 10.5° C (minimum, in December/January) and 30° C (maximum, in July/August). South west monsoon activates from May and continues up to September-October. The average annual rainfall of the district, as recorded at Dhubri is 2,363 mm with about 65% rainfall occurring during the monsoon. The monthly evapo-transpiration is about 40% of the rainfall, the highest in August and lowest in January.

¹³ National Agricultural Research Project

¹⁴ Ground Water Information Booklet Dhubri District, Assam, Central Ground Water Board North Eastern Region, Ministry of Water Resources Guwahati March 2013.

DHUBRI	
	<h3>Biodiversity and Forest</h3> <p><u>Forest</u></p> <ul style="list-style-type: none"> The district covers a forest land of 418 square kilometers. Moderately dense forest and Open forest dominates the region covering 48.08% and 46.88% of the total forest land respectively. Whereas very dense forest covers only 5.02%¹⁵. <p><u>Flora and Fauna</u></p> <ul style="list-style-type: none"> On 14 July 1994, a virgin forest patch of Dhubri District of Assam was declared as a wildlife sanctuary by the gazette notification of the Assam government. This sanctuary has been named as "Chakrashila Wildlife Sanctuary". It is the youngest sanctuary of North East India having an area of 11,260.00 acres (45.5676 km²). The diverse eco-systems of Chakrasila present model habitat diversity and support various mammalian species like tiger, leopard, golden langur, leopard cat, gaur, mongoose, porcupine, pangoline, flying squirrel, civet cat. Along with all these prolific gifts of the nature Chakrasila has a wide variety of avifauna.¹⁶
<h3>Natural Hazard and Calamities</h3> <ul style="list-style-type: none"> The most common vulnerability to the all over state is flood and Seismicity¹⁷. Dhubri district is also vulnerable to flood which occur almost in every monsoon. 	

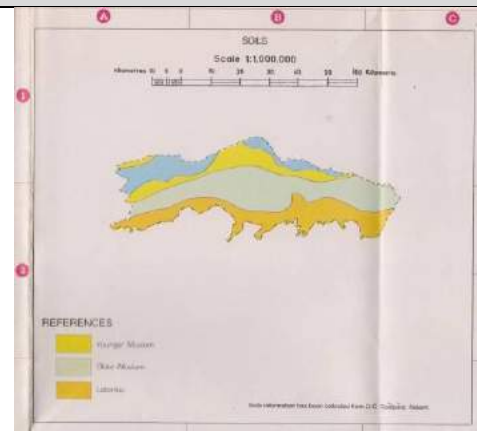
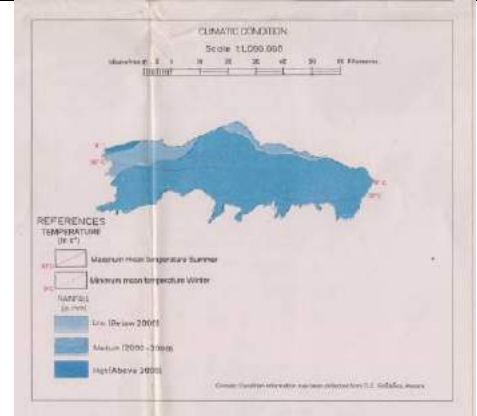
5. Goalpara

GOALPARA	
	<h3>Topography</h3> <ul style="list-style-type: none"> Goalpara district, of Assam is located between 25°33' and 26°12' North latitude and 90°07' and 91° 15' East longitude and is situated entirely on the south bank of the river Brahmaputra.

¹⁵Indian State Forest Report, 2011.

¹⁶https://en.wikipedia.org/wiki/Dhubri_district#Flora_and_fauna

¹⁷ All over state is coming under seismic zone V, i.e. very high damage zone

GOALPARA										
	<p>Geology and Soil</p> <ul style="list-style-type: none"> The plain areas bordering Brahmaputra River and in between the inselbergs are occupied by alluvial sediments belonging to Quaternary ages. Based on such criteria such as sedimentation, soil characteristics and geomorphic features, the Quaternary sediments can be grouped into two subdivisions, viz. <ul style="list-style-type: none"> Older Alluvium, and Younger alluvium. The Older alluvium by virtue of its relative maturity is composed of somewhat oxidized sediments comprising yellow and the reddish brown colour sand, silt and clay in contrast to the light colour, less compact Younger alluvial sediment. The Older alluvium always occupies the higher grounds than the adjacent Younger alluvium but takes the proper stratigraphical position underlying the Younger alluvium sediments in the plain areas. A scarp as seen in the Krishnai River valley sometimes separates these two groups. <p>Agro climatic zone</p> <ul style="list-style-type: none"> The district falls under the Lower Brahmaputra valley zone (NARP¹⁸). Summer Paddy, Winter Paddy, Autumn Paddy, Rapseed& Mustard, Wheat, Black gram, Nizer, Sesamum, Lentil, Linseed Pea, Groundnut, Green gram are the major field crops grown here. 									
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Parameters	Values/ Remakes									
Electrical Conductivity	Except Fe and F problems in some parts of the district, other elements are within the permissible limit. Occurrence of Fe is more than permissible limit in the shallow aquifers. F content in deeper aquifers is more than permissible limit.									
Fluoride										
Iron										
Arsenic										
Type of water										
	<p>Climate and Meteorology</p> <ul style="list-style-type: none"> The climate in the district is moderate during the winter and in summer, it is hot. Rain makes its first appearance in the month of April with occasional and irregular light showers and at times, heavy down pour is followed by cyclonic storm. This irregular rainfall continues up to the end of May It occurs due to the influence of Northeaster wind. Physiographically, the area is occupied by both the hills and plains. The alluvial land is flat with a gentle regional slope of less than 1 m/km towards Brahmaputra River. The hills mostly occur as isolated inselberg whose areas vary from less than 1 sq km to almost 15 sq 									

¹⁸ National Agricultural Research Project

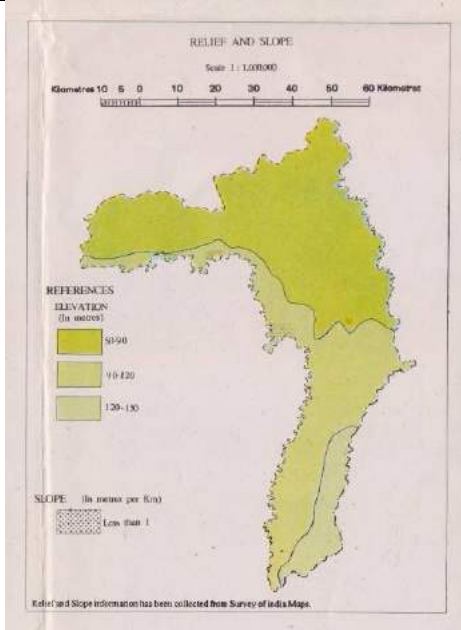
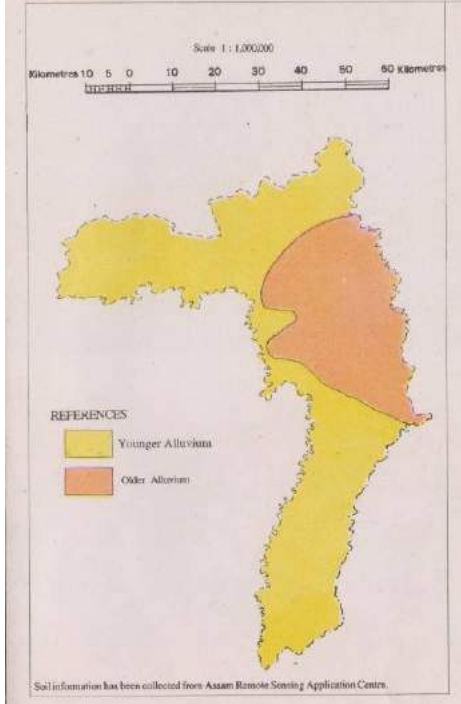
GOALPARA															
	<p>km (e.g. inselberg west of Goalpara town) with heights ranging between 60 to 300 m above MSL. The hills are veneered by lateritic mantle and are deeply forested with evergreen mixed open jungles. Tongue like projections of the main Shillong Plateau are also seen in the area around Agia (26o 05' / 90o 33'), Krishnai (26o02' / 90o 39'), and southeast of Rangjuli (25058' / 90004'). The height of the hills varies between 60 and 550 m above MSL.</p>														
<table border="1" style="margin: 10px auto;"> <caption>Land Use Distribution</caption> <thead> <tr> <th>Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Forests</td> <td>44%</td> </tr> <tr> <td>Agriculture</td> <td>35%</td> </tr> <tr> <td>Wetland/Water body</td> <td>14%</td> </tr> <tr> <td>Grass/Grazing</td> <td>3%</td> </tr> <tr> <td>Barren/Waste land</td> <td>2%</td> </tr> <tr> <td>Built up</td> <td>2%</td> </tr> </tbody> </table>	Category	Percentage	Forests	44%	Agriculture	35%	Wetland/Water body	14%	Grass/Grazing	3%	Barren/Waste land	2%	Built up	2%	<p>Biodiversity and Forest</p> <p><u>Forest</u></p> <ul style="list-style-type: none"> The district covers a forest land of 337 square kilometers. Open forest dominates the region covering 78.63% of the total forest land respectively. Whereas moderately dense forest and very dense forest covers only 21.06% and 0.29% only¹⁹. <p><u>Flora and Fauna</u></p> <ul style="list-style-type: none"> The Surya pahar and Tukreswaripahar of district are the abode of monkeys. There are about 264 commonly known plant species in the district. About 67 plant species have medicinal properties, which are being traditionally used in Unani system of treatment. About 13 plant species are endangered. The area offers habitat to 104 species of birds, out of which 68 are residential and 21 are migratory. A total of 210 native fish species were reported to be available in the water bodies of the district. Naemecheilusgoalparanensis, an endemic fish of Goalpara area is already extinct²⁰.
Category	Percentage														
Forests	44%														
Agriculture	35%														
Wetland/Water body	14%														
Grass/Grazing	3%														
Barren/Waste land	2%														
Built up	2%														
<p>Natural Hazard and Calamities</p> <ul style="list-style-type: none"> The most common vulnerability to the all over state is flood and Seismicity²¹. Goalpara district is also vulnerable to flood which occur almost in every monsoon. 															

¹⁹Indian State Forest Report, 2011.

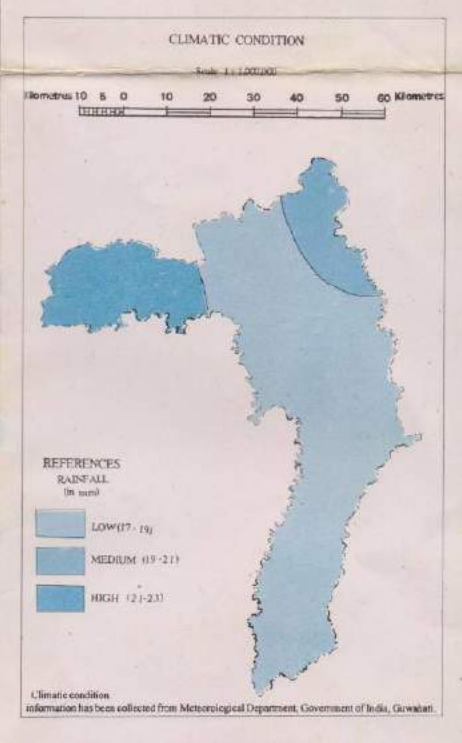
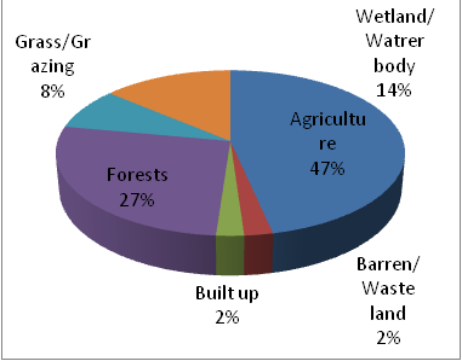
²⁰http://www.goalpara.assampanchayat.gov.in/hidden/-/asset_publisher/XBzK2WCFJ2IJ/content/district-profile/7788096

²¹ All over state is coming under seismic zone V, i.e. very high damage zone

6. Golaghat

GOLAGHAT													
	<p>Topography</p> <ul style="list-style-type: none"> The district is situated between 25°50'N to 26°47'N latitudes and 93°16'E to 94°10'E longitudes and is surrounded by Brahmaputra in the North. 												
	<p>Geology and Soil</p> <ul style="list-style-type: none"> Two important soil groups are seen in the district. These are (i) deep reddish coloured soil developed over older geological formation and (ii) light grey to dark grey coloured soil covering the major parts of the district. Low nitrogen, low phosphate, medium to high potash, acidic characters of the soil are representative of the soil cover found in the hills. In the plain areas, the other type of the soil covers is found to be feebly alkaline. <p>Agro climatic zone</p> <ul style="list-style-type: none"> The district falls under the Hill zone (NARP²²). Autumn rice, Winter rice, Summer Rice, Rapeseed & Mustard, Potato, Sugarcane are some of the major crops grown here. 												
<table border="1"> <thead> <tr> <th>Parameters</th> <th>Values/Remarks</th> </tr> </thead> <tbody> <tr> <td>Electrical Conductivity</td> <td>56.00 – 820.00</td> </tr> <tr> <td>Fluoride</td> <td>Nil</td> </tr> <tr> <td>Iron</td> <td>0.10 – 4.60</td> </tr> <tr> <td>Arsenic</td> <td>NA</td> </tr> <tr> <td>Type of water</td> <td>NA</td> </tr> </tbody> </table>	Parameters	Values/Remarks	Electrical Conductivity	56.00 – 820.00	Fluoride	Nil	Iron	0.10 – 4.60	Arsenic	NA	Type of water	NA	<p>Surface Water</p> <ul style="list-style-type: none"> Major drainage pattern of the district falls under Brahmaputra River and Dhansiri, Galabil, Desoi, Kakodanga Rivers. <p>Groundwater</p> <ul style="list-style-type: none"> As per Central Ground Water Board, the present stage of ground
Parameters	Values/Remarks												
Electrical Conductivity	56.00 – 820.00												
Fluoride	Nil												
Iron	0.10 – 4.60												
Arsenic	NA												
Type of water	NA												

²² National Agricultural Research Project

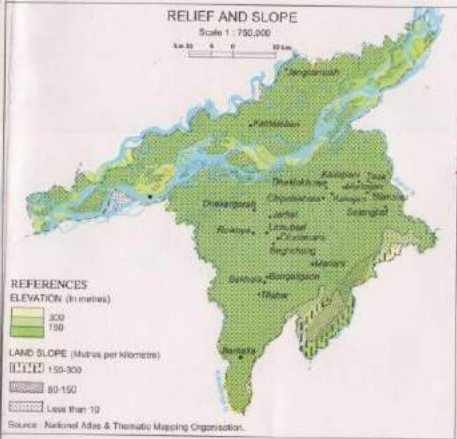
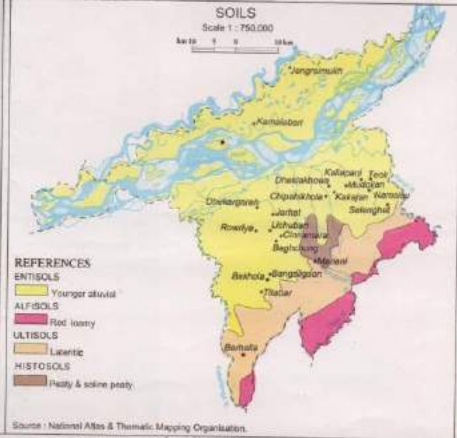
GOLAGHAT	
	<p>water development is only 41 per cent and district is still under 'safe' category.</p>
 <p style="font-size: small;">Climatic condition information has been collected from Meteorological Department, Government of India, Guwahati.</p>	<p>Climate and Meteorology</p> <ul style="list-style-type: none"> The district enjoys sub-tropical humid climate. Average annual rainfall in the district is 2,012 mm. About 60 to 65% of the annual precipitation is received during south-west monsoon from June to September. The pattern of rainfall varies in the district, from south to north, the intensity of rainfall increases and the maximum rainfall is recorded in the north eastern parts of the district. Annual average temperature of the district during winter period varies from 6 to 14°C and during summer, it varies from 29 to 36°C. The relative humidity varies from 93 to 95% during morning hours and during afternoon hours it varies from 53 to 75%.
	<p>Biodiversity and Forest</p> <p><u>Forest</u></p> <ul style="list-style-type: none"> The district covers a forest land of 525 square kilometers. Open forest and moderately dense forest dominates the region covering 75.61% and 23.23% of the total forest land respectively. Whereas very dense forest covers only 1.14%²³. <p><u>Flora and Fauna</u></p> <ul style="list-style-type: none"> In 1974 Golaghat district became home to Kaziranga National Park, which has an area of 472 km². It shares the park with Nagaon district. It also home to Nambor - Doigrung Wildlife Sanctuary²⁴.
<p>Natural Hazard and Calamities</p> <ul style="list-style-type: none"> The most common vulnerability to the all over state is flood and Seismicity²⁵. Barpeta district is also vulnerable to flood which occur almost in every monsoon. 	

²³Indian State Forest Report, 2011.

²⁴https://en.wikipedia.org/wiki/Golaghat_district#Flora_and_fauna

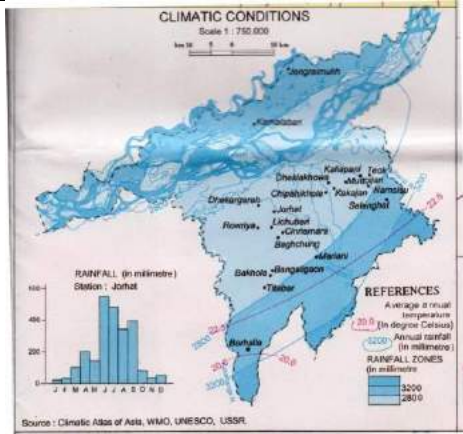
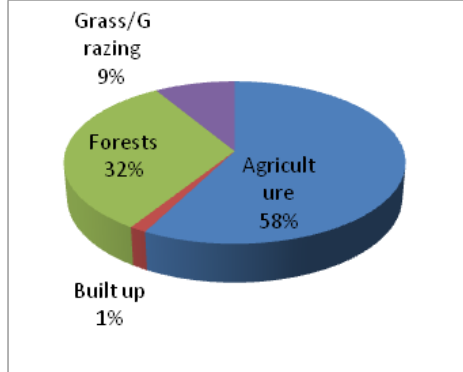
²⁵ All over state is coming under seismic zone V, i.e. very high damage zone

7. Jorhat

JORHAT													
 <p>RELIEF AND SLOPE Scale 1 : 750,000</p> <p>REFERENCES ELEVATION (in metres) 300 150</p> <p>LAND SLOPE (Metres per kilometre) 150-300 80-150 Less than 10</p> <p>Source : National Atlas & Thematic Mapping Organisation.</p>	<p>Topography</p> <ul style="list-style-type: none"> The district is situated at the central part of the Brahmaputra valley between 26.74°N latitudes and 94.20°E longitudes. 												
 <p>SOILS Scale 1 : 750,000</p> <p>REFERENCES ENTISOLS Younger alluvial ALFISOLS Red loamy LALISOLS Lacartic HISTOSOLS Peaty & saline peaty</p> <p>Source : National Atlas & Thematic Mapping Organisation.</p>	<p>Geology and Soil</p> <ul style="list-style-type: none"> The soil of Jorhat district predominantly sandy loam (58.25%) of total soils. While 15.40% silty clay loam, 9.92% sandy, 8.17% loamy and 8.26% clay soils. However, this composition varies across the blocks²⁶. <p>Agro climatic zone</p> <ul style="list-style-type: none"> The district falls under the Upper Brahmaputra Valley zone (NARP²⁷). Rice, Wheat, Rapeseed, Green gram, Black gram, Potato, Pea, are some of the major crops grown here. 												
<table border="1"> <thead> <tr> <th>Parameters</th> <th>Values/ Remakes</th> </tr> </thead> <tbody> <tr> <td>Electrical Conductivity</td> <td>136 to 1,653 micromhos/cm at 25°C (Mariani)</td> </tr> <tr> <td>Fluoride</td> <td>0.37 to 1.49 ppm</td> </tr> <tr> <td>Iron</td> <td>0.20 to 2.36 ppm</td> </tr> <tr> <td>Arsenic</td> <td>NA</td> </tr> <tr> <td>Type of water</td> <td>NA</td> </tr> </tbody> </table>	Parameters	Values/ Remakes	Electrical Conductivity	136 to 1,653 micromhos/cm at 25°C (Mariani)	Fluoride	0.37 to 1.49 ppm	Iron	0.20 to 2.36 ppm	Arsenic	NA	Type of water	NA	<p>Surface Water</p> <ul style="list-style-type: none"> Major drainage pattern of the district falls under River Brahmaputra, Bhogdoi and Kakodonga.
Parameters	Values/ Remakes												
Electrical Conductivity	136 to 1,653 micromhos/cm at 25°C (Mariani)												
Fluoride	0.37 to 1.49 ppm												
Iron	0.20 to 2.36 ppm												
Arsenic	NA												
Type of water	NA												

²⁶Bhalerao A.K., Kumar B., Singha A. K., Jat P.C., Bordoloi, R., DekaBidyut C., 2015, Jorhat district inventory of Agriculture, ICAR- Agricultural Technology Application Research Institute, Umiam, Meghalaya, India

²⁷ National Agricultural Research Project

JORHAT	
 <p>The figure consists of a map of Jorhat district and its surrounding areas, including parts of Dibrugarh, Karbi Anglong, and Lakhimpur districts. The map shows various towns and geographical features. A bar chart titled 'RAINFALL (in millimetre) Station: Jorhat' shows monthly rainfall from January to December. The rainfall is highest in the monsoon months (June, July, August) and lowest in the winter months (January, February, March). A legend indicates rainfall zones: 2500 mm and 2800 mm. A reference table provides average annual rainfall (1,867.08 mm) and average annual temperature (29°C).</p>	<p>Climate and Meteorology</p> <ul style="list-style-type: none"> The climate of the district is classified as meso -thermal wet climate with forest type of vegetation . January is the coldest month with temperature of 6.1°C. July and August are the hottest period with average monthly temperature of about 29°C. The average relative humidity in a year is 78.7 per cent. The average annual rainfall for last ten years from 1998 to 2007 has been computed to be 1,867.08 mm. The amount of rainfall increases from southwest to northeast.
 <p>The pie chart illustrates the land use distribution in Jorhat district. Agriculture is the dominant land use, accounting for 58% of the total area. Forests cover 32%, Grass/Grazing covers 9%, and Built up areas account for 1%.</p>	<p>Biodiversity and Forest</p> <p><u>Forest</u></p> <ul style="list-style-type: none"> The district covers a forest land of 613 square kilometers. Open forest dominates the region covering 81.23%. Whereas moderately dense forest and very dense forest covers 18.43% and 1.225 respectively²⁸. <p><u>Flora and Fauna</u></p> <ul style="list-style-type: none"> In 1997 Jorhat district became home to the Gibbon Wildlife Sanctuary, which has an area of 21 km² is a protected area which is home of hoolock gibbons. There is another forest called MulaiKathoni, a man made forest covering 550 hectares of area on a Brahmaputra river sandbar located near Kokilamukh area.
<p>Natural Hazard and Calamities</p> <ul style="list-style-type: none"> The most common vulnerability to the all over state is flood and Seismicity²⁹. Jorhat district is also vulnerable to flood which occur almost in every monsoon. 	

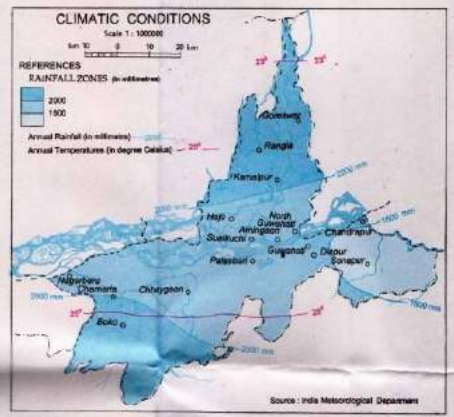
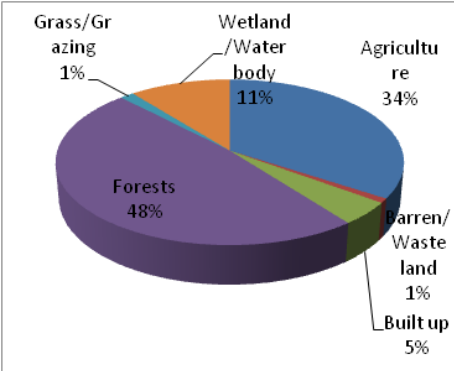
²⁸Indian State Forest Report, 2011.

²⁹ All over state is coming under seismic zone V, i.e. very high damage zone

8. Kamrup

KAMRUP													
	<p>Topography</p> <ul style="list-style-type: none"> Kamrup District is situated on the bank of River Brahmaputra between 25.46° and 26.49° North Latitude and between 90.48° & 91.50° East Longitude. 												
	<p>Geology and Soil</p> <ul style="list-style-type: none"> The different rock formation occurring in the district has been subjected to various soil forming processes through agents of weathering and transportation during different geological ages. Soils comprising various proportions of sand, silt, clay and organic material in the district are grouped into three broad categories – a) newer alluvial soil, b) valley fill/older alluvial soil and c) soils over forest and hilly terrain. <p>Agro climatic zone</p> <ul style="list-style-type: none"> The district falls under the Lower Brahmaputra valley zone (NARP³⁰). Summer Paddy, Winter Paddy, Autumn Paddy, Rapseed & Mustard, Wheat, Black gram, Nizer, Sesamum, Lentil, Linseed Pea, Groundnut, Green gram are the major field crops grown here. 												
<table border="1"> <thead> <tr> <th>Parameters</th> <th>Values/Remakes</th> </tr> </thead> <tbody> <tr> <td>Electrical Conductivity</td> <td>NA</td> </tr> <tr> <td>Fluoride</td> <td>Present</td> </tr> <tr> <td>Iron</td> <td>Present</td> </tr> <tr> <td>Arsenic</td> <td>NA</td> </tr> <tr> <td>Type of water</td> <td>NA</td> </tr> </tbody> </table>	Parameters	Values/Remakes	Electrical Conductivity	NA	Fluoride	Present	Iron	Present	Arsenic	NA	Type of water	NA	<p>Surface Water</p> <ul style="list-style-type: none"> Major drainage pattern of the district falls under Brahmaputra, Puthimari, Digaru, Kuls, Singra River. <p>Groundwater</p> <ul style="list-style-type: none"> The district is still under 'Safe' category and sufficient resources are still available for future development.
Parameters	Values/Remakes												
Electrical Conductivity	NA												
Fluoride	Present												
Iron	Present												
Arsenic	NA												
Type of water	NA												

³⁰ National Agricultural Research Project

KAMRUP	
	<h3>Climate and Meteorology</h3> <ul style="list-style-type: none"> The climate of the area has been classified as sub-tropical humid climate with heavy rainfall, hot summer and high humidity. Average temperature ranges from 12 to 38oC during the year. In winter, temperature ranges from 15 to 25oC during day and 8 to 15oC during night. The summer temperature ranges from 25 to 38oC during day and 15 to 25oC during night.
	<h3>Biodiversity and Forest</h3> <p><u>Forest</u></p> <ul style="list-style-type: none"> The district covers a forest land of 1433 square kilometers. Open forest and Moderately dense forest dominates the region covering 52.54% and 42.70% of the total forest land respectively. Whereas very dense forest covers only 4.74%³¹. <p><u>Flora and Fauna</u></p> <ul style="list-style-type: none"> In 1989 Kamrup district became home to the Dipor Bil Wildlife Sanctuary, which has an area of 4.1 km² (1.6 sq mi). There is also a plantation where seedlings of teak, sal, sissu, sum, and nahor are reared, and experiments are being made with the caoutchouc tree.³²
<h3>Natural Hazard and Calamities</h3> <ul style="list-style-type: none"> The most common vulnerability to the all over state is flood and Seismicity³³. Kamrup district is also vulnerable to flood which occur almost in every monsoon. 	

9. Karbi Anglong

KARBI ANGLONG
<h3>Topography</h3> <ul style="list-style-type: none"> The Karbi Anglong District is situated in the central part of Assam. The district with dense tropical forest covered hills and flat plains are situated between 25^o33'N to 26^o35' N Latitude and 92^o10' to 93^o50' E Longitude. Even though, the district is dotted with hills, a few of which can be categorized into Mountain. Among them, the highest is the Singhason Peak which is at about 1360 metres above the sea level.
<h3>Geology and Soil</h3>

³¹Indian State Forest Report, 2011.

³²https://en.wikipedia.org/wiki/Kamrup_district#Flora_and_fauna

³³ All over state is coming under seismic zone V, i.e. very high damage zone

KARBI ANGLONG

- Two types of soils are mainly observed in the district. These are (1) Brown to pale brown soil developed on the top of the hills, lateritic in places and (2) the alluvial soil, sandy loam or clayey developed on the low lying terrain.

Agro climatic zone

- The district falls under the Hills zone (NARP³⁴). Rice, Rape & Mustard, Maize, Sugarcane, Sesame, Wheat, Jute, Arhar, Cotton etc. are some of the crops cultivated here.

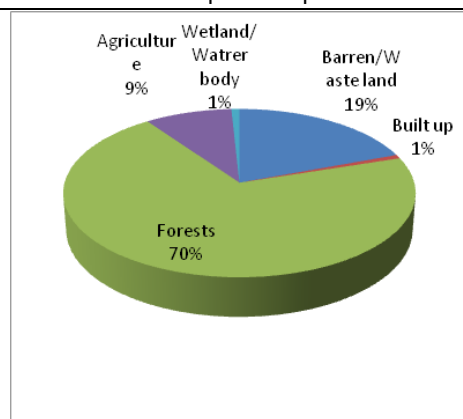
Parameters	Values/Remakes
Electrical Conductivity	varies from 121-1168 mus/cm at 250C
Fluoride	0.7-1.16 in dug well zone, beyond permissible limit in shallow and deep tube well up to 16 ppm.
Iron	0.29 ppm
Arsenic	NA
Type of water	NA

Surface Water

- Major drainage pattern of the district falls under Yamuna river with its tributaries.

Climate and Meteorology

- The average annual rainfall of the district is 1121.5 mm. The rainfall is unevenly distributed over the period of six months from April to September. About 60% of rainfall is received during July to September.

**Biodiversity and Forest**Forest

- The district covers a forest land of 7939 square kilometers. Moderately dense forest and Open forest dominates the region covering 48.10% and 44.76% of the total forest land respectively. Whereas very dense forest covers only 7.12%³⁵.

Flora and Fauna

- In 1952, Karbi Anglong district became home to the Garampani Wildlife Sanctuary, which has an area of 6 km². Nambor Wildlife Sanctuary is another wildlife sanctuary of Karbi Anglong covering 37 km². More than 75% of the district is forested. The main vegetation is Tropical semi-evergreen with patches of Moist Deciduous and wet Evergreen forests in certain areas. The district boasts the largest population of hoolock gibbons in Assam.³⁶

Natural Hazard and Calamities

- The most common vulnerability to the all over state is flood and Seismicity³⁷. Karbi Anglong is also vulnerable to flood which occur almost in every monsoon.

³⁴ National Agricultural Research Project

³⁵ Indian State Forest Report, 2011.

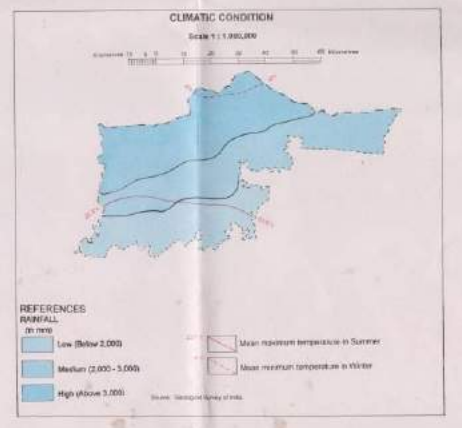
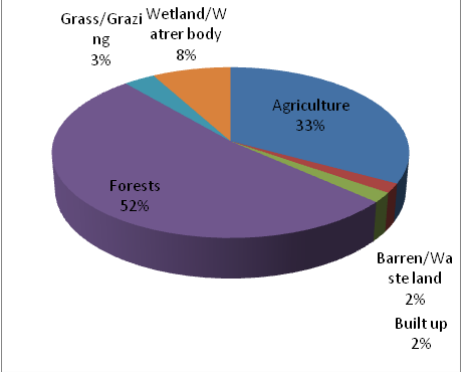
³⁶ https://en.wikipedia.org/wiki/East_Karbi_Anglong_district#Flora_and_fauna

³⁷ All over state is coming under seismic zone V, i.e. very high damage zone

10. Kokrajhar

KOKRAJHAR													
	<p>Topography</p> <ul style="list-style-type: none"> The district is located on the north bank of the mighty Brahmaputra and stretches to the international border with the Kingdom of Bhutan. Kokrajhar district lies roughly within 89°46' East to 90°38' East and 26°19' North to 26°54' North Latitude. 												
	<p>Geology and Soil</p> <ul style="list-style-type: none"> Soils are mainly alluvial in nature composed mixture of sand, clay and silt in varying proportions. The soils in Piedmont Plain have sandy in nature, alkaline to slightly acidic and highly permeable. The soils in flood plains have loamy soil, moderately permeable and are less acidic than piedmont plain soils. <p>Agro climatic zone</p> <ul style="list-style-type: none"> Agro climatic zone: The district falls under the Lower Brahmaputra Valley zone (NARP³⁸). Winter Rice, Autumn Rice, Rape and Mustard, Summer Rice, Jute, Wheat, Mesta, Maize, Niger, Black gram, Lentil, Sesamum, Linseed, Pea, are some of the crops cultivated here. 												
<table border="1"> <thead> <tr> <th>Parameters</th> <th>Values/Remakes</th> </tr> </thead> <tbody> <tr> <td>Electrical Conductivity</td> <td>Permissible limit</td> </tr> <tr> <td>Fluoride</td> <td>Within desirable limit</td> </tr> <tr> <td>Iron</td> <td>0.35 -2.25 mg/l</td> </tr> <tr> <td>Arsenic</td> <td>Not detected.</td> </tr> <tr> <td>Type of water</td> <td>NA</td> </tr> </tbody> </table>	Parameters	Values/Remakes	Electrical Conductivity	Permissible limit	Fluoride	Within desirable limit	Iron	0.35 -2.25 mg/l	Arsenic	Not detected.	Type of water	NA	<p>Surface Water</p> <ul style="list-style-type: none"> Major drainage pattern of the district falls under Gangia, Paponi, Saumukha, Saralaganga and Lonya rivers and their tributaries. <p>Groundwater</p> <ul style="list-style-type: none"> As long-term water level trend does not show any major change so the whole district may be considered as SAFE.
Parameters	Values/Remakes												
Electrical Conductivity	Permissible limit												
Fluoride	Within desirable limit												
Iron	0.35 -2.25 mg/l												
Arsenic	Not detected.												
Type of water	NA												

³⁸ National Agricultural Research Project

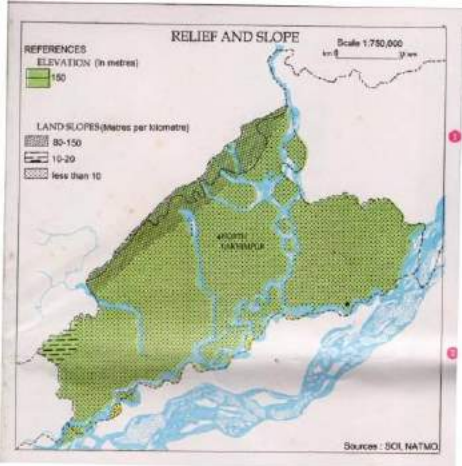
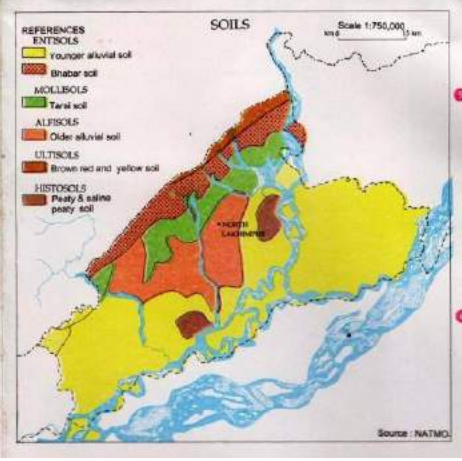
KOKRAJHAR	
 <p style="text-align: center;">CLIMATIC CONDITION SCALE 1 : 1,00,000</p> <p>REFERENCES RAINFALL (in mm) Low (Below 2,000) Medium (2,000-3,000) High (Above 3,000)</p> <p>Mean maximum temperature in Summer Mean minimum temperature in Winter</p>	<h3>Climate and Meteorology</h3> <ul style="list-style-type: none"> The district experiences a Sub-tropical and Humid climate with heavy rainfall and hot summer. The average temperature ranges from minimum 10°C to maximum 35°C throughout the year. The average humidity remains almost same with variation from 62% in winter to 87% in post monsoon period. The average annual rainfall of the district is 3102.4 mm with 110 annual average rainy days.
 <p>Grass/Grazing 3% Wetland/Waterbody 8% Agriculture 33% Forests 52% Barren/Waste land 2% Built up 2%</p>	<h3>Biodiversity and Forest</h3> <p><u>Forest</u></p> <ul style="list-style-type: none"> The district covers a forest land of 1144 square kilometers. Moderately dense forest dominates the region covering 62.58%. Whereas Very dense forest and Open forest covers only 18.18% and 19.23% respectively³⁹. <p><u>Flora and Fauna</u></p> <ul style="list-style-type: none"> In 1990 Kokrajhar district became home to Manas National Park, which has an area of 500 km². It shares the park with four other districts also. Since Chakrashila Wildlife Sanctuary of the district is the protected habitat of endangered Golden Langur and Ultapani Reserve forest is the home of more than 300 different species of butterflies so the district has been declared as the land of Butterflies and Golden Langur. Even different species of butterflies are found in different areas also as well as the Golden Langur is also can be found in Ultapani Reserve Forest. Kokrajhar town has also been declared as the city of Guinness World Record⁴⁰.
<h3>Natural Hazard and Calamities</h3> <ul style="list-style-type: none"> The most common vulnerability to the all over state is flood and Seismicity⁴¹. Some parts of Kokrajhar district is also vulnerable to flood which occur almost in every monsoon. 	

³⁹ Indian State Forest Report, 2011.

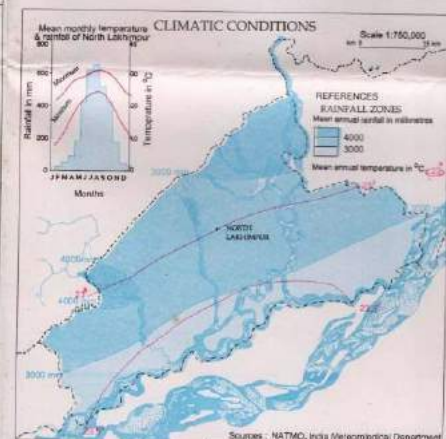
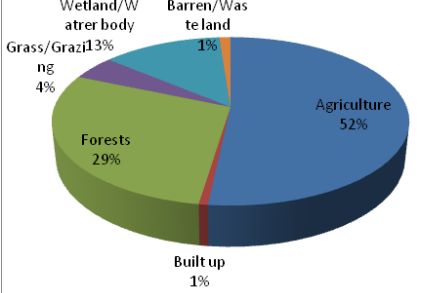
⁴⁰ https://en.wikipedia.org/wiki/Kokrajhar_district#Flora_and_fauna

⁴¹ All over state is coming under seismic zone V, i.e. very high damage zone

11. Lakhimpur

LAKHIMPUR								
 <p>RELIEF AND SLOPE Scale: 1:750,000</p> <p>REFERENCES ELEVATION (in metres) 150</p> <p>LAND SLOPES (metres per kilometre) 40-150 10-20 less than 10</p> <p>Sources: SOI, NATMO</p>	<p>Topography</p> <ul style="list-style-type: none"> Lakhimpur District is situated on the North East corner of Assam and at the north bank of the River Brahmaputra. The district lies between 26°48' and 27°53' Northern latitude and 93°42' and 94°20' East longitude (approx.) 							
 <p>SOILS Scale: 1:750,000</p> <p>REFERENCES ENTSOILS Younger alluvial soil Bhabar soil</p> <p>MOLLISOLS Tara soil</p> <p>ALFISOLS Older alluvial soil</p> <p>ULTISOLS Brown red and yellow soil</p> <p>HISTOSOLS Peaty & saline peaty soil</p> <p>Source: NATMO</p>	<p>Geology and Soil</p> <p>The soils of the district can broadly be classified into the following groups:</p> <ul style="list-style-type: none"> Red Loamy soils: This soil is characterized by low nitrogen, low phosphate and medium to high potash and acidic in nature. Lateritic Soil: The lateritic soils are the product of high leaching and found in hilly region. Soil PH is acidic due to intensive leaching of bases and formation of clay minerals and ferric hydroxides. New Alluvial Soils: The new alluvial soils are found in the flood plain area and are subjected to occasional floods and consequently receive considerable silt deposit after the flood recedes. Soil PH is feebly alkaline and moderately rich in plant nutrient. Older Alluvial Soil: The soils are comparatively more acidic than the newer alluvial soil and hence more crop sensitive. The soils of the district as classified by NBSS and ICAR Nagpur are: Udalfs-Orchaps-Acquents, Fluvent-Aquepts, Aquepts-Aqualfs-Fluvent. <p>Agro climatic zone</p> <ul style="list-style-type: none"> The district falls under the North Bank Plain Zone (NARP⁴²). Rice, Rapeseed & Mustard, Rabi pulse, Black gram, Green gram are some of the major crops cultivated here. 							
<table border="1"> <thead> <tr> <th>Parameters</th> <th>Values/Remakes</th> </tr> </thead> <tbody> <tr> <td>Electrical Conductivity</td> <td rowspan="4">Most of the chemical parameters are within the permissible limit set by BIS, except Fe. Iron content range from 0.13 to 6.90mg/l.</td> </tr> <tr> <td>Fluoride</td> </tr> <tr> <td>Iron</td> </tr> <tr> <td>Arsenic</td> </tr> </tbody> </table>	Parameters	Values/Remakes	Electrical Conductivity	Most of the chemical parameters are within the permissible limit set by BIS, except Fe. Iron content range from 0.13 to 6.90mg/l.	Fluoride	Iron	Arsenic	<p>Surface Water</p> <ul style="list-style-type: none"> Major drainage pattern of the district falls under Subansiri, Ranga Nadi, Dikrong, Boginadi. <p>Groundwater</p> <ul style="list-style-type: none"> As long-term water level trend does not show any major change so the whole district may be considered as SAFE.
Parameters	Values/Remakes							
Electrical Conductivity	Most of the chemical parameters are within the permissible limit set by BIS, except Fe. Iron content range from 0.13 to 6.90mg/l.							
Fluoride								
Iron								
Arsenic								

⁴² National Agricultural Research Project

LAKHIMPUR	
	<h3>Climate and Meteorology</h3> <ul style="list-style-type: none"> The climate of the district is subtropical and humid characterized by high rainfall. The annual rainfall is 3268mm and relative humidity 74 to 89 percent with a mean of 81 percent. The district receives SW monsoon rainfall from the month of April and continues up to September/October. The highest rainfall areas of the district are located near the foothills of Arunachal Himalayas, i.e., in the northern part of the district. The maximum temperature goes up to 35oC during June / July and minimum temperature falls to 8oC in December and January.
	<h3>Biodiversity and Forest</h3> <p><u>Forest</u></p> <ul style="list-style-type: none"> The district covers a forest land of 293 square kilometers. Open forest and moderately dense forest dominates the region covering 58.36% and 40.27% respectively. Whereas Very dense forest covers only 1.36%⁴³. <p><u>Flora and Fauna</u></p> <ul style="list-style-type: none"> In 1996 Lakhimpur district became home to the Bardoibum-Beelmukh Wildlife Sanctuary, which has an area of 11 km². It shares the park with Dhemaji district⁴⁴.
<h3>Natural Hazard and Calamities</h3> <ul style="list-style-type: none"> The most common vulnerability to the all over state is flood and Seismicity⁴⁵. Some parts of Lakhimpur district is also vulnerable to flood which occur almost in every monsoon. 	

⁴³Indian State Forest Report, 2011.

⁴⁴https://en.wikipedia.org/wiki/Lakhimpur_district#History

⁴⁵ All over state is coming under seismic zone V, i.e. very high damage zone

12. Morigaon

MORIGAON											
	<p>Topography</p> <ul style="list-style-type: none"> The district is bounded by the mighty Brahmaputra on the North, KarbiAnglong district on the South, Nagaon District on the East and Kamrup District on the West between 26.15 degrees North latitude and 92 degree East Longitude. 										
	<p>Geology and Soil</p> <p>The soil of the district is very suitable for production of all seasonal paddy and other Rabi and Horticultural crops. The soil of the district has been classified on the basis of chemical composition as follows:-</p> <ul style="list-style-type: none"> Strongly acidic to alkaline Low to medium content of total soluble salts Medium to high phosphate Low to medium inorganic carbon percentage Medium to high in Potash content <p>Agro climatic zone</p> <ul style="list-style-type: none"> The district falls under the Central Brahmaputra Valley Zone (NARP⁴⁶). Summer Paddy, Winter Paddy, Autumn Paddy, Rapeseed & Mustard, Wheat, Black gram, Sugarcane are some of the major crops cultivated here. 										
<table border="1"> <thead> <tr> <th>Parameters</th> <th>Values/Remarks</th> </tr> </thead> <tbody> <tr> <td>Electrical Conductivity</td> <td>NA</td> </tr> <tr> <td>Fluoride</td> <td>0.1 – 0.7 ppm</td> </tr> <tr> <td>Iron</td> <td>0.1 – 2.5 ppm</td> </tr> <tr> <td>Arsenic</td> <td>NA</td> </tr> </tbody> </table>	Parameters	Values/Remarks	Electrical Conductivity	NA	Fluoride	0.1 – 0.7 ppm	Iron	0.1 – 2.5 ppm	Arsenic	NA	<p>Surface Water</p> <ul style="list-style-type: none"> The district is drained by several perennial rivers flowing from south to north. Rivers Kalong and Kopili are two most important rivers.
Parameters	Values/Remarks										
Electrical Conductivity	NA										
Fluoride	0.1 – 0.7 ppm										
Iron	0.1 – 2.5 ppm										
Arsenic	NA										

⁴⁶ National Agricultural Research Project

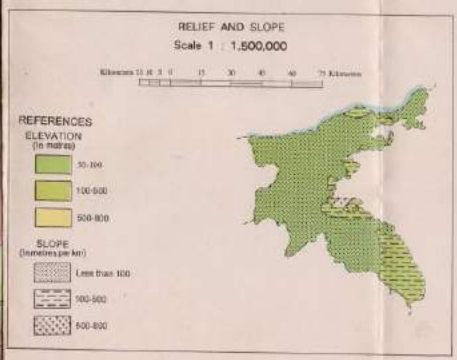
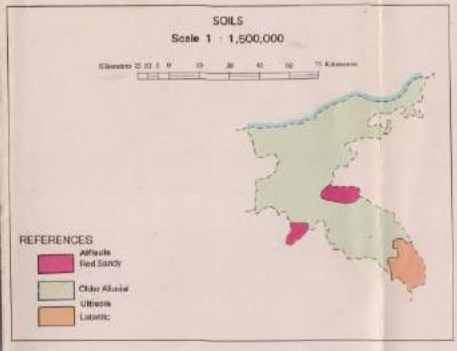
MORIGAON	
	<p>Climate and Meteorology</p> <ul style="list-style-type: none"> The average annual rainfall of the district is 1770 mm out of which monsoon contribution is 83%. The maximum temperature is 29.5°C (average) while minimum temperature is 17.5°C (average). The numbers of rainy days is 24 from May to September. Morigaon district has sub-tropical and humid type of climate. The humidity data reveal that the air is humid throughout the year. It has the value of 67 to 79 % during dry period.
	<p>Biodiversity and Forest</p> <p><u>Forest</u></p> <ul style="list-style-type: none"> The district covers a forest land of 133 square kilometers. Open forest dominates the region covering 64.66% of the total forest land. Whereas moderately dense forest and Very dense forest covers only 30.82% and 4.81% respectively⁴⁷. <p><u>Flora and Fauna</u></p> <ul style="list-style-type: none"> There are three Reserved Forest constituted under Assam Forest Regulation Act, 1891. These are Sunaikuchi, Khulahat, and BuraMayong. There is also one wildlife Sanctuary, named Pobitora Wildlife Sanctuary, located in Mayong which is famous for the Indian one horned Rhinoceros⁴⁸.
<p>Natural Hazard and Calamities</p> <ul style="list-style-type: none"> The most common vulnerability to the all over state is flood and Seismicity⁴⁹. Some parts of Morigaon district is also vulnerable to flood which occur almost in every monsoon. 	

⁴⁷Indian State Forest Report, 2011.

⁴⁸https://en.wikipedia.org/wiki/Morigaon_district#Flora_and_fauna

⁴⁹ All over state is coming under seismic zone V, i.e. very high damage zone

13. Nagaon

NAGAON													
	<p>Topography</p> <ul style="list-style-type: none"> The district extends between 26.3464° N latitude to 92.6840° E longitude. On the north, Nagaon is bounded by Sonitpur district & the Brahmaputra, towards its south lies West Karbi Anglong and North Cachar Hills, towards its east lies the districts of East Karbi Anglong and Golaghat 												
	<p>Geology and Soil</p> <ul style="list-style-type: none"> The alluvial soil is mostly loamy and consists of a mixture of clay and sand in varying proportions, ranging from pure sand on the banks of the Brahmaputra to sticky clay which is considered unfit for cultivation. Marshy soil is chiefly found in the low lying areas. These are black in colour. The red soil generally occupies the hill slopes and foot hills. Occasionally lateritic soil is also found near about Lumding. <p>Agro climatic zone</p> <ul style="list-style-type: none"> The district falls under the Central Brahmaputra Valley Zone (NARP⁵⁰). Summer Paddy, Winter Paddy, Autumn Paddy, Rapeseed & Mustard, Wheat, Black gram, Sugarcane are some of the major crops cultivated here. 												
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Parameters</th> <th style="text-align: left;">Values/Remarks</th> </tr> </thead> <tbody> <tr> <td>Electrical Conductivity</td> <td>Permissible limit</td> </tr> <tr> <td>Fluoride</td> <td>Within desirable limit</td> </tr> <tr> <td>Iron</td> <td>0.35 -2.25 mg/l</td> </tr> <tr> <td>Arsenic</td> <td>Not detected</td> </tr> <tr> <td>Type of water</td> <td>NA</td> </tr> </tbody> </table>	Parameters	Values/Remarks	Electrical Conductivity	Permissible limit	Fluoride	Within desirable limit	Iron	0.35 -2.25 mg/l	Arsenic	Not detected	Type of water	NA	<p>Surface Water</p> <ul style="list-style-type: none"> The district is drained Brahmaputra and its tributaries mainly Kolong, Kopili, Sonai and Diyang. <p>Groundwater</p> <ul style="list-style-type: none"> In Nagaon district stage of ground water development is 39 %, which shows under the SAFE category. As long-term water level trend does not show any major change so the whole district may be considered as SAFE.
Parameters	Values/Remarks												
Electrical Conductivity	Permissible limit												
Fluoride	Within desirable limit												
Iron	0.35 -2.25 mg/l												
Arsenic	Not detected												
Type of water	NA												

⁵⁰ National Agricultural Research Project

NAGAON	
	<h3>Climate and Meteorology</h3> <ul style="list-style-type: none"> The climate is in general Monsoon type. But there are some differences from the other districts of Assam. Rainfall increases towards the east and the west of Assam from this district. The climate is of an extreme type compared to other districts of Assam. The pattern of rainfall is such that the south is usually dry and the north is relatively rainier. Rainfall from south to north increases from 1000 mm per annum to 2000 mm per annum. The area around Lanka is a semi desert. The cold season is from December to February. Floods create havoc usually from June to October. The monsoon lasts from April to May. The post monsoon season lasts from October to November. The average rainfall is about 1750 mm. Deforestation, El-Nino effect; speedy urbanization and global warming in general are changing the rainfall pattern of the district. Today the district has a vegetation cover of only 12%⁵¹.
	<h3>Biodiversity and Forest</h3> <p><u>Forest</u></p> <ul style="list-style-type: none"> The district covers a forest land of 796 square kilometers. Open forest and moderately dense forest dominates the region covering 50.62% and 44.34% respectively of the total forest land. Whereas moderately dense forest and Very dense forest covers only 5.02%⁵². <p><u>Flora and Fauna</u></p> <ul style="list-style-type: none"> In 1974 Nagaon district became home to Kaziranga National Park, which has an area of 175 km² within nagaon district. It shares the park with Golaghat district. It is also home to the Laokhowa Wildlife Sanctuary⁵³.
<h3>Natural Hazard and Calamities</h3> <ul style="list-style-type: none"> The most common vulnerability to the all over state is flood and Seismicity⁵⁴. Some parts of Nagaon district is also vulnerable to flood which occur almost in every monsoon. 	

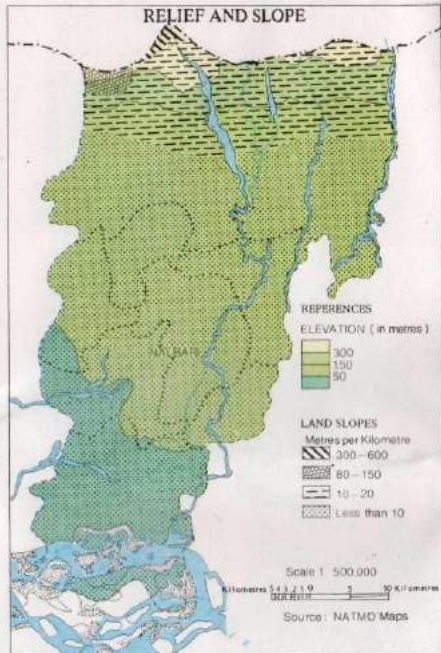
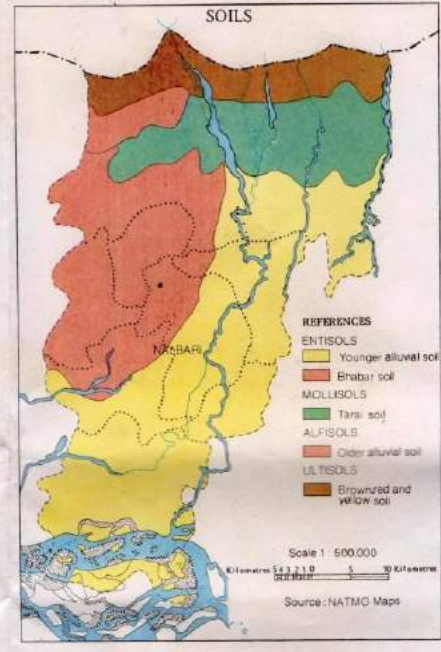
⁵¹<http://nagaon.gov.in/geog.html>

⁵²Indian State Forest Report, 2011.

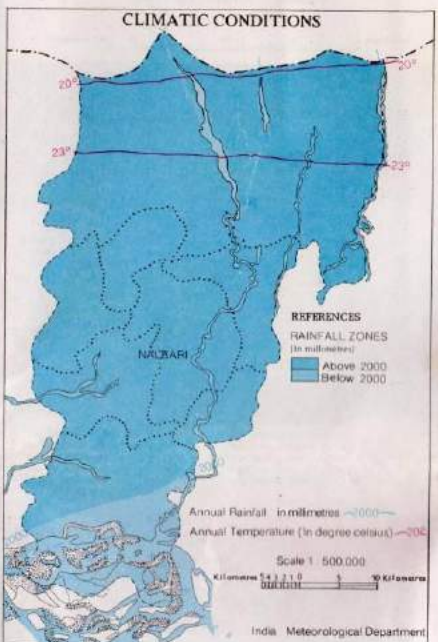
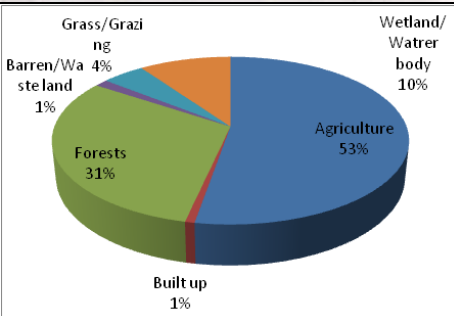
⁵³https://en.wikipedia.org/wiki/Nagaon_district#Flora_and_fauna

⁵⁴ All over state is coming under seismic zone V, i.e. very high damage zone

14. Nalbari

NALBARI													
 <p>RELIEF AND SLOPE</p> <p>REFERENCES ELEVATION (in metres) 300 150 50</p> <p>LAND SLOPES Metres per Kilometre 300-600 80-150 10-20 Less than 10</p> <p>Scale 1 : 500,000 Kilometres 0 5 10 15 20 Source : NATMO Maps</p>	<p>Topography</p> <ul style="list-style-type: none"> Nalbari District is situated between 26°N and 26.51° N latitude and 91° E and 91.47° E longitude. The north and west side of the district is bounded by Baksa and Barpeta districts respectively .The southern and eastern side of the district is bounded by Kamrup district. The entire area of the District is situated at the plains of the Brahmaputra Valley. The tributaries of the Brahmaputra, Nona, Buradia, Pagaldia, Borolia and Tihu that originate from the foothills of the Himalayan Range are wild in nature and have enormous contribution towards the agrarian economy of the district. 												
 <p>SOILS</p> <p>REFERENCES ENTISOLS Younger alluvial soil Brabar soil MOLLISOLS Tara soil ALFISOLS Older alluvial soil ULFISOLS Brown and yellow soil</p> <p>Scale 1 : 500,000 Kilometres 0 5 10 15 20 Source : NATMO Maps</p>	<p>Geology and Soil</p> <p>The soil of the district can broadly be classified into two groups:</p> <ul style="list-style-type: none"> Deep reddish clayey soil in forest and hilly area and Alluvial soil of Recent age occurring along the alluvial plains of the Brahmaputra river. The red clayey alluvial highlands of the district are ideally suited for the tea and sugarcane cultivation. The swampy and very low lands are characterised by deep grey silty soil suitable for jute cultivation. <p>Agro climatic zone</p> <ul style="list-style-type: none"> The district falls under the Lower Brahmaputra Valley Zone (NARP⁵⁵). Rice, Rapeseed & Mustard, Pea, Lentil, Black gram some of the major crops cultivated here. 												
<table border="1"> <thead> <tr> <th>Parameters</th> <th>Values/Remarks</th> </tr> </thead> <tbody> <tr> <td>Electrical Conductivity</td> <td>Permissible limit</td> </tr> <tr> <td>Fluoride</td> <td>Within desirable limit</td> </tr> <tr> <td>Iron</td> <td>0.2-1.40</td> </tr> <tr> <td>Arsenic</td> <td>Not detected</td> </tr> <tr> <td>Type of water</td> <td>NA</td> </tr> </tbody> </table>	Parameters	Values/Remarks	Electrical Conductivity	Permissible limit	Fluoride	Within desirable limit	Iron	0.2-1.40	Arsenic	Not detected	Type of water	NA	<p>Surface Water</p> <ul style="list-style-type: none"> The district is drained by Pagladia river and its tributaries. <p>Groundwater</p> <ul style="list-style-type: none"> The stage of ground water development is the under SAFE category.
Parameters	Values/Remarks												
Electrical Conductivity	Permissible limit												
Fluoride	Within desirable limit												
Iron	0.2-1.40												
Arsenic	Not detected												
Type of water	NA												


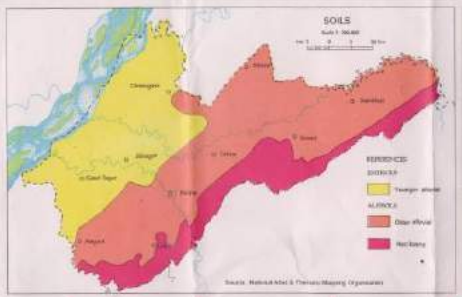
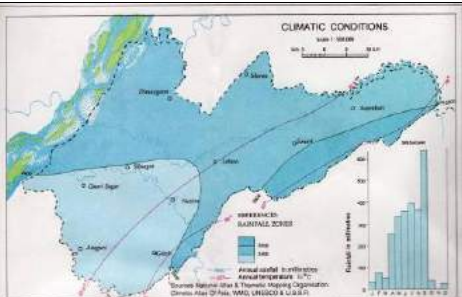
⁵⁵ National Agricultural Research Project

NALBARI															
 <p>CLIMATIC CONDITIONS</p> <p>Annual Rainfall (in millimeters) ~2000 Annual Temperature (in degree celsius) ~20°C</p> <p>Scale 1:500,000</p> <p>India Meteorological Department</p>	<p>Climate and Meteorology</p> <ul style="list-style-type: none"> The district experiences a tropical humid climate with heavy rainfall and hot summer. The average temperature ranges from minimum 8°C to maximum 34°C throughout the year. The average humidity remains almost same with variation from 62% in winter to 87% in post monsoon period. The average annual rainfall of the district is 1904.4 mm with minimum rainfall as zero mm in November to maximum 395 mm during August. The maximum rainfall occurs during the period from April to August. Heavy rainfall starts from April with the onset of monsoon and continues till August. Then it recedes afterward. 														
 <table border="1"> <caption>Land Use Distribution</caption> <thead> <tr> <th>Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Agriculture</td> <td>53%</td> </tr> <tr> <td>Forests</td> <td>31%</td> </tr> <tr> <td>Wetland/Water body</td> <td>10%</td> </tr> <tr> <td>Grass/Grazing</td> <td>4%</td> </tr> <tr> <td>Barren/Wasteland</td> <td>1%</td> </tr> <tr> <td>Built up</td> <td>1%</td> </tr> </tbody> </table>	Category	Percentage	Agriculture	53%	Forests	31%	Wetland/Water body	10%	Grass/Grazing	4%	Barren/Wasteland	1%	Built up	1%	<p>Biodiversity and Forest</p> <p><u>Forest</u></p> <ul style="list-style-type: none"> The district covers a forest land of 282 square kilometers. Open forest dominates the region covering 73.75% of the total forest land. Whereas moderately dense forest and Very dense forest covers only 33.65% and 1.41% respectively⁵⁶. The region possesses some valuable species like Goman, Titasopa, Uriam, Sonaru, Hallong, Sam, Simul, Khoira and Sisso which are abundantly found in the northern part of the district.
Category	Percentage														
Agriculture	53%														
Forests	31%														
Wetland/Water body	10%														
Grass/Grazing	4%														
Barren/Wasteland	1%														
Built up	1%														
<p>Natural Hazard and Calamities</p> <ul style="list-style-type: none"> The most common vulnerability to the all over state is flood and Seismicity⁵⁷. Some parts of Nalbari district is also vulnerable to flood which occur almost in every monsoon. 															

⁵⁶Indian State Forest Report, 2011.

⁵⁷ All over state is coming under seismic zone V, i.e. very high damage zone

15. Sivasagar

SIVASAGAR									
	<p>Topography</p> <ul style="list-style-type: none"> Sivasagar District is situated between 94.25° and 95.25° East Longitude and 21.45° and 27.15° North Latitude. There is no hill area in the district. The Southern part extends up to the foot hills of Nagaland and it is well drained and high land and suitable for Tea plantation. 								
	<p>Geology and Soil</p> <ul style="list-style-type: none"> Geologically, the district is a part of the Brahmaputra valley covered by recent alluvial deposits showing wide variations from place to place. Approximate thickness of this formation is 200 to 300 m. Soil is suitable for cultivation. High land is suitable for vegetable, pulses and Tea and other garden crops. <p>Agro climatic zone</p> <ul style="list-style-type: none"> The district falls under the Upper Brahmaputra Valley Zone (NARP⁵⁸). Winter Rice, Autumn Rice, Summer Rice, Wheat, Green gram, Black gram, Peas, Rape and Mustard, Sugarcane, Jute are some of the major crops cultivated here. 								
<table border="1"> <thead> <tr> <th>Parameters</th> <th>Values/Remarks</th> </tr> </thead> <tbody> <tr> <td>Electrical Conductivity</td> <td rowspan="5">Sporadic occurrence of iron</td> </tr> <tr> <td>Fluoride</td> </tr> <tr> <td>Iron</td> </tr> <tr> <td>Arsenic</td> </tr> <tr> <td>Type of water</td> </tr> </tbody> </table>	Parameters	Values/Remarks	Electrical Conductivity	Sporadic occurrence of iron	Fluoride	Iron	Arsenic	Type of water	<p>Surface Water</p> <ul style="list-style-type: none"> The district is drained by Brahmaputra, Janji, Dikhow, Disang, Namdang, Mitong, Dorika Rivers. <p>Groundwater</p> <ul style="list-style-type: none"> The stage of ground water development is the under SAFE category.
Parameters	Values/Remarks								
Electrical Conductivity	Sporadic occurrence of iron								
Fluoride									
Iron									
Arsenic									
Type of water									
	<p>Climate and Meteorology</p> <ul style="list-style-type: none"> The climate of the district is humid and sub-tropical with maximum temperature ranging from 27° to 38°C in the summer and minimum winter temperature varying between 3.4° and 11°C. Humidity is very high ranging from 74 to 87 per cent. The extreme humidity causes sweltering conditions during June to September. 								

⁵⁸ National Agricultural Research Project

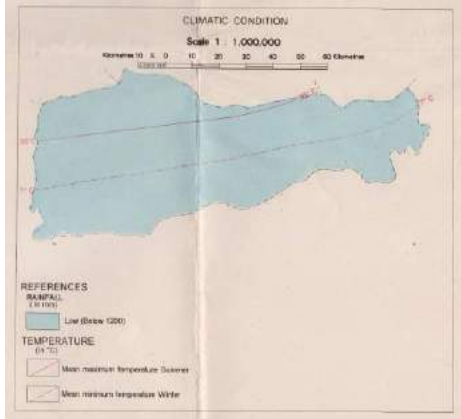
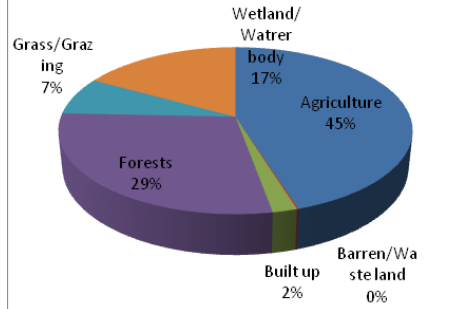
SIVASAGAR	
	<p>Biodiversity and Forest</p> <p><u>Forest</u></p> <ul style="list-style-type: none"> The district covers a forest land of 695 square kilometers. Open forest dominates the region covering 78.12% of the total forest land. Whereas moderately dense forest and Very dense forest covers only 20.71% and 1.15% respectively⁵⁹.
<p>Natural Hazard and Calamities</p> <ul style="list-style-type: none"> The most common vulnerability to the all over state is flood and Seismicity⁶⁰. Some parts of Sivasagar district is also vulnerable to flood which occur almost in every monsoon. 	

16. Sonitpur

SONITPUR	
	<p>Topography</p> <ul style="list-style-type: none"> The district is located on the Northern Bank of River Brahmaputra between 92°57' - 93° East Longitude and 26° 50' - 27° 01' North Latitude. Located between mighty Brahmaputra River and Himalayan foothills of Arunachal Pradesh, the district is largely plain with some hills. Brahmaputra River forms the south boundary of the district. A number of rivers which originate in the Himalayan foothills flow southwards and ultimately fall in Brahmaputra River.
	<p>Geology and Soil</p> <p>The soils of the district can broadly be classified into the following groups:</p> <ul style="list-style-type: none"> Red Loamy soils, found in the northern border of the district, with low nitrogen, low phosphate and medium to high potash and acidic in nature. Lateritic Soil, found in hilly region, acidic in nature and poor plant nutrient. New Alluvial Soil, found in the flood plain area and is subjected to occasional floods and consequently receives considerable silt deposit after the flood recedes. Soil PH is feebly alkaline and moderately rich in plant nutrient. Older Alluvial Soil, are comparatively more acidic than the newer alluvial soil and hence more crop sensitive.

⁵⁹Indian State Forest Report, 2011.

⁶⁰ All over state is coming under seismic zone V, i.e. very high damage zone

SONITPUR									
<p style="text-align: center;">Agro climatic zone</p> <ul style="list-style-type: none"> The district falls under the Lower Brahmaputra Valley Zone (NARP⁶¹). Paddy, Wheat, Maize, Linseed, Rapeseed/mustard, Black gram, Green gram, Arahar, Lentil, are some of the major crops cultivated here. 									
<table border="1"> <thead> <tr> <th>Parameters</th> <th>Values/Remarks</th> </tr> </thead> <tbody> <tr> <td>Electrical Conductivity</td> <td rowspan="5">Most of the chemical parameters are within the permissible limit set by BIS, except higher content of iron.</td> </tr> <tr> <td>Fluoride</td> </tr> <tr> <td>Iron</td> </tr> <tr> <td>Arsenic</td> </tr> <tr> <td>Type of water</td> </tr> </tbody> </table>	Parameters	Values/Remarks	Electrical Conductivity	Most of the chemical parameters are within the permissible limit set by BIS, except higher content of iron.	Fluoride	Iron	Arsenic	Type of water	<p style="text-align: center;">Surface Water</p> <ul style="list-style-type: none"> The district is drained by Jia Bharali, Gabharu, Ghiladhari, Bargang, Belsiri Rivers.
Parameters	Values/Remarks								
Electrical Conductivity	Most of the chemical parameters are within the permissible limit set by BIS, except higher content of iron.								
Fluoride									
Iron									
Arsenic									
Type of water									
	<p style="text-align: center;">Climate and Meteorology</p> <ul style="list-style-type: none"> The climate of the district is subtropical and humid characterized by high rainfall. The annual rainfall is 2,173 mm and relative humidity 65 to 85 percent. The district receives SW monsoon rainfall from the month of June and continues up to September/October. The highest rainfall areas of the district are located near the foothills of Arunachal Himalayas, i.e., in the northern part of the district. The maximum temperature goes up to 37.5°C during June / July and minimum temperature falls to 7.6°C in December and January. 								
	<p style="text-align: center;">Biodiversity and Forest</p> <p><u>Forest</u></p> <ul style="list-style-type: none"> The district covers a forest land of 960 square kilometers. Open forest and moderately dense forest dominates the region covering 65% and 29.16% respectively of the total forest land. Whereas Very dense forest covers only 5.83%⁶². <p><u>Flora and Fauna</u></p> <ul style="list-style-type: none"> In 1998 Sonitpur district became home to Nameri National Park, which has an area of 200 km². It is also home to Orang National Park, which it shares with Darrang district. Orang was established in 1999 and has an area of 79 km². Sonitpur is home to two wildlife sanctuaries, namely Burachapori Wildlife Sanctuary and Sonai Rupai Wildlife Sanctuary. It is also home to Behali, Naduar, Charduar Reserve Forests⁶³. 								

⁶¹ National Agricultural Research Project

⁶² Indian State Forest Report, 2011.

⁶³ https://en.wikipedia.org/wiki/Sonitpur_district#Geography

SONITPUR**Natural Hazard and Calamities**

- The most common vulnerability to the all over state is flood and Seismicity⁶⁴. Some parts of Sonitpur district is also vulnerable to flood which occur almost in every monsoon.

⁶⁴ All over state is coming under seismic zone V, i.e. very high damage zone

Annex 4

ANNEXURE 4: BIODIVERSITY HOTSPOTS

1. List of National Parks and Wildlife Sanctuaries under project districts

Name of District	National Parks	Wildlife Sanctuaries ⁶⁵	Elephant Reserves	Recognized Important Bird area as per Bird Life International
Nagaon	Kaziranga NP	Lawkhowa WLS	Kaziranga-Karbi Anglong	Deobali Jalah
			Dhansiri-Lungding	Kaziranga NP
				Laokhowa and Burhachapori Sanctuaries
Sonitpur	Kaziranga NP	Burachapori WLS	Sonitpur	Behali Reserve Forest
	Nameri NP	SonaiRupai WLS		Kaziranga NP
	Rajiv Gandhi Orang NP			Laokhowa and Burhachapori Sanctuaries
				Nameri National Park
				Orang National Park
	Barpeta			
KarbiAnglong		East Karbi Anglong WLS	Kaziranga-Karbi Anglong	Dhansiri Reserve Forest
			Dhansiri-Lungding	East and North Karbi Anglong Wildlife Sanctuaries
		Garampani WLS		Garampani, Nambor and Doigrung
		North Karbi Anglong WLS		Lumding-Marat Longri
		Marat Longri WLS		
		Nambor WLS		
		Nambor Doigrung WLS		
Kamrup				Chandubi Lake and adjoining areas
				Jengdia Beel and Satgaon
Dhubri				Chakrasila Complex
Golaghat	Kaziranga NP		Kaziranga-Karbi Anglong	Garampani, Nambor and Doigrung
				Kaziranga NP
Kokrajhar		Chakrashila WLS	Chirang-Ripu	Chakrasila Complex
Lakhimpur				Ripu and Chirang-Reserve Forest
				Bordoibam-Bilmukh Bird Sanctuary
				Bordoloni-Sampora
				Kuarbari-Dalani
				Pabho Reserve Forest
Darrang	Part of Orang National Park	-	-	Subansiri
Cachar		Barail WLS		Orang National Park
				Barail Range
				Habang
				Inner Line, Kathakal and Barak Reserve Forests

⁶⁵Statistical Handbook of Assam 2013 and 2014

Name of District	National Parks	Wildlife Sanctuaries ⁶⁵	Elephant Reserves	Recognized Important Bird area as per Bird Life International
Sibsagar		Pani-Dihing Bird WLS		Pani-Dihing Bird Sanctuary Sibsagar Tanks
Jorhat		Hollongapar Gibbon WLS		Gibbon (Hollongapar) Sanctuary Jhanjimukh-Kokilamukh Majuli
Goalpara				UrpodBeel
Morigaon		Porbitora WLS		Pabitora Wildlife Sanctuary
Nalbari	-	-	-	-

2. Rare Threatened and Endangered Species of Project District

- Pygmy Hog , *Porculasalvania* (Critically Endangered)
- Greater One Horned Rhinoceros, *Rhinoceros unicornis* Gorh(Vulnerable)
- Wild , *Bubalusarnee* BonoriaMoh(Endangered)
- Asian Elephant ,*Elephas maximus* Hati(Endangered)
- RoyalBengal,Tiger *Pantheratigris* DhekiapatiaBagh(Endangered)
- Swamp Deer, *Rucervusduvauceli* DolHorina(Vulnerable)
- Sambar, *Rusa unicolor* HorPahu(Vulnerable)
- Hoolock or White Browed Gibbon, *Hylobateshoolock* Halou Bandar Endangered (Project districts in the south bank of the river Brahmaputra)
- Hog Deer *Axis porcinus* KhotiaPahu(Endangered)
- Capped Langur or LeafMonkey *Trachypithecuspileatus* Tupipindha HanumanBandar (Vulnerable)
- Assamese Macaque *Macacaassamensis* Jati Bandar Near (Threatened)
- Leopard *Pantherapardus* NaharphutukiBagh(Vulnerable)
- Bear *Melursusursinus* Mati Bhaluk(Vulnerable)
- Fishing Cat *Prionailurusviverrinus*MasuoimEkuri(Vulnerable)
- CommonOtter *Lutralutra* Ud (Near Threatened)
- HogBadger *Arctonyxcollaris* –(Vulnerable)
- Pangolin *Manis crassicaudata* (Endangered)
- Gangetic Dolphin *Platanistaganetica* Hihu(Endangered)
- Himalayan Bear *Ursusthibetanus* Kolabhaluk(Vulnerable)
- Golden Langur *Trachypithecusgeeii* (Endangered Endemic (Kokrajhar, Bangaigaon))
- Bengal Slow lorisNycticeusbengalensis (Vulnerable)
- Hispid Hare *Caprolagushispidus*(Endangered)
- Indian Gaur *Bosgaurus* Gaur (Vulnerable)
- Clouded Leopard *Neofelisnebulosa* (Vulnerable)
- Ganges River Dolphin *Platanistaganetica* Endangered (National Aquatic Animal)
- Asiatic Golden Cat *Catopumatemminckii*(Near Threatened)

Schedule I

- Binturong *Arctictis binturong*,
- Himalayan Brown Bear *Ursusarctos*,
- Capped Langur *Trachypithecuspileatus*,
- Ganges River Dolphin *Platanistaganetica*,
- Chinese Pangolin *Manis pentadactyla*,
- Clouded Leopard *Neofelisnebulosa*,
- Fishing Cat *Prionailurusviverrinus*,
- Gaur *Bosgaurus*,
- Golden Cat *Catopumatemminckii*,
- Golden Langur *Trachypithecusgeeii*,
- Hispid Hare *Caprolagushispidus*,
- Hog Badger *Arctonyxcollaris*
- Western Hoolock Gibbon *Hoolockhoolock*,

- Asian Elephant *Elephas maximus*,
- Phayre's Leaf Monkey *Trachypithecus phayrei*,
- Common Leopard *Panthera pardus*,
- Leopard Cat *Prionailurus bengalensis*,
- Pangolin *Manis crassicaudata*,
- Pygmy Hog *Porcula salvanius*
- Greater One-horned Rhinoceros *Rhinoceros unicornis*,
- Sloth Bear *Melursus ursinus*
- Slow Loris *Nycticebus bengalensis*,
- Swamp Deer *Rucervus duvaucelii*,
- Tiger *Panthera tigris*,
- Asiatic Wild Buffalo *Bubalus arnee*

Schedule II

- Assamese Macaque *Macaca assamensis*,
- Pig-tailed Macaque *Macaca leonine*
- Rhesus Macaque *Macaca mulatta*,
- Stump-tailed macaque *Macaca arctoides*
- Indian wild Dog *Cuon alpinus alpinus*,
- Large Indian Civet *Viverricivictor*
- Small Indian Civet *Viverricivictor zibetha*,
- Indian Fox *Vulpes bengalensis*
- Jungle Cat *Felis chaus*,
- Common Otter *Lutra lutra*

Schedule III

- Barking deer *Muntiacus muntjac*,
- Hog deer *Axis porcinus*,
- Sambar *Cervus unicolor*
- Wild Pig *Sus scrofa*

3. Food plants of silkworm in Assam

Type of Silk		Local name	Botanical name
Muga	Major Plant	Som	<i>Machilus bombycina</i>
		Soalu	<i>Litsea polyantha</i>
	Second Alternative of food plant	Digloti	<i>Litsea salicifolia</i>
		Mejankori	<i>Litsea citrate</i>
		Kathalua	<i>Litsea vitida</i>
		Panchapa	<i>Machilus oblonga</i>
		Champa	<i>Michilia champaka</i>
	Third alternative of food plant	Bhomloti	<i>Celastrus monosperma</i>
Bajramani		<i>Zanthoxylum rhesta</i>	
Mulberry	Major Plant	Nuni	<i>Morus indica</i>
	Other variety	--	<i>M. Sereta</i>
		Bola	<i>L. laevioat</i>
		Improved Berhampores variety	S-2, S-799, C-779, S-54
Eri	Major Plant	Castor	<i>Ricinus communis</i>
		Kessuru	<i>Heteropanax fragrans</i>
		Bar Kessuru	<i>Alanthus olandulosa</i>
	Alternative	Tapioca	<i>Manihot cecalisemia</i>
		Gulanha	<i>Plumeria acutifolia</i>

Annex 5

ANNEXURE 5: AQUATIC MANAGEMENT PLAN

1. INTRODUCTION

The wetlands, vital parts of the hydrological cycle, are lifelines of society on account of their wide ranging ecosystem goods and services such as water supply and purification; waste assimilation; buffering extreme events as floods, droughts, storms and cyclones; groundwater recharge; erosion control; microclimate regulation; and aesthetic enhancement of landscapes and the wetlands also support significant recreational, social and cultural activities, and are a part of our rich cultural heritage and the ecosystems harbour a range of floral and faunal diversity, including several rare, endangered and endemic species, and support complex food chains and the wetlands can help mitigate and adapt to changing climate through their ability to act as carbon sinks, regulate water regimes, prevent erosion and provide habitat to biodiversity under stress.

Many wetlands are seriously threatened by reclamation and degradation through drainage and landfill, pollution (discharge of domestic and industrial effluents, disposal of solid wastes), hydrological alterations (water withdrawal and inflow changes) and over-exploitation of their natural resources resulting in loss of biodiversity and disruption in goods and services provided by wetlands.

The clause (g) of article 51A of the Constitution stipulates that it shall be the duty of every citizen of India **"to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures"**;

The **National Environment Policy, 2006** recognises the ecological services provided by wetlands and emphasizes the need to set up a regulatory mechanism for all wetlands so as to maintain their ecological character, and ultimately support their integrated management.

Table 1: Wetlands under each project districts

Sl. No.	District	Geographic area (Sq.km)	Wetland area (sq.km)	% of total wetland area	% of district geographic area
1	Kokrajhar	3129	248.33	3.25	7.94
2	Dhubri	2838	565.38	7.4	19.92
3	Goalpara	1824	332.21	4.35	18.21
4	Barpeta	3245	590.38	7.72	18.19
5	Kamrup (2 districts)	4345	436.55	5.71	10.05
6	Nalbari	2257	201.4	2.63	8.92
7	Darrang	3481	489.83	6.41	14.07
8	Marigaon	1704	287.37	3.76	16.86
9	Nagaon	3831	356.95	4.67	9.32
10	Sonitpur	5324	834.27	10.91	15.67
11	Lakhimpur	2277	273.07	3.57	11.99
12	Sibsagar	2668	125.82	1.65	4.72
13	Jorhat	2851	459.79	6.02	16.13
14	Golaghat	3502	436.35	5.71	12.46
15	KarbiAnglong	10434	58.10	0.76	0.56
16	Cachar	3786	104.19	1.36	2.75

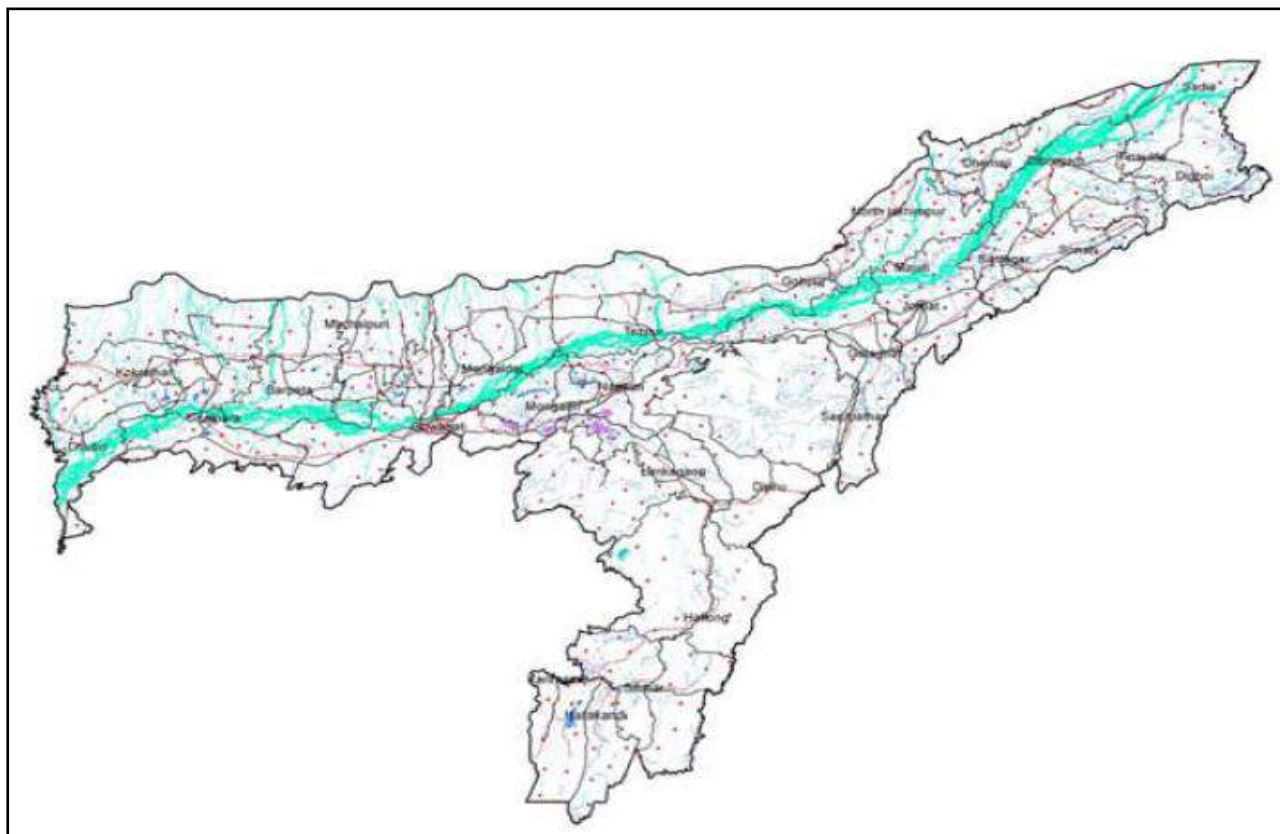


Figure 1: Map showing Wetlands of Assam

1.1 Management Plan Purpose and Scope

With increasing development, recreation and economic pressures, our aquatic resources have the potential to be significantly impacted, either directly or indirectly. These potential impacts to resources can reduce the health and viability of the ecosystems that contain them, requiring active management to ensure the long-term health of the entire network. Effective management plans for the aquatic preserves are essential to address this goal and each site's own set of unique challenges. The purpose of these plans is to incorporate, evaluate and prioritize all relevant information about the site into a cohesive management strategy, allowing for appropriate access to the managed areas while protecting the long-term health of the ecosystems and their resources.

1.2 Administrative Rules

According to The Wetlands (Conservation and Management) Rules, 2010, *Section 4* restricts the activities within wetlands, which are:

- (1) The following activities within the wetlands shall be prohibited, namely:-
 - (i) reclamation of wetlands;
 - (ii) setting up of new industries and expansion of existing industries;
 - (iii) manufacture or handling or storage or disposal of hazardous substances covered under the Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 notified vide S.O. No. 966(E), dated the 27th November, 1989 or the Rules for Manufacture, Use, Import, Export and Storage of Hazardous Micro-organisms/Genetically engineered organisms or cells notified

vide GSR No. 1037(E), dated the 5th December, 1989 or the Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008 notified vide S.O. No. 2265(E), dated the 24th September, 2008;

- (iv) solid waste dumping: provided that the existing practices, if any, existed before the commencement of these rules shall be phased out within a period not exceeding six months from the date of commencement of these rules;
- (v) discharge of untreated wastes and effluents from industries, cities or towns and other human settlements: provided that the practices, if any, existed before the commencement of these rules shall be phased out within a period not exceeding one year from the date of commencement of these rules;
- (vi) any construction of a permanent nature except for boat jetties within fifty metres from the mean high flood level observed in the past ten years calculated from the date of commencement of these rules;
- (vii) any other activity likely to have an adverse impact on the ecosystem of the wetland to be specified in writing by the Authority constituted in accordance with these rules.

(2) The following activities shall not be undertaken without the prior approval of the State Government within the wetlands, namely:-

- (i) withdrawal of water or the impoundment, diversion or interruption of water sources within the local catchment area of the wetland ecosystem;
- (ii) harvesting of living and non-living resources;
- (iii) grazing to the level that the basic nature and character of the biotic community is not adversely affected;
- (iv) treated effluent discharges from industries, cities or towns, human settlements and agricultural fields falling within the limits laid down by the Central Pollution Control Board or the State Pollution Control Committee, as the case may be;
- (v) plying of motorized boat, if it is not detrimental to the nature and character of the biotic community;
- (vi) dredging, only if the wetland is impacted by siltation;
- (vii) construction of boat jetties;
- (viii) activities within the zone of influence, as per the definition of wetlands, that may directly affect the ecological character of the wetland;
- (ix) facilities required for temporary use, such as pontoon bridges, that do not affect the ecological character of the wetland;
- (x) aquaculture, agriculture and horticulture activities within the wetland;
- (xi) repair of existing buildings or infrastructure including reconstruction activities;
- (xii) any other activity to be identified by the Authority.

The Assam Fishery Rules 1953

Rule No 23-A.

Restriction on fishing during breeding season on catching and selling of under sized fish.-

(1) Catching of brood fish (fish carrying eggs and sperm) of the following species, namely-*Rohu, Catla, (Bahu), Mrigal, Mali (Calbasu), Chital, Kharia, Pithia (Mahasol), Gharia and Kuri (Gonius)* is prohibited

during season beginning from the first day of the month of May and ending on the fifteen day of the month of July, both days inclusive, in any proclaimed fishery.

(2) Catching and killing, by any method, of fish for any purpose whatsoever including consumption and selling of under size fish of the following species, namely- *Rohu*, *Catla*, *Bahu*, *Mrigal*, *Chital*, *Kharia*, *Pithia (Mahasul)* *Ghari* below 23 cm in length and *Mali (Calbasu)*, *Gonius*, *Kurhi/ Bhagan* below 10 cm in length is prohibited between the first day of August and 31st of October:

Provided that the above restriction may be relaxed by the order of the Directed of Fineries in writing, for piscicultural purposes only.

(3) All under sized fish specified in sub-rule (2) above caught in the nets shall either be let off into the fishery or supplied to the Fisheries Department by the lessee in live conditions at the rate to be fixed by Government from time to time.”]2

Rule No 24

No movable *Bana* with gap less than 7 cm sq. shall be used for fishing between the first day of the month of May and the fifteen day of the month of July, both days inclusive, in any rivers, *Dobas or Bees* or Fisheries.”

Bana with less than 7 cm. sq. gaps fixed at the mouth of *Beels or Dobas* or at the boundaries of River Fisheries by which water is drained out it permissible to be used only during fishing season excepting the period between the first day of the month of May and the fifteen day of the month of July of the year, both days inclusive.”

Table 2: List of available Fish Species in Assam

Sl. No.	Assamese Name	English Name	Scientific Name
1.	Salo/ Chalo	Gangetic hair fin anchovy	<i>Setipinnaphasa</i>
2.	Karoti	Indian river shed	<i>Gudusiachapra</i>
3.	Karoti	Burmese river shed	<i>Gudusiavariiegata</i>
4.	Karoti	Ganges river gizzard shad	<i>Gonialosamanmina</i>
5.	Ilish	Indian shad	<i>Hilsailisha</i>
6.	Chital	Humped feather back	<i>Notopteruschitala</i>
7.	Kandhuli	Feather back	<i>Notopterusnotopterus</i>
8.	Laupatia/ Laupati/ Herbeggi	Indian hatchet fish/ Indian glass barb	<i>Chela laubuca</i>
9.	Selkona	Chela	<i>Chela atpar</i>
10.	Laupati	Silver hatchet chela	<i>Chela cachius</i>
11.	Selkona	Large razorbelley minnow	<i>Salmostomabacalia</i>
12.	Selkona	Fine scale razorbelley minnow	<i>Oxygasterphulo</i>
13.	Selkona	Gora chela	<i>Oxygastergora</i>
14.	Silkamura	Gara	<i>Garalamta</i>
15.	Korang	Barred baril	<i>Bariliusbarila</i>
16.	Korang	Hamilton's barila	<i>Bariliusbendelisis</i>
17.	Korang/ Rajahmas	Indian trout	<i>Barilius bola</i>
18.	Balisonda/ Ozola	Barnabaril	<i>Bariliusbarna</i>

Sl. No.	Assamese Name	English Name	Scientific Name
19.	Korang	Shacrabaryl	<i>Bariliusshacra</i>
20.	Korang	Vagrabaryl	<i>Bariliusvagra</i>
21.	Tilei/ Selleng/ Boolla	<i>Tileobaril</i>	<i>Bariliustileo</i>
22.	Saldarikana	Giant Danio	<i>Danio aequipinnatus</i>
23.	Laupati/ Dahrie	Devario danio	<i>Danio devario</i>
24.	Laupati	Dangila danio	<i>Danio dangila</i>
25.	Laupati	Zebra danio	<i>Brachidaniorerio</i>
26.	Darikana	Flying barb	<i>Esomusdanricus</i>
27.	Darikana	Blackline rasbora	<i>Rasboradaniconius</i>
28.	Eleng	Bengla barb	<i>Rasboraelanga</i>
29.	Darikana	Rasbora	<i>Rasborabonensis</i>
30.	Darikana	Gangetic scissortail rasbora	<i>Rsborarasbora</i>
31.	Moa	Mola/ Indian carplet/ Pale carplet	<i>Amblypharyngodon mola</i>
32.	Bariala/Baliara/ Boreala/ Mouah	Aspodiparia	<i>Aspidopariamorar</i>
33.	Mouah/ Bariala	Jaya	<i>Aspidopariajaya</i>
34.	Keintahputhi/ Pootee- Keintah	Chenguni	<i>Changuniuschangunio</i>
35.	Pakhironga/ Bokar/ Boolooah	Chocolate mahseer/ Katli	<i>Acrossocheilushexagonolepis</i>
36.	Jongapithia/ Pithia	Golden mahseer	<i>Tor putitora</i>
37.	Laopithia/ Burapatra/ Pakhiranga/ Pithia	Turiamahseer	<i>Tor tor</i>
38.	Jungha/ Pithia	Junghamahseer	<i>Tor progenius</i>
39.	Lobura	Copper mahseer/ Mosalmahseer	<i>Tor massal</i>
40.	Lurali	Gangetic latia	<i>Crossocheiluslatiuslatius</i>
41.	Puthi	Swam barb/ Chola barb	<i>Puntius chola</i>

Table 3: List of threatened fish fauna of Assam and their present status⁶⁶

Sl. No.	Fish Family	Fish Species	Conservation Status
1.	Cyprinidae	<i>Semiplotus semiplotus</i>	Most Threatened
		<i>Tor tor</i>	Endangered
		<i>Tor putitora</i>	Endangered
		<i>Labeo pungusia</i>	Vulnerable Most
		<i>Labeo dyocheilus</i>	Threatened
		<i>Garra litanensis</i>	Critically Endangered
		<i>Chagunius Chagunio</i>	Rare
		<i>Garra manipurensis</i>	Critically Endangered
		<i>Puntius sarana</i>	Vulnerable
		<i>Barbus dukai</i>	Most Threatened
2.	Siluridae	<i>Ompok pabo</i>	Most Threatened
		<i>Ompok pabda</i>	Most Threatened

⁶⁶ Chiarya, H. R., Singh N., Singh, H.S., Loss of Fish Diversity of Assam (India): A Threat to Ichthyo fauna, the Journal of Biodiversity. Photon 115 (2015) 419-422

Sl. No.	Fish Family	Fish Species	Conservation Status
		<i>Ompok bimaculatus</i>	Endangered
3.	Balitoridae	<i>Balitora brucci</i>	Most Threatened
		<i>Noemacheilus multifasciatus</i>	Endangered
		<i>Noemacheilus elongates</i>	Most Threatened
		<i>Aborichthys garoensis</i>	Critically Endangered
		<i>Aborichthys elongates</i>	Endangered
		<i>Aborichthys tikaderi</i>	Endangered
4.	Bagridae	<i>Mystus vittatus</i>	Vulnerable
		<i>Mystus tengara</i>	Vulnerable
		<i>Mystus cavasius</i>	Near threatened
		<i>Mystus bleekeri</i>	Vulnerable
5.	Olyridae	<i>Olyra longicaudata</i>	Most threatened
6.	Channidae	<i>Channa barca</i>	Rare
		<i>Channa orientalis</i>	Vulnerable
7.	Schilbeidae	<i>Clupisoma garua</i>	Vulnerable
8.	Psylorhynchidae	<i>Psilorhynchus homaloptera</i>	Most threatened
9.	Amblycipitida	<i>Pangasius pangasius</i>	Vulnerable
10.	Anguillidae	<i>Anguilla bengalensi</i>	Vulnerable
11.	Cobitidae	<i>Lepidocephalus goalparensis</i>	Critically endangered

2. OVERVIEW OF THE ENVIRONMENTAL IMPACT OF AQUACULTURE AND MANAGEMENT

Aquaculture, like any human activity, will have some effects on the environment. As long as these activities permit natural adjustment in the environment, it is recognised that their impact will be minimal. In well-managed farms, the water quality of influents and effluents may not be significantly different. Adverse effects associated with aquaculture include habitat destruction, discharge of effluents containing high concentrations of organic matter and the contamination of the aquatic environment and organisms with chemicals. Common-user conflict and the introduction of exotics, which may alter the diversity the natural flora and fauna, and escapees from aquaculture, are also contentious issues. The negative environmental impact attributed to aquaculture has mostly resulted from poor planning, inadequate site selection, inappropriate management procedures and lack of attention to environment protection. Nevertheless, aquaculture can also have positive effects on the environment, if the right methods are used. For example, in integrated fish farming recycling of wastes or by-products of one culture may occur if wastes from that culture are used as inputs for other culture and an efficient use of farm space for multiple cultures may be observed.

2.1 Climate

Climate variability will affect socio-economic sectors which include water resources, agriculture, aquaculture, fisheries, human settlements, ecological systems and human health. The ecological systems which support aquaculture are already known to be sensitive to climate variability. There is very limited work done on climate change and the effects of climate change on aquaculture production. Therefore, it is urgent need to improve management and better aquaculture practices to minimize the loss of aquaculture production due to climate variability.

Climate change and North east India: Some facts in recent years
(Source: NICRA project, ICAR RC NEHR):

- 2001-2010 has been identified as the warmest decade.
- The year 2010 was the warmest year since 1901 with temperature being 1.8 °C above normal.
- In the year 2009, NE India observed one of the biggest droughts.
- In 2012, NE Indian states of Assam, Meghalaya, Arunachal Pradesh and Mizoram faced never before happening floods. All the 27 districts of Assam were under the grip of severe flood for the entire month of June. Again, flood reappeared in the month of September in the same year.
- Heavy intensity rainfall events increasing every year whereas, the distribution is getting more and more erratic.
- Mean maximum temperature of NE region is increasing @ +0.11 °C per decade.
- Climate models projects 2.0-3.5 °C increase in temperature and 250-500 mm increase in precipitation in the NE region by 2050.

Table 4: Monsoon rainfall amount in Assam

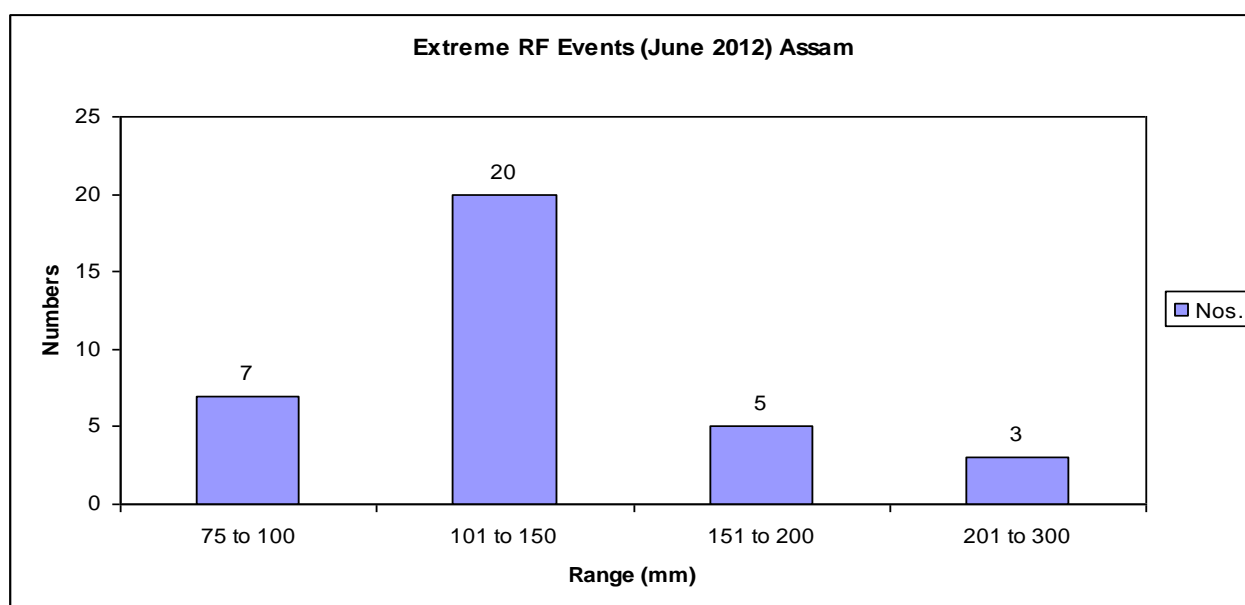
State	1951-1990	1991-2007	% Change
Assam	1788	1613	-9.8

Table 5: Monsoon rainfall Distribution (Rainy days) in Assam

State	1951-1990	1991-2007	% Change
Assam	78	72	-7.7

A normal arrival of monsoon in NE converted to great sorrow in June 2012 as unprecedented flood devastated 27 of the 29 districts of Assam (Source of data: AWS, IMD)

A total of 35 extreme rainfall events (>75 mm in 24 hrs.) were recorded in June 2012 in 10 Lower Assam locations. In June, 20 extreme rainfall events occurred between 101-150 mm range (Source of data: AWS, IMD)



- Incessant rainfall for days together in the hills of Arunachal Pradesh and Tibetan China initiated the 1st wave of serious flood in Assam around June 7th with serious impact on all 27 districts
- The flood situation started deteriorating since then and continued for the entire month before started receding since 30th June onward.
- The Brahmaputra/Barak and its major tributaries which caused havoc were:
 - *Upper Assam*: Burhidehing and Dikhow in Upper Assam
 - *Lower and North bank of Assam*: Suklai, Bornodi, Naobondha, JiaBharali, Pahumara, Palla, Kaldia, Burhadiya, Tihu, Beki, Jiadhol, Puthimari, Pagladiya, and Manas
 - *Barak Valley*: Barak, Katakhal and Kushiya
 - About 4,83,536 hectare land area came under grip of flood water of which total crop area damaged was about 70,000 hectares.
 - Impact: Major crops affected were –Boro paddy and Ahu paddy (in maturity and reproductive stages, respectively) and Jute. The process of nursery bed and main field preparation for Sali paddy delayed by almost 1 month in the flood affected areas.

2.2 Temperature

In general, fishes cannot maintain a constant body temperature like the one mammals do. Their body is exactly the same temperature as the water they are living in. Fishes can live in very cold or very hot water, but each species has a range of preferred temperatures. Most fish cannot survive in temperatures too far out of this range. When fish encounter water that is too cold for them, their metabolic activities slow down and become lethargic. On the contrary, as the surrounding water warms up, metabolic activities speed up and they digest food more rapidly, grow more quickly, and eventually have more energy for reproduction. However, fish need more food and more oxygen to support this higher metabolism. On the contrary, when the water temperature in the pond/ mini-barrage falls below the optimal range during winter months, the rate of application of artificial feed and fertilizers /manures should be reduced.

Generally, the rate of all the biochemical reactions in aquatic organisms doubles with every 10°C rise in water temperature. Higher water temperature adversely influences solubility of oxygen in water. As a result, fish growth depends on water temperature to a large extent. For the Indian major carps fish species (Rohu, Catla & Mrigal) 25°C to 32°C has been found to be optimal for their growth and reproduction in the plains.

Impact of Global warming

All cultured aquatic organisms are poikilotherms. Hence any temperature change impacts on production. As the surrounding water warms up, metabolic activities of species speed up and they digest food more rapidly, grow more quickly, and eventually have more energy for reproduction. But fish need more food and more oxygen to support this higher metabolism. Generally, the rate of all the biochemical reactions in aquatic organisms doubles with every 10°C rise in water temperature. Higher water temperature adversely influences solubility of oxygen in water. As a result fish growth depends on water temperature to a large extent.

- Possibility of being higher than the optimal temperature range may cause stress (Physiological) to aquatic organisms.
- In general, Tropical fisheries: Positive; higher growth & production– Will need more feed inputs

2.3 Water stress

The predicted stress is decrease in water availability in major river where there is major aquaculture activities at present. The wetlands (Beels) where intense aquaculture activity is proposed for enhancement of fish production may be affected.

Climate change will also affect wetlands and their species e.g. through biological responses to changes in temperature, rainfall, water regimes etc. Wetlands play important roles in the global cycling of water, and the storage and cycling of carbon gases – these cycles will be affected by climate change.

In semi intensive aquaculture, the fish farms can be prepared for approaching high water temperatures by:

- Providing oxygen supplementation,
- Changing feeding regimes, Recirculating water/ aeration, and De-stocking

Reduced water level increases the catch per unit effort in the inland capture fisheries. (concentrate fish in deeper pools, fish are squeezed into less water ;which can make them more vulnerable to exploitation (Fishing etc). Future fishing opportunities could be harmed by overharvest.)

Water quality Changes

Very high temperature, coupled with critically low water levels can reduce the buffering capacity of water, deplete oxygen and increase toxicity due to algal blooms. These stresses can affect the fish growth and biomass production and even lead to mass mortality.

2.4 Other major issues for sustainably intensified aquaculture

The prime challenges for the Fishery sector to support the sustainable development in Assam highlighted in the project implementation plan (PIP) are expected to have a positive impact on the food, nutrition and economic security.

Sl. No	Issues	Impacts
1.	<i>Alien Fish species</i>	<ul style="list-style-type: none"> • Culture of Alien fish species such as Thai magur (<i>Clarias gariepinus</i>), Tilapia, hybrid Kawoi (<i>Anabas testeduneus</i>), Roopchanda⁶⁷ (<i>Colossoma macropomum</i>), Bighead carp (<i>Hypophthalmichthys nobilis</i>) Iridescent shark (<i>Pangasius sutchi</i>) etc. pose threat to native fish species and gene pool and may result in ecological imbalance and may lead to loss of bio-diversity. • Therefore requires adequate measures to eliminate these species from culture system or culture with do's and dont's as prescribed by the ICAR-NBFGR, Lucknow, UP, India for enhancing fish production from confined environment.
2.	<i>Fish species for aquaculture</i>	<ul style="list-style-type: none"> • Diversification of fish species. Conservation of native fish species, breeding and culture technologies for lesser known high value fish species for large scale-production.

⁶⁷ The Red Ballied Pacu or "Roopchanda" as known commonly (scientific name: *Colossoma macropomum*) is closely related to the piranha. While they are not aggressive carnivores like the piranha, they eat small fish, insects, and meat on fishing lures. Their teeth, which may resemble human teeth, are used to cut through vegetation and crush seeds that fall into the water. Their culture can be hazardous. According to a report, one toddler needed surgery after a pacu (misreported as a piranha) bit her finger at Edinburgh Butterfly and Insect World in Scotland.

Sl. No	Issues	Impacts
3.	<i>Availability of quality inputs</i>	<ul style="list-style-type: none"> The production of quality seeds is a major challenge for State's aquaculture sector. The Fish seed sector is mostly governed by the private hatchery operators. Due to lack of scientific knowledge, poor management and resources; although seeds are produced in large quantity, majority of them are of poor quality resulting in low fish production.
4.	<i>Viable technologies</i>	<ul style="list-style-type: none"> Environment friendly technologies. Intensification of culture practices through high stocking density, feed & fertilizer, aeration with better management practices and waste water treatment. Biofloc technology, Integrated aquaculture, multiple stocking –harvesting are other possible options.
5.	<i>Aquaculture activities both small and large scale operations</i>	<ul style="list-style-type: none"> Lack of technical know-how and technology, resulting in huge losses due to poor management and diseases. This in turn results in the increased use of antibiotics and other chemicals which in turn increase risks for the aquatic environment and public health. At the same time while expanding or intensifying the aquaculture activities in an effort to enhance Fish production, the existing productive paddy/rice field should never be converted in to fish ponds.
6.	<i>Biosecurity</i>	<ul style="list-style-type: none"> To prevent spoilage and outbreak of any diseases in any aquaculture operations, adequate measures for disease prevention and spoilage at the production sites are required during post-harvest stages. The private sector, especially smallholders, is affected by huge production losses due to diseases and spoilage with limited knowledge or resources to address the issue.
7.	<i>Agricultural activities in shallow pond.</i>	<ul style="list-style-type: none"> Farmers growing vegetables on the pond bed use pesticides, as they are prone to attack by pests. The residual pesticides are washed with water and pose threat to enter the food chain.
8.	<i>Participation of cluster farmers in the value chain and social issues</i>	<ul style="list-style-type: none"> To enhance participation of fish farmers operating in the selected cluster, the Government institutions and other agencies in the project should facilitate their access to quality inputs, technical services, innovation, capital, markets and other infrastructures such as transport and electricity for sustainable development. Any large operations towards intensification in aquaculture and processing may emerge potential issues related to employment, labour and trade policies which will have to be addressed.
9.	<i>Environment</i>	<ul style="list-style-type: none"> The intensification of aquaculture for boosting production level requires the establishment and enforcement of strict limits and a careful monitoring of farming practices. Better management practices and code of practice for each intervention should be formulated and promoted among the stakeholders. The government institutions must build capacity and lay down legal framework to regulate the sector and monitor its impact on the environment. Also requires attention towards water availability and quality and its efficient use.
10.	<i>Climate</i>	<ul style="list-style-type: none"> The Fishery sector is vulnerable to climatic variability. Almost every year the seasonal flooding and drought affect inland aquaculture farms and other aquatic bodies especially the beels/ wet lands of Assam; which are known to harbor several indigenous fish species. The ICAR–AAU has already developed district contingency plans for the state which may be referred, refined according to the situation and disseminated.
11.	<i>Capacity building</i>	<ul style="list-style-type: none"> In the value chain of production to the market, the project should build a skilled workforce for the sector at every stage through training, demonstration, exposure visits etc



Alien Fish species: Roopchanda, Hybrid Anabas (Kawoi), and Chinese/ Thai magur



Potential Fish species for culture: Mola and Murrels

3. MANAGEMENT PRACTICES

3.1 The Surrounding Biophysical Environment

3.1.1 Management of Vegetation

Vegetation management refers mainly to the approach required in dealing with the vegetation (including aquatic vegetation) within and around any aquaculture production facilities.

Best Management Practices Concepts and Approach

- a) Wherever practical, the vegetation on and around aquaculture ventures should be indigenous, while plant species regarded as invasive are prohibited and should be removed.
- b) An active alien vegetation eradication programme should be implemented where alien vegetation occurs. Such a program should however caution against erosion and soil destabilisation after eradication.
- c) Special attention must be paid to invasive aquatic plant species that could invade the core water supplies or the production systems. Such invasive aquatic species require dedicated control and management. Control can be achieved by physical removal, responsible and careful chemical treatment or by biological control measures.
- d) Wherever practically possible, the planting of indigenous plants and trees should be encouraged. This lessens the aesthetic impact of aquaculture activities, serves as ecological transition zones or corridors and contributes to the environmental integrity any aquaculture venture.
- e) Where virgin or sensitive vegetation occurs, general access should be limited and well-maintained footpaths used in places where these areas need to be traversed.

- f) Cut, trimmed, mowed and felled vegetation must either be removed to a suitable disposal site or composted on site for further application. Cut vegetation can also be used as brush pack in the control of erosion, but care must be taken to prevent the spread of seed of alien species in this manner. The burning of vegetation is discouraged, unless done under favourable climatic conditions and with the permission of the local disaster or fire management services.
- g) Where any vegetation stripping is required, this is to be kept to a minimum footprint and in compliance with any legislation that may apply. Where appropriate, clearing should be done in a phased manner and cleared areas rehabilitated as soon as is practically possible.
- h) Care should be taken during the translocation of aquaculture organisms from other locations, or when using equipment from other farms, so as to prevent the spread of invasive aquatic plants.

3.1.2 Managing Non-Production and Non-Predatory Animals (Fauna)

At some stage most aquaculture facilities will be faced with the presence of fauna that are neither related to the production activities, nor pose a predatory (or parasitic or disease) threat to the production activities. In maintaining best practices, the approach taken to these animals should be responsible and should cause the least possible harm to these organisms.

Best Management Practices Concepts and Approach

- a) Wherever practically possible, and where these animals do not pose a risk to the aquaculture facilities, these animals must be accommodated and be granted freedom of movement and existence. Catching of wild animals, by any means, is illegal and should not be considered unless authorised or done in conjunction with the relevant delegated authorities.
- b) Where aquaculture facilities are surrounded by boundary walls or fences, these must be of such a nature so as to prevent injury, harm or death of any animals that inhabit the area.
- c) Channels, dams and other infrastructure must be designed and built in such a manner so as to prevent injury, harm or death of any animals.
- d) Under no circumstances may animals that pose no risk to the aquaculture activities be shot, trapped, killed, bewildered, injured, poisoned or harmed in any manner. Acceptable deterrents may be used to discourage animals from entering into or inhabiting aquaculture facilities.
- e) No animals (including predatory animals) may be poisoned. The only exception to this is in the responsible control of vermin, in which case recognised poisons may be used in the prescribed methods.
- f) Aquaculture feeds and other production resources that may attract animals should be stored in such a manner so as to prevent access to these animals and to prevent animals from becoming trapped, killed or harmed.
- g) Operators (farmers) of aquaculture facilities must ensure that feed and equipment stores do not become overrun with rodents or other pests. A responsible control program for such vermin must be implemented.

3.1.3 Stabilisation and Soil Management

Due to the use of water in aquaculture, the management of soil stability and water erosion is of importance. Ignorance of the importance of soil and stabilisation management in and around aquaculture facilities can cause significant infrastructure damage, stock loss and negative environmental impacts.

Best Management Practices Concepts and Approach

- a) The soil of the terrestrial environment, surrounding aquaculture activities, should be stable, protected from erosion and maintained as a suitable growth medium for natural vegetation.
- b) Where vegetation is removed, this should be done in a phased manner to prevent unnecessary destabilisation and erosion.
- c) When undertaking any earthworks, the topsoil must be stripped separately and retained for later re-use. Topsoil stockpiles must be stable, less than 2 meters high and free of invasive alien vegetation.
- d) Following the exposure of any soils for construction, shaping or other activities, a suitable vegetation cover must be established immediately thereafter to ensure soil protection. Where appropriate, straw stabilisation or hydro seeding with environmentally compatible grasses and plants may be used to prevent erosion.
- e) Barren soils should be tilled, treated with fertiliser or compost and vegetation cover encouraged and irrigated.
- f) The upper contours of any terrestrial components of aquaculture facilities (and at intervals on the lower contours of large or steep sites), should have storm water cut-off trenches capable of accommodating a 1:50 year flood. Water must exit storm water trenches below the terrestrial components of production facilities, in a manner that does not cause downstream erosion or degradation. Soil in the storm water trenches must be protected from secondary erosion by means of suitable flow speed inhibition. This can be done by stone packing, vegetation establishment, brush packing or through the channel design characteristics.
- g) All slopes with a gradient exceeding 2:1 on the terrestrial areas of aquaculture facilities must be protected from erosion. This can be accomplished with good vegetation cover, brush packing, sand bagging, retaining walls, log stepping, etc. The chosen method will depend on the availability of materials and the degree of instability.
- h) Any erosion must be treated without delay. Where applicable, anti-erosion compounds may be used to prevent erosion, but the application methods must conform to the manufacturer's recommendations.
- i) Paths and roads must be formalised and stabilised against erosion by means of suitable materials, compaction and functional design. Storm water cut off trenches can be used to prevent erosion.
- j) Access points to production facilities (e.g. slipways or pontoon launches and jetty ramps) should be stabilised down to water level, preferably with vegetation or through more formal structures such as concrete landings, etc.

3.1.4 Managing Sensitive Areas

Many aquaculture facilities are established alongside sensitive environmental areas such as water tributaries, wetlands, rivers, etc. In order to achieve best practice standards these aquaculture activities should be conducted so as not to disturb these areas unnecessarily.

Best Management Practices Concepts and Approach

- a) In general, access to sensitive areas should be kept to a minimum by means of designing access around these areas, by fencing them off and by educating employees of their existence and sensitivity.
- b) Sensitive areas should not be used as storage areas or sites for old, disused or periodically unused equipment.
- c) Sensitive areas should not be used for the dumping of waste of any nature (including vegetation matter such as mowed grass).
- d) Natural features such as outcrops, rock faces, trees and natural vegetation should be protected when found in proximity to aquaculture facilities.

- e) All buildings over 100 years of age, all fossils, archaeological and palaeontological materials, graves and burial grounds, wetlands, forests are protected by law and may not be disturbed in any manner without authorisation to do so.

3.1.5 Noise, Light and Odour Management

Noise generation by aquaculture activities is generally minimal, but can become a disturbance when the activities take place in close proximity to human settlements. Likewise, odours are generally not problematic in aquaculture, except when raw feed products are processed, in certain postproduction processing activities, in certain instances in the cleaning of production facilities and filters or in the laying fallow of ponds. Excessive light pollution is generally limited in aquaculture and is usually used for security purposes only. In spite of the limited impacts of noise, light and odours, it is important that these aspects be considered and managed to prevent any undue impacts.

Best Management Practices Concepts and Approach

- a) Where practically possible, pumps, aerators and other noise generating devices should be equipped with a sound dampening cover or container.
- b) All pumps, aerators and other noise generating devices (including motor vehicles) should be in a good working order to prevent excessive noise.
- c) The use of noise dampening methods such as the planting of windrows should be considered if noise generation becomes excessive.
- d) All employees should be made aware of the fact that unnecessary noise, light and odour pollution should be prevented by means of responsible conduct.
- e) Where practically possible, sources of potential light or noise pollution should be placed in areas where they will cause the least possible disturbance.
- f) Above average noise generation should be limited to normal business hours.
- g) If odours are generated from any aquaculture facilities, efforts should be made to limit their impact on surrounding settlements, communities and operations. This can be done by taking cognisance of wind direction and speed, ensuring that odour generating activities are completed in as short a space of time as possible and by ensuring that any dead aquaculture organisms (or unused feed) are disposed of responsibly.

3.1.6 Approach to the respective culture systems

The aquaculture sector employs a range of production techniques in many different culture systems that range from tanks to ponds. Tank culture are mostly of concrete materials and pond culture typically refers to earthen ponds. It is important that all aquaculture systems be managed with the interest of the production organisms and the surrounding environment in mind.

Best Management Practices Concepts and Approach

General Concepts:

- a) Production systems should be designed and constructed in a manner that allows for the safety of employees, the farmed organisms and the surrounding environment.
- b) Aquaculture production systems should be structurally sound and not leak unnecessarily.
- c) Aquaculture systems should be readily accessible for daily operations.

- d) Aquaculture systems should be designed and constructed in a manner that prevents the escape of production organisms.
- e) In aquaculture, cover netting is used for keeping predatory animals such as birds and otters out and for providing shade. Such netting must be used and maintained in a manner that does not pose a threat to birds and other animals:
 - Shade cloth or bird netting (including submerged predator netting) must be of a mesh size, structure and rigidity so that entrapment or injury to birds and other animals is prevented.
 - Cover netting should be UV and weather resistant to prevent it from tearing and becoming tattered.
 - Netting must be firmly secured to prevent it from tearing in windy conditions or from trapping predatory birds or other animals.
 - Although the colour of cover netting should not be bright (to lessen the aesthetic impact), it should be clearly visible for approaching birds.

Specific Concepts:

Pond Culture Systems

- a) Aquaculture ponds must be designed and constructed to allow for complete drainage.
- b) Aquaculture ponds should have adequate overflow capability and flood protection (e.g. by means of stabilized spillways), but should also allow for early detection of rising water levels that could cause flooding. This means that inflow and outflow control is of importance.
- c) Where earthen ponds are used, the inner walls must be of a suitable slope to prevent internal erosion and collapse. Furthermore, the effects of surface wind and wave erosion must be combated by means of vegetation establishment or stone packing.
- d) If pond sediments are removed, these must be disposed of responsibly or used as compost.
- e) Trees and other large plants should not be allowed to grow on the retaining walls of earthen ponds as their roots may weaken the structure.
- f) Adequate control measures should be put into place to prevent moles and crabs from digging into the retaining walls of earthen ponds and dams as these may destabilize the structure.

3.1.7 Refuse and Waste Management

Aquaculture produces various waste streams, which can be categorised as follows:

- a) General waste (fish feed bags, paper, plastic, glass, etc.).
- b) General organic waste from landscape maintenance.
- c) Production related organic waste (e.g. old feed, dead aquaculture organisms and material removed from filtration units).
- d) Sewerage and non-production related waste water.
- e) Production related waste water.
- f) Post production and processing waste.
- g) Hazardous waste materials and chemicals.

Waste management must be formalised to ensure that it does not cause pollution and potential environmental degradation.

Best Management Practices Concepts and Approach

- a) General waste must be collected and disposed to the nearby disposal site (legally compliant) on a regular basis.
- b) Where possible, general waste should be separated into glass, paper and plastics so that these can be recycled.
- c) Emptying out of waste containers should be regular to prevent overfilling.
- d) Waste should not be allowed to litter aquaculture facilities or the surrounding areas (especially applicable to wind-blown litter).
- e) A culture of waste reduction, collection and disposal must be instilled with all employees by means of guidance and training.
- f) Vegetation matter from landscaping activities must be removed to a suitable disposal site or composted for later use.
- g) Old feed should be disposed of via composting (for small volumes) or via a formalised waste disposal system (for large volumes).
- h) Where postproduction and processing waste (e.g. intestines, gills, heads, etc.) is generated, it should be dealt with in one or more of the following manners:
 - For small volumes (i.e. less than 50 kg. per week), a system of liming and burying or incineration may be employed, provided that this does not cause groundwater pollution or other impacts of significance (e.g. health risks, odours, etc).
 - For large volumes (i.e. more than 50 kg. per week), it is recommended that a silage system be employed, which can liquefy and stabilise waste material by grinding and lowering the pH. This silage can then be incorporated into animal feeds as a high protein supplement.
 - A suitable bulk service provider may be contracted to remove processing waste.
 - Waste may be removed to a recognised disposal site equipped to deal with the waste type.
 - Waste may be incinerated, provided that it is formalised and legally compliant.
- i) Hazardous waste (e.g. expired chemicals) must be disposed of via an approved hazardous waste disposal site.

3.1.8 Managing Buildings and Storage

The structural integrity of buildings and storage spaces is largely determined during design and initial construction. It is therefore essential that the design of such infrastructure be done carefully to accommodate potential environmental issues. Nevertheless, these structures must be maintained in a good order, kept clean, free of vermin and in a safe condition for employees. Additionally, storage areas should be well ventilated and dry.

Best Management Practices Concepts and Approach

- a) Unauthorised access to buildings and stores should be controlled to prevent theft and vandalism.
- b) Access to vermin and animals such as rodents must also be controlled.
- c) Buildings should be regularly maintained so that they remain structurally safe and aesthetically acceptable.
- d) Responsible rodent and vermin control programs must be employed in buildings and storage areas.
- e) Sufficient ventilation must be provided in buildings and stores.
- f) Buildings and stores must be equipped with the necessary fire fighting and first aid equipment and the applicable emergency contact numbers clearly displayed.

3.1.9 Planning Future Activities and Expansion

The expansion of aquaculture activities must be planned to minimise potential environmental impacts. In addition to this, applicable statutory authorisations for upgrade and expansion activities must be obtained prior to commencement thereof.

Best Management Practices Concepts and Approach

- a) Plans for expansion and upgrade must be checked for environmental compatibility.
- b) Local and district authorities must be consulted to ascertain their statutory requirements.
- c) Where construction activities take place, specific provision must be made for the control of erosion and storm water, soil stabilisation, rehabilitation, dust prevention, employee safety, waste removal and for the other provisions that constitute best practices.

3.1.10 Water Monitoring and Management

Aquaculture activities add nutrients, metabolites and other wastes to the water column, which creates the potential for water quality deterioration. These impacts could include the creation of eutrophic zones, fluctuations in dissolved oxygen, algal blooms, changes in species compositions and more. Water quality and quantity management is therefore of primary importance in aquaculture.

3.1.11 Managing Species and Species Escape

The introduction of alien aquaculture species (including translimital species), potential diseases and foreign genetic traits into an area can pose a significant environmental risk. The global redistribution of aquaculture species is not well controlled and has caused irreparable environmental damage in certain areas. This, coupled with the unseen and unpredictable ability of some species in escaping from production facilities, makes the choice and management of aquaculture species important.

Best Management Practices Concepts and Approach

- a) Unless authorised, only locally indigenous species may be used. Care must also be taken that secondary species are not accidentally introduced with the target species.
- b) Aquaculture species that are able to hybridise should not be farmed together, while species that are able to hybridise with indigenous species in the surrounding environment should not be used as production candidates.
- c) Whenever possible, the genetic make-up of an aquaculture population should be compared with the genetic make-up of the same species, if it occurs in the surrounding environment. The potential genetic impact should be established and if found to be significant, such species should be avoided.
- d) Prior to the purchase and stocking of any organisms, the disease and parasitic status and risk of the species must be investigated in context to the area from which it originates, the area to which it will be taken and the degree to which any potential disease may pose a threat to the surrounding environment. In certain instances the introduction of aquaculture organisms may require specific veterinary assessments, treatments and quarantine measures. Assistance in this regard can be obtained from the Department of Agriculture (Veterinary Services).
- e) Aquaculture farmers must make specimens of the production organisms available to authorities that need to determine the species, disease status or genetic characteristics.
- f) Adequate steps must be taken to prevent the escape of production organisms, especially from the hatchery environment where individual organisms may be very small. In this regard, regular inspection of production infrastructure and escape barriers is important. Escape barriers may include netting, grids, sand and other filters, predator ponds, chemical treatment areas, soak away systems, etc. Barriers

should be adequate to prevent escape during flooding, overflows and during other unforeseen circumstances.

- g) In cage culture the integrity of the nets should be inspected regularly and safety nets used to prevent the escape of fish during stocking, harvesting, sampling and grading. Generally, aquaculture species are propagated from a tailored gene pool and thus not suitable for restocking or supplementation of natural stocks.

3.1.12 Feed Management

Feed and feed management is a primary cause of direct and indirect pollution of water resources used for aquaculture. The management and responsible use of feed is not only an important environmental consideration; it is also a key factor in determining the financial viability of most aquaculture ventures.

Best Management Practices Concepts and Approach

- a) Only registered aquaculture feeds should be purchased from recognised feed companies that produce high quality feeds. Aquaculture farmers should be familiar with the nutrient make-up, the primary ingredients and production techniques for the feeds used.
- b) Feed producers should provide the date of manufacture, information pertaining to the ideal storage conditions and estimated shelf life.
- c) Feed stores should be lockable to prevent theft.
- d) Feed should be stored and used on a “*first-in-first-out*” basis to prevent unnecessary aging and deterioration in quality.
- e) Feed storage areas should be well ventilated, dry and free of vermin that can damage, contaminate and consume feeds. Dampness and heat can also damage feeds.
- f) It is good practice to store feeds on individually stacked pallets that can allow for full ventilation of bags that would otherwise be in direct contact with floor and wall surfaces.
- g) Feed types and feeding strategies are specific to each species, to the culture conditions, climate and growth stage. In this regard, feed types and feeding rates should be recorded daily so that feed conversion efficiency can be calculated and monitored.

3.1.13 Disease Monitoring, Control and Treatment

Aquaculture disease is an threat, not only because of its potential impact on production, but also due to the potential of infecting downstream populations and the environment in general. Aquaculture farmers must be aware of the impacts that disease could have and should manage towards prevention and preparedness for any outbreaks that may occur.

Best Management Practices Concepts and Approach

- a) No aquaculture organisms should be introduced from an unrecognised source.
- b) Prior to the purchase and stocking of any organisms, the disease and parasitic status and risk of the species must be investigated in context to the area from which it originates, the area to which it will be taken and the degree to which any potential disease may pose a threat to the surrounding environment. In certain instances the introduction of aquaculture organisms may require specific veterinary assessments, treatments and quarantine measures. Assistance in this regard can be obtained from the Department of Agriculture (Veterinary Services).

- c) Aquaculture farmers should monitor the health status of aquaculture organisms as part of the daily operational activities. This includes behavioral monitoring, sampling, diagnostic dissection, microscopic investigation and more.
- d) It is advisable that a health assessment be conducted on aquaculture facilities at least twice a year. The assessment should be diagnostic, with recommendations of treatments or management of any diseases or parasites.

3.1.14 Managing Aquaculture Chemicals

Chemicals are mainly used for the treatment of diseases and parasites, while some hormonal preparations, anaesthetics, disinfectants and water treatments are also found. Some concerns around the use of chemicals include the potential longevity of bioactive compounds in animal tissues, the fate and effect of these compounds or their residues in the aquatic environment (i.e. toxicity to non-target organisms) and the creation of antibiotic resistance. The use of chemicals must be done in a responsible manner and farmers must ensure the safety of the surrounding environment. The use of aquaculture chemicals is also a significant factor which influences safety, consumer acceptance and marketability of products.

Best Management Practices Concepts and Approach

- a) Aquaculture farmers should be encouraged to reduce their reliance on chemicals through the use of sound husbandry practices aimed at disease and stress prevention. More emphasis should be placed on preventive measures where the use of chemicals is a last resort when other measures have proved to be inadequate.
- b) Responsible use of chemicals and treatments in aquaculture is characterised by:
 - Chemical application based on an accurate diagnosis.
 - The use of an appropriate compound and application method.
 - Chemical dosage for the minimum effective time.
 - The keeping of records and evaluation of treatments.
 - An awareness of potential chemical residues.
- c) Chemicals should be used for specific and not general purposes. Dosages, application methods and the resultant outcome should be known and recorded in a treatment register.
- d) The use of chemical cocktails should not be permitted.
- e) In the use of chemicals, consideration must be given to the potential for residues and the need for withdrawal periods before consumption of the aquaculture products.
- f) Chemicals must be stored in a dry, well-ventilated and lockable store. Chemicals must be clearly labelled and the purchase date, use and expiry date must be recorded. Expired chemicals must be disposed of at a suitable hazardous waste disposal site.

3.1.15 Other Management Practices

Rice fish farming:

Rice fish farming is practiced in different agro-ecological zones all through most of the subtropics, warm humid subtropics and in warm sub-humid tropics. The rain fed lowland rice ecosystem is characterized by its lack of control over the water and by both flooding and drought problems. Rice fish farming can contribute to household income, contribute to food security and nutrition and contribute to improved sustainability of rice production. Generally two production systems has been recommended

for culturing fish in the rice fields throughout the world viz Simultaneous or Concurrent Method and Alternate or Rotational Method.

Pig-Cum-Fish Farming:

At the same time from the same place pig meat and fish can be produced in this type of practice. Water needed for pig husbandry practice can get from fish pond and some percentage of pig feed can be produced from agricultural crops cultured in the fish pond embankment. Fish also feed directly on the pig excreta which contains 70% digestible food for the fish. Pig dung contains: 69- 71% moisture, 1.36- 2.0% nitrogen and 0.36- 0.39% phosphorous when the pigs are fed with pig mesh containing 16- 17% protein, therefore it act as a good fertilizer which helps in producing fish feed i.e. phytoplankton & zooplankton in fish pond. So application of extra fertilizer to fish pond for raising fish and supplementary feeding to the cultured fish is not needed. This cuts the cost of fish production by 60%. The pond muck which gets accumulated in the pond bottom due to constant application of pig dung can be used as fertilizer for horticultural crops grown over the pond embankments.

3.2 Management of Beel

3.2.1 Deweeding in Beel

Majority of the Beels in Assam are thickly infested with water hyacinth. 100% removal of aquatic weeds is not recommended especially in the open beel which provides shelter and breeding ground to many of the indigenous fish species. The best environment friendly method for deweeding is through manual operation or through introduction of Chinese grass carp, ducks, geese etc.

Aquatic weeds may be harnessed for sustainable development. These plants have potential for exploitation as animal feed, human food, soil additives, fuel production, organic fertilizer, waste water treatment etc. In recent years water hyacinth is also used for preparation handicraft items such as basket, bag etc. The community involved in the beel development projects should be adequately trained ,especially the women to utilize the aquatic weed for economic benefits.

Annex 6

ANNEXURE 6: ENVIRONMENTAL SURVEY CHECKLIST

1. Is the subproject component is a proposed one (new activity)

If yes, use **6A Environmental Survey Checklist (NEW SUBPROJECTS)**

2. Is the subproject component is an existing one (undergoing for expansion)

If yes, please use **6B Environmental Survey Checklist (EXISTING SUBPROJECTS)**

3.

Annexure 6-A: Environmental Survey Checklist (New)**SCREENING CHECKLIST – AGRICULTURE SECTOR (NEW
SUBPROJECTS)****ASSAM AGRIBUSINESS AND RURAL TRANSFORMATION PROJECT****Basic Information**

Name of Project:

Village:

Cluster:

Block:

District

Type of the Project:

Total Area:

Name of Monitor's:

Name of Supervisor:

Section A: Project Siting

Will the Project :	Yes	No	Specify/Remarks
1. Be located within or near environmentally sensitive areas like: i. Forests (Protected / Reserve) ii. wetlands iii. Threatened species iv. Special area for protecting biodiversity v. Cultural heritage site			
2. Affect environmentally sensitive areas or critical habitats – wetlands, woodlots, natural forests, rivers, etc.)?			
3. Affect the indigenous biodiversity (flora and fauna)?			
4. Cause any loss or degradation of any natural habitats, either directly (through project works) or indirectly?			
5. Affect the aesthetic quality of the landscape?			
6. Cause soil erosion or degradation?			
7. Have risk of deforestation?			
8. Divert the water resource from its natural course /location?			
9. Cause ecological degradation resulting from modification of non-agricultural lands to agricultural lands?			
10. Reduce people's access to the pasture, water, public services or other resources they depend on?			
11. Cause any dislocation or involuntary resettlement of people?			
12. Cause social problems due to land tenure and use conflicts?			
13. Result in any type of human wildlife conflicts?			

SCREENING CHECKLIST – AGRICULTURE SECTOR (NEW SUBPROJECTS)

ASSAM AGRIBUSINESS AND RURAL TRANSFORMATION PROJECT

14. Affect the natural drainage of the area?			
15. Be located in a site vulnerable to major natural or induced hazards such as: i. Landslides ii. Flooding iii. Storm iv. Earthquakes			
16. Have approach to roads and what is its quality?			
17. Have suitable area for construction purposes?			

Section B: Constructional Impacts (w.r.t Infrastructure requirements)

Will the Project cause:	Yes	No	Specify/Remarks
1. Noise from construction?			
2. Air pollution from the construction?			
3. Water pollution from the constructional activities?			
4. Soil contamination and degradation due to construction?			
5. Risk and vulnerabilities related to occupational health and safety due to physical chemical and biological hazards during project construction and operation?			
6. Large population influx during project construction and operation that cause increased burden on social infrastructure and services (such as water supply and sanitation systems)?			
7. Social conflicts if workers from other regions are hired?			
8. Any generation of construction and disposal wastes?			

Section C: Potential Environmental Impacts

Will the Project cause:	Yes	No	Specify/Remarks
1. Any type of accidental damage?			
2. Downstream water pollution from discharge of contaminated water from the agricultural field with drain water?			
3. Reduction of water supplies from competing uses (e.g., irrigation or domestic)?			
4. Pollution in nearby aquatic environments from adequate farm management?			
5. Threat to local varieties of crops and vegetables by introduction of new genetically modified varieties?			
6. Spread of diseases from exotic cultivated species?			
7. Reduction of water available to downstream users during peak seasons?			
8. Risk to community health and safety due to transport, storage and use and/or disposal of materials likely to create physical chemical and biological hazards during construction and operation?			

Section D: Seeds, Chemicals and Waste Disposal

**SCREENING CHECKLIST – AGRICULTURE SECTOR (NEW
SUBPROJECTS)**
ASSAM AGRIBUSINESS AND RURAL TRANSFORMATION PROJECT

Will the Project :	Yes	No	Specify/Remarks
1. Involve the use of chemicals/ fertilizers/pesticides, or increase existing use?			
2. Cause contamination of water courses by chemicals/fertilizers/pesticides?			
3. Cause contamination of soil by chemicals/fertilizers/pesticides or affect soil salinity and alkalinity?			
4. Require scheduled chemical application?			
5. Introduce new varieties of seeds?			
6. Experience effluent and /or emissions discharge?			
7. Introduce waste management and disposal practices?			
8. Introduce integrated pest management practices?			

SCREENING CHECKLIST – DAIRY SECTOR

ASSAM AGRIBUSINESS AND RURAL TRANSFORMATION PROJECT

Basic Information

Name of Project:

Village:

Cluster:

Block:

District

Type of the Project:

Total Area:

Name of Monitor's:

Name of Supervisor:

Section A: Project Siting

Will the Project :	Yes	No	Specify/Remarks
1. Be located within or near environmentally sensitive areas like: i. Intact natural forests ii. Wetlands iii. Threatened species iv. Special area for protecting biodiversity v. Cultural heritage site?			
2. Adversely affect environmentally sensitive areas or critical habitats – wetlands, woodlots, natural forests, rivers, etc.)?			
3. Affect the indigenous biodiversity (flora and fauna)?			
4. Cause any loss or degradation of any natural habitats, either directly (through project works) or indirectly?			
5. Affect the aesthetic quality of the landscape?			
6. Cause soil erosion or degradation?			
7. Have risk of deforestation?			
8. Cause ecological degradation resulting from modification of natural habitats to grazing lands?			
9. Reduce people's access to the pasture, water, public services or other resources they depend on?			
10. Cause any dislocation or involuntary resettlement of people?			
11. Cause social problems due to land tenure and use conflicts?			
12. Result in any type of human wildlife conflicts?			
13. Affect the natural drainage of the area?			
14. Be located in a site vulnerable to major natural or induced hazards such as: i. Landslides ii. Flooding iii. Storm iv. Earthquakes			
15. Have approach to roads and what is its quality?			

SCREENING CHECKLIST – DAIRY SECTOR

ASSAM AGRIBUSINESS AND RURAL TRANSFORMATION PROJECT

16. Have suitable area for construction purposes?			
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Section B: Constructional Impacts(w.r.t Infrastructure requirements)

Will the Project cause:	Yes	No	Specify/Remarks
1. Noise from construction?			
2. Air pollution from the construction?			
3. Water pollution from the constructional activities?			
4. Soil contamination and degradation due to construction?			
5. Risk and vulnerabilities related to occupational health and safety due to physical chemical and biological hazards during project construction and operation?			
6. Large population influx during project construction and operation that cause increased burden on social infrastructure and services (such as water supply and sanitation systems)?			
7. Social conflicts if workers from other regions are hired?			
9. Any generation of construction and disposal wastes?			

Section C: Potential Environmental Impacts

Will the Project cause:	Yes	No	Specify/Remarks
1. Overexploitation and long-term degradation of resource base?			
2. Accidental damage?			
3. Downstream water pollution from discharge of dairy effluents with drain water?			
4. Reduction of water supplies from competing uses (e.g., irrigation or domestic)?			
5. Threat to the local and wild variety of cows due to introduction of high productive exotic breeds?			
6. Spread of diseases and parasites from exotic breeds or escape to wild?			
7. Reduction of water available to downstream users during peak seasons?			
8. Increased community health risks due to increased incidence or introduction of waterborne or water related diseases?			
9. Risk to community health and safety due to transport, storage and use and/or disposal of materials likely to create physical chemical and biological hazards during construction and operation?			
10. Risk to community health due to contamination of diseases from cattles?			

Section D: Seeds, Feeds, Chemicals and Waste Disposal

Will the Project :	Yes	No	Specify/Remarks
1. Involve the use of chemicals/ medicines, or increase existing use?			
2. Cause contamination of water courses by chemicals /dairy wastes?			
3. Cause contamination of soil by chemicals/dairy wastes			

SCREENING CHECKLIST – DAIRY SECTOR
ASSAM AGRIBUSINESS AND RURAL TRANSFORMATION PROJECT

or affect soil salinity and alkalinity?			
4. Require monitoring by Animal husbandry and Veterinary Department?			
5. Introduce new breeds?			
6. Introduce better quality of feeds?			
7. Experience effluent and /or emissions discharge?			
8. Introduce waste management and disposal practices?			

SCREENING CHECKLIST – ENTERPRISE SECTOR

ASSAM AGRIBUSINESS AND RURAL TRANSFORMATION PROJECT

Basic Information

Name of Project:

Village:

Cluster:

Block:

District

Type of the Project:

Total Area:

Name of Monitor's:

Name of Supervisor:

Section A: Project Siting

Will the Project :	Yes	No	Specify/Remarks
1. Be located within or near environmentally sensitive areas like: i. intact natural forests ii. wetlands iii. Threatened species iv. Special area for protecting biodiversity v. Cultural heritage site?			
2. Affect environmentally sensitive areas or critical habitats – wetlands, woodlots, natural forests, rivers, etc.)?			
3. Affect the indigenous biodiversity (flora and fauna)?			
4. Cause any loss or degradation of any natural habitats, either directly (through project works) or indirectly?			
5. Affect the aesthetic quality of the landscape?			
6. Cause soil erosion or degradation?			
7. Have risk of deforestation?			
8. Divert the water resource from its natural course /location?			
9. Cause any dislocation or involuntary resettlement of people?			
10. Cause social problems due to land tenure and use conflicts?			
11. Affect the natural drainage of the area?			
12. Be located in a site vulnerable to major natural or induced hazards such as: i. Landslides ii. Flooding iii. Storm iv. Earthquakes			
13. Have approach to roads and what is its quality?			
14. Have suitable area for construction purposes?			

SCREENING CHECKLIST – ENTERPRISE SECTOR

ASSAM AGRIBUSINESS AND RURAL TRANSFORMATION PROJECT

Section B: Constructional Impacts(w.r.t Infrastructure requirements)

Will the Project cause:	Yes	No	Specify/Remarks
1. Noise from construction?			
2. Air pollution from the construction?			
3. Water pollution from the constructional activities?			
4. Soil contamination and degradation due to construction?			
5. Risk and vulnerabilities related to occupational health and safety due to physical chemical and biological hazards during project construction and operation?			
6. Large population influx during project construction and operation that cause increased burden on social infrastructure and services (such as water supply and sanitation systems)?			
7. Social conflicts if workers from other regions are hired?			
8. Any generation of construction and disposal wastes?			

Section C: Potential Environmental Impacts

Will the Project cause:	Yes	No	Specify/Remarks
1. Any type of accidental damage?			
2. Downstream water pollution from discharge of contaminated water from the enterprise with drain water?			
3. Reduction of water available to downstream users during peak seasons?			
4. Risk to community health and safety due to transport, storage and use and/or disposal of materials likely to create physical chemical and biological hazards during construction and operation?			

Section D: Chemicals and Waste Disposal

Will the Project :	Yes	No	Specify/Remarks
1. Involve the use of chemicals/ preservatives, or increase existing use?			
2. Cause contamination of water courses by chemicals/preservatives?			
3. Cause contamination of soil by chemicals/preservatives or affect soil salinity and alkalinity?			
4. Experience effluent and /or emissions discharge?			
5. Introduce waste management and disposal practices?			

SCREENING CHECKLIST – FISHERY SECTOR

ASSAM AGRIBUSINESS AND RURAL TRANSFORMATION PROJECT

Basic Information

Name of Project:

Village:

Cluster:

Block:

District

Type of the Project:

Total Area:

Name of Monitor's:

Name of Supervisor:

Section A: Project Siting

Will the Project :	Yes	No	Specify/Remarks
1. Be located within or near environmentally sensitive areas like: i. intact natural forests ii. wetlands iii. Threatened species iv. Special area for protecting biodiversity v. Cultural heritage site?			
2. Affect environmentally sensitive areas or critical habitats – wetlands, woodlots, natural forests, rivers, etc.)?			
3. Affect the indigenous biodiversity (flora and fauna)?			
4. Cause any loss or degradation of any natural habitats, either directly (through project works) or indirectly?			
5. Affect the aesthetic quality of the landscape?			
6. Cause soil erosion or degradation?			
7. Have risk of deforestation?			
8. Divert the water resource from its natural course /location?			
9. Cause ecological degradation resulting from modification of non-fishery lands to fishery ponds?			
10. Reduce people's access to the pasture, water, public services or other resources they depend on?			
11. Cause any dislocation or involuntary resettlement of people?			
12. Cause social problems due to land tenure and use conflicts?			
13. Result in any type of human wildlife conflicts?			
14. Affect the natural drainage of the area?			

SCREENING CHECKLIST – FISHERY SECTOR			
ASSAM AGRIBUSINESS AND RURAL TRANSFORMATION PROJECT			
15. Be located in a site vulnerable to major natural or induced hazards such as: i. Landslides ii. Flooding iii. Storm iv. Earthquakes			
16. Affect the migratory birds visiting that area?			
17. Have approach to roads and what is its quality?			
18. Have suitable area for construction purposes?			
Section B: Constructional Impacts(w.r.t Infrastructure requirements)			
Will the Project cause:	Yes	No	Specify/Remarks
1. Noise from construction?			
2. Air pollution from the construction?			
3. Water pollution from the constructional activities?			
4. Soil contamination and degradation due to construction?			
5. Risk and vulnerabilities related to occupational health and safety due to physical chemical and biological hazards during project construction and operation?			
6. Large population influx during project construction and operation that cause increased burden on social infrastructure and services (such as water supply and sanitation systems)?			
7. Social conflicts if workers from other regions are hired?			
8. Any generation of construction and disposal wastes?			
Section C: Potential Environmental Impacts			
Will the Project cause:	Yes	No	Specify/Remarks
1. Overexploitation of the fish stocks and long-term degradation of resource base?			
2. Capture of non-target species and habitat damage through use of destructive fishing methods and gears?			
3. Accidental damage?			
4. Downstream water pollution from discharge of pond effluents with drain water?			
5. Reduction of water supplies from competing uses (e.g., irrigation or domestic)?			
6. Pollution from nearby aquatic environments by pond drainage and in adequate farm management?			
7. Depletion of local fish population by stocking of wild fry/fingerlings in ponds?			
8. Spread of diseases and parasites from exotic cultured species or escape of pond fish to wild?			
9. Reduction of water available to downstream users during peak seasons?			
10. Increased community health risks due to increased			

SCREENING CHECKLIST – FISHERY SECTOR
ASSAM AGRIBUSINESS AND RURAL TRANSFORMATION PROJECT

incidence or introduction of waterborne or water related diseases?			
11. Risk to community health and safety due to transport, storage and use and/or disposal of materials likely to create physical chemical and biological hazards during construction and operation?			
Section D: Seeds, Feeds, Chemicals and Waste Disposal			
Will the Project :	Yes	No	Specify/Remarks
1. Involve the use of chemicals/ fertilizers, or increase existing use?			
2. Cause contamination of water courses by chemicals/fertilizers?			
3. Cause contamination of soil by chemicals/fertilizers or affect soil salinity and alkalinity?			
4. Require scheduled chemical application?			
5. Introduce new varieties of seeds?			
6. Introduce better quality of feeds?			
7. Experience effluent and /or emissions discharge?			
8. Introduce waste management and disposal practices?			

SCREENING CHECKLIST – PIGGERY SECTOR

ASSAM AGRIBUSINESS AND RURAL TRANSFORMATION PROJECT

Basic Information

Name of Project:

Village:

Cluster:

Block:

District

Type of the Project:

Total Area:

Name of Monitor's:

Name of Supervisor:

Section A: Project Siting

Will the Project :	Yes	No	Specify/Remarks
1. Be located within or near environmentally sensitive areas like: i. Intact natural forests ii. Wetlands iii. Threatened species iv. Special area for protecting biodiversity v. Cultural heritage site?			
2. Adversely affect environmentally sensitive areas or critical habitats – wetlands, woodlots, natural forests, rivers, etc.)?			
3. Affect the indigenous biodiversity (flora and fauna)?			
4. Cause any loss or degradation of any natural habitats, either directly (through project works) or indirectly?			
5. Affect the aesthetic quality of the landscape?			
6. Cause soil erosion or degradation?			
7. Have risk of deforestation?			
8. Cause ecological degradation resulting from modification of natural habitats to piggery farm lands?			
9. Reduce people's access to the pasture, water, public services or other resources they depend on?			
10. Cause any dislocation or involuntary resettlement of people?			
11. Cause social problems due to land tenure and use conflicts?			
12. Result in any type of human wildlife conflicts?			
13. Affect the natural drainage of the area?			
14. Be located in a site vulnerable to major natural or induced hazards such as: i. Landslides ii. Flooding iii. Storm iv. Earthquakes			
15. Have approach to roads and what is its quality?			

SCREENING CHECKLIST – PIGGERY SECTOR

ASSAM AGRIBUSINESS AND RURAL TRANSFORMATION PROJECT

16. Have suitable area for construction purposes?			
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Section B: Constructional Impacts(w.r.t Infrastructure requirements)

Will the Project cause:	Yes	No	Specify/Remarks
1. Noise from construction?			
2. Air pollution from the construction?			
3. Water pollution from the constructional activities?			
4. Soil contamination and degradation due to construction?			
5. Risk and vulnerabilities related to occupational health and safety due to physical chemical and biological hazards during project construction and operation?			
6. Large population influx during project construction and operation that cause increased burden on social infrastructure and services (such as water supply and sanitation systems)?			
7. Social conflicts if workers from other regions are hired?			
8. Any generation of construction and disposal wastes?			

Section C: Potential Environmental Impacts

Will the Project cause:	Yes	No	Specify/Remarks
1. Overexploitation and long-term degradation of resource base?			
2. Accidental damage?			
3. Downstream water pollution from discharge of piggery effluents with drain water?			
4. Reduction of water supplies from competing uses (e.g., irrigation or domestic)?			
5. Threat to the local and wild variety of pigs due to introduction of high productive exotic breeds?			
6. Spread of diseases and parasites from exotic breeds or escape to wild?			
7. Reduction of water available to downstream users during peak seasons?			
8. Increased community health risks due to increased incidence or introduction of waterborne or water related diseases?			
9. Risk to community health and safety due to transport, storage and use and/or disposal of materials likely to create physical chemical and biological hazards during construction and operation?			
10. Risk to community health due to contamination of diseases from pigs?			

Section D: Feeds, Chemicals/Medicine and Waste Disposal

Will the Project :	Yes	No	Specify/Remarks
1. Involve the use of chemicals/ medicines, or increase existing use?			
2. Cause contamination of water courses by chemicals /piggery wastes?			

SCREENING CHECKLIST – PIGGERY SECTOR
ASSAM AGRIBUSINESS AND RURAL TRANSFORMATION PROJECT

3. Cause contamination of soil by chemicals/piggery wastes or affect soil salinity and alkalinity?			
4. Require monitoring by Animal husbandry and Veterinary Department?			
5. Introduce new breeds?			
6. Introduce better quality of feeds?			
7. Experience effluent and /or emissions discharge?			
8. Introduce waste management and disposal practices?			

SCREENING CHECKLIST – SERICULTURE AND HANDLOOM & TEXTILES SECTOR

ASSAM AGRIBUSINESS AND RURAL TRANSFORMATION PROJECT

Basic Information

Name of Project:

Village:

Cluster:

Block:

District

Type of the Project:

Total Area:

Name of Monitor's:

Name of Supervisor:

Section A: Project Siting

Will the Project :	Yes	No	Specify/Remarks
1. Be located within or near environmentally sensitive areas like: i. intact natural forests ii. wetlands iii. Threatened species iv. Special area for protecting biodiversity v. Cultural heritage site?			
2. Affect environmentally sensitive areas or critical habitats – wetlands, woodlots, natural forests, rivers, etc.)?			
3. Affect the indigenous biodiversity (flora and fauna)?			
4. Cause any loss or degradation of any natural habitats, either directly (through project works) or indirectly?			
5. Affect the aesthetic quality of the landscape?			
6. Cause soil erosion or degradation?			
7. Have risk of deforestation?			
8. Cause ecological degradation resulting from modification of natural habitats to VGR?			
9. Reduce people's access to the pasture, water, public services or other resources they depend on?			
10. Cause any dislocation or involuntary resettlement of people?			
11. Cause social problems due to land tenure and use conflicts?			
12. Result in any type of human wildlife conflicts?			
13. Be located in a site vulnerable to major natural or induced hazards such as: i. Landslides ii. Flooding iii. Storm iv. Earthquakes			
14. Have approach to roads and what is its quality?			

SCREENING CHECKLIST – SERICULTURE AND HANDLOOM & TEXTILES SECTOR

ASSAM AGRIBUSINESS AND RURAL TRANSFORMATION PROJECT

15. Have suitable area for construction purposes?

Section B: Constructional Impacts(w.r.t Infrastructure requirements)

Will the Project cause:	Yes	No	Specify/Remarks
1. Noise from construction?			
2. Air pollution from the construction?			
3. Water pollution from the constructional activities?			
4. Soil contamination and degradation due to construction?			
5. Risk and vulnerabilities related to occupational health and safety due to physical chemical and biological hazards during project construction and operation?			
6. Large population influx during project construction and operation that cause increased burden on social infrastructure and services (such as water supply and sanitation systems)?			
7. Social conflicts if workers from other regions are hired?			
8. Any generation of construction and disposal wastes?			

Section C: Potential Environmental Impacts

Will the Project cause:	Yes	No	Specify/Remarks
1. Overexploitation and long-term degradation of resource base?			
2. Accidental damage?			
3. Downstream water pollution from discharge of effluents with drain water?			
4. Depletion of local fish population by stocking of wild fry/fingerlings in ponds?			
5. Spread of diseases and parasites from exotic cultured species?			
6. Increased community health risks due to rearing of the worms and weaving?			
7. Risk to community health and safety due to transport, storage and use and/or disposal of materials likely to create physical chemical and biological hazards during construction and operation?			
8. Overconsumption of energy?			

Section D: Seeds, Chemicals and Waste Disposal

Will the Project :	Yes	No	Specify/Remarks
1. Involve the use of chemicals/ fertilizers/pesticides, or increase existing use?			
2. Cause contamination of water courses by chemicals/fertilizers/ pesticides?			
3. Cause contamination of soil by chemicals/fertilizers/ pesticides or affect soil salinity and alkalinity?			
4. Require scheduled chemical application?			

**SCREENING CHECKLIST – SERICULTURE AND HANDLOOM &
TEXTILES SECTOR****ASSAM AGRIBUSINESS AND RURAL TRANSFORMATION PROJECT**

5. Introduce new varieties of seeds?			
6. Experience effluent and /or emissions discharge?			
7. Introduce waste management and disposal practices?			

Annexure 6-B: Environmental Survey Checklist (Existing)**SCREENING CHECKLIST – AGRICULTURE SECTOR (EXISTING)****ASSAM AGRIBUSINESS AND RURAL TRANSFORMATION PROJECT****Basic Information**

Name of Project :

Village : Cluster:

Block : District:

Type of the Project :

Total Area :

Name of Monitor's :

Name of Supervisor :

Sl. No.	Questions asked to the Farmers	Response	Specify/Remarks
1)	How many times a year the farmers cultivate?		
2)	What are the crop varieties the famers cultivate?		
3)	Do they cultivate any local varieties?		
4)	From where do they bring the seeds?		
5)	Do the farmers use any types of fertilizers? What are those?		
6)	What steps the farmers take in case of disease outbreak and pest attacks in crops?		
7)	Do they use pesticides? What are those?		
8)	Do they procure chemicals, fertilizers and pesticides from licensed seller?		
9)	Dot he farmers use persona protective equipment during handling and application of chemicals/pesticides/fertilizers?		
10)	Does the agricultural field have proper irrigation facility?		
11)	What is the period of occurrence of flood in that area?		
12)	Do the farmers practice fish cum rice cultivation?		
13)	Do the farmers have proper storage facilities for the gains?		
14)	Do the agricultural fields have proper drainage system?		
15)	Do the farmers undergo any soil test?		
16)	Do they follow integrated pest management practices?		

SCREENING CHECKLIST – AGRICULTURE SECTOR (EXISTING)
ASSAM AGRIBUSINESS AND RURAL TRANSFORMATION PROJECT

17)	Are there any disturbances from wild animals or birds?		
18)	Do they follow any type of waste management practices?		

SCREENING CHECKLIST – DAIRY SECTOR (EXISTING)

ASSAM AGRIBUSINESS AND RURAL TRANSFORMATION PROJECT

Basic Information

Name of Project : _____

Village : _____ Cluster: _____

Block : _____ District: _____

Type of the Project : _____

Total Area : _____

Name of Monitor's : _____

Name of Supervisor : _____

Milk Producing Cluster

Sl. No.	Questions asked to the Farmers	Response	Specify/Remarks
1	What are the other types of agricultural practices the farmers practice rather than dairy?		
2	Whether the farmers had received any training in dairy farming?		
3	What are the Breeds used by the farmers?		
4	What steps do they take in case of cattle treatment?		
5	What is the daily production of their breed?		
6	What are the feeds the farmers use?		
7	What types of wastes are being produced from the farm?		
8	Do they follow any waste management system?		
9	Do they have any biogas plant installed?		
10	Do they use any Personal Protective Equipment?		

Dairy Processing Plant

Sl. No.	Questions asked to the Plant Representatives	Response	Specify/Remarks
1	What is the capacity of the milk processing plant?		
2	What is the amount of water required in the plant per day?		
3	What is the source of water?		
4	What is the water balance of the plant?		

SCREENING CHECKLIST – DAIRY SECTOR (EXISTING)**ASSAM AGRIBUSINESS AND RURAL TRANSFORMATION PROJECT**

5	What are the wastes generated by the plant per day?		
6	What is the generation point of the waste and its quantity?		
7	Is there any facility to treat waste water?		
8	What is the capacity of Effluent Treatment Plant (ETP)?		
9	Is the waste being treated at intake point of ETP?		
10	Where is the treated waste water disposed?		
11	Does the plant have proper consent from the PCB?		
12	Is the electricity is sufficient or not?		
13	What is the approximate power requirement of the plant in a day?		
14	How many Diesel Generator (DG) sets are installed in the plant?		
15	What is the capacity of these DGs?		
16	How may hour the DGs operate in a day on an average?		
19	What are the procedures followed to ensure quality of intake milk before processing and before packing?		
22	Does the plant maintain daily record of its operation and maintenance?		
23	What are the tests carried out to ensure quality of milk at the collection point?		
24	What is the frequency to encounter adulterated milk at the collection point?		
25	What are the preventive and corrective actions to be taken by the Dairy to minimize such events?		
26	What is the action taken on the unsuitable milk?		
27	What is the capacity of boiler installed in your plant?		
28	How much is the power consumption rate?		
29	Do they use any Personal Protective Equipment?		

SCREENING CHECKLIST – ENTERPRISE SECTOR (EXISTING)

ASSAM AGRIBUSINESS AND RURAL TRANSFORMATION PROJECT

Basic Information

Name of Project : _____

Village : _____ Cluster: _____

Block : _____ District: _____

Type of the Project : _____

Total Area : _____

Name of Monitor's : _____

Name of Supervisor : _____

Sl. No.	Questions asked to the Unit Representatives	Response	Specify/Remarks
1	What is the type of the enterprise?		
2	What are the types of products processed in your unit? i. White Rice ii. Parboiled Rice iii. Brown Rice iv. Snacks v. Oil vi. Pickles vii. Spices viii. Jam & Jelly		
3	What are the byproducts generated from your unit?		
4	What is the capacity of your unit?		
5	Does the unit have proper ventilation and chimney?		
6	Do you have any or all of the following? If yes mention the capacities i. Generator ii. Motor pump iii. Trucks iv. Winnowing Machine v. Packaging Machine		
7	Does the unit have any storage facility for raw materials and finished products?		
8	What are the packaging materials used? i. Plastic ii. Paper Bags iii. Jute iv. Cloth		

SCREENING CHECKLIST – ENTERPRISE SECTOR (EXISTING)**ASSAM AGRIBUSINESS AND RURAL TRANSFORMATION PROJECT**

9	What are the types of preservatives used for the finished products?		
10	Do they follow FSSAI guidelines for the use of preservatives?		
11	What is the daily energy consumption of the unit?		
12	What is the water source for the unit?		
13	What is the quantum of water required per day?		
14	What is the status of supply of electricity? Mention the daily average hours of electricity supply.		
15	Does the Unit have antiseptic/ disinfectant foot bath is provided at the entrance?		
16	What are the control measures taken to prevent insects and rodents from entering the processing area?		
17	Is your unit located near other industries emitting harmful gases, obnoxious odour, chemical etc.?		
18	Does the unit have proper drainage facility?		
19	What are the types of wastes generated from the plant?		
20	Where the wastes are disposed?		
21	Do they follow any waste management practices?		
22	Do they use any Personal Protective Equipment at the time of operation?		
23	What are the provisions for cleanliness of the unit? i. Toilet ii. Hand wash and footbath with detergent iii. Hand wash and footbath with bactericidal soap iv. Hand drying facility v. Nail Cutter		
24	Are there any employees with hand injury, skin infection, or any contagious diseases permitted to work?		
25	Does the unit have proper consent for the PCB?		
26	Does the unit have any DG sets? (If yes, what is the capacity of the set?)		

SCREENING CHECKLIST – FISHERY SECTOR (EXISTING)

ASSAM AGRIBUSINESS AND RURAL TRANSFORMATION PROJECT

Basic Information

Name of Project :
 Village : Cluster:
 Block : District:
 Type of the Project :
 Total Area :
 Name of Monitor's :
 Name of Supervisor :

Fishery Farm			
Sl. No.	Questions asked to the Farmers	Response	Specify/Remarks
1	What are the fish varieties being cultured by the farmers?		
2	How often indigenous varieties are being cultured?		
3	From where the seeds are brought? Were they able to meet their requirements?		
4	What are the feed materials used?		
5	From where do they buy the feed materials?		
6	Were they able to meet their feed requirements? If not, what are the alternative feeds used?		
7	What is the most common natural risk occurs every year/half-year/seasonally?		
8	What are the common diseases the fishes suffer from? Were they aware of the fish infections, caused by lice, worms, fungi, bacteria etc.?		
9	What steps do they take in such cases? Are they provided with any remedial facilities in such cases?		
10	What is the amount of fishes dies every year due to disease, natural calamities or any other accidents?		
11	What is done to the diseased dead fishes?		
12	What are the other wastes generated from fishery? How they manage and dispose the wastes?		
13	Do they apply any chemicals to overcome the accidents?		

SCREENING CHECKLIST – FISHERY SECTOR (EXISTING)**ASSAM AGRIBUSINESS AND RURAL TRANSFORMATION PROJECT**

14	What are the fertilizers or other chemicals use to increase the fodder growth in the area?		
15	From where do they buy these, chemicals, fertilizers, medicines?		
16	Do the farmers use any Personal Protective Equipment at the time of handling the chemicals?		
17	How the cleanliness and oxygen level is maintained in the pond water?		
18	Is there any monitoring program running to check the quality of aquaculture water?		
19	Do any migratory birds visit the site?		
20	What are the types of local bird species found in that area?		
21	What are the types of water flora found in that area and how they are managed during fish farming?		
22	Are there any cases of disease contamination from diseased fish to local animals and birds?		
23	Are they aware of the advance technologies and methods in fish farming?		
24	Are they getting satisfactory results in case of productivity by their present farming techniques and methods?		
25	What is the distance of their nearby market and what is their mode of transportation?		
26	What is the condition of road to the market?		
27	Are the farmers aware of their health and what are the type of medical facilities are being provided?		

Fishery Whole Sale Market

Sl. No.	Questions asked to the Whole Sellers	Response	Specify/Remarks
1	What are the types of wastes generated at the market?		
2	Where the wastes are disposed?		
3	Is there any waste management practices followed?		
4	Is the market provided with well drainage facility?		
5	Does the market have lavatory facility?		
6	What are the cleaning agents/detergents used for cleaning and disinfecting the market?		

SCREENING CHECKLIST – FISHERY SECTOR (EXISTING)**ASSAM AGRIBUSINESS AND RURAL TRANSFORMATION PROJECT**

7	Is there any cold storage/ware house/ice plant near the market?		
8	What are the pest management practices followed at the market?		

SCREENING CHECKLIST – PIGGERY SECTOR (EXISTING)

ASSAM AGRIBUSINESS AND RURAL TRANSFORMATION PROJECT

Basic Information

Name of Project : _____

Village : _____ Cluster: _____

Block : _____ District: _____

Type of the Project : _____

Total Area : _____

Name of Monitor's : _____

Name of Supervisor : _____

Piggery Farm			
Sl. No.	Questions asked to the Farmers	Response	Specify/Remarks
1	What type of farming do they practice? i. Extensive (free range), ii. Semi-intensive iii. Intensive		
2	What are the breeds they rear? a) Large white Yorkshire b) Landrace c) Middle white Yorkshire d) Hampshire e) HSX1 f) Duroc g) Landrace h) Indigenous type (Ghungroo pig)		
3	Which breed is more economical and productive?		
4	What is the life time and time for slaughtering for the breed?		
5	What types of feed they use? Do they meet their requirements?		
6	From where do they buy feeds?		
7	Do they have proper facility for vaccination?		
8	Do they have any facilities for artificial insemination?		
9	Are they aware of the diseases in pigs? a) <u>Bacterial diseases</u> : swine plague, swine erysipelas anthrax and inflectional abortions. b) <u>Viral origin diseases</u> : swine fever, rind pest, foot and mouth disease, viral pneumonia and swine pox. c) Pigs also suffer from internal and external parasitism.		

SCREENING CHECKLIST – PIGGERY SECTOR (EXISTING)**ASSAM AGRIBUSINESS AND RURAL TRANSFORMATION PROJECT**

10	What they do to the diseased dead pig?		
11	What are the present waste management practices of the piggery farm in terms of: a) Waste collection method; and b) Waste treatment and disposal?		
12	How far is the nearby water body? (River or pond).		
13	What is the water requirement of for the farm? Do they meet their requirements?		
14	Are there any impacts on the local flora and fauna from piggery?		
15	Were the farmers aware of diseases caused to them from piggery? Do they suffer from any of these diseases like: a) Respiratory problems: asthma, bronchitis b) Gastrointestinal problems: diarrhea c) Any cases of, conjunctivitis, influenza, allergies, like tape worm, swine flu etc.?		
16	Do they have proper license for the slaughter house?		

Slaughter Houses

Sl. No.	Questions asked to the Farmers	Response	Specify/Remarks
1	What is the number of pigs being slaughtered per day?		
2	Is there any inspection and monitoring from veterinary department for, pre mortem and post mortem?		
3	Does the slaughter house have proper drainage facilities?		
4	Are there any treatment, management and recycling practices for the wastes generated?		
5	What they do to the unsold pork?		
6	What is the daily water requirement of the slaughter house?		
7	What is the energy requirement of the slaughter house per day?		
8	Do the butchers use any Personal Protective Equipment?		

SCREENING CHECKLIST – SERICULTURE AND HANDLOOM & TEXTILES SECTOR (EXISTING)

ASSAM AGRIBUSINESS AND RURAL TRANSFORMATION PROJECT

Basic Information

Name of Project :
 Village : Cluster:
 Block : District:
 Type of the Project :
 Total Area :
 Name of Monitor's :
 Name of Supervisor :

SI. No.	Questions asked to the Farmers	Response	Specify/Remarks
4. 1	What are the disturbances faced by Farmers in culturing the worms/from pests/insects/animals/birds/tree?		
5. 2	What action has been taken in case of such disturbances?		
6. 3	Do the farmers use chemicals, pesticides and fertilizers?		
7. 4	What are those (formaldehyde, bleaching powder, hydrogen peroxide)?		
8. 5	From where do they buy the pesticides and what is the amount required?		
9. 6	Do the farmers have proper storage facility for the chemicals?		
10. 7	Do they use any Personal Protective Equipment at the time of handling the chemicals?		
11. 8	When and what are the types of wastes (both solid and liquid) generated during the entire process?		
12. 9	What is the amount of waste generated in a day?		
13. 10	Where the wastes are being disposed?		
14. 11	What cleaning agents and disinfectants are used by the farmers?		
15. 12	Do the farmers practice dyeing?		
16. 13	What types of chemicals are used in dyeing?		
17. 14	What is the source of energy used for cocoon boiling? Were they able to meet the requirement?		
18. 15	From where do they collect it (in case of fire woods)?		
19. 16	What is the source of water they use?		

**SCREENING CHECKLIST – SERICULTURE AND HANDLOOM &
TEXTILES SECTOR (EXISTING)**

ASSAM AGRIBUSINESS AND RURAL TRANSFORMATION PROJECT

20. 17	What is the amount required daily and were they able to meet the daily requirements?		
21. 18	Where the boiled water is disposed and what is the amount disposed daily?		
22. 19	Do they follow the safety techniques like wearing masks and gloves during the process?		
23. 20	Does the processing house have proper ventilation and high stack facility?		
24. 21	Are the farmers aware of their health and what are the types of medical facilities provided?		

Annex 7

ANNEXURE 7: ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES (BY PROJECT SECTORS)

1. Agriculture and Horticulture

Sl. No.	Project Stage	Project Activity	Environmental / Operational Impacts	Mitigation Measures
1.	Pre-Construction Stage Impacts	<ul style="list-style-type: none"> Land requirement Land and soil surveys Conflict with small land holder farmers over land resources 	<ul style="list-style-type: none"> Loss of land and properties Habitat modification Effect to the local flora and fauna Change in landuse pattern 	<ul style="list-style-type: none"> Provision of compensation for the affected people (PAP's) as per the proposed Entitlement Matrix. In the worst case, there should be a provision for Resettlement and Rehabilitation (R&R) Use of participatory methods to include affected people in decision making process Compensatory measures for restoring the affected flora and fauna should be explored Provision should be made as per the existing landuse policies, laws and land rights
		<ul style="list-style-type: none"> Site Selection 	<ul style="list-style-type: none"> Inappropriate site selection may lead to lesser yield and loss 	<ul style="list-style-type: none"> Suitable soil selection should be done as per the crops requirements. Any well drained soil is suitable for maize cultivation. Sites having sandy and sandy loam fertile soils shall be preferred. Generally sandy soils are suitable for mustard cultivation. However, other light soils are also equally good for Mustard crop cultivation.
2.	Construction Stage Impacts	<ul style="list-style-type: none"> Land Preparation Farm layout 	<ul style="list-style-type: none"> Soil erosion 	<ul style="list-style-type: none"> Appropriate soil and water conservation measures should be adopted
			<ul style="list-style-type: none"> Loss of biodiversity 	<ul style="list-style-type: none"> Limiting clearance of vegetation to those areas where farming will be conducted only
			<ul style="list-style-type: none"> Disruption of hydrological cycle 	<ul style="list-style-type: none"> Preserve surface water hydrology, surface water quality or water resource within or adjacent to project Abide to the existing rules and regulations
			<ul style="list-style-type: none"> Increase stream sedimentation and damage to aquatic ecosystem 	<ul style="list-style-type: none"> Protect water catchment areas
			<ul style="list-style-type: none"> Air and Noise pollution caused by heavy machineries 	<ul style="list-style-type: none"> Use appropriate and regularly services of machineries Encourage use of protective gears Use sound proof machines
			<ul style="list-style-type: none"> Contamination of soil due to oil leakage from machineries 	<ul style="list-style-type: none"> Use appropriate and provide regular services of Machinery and vehicles Provide specific area for conducting machine services
			<ul style="list-style-type: none"> Soil compaction due to 	<ul style="list-style-type: none"> Use of environmentally friendly Machinery e.g. Subsoilers and

Sl. No.	Project Stage	Project Activity	Environmental / Operational Impacts	Mitigation Measures
			heavy machineries	<ul style="list-style-type: none"> rippers Concentrate activities in the project core areas.
3.	Operation Stage Impact (Productivity Enhancement)	<ul style="list-style-type: none"> Use of chemical and pesticides 	<ul style="list-style-type: none"> Soil contamination may result due to overuse of fertilizer and other chemicals that are used to enhance the productivity/ yield. Increased use of pesticides/ fertilizers could lead to issues related to storage, handling, application and disposal probability of pesticides and fertilizers flowing into food chain and posing a health risks/ hazards 	<ul style="list-style-type: none"> Use of suitable fertilizer with a prescribed dose limit (guidance shall be obtained from Agriculture Department). Overuse of fertilizers particularly nitrogen attract more aphids. A combination of organic and inorganic fertilizer is a good option Promoting the use of bio-fertilizer Training on IPM should be facilitated to farmer in order to make them aware of the hazards of fertilizer and other alternative climate resilient methods. Integrated pest management plan should be referred with respect to the proposed Project Interventions and accordingly the suggested mitigation/ management measures should be adopted.
		<ul style="list-style-type: none"> Selection of crop (Cereals, Pulses, Fruits and Vegetables) variety 	<ul style="list-style-type: none"> If appropriate variety of crop (Cereals, Pulses, Fruits and Vegetables) with respect to the particular season and climatic zone 	<ul style="list-style-type: none"> Selection of suitable crop (Cereals, Pulses, Fruits and Vegetables) variety with respect to area/ zone should be adopted. (please refer Annexure 5, detailing the variety of crops (Cereals, Pulses, Fruits and Vegetables) recommended for particular season and climatic zone)
		<ul style="list-style-type: none"> Cultivation precautions 	<ul style="list-style-type: none"> Use of chemicals in the waterlogged paddy field may create GHG emission (N₂O) 	<ul style="list-style-type: none"> Use Azolla as a good alternative for Nitrogen dosage.
		<ul style="list-style-type: none"> Soil Nutrient deficiency 	<ul style="list-style-type: none"> Excessive use of chemical Fertilizers would leave residues in the soil which would ultimately increase salinity / alkalinity of the soil which in turn will affect the soil structure. 	<ul style="list-style-type: none"> Integrated Soil Fertility management using organic manures, bio-fertilizers should be adopted Crop rotation practice should be followed such as before sowing paddy any crop related to legume family (pea, pulse, lentil) should be practiced so as to restore the nitrogen and other micronutrient. Rhizobium inoculum mixed with soil should be used for soil treatment. Organic manure such as cow dung, crop residue etc., should be used to keep the soil healthy. Intercropping of Mustard with wheat, barley, gram and lentil under the rain fed conditions and intercropping of mustard with potato under the irrigated conditions could be promoted. Creating awareness among the farmers to grow pulses following crop

Sl. No.	Project Stage	Project Activity	Environmental / Operational Impacts	Mitigation Measures
				<p>rotations for increasing production by restoration of soil fertility and biological nitrogen for long life of soil.</p> <ul style="list-style-type: none"> Integrated pest management plan should be referred and accordingly the suggested mitigation/management measures should be adopted.
		<ul style="list-style-type: none"> Crop rotation problem 	<ul style="list-style-type: none"> Mono cropping of paddy may lead to depletion of similar kind of nutrients from the soil 	<ul style="list-style-type: none"> Rice cultivation shall be followed by short duration legumes such as green gram, black gram which shall be cultivated to maintain the soil nutrient balance.
		<ul style="list-style-type: none"> Irrigation 	<ul style="list-style-type: none"> Increase in production and farming will increase the demand for irrigation facilities 	<ul style="list-style-type: none"> All Irrigation facilities should be carried out after obtaining legal consent from irrigation department. Promotion of more efficient method of irrigation like drip irrigation can be practiced
4.	Post Construction and Operation Stage Impacts	<ul style="list-style-type: none"> Field sorting, grading and packing 	<ul style="list-style-type: none"> Inadequate field sorting, grading and packing protocols for commodities that lend well to field packing 	<ul style="list-style-type: none"> Establish sorting, grading and packing protocols for certain commodities Educate the farmers and stakeholders
		<ul style="list-style-type: none"> Storage of the agro products in dry and cold storages 	<ul style="list-style-type: none"> Insect pests of stored grain / agro products (fruits and vegetables) High consumption of electricity. Gas emissions from the unit. Use of water for cleaning and cooling purposes. Waste disposal. 	<ul style="list-style-type: none"> Use Hot water treatment to control fungal infection and hot air treatment to decrease fungal infection. Maintaining temperature at 38°C for 4 days, or within one week of being retained at 20°C shall increase the shelf life of the fruits Use of suitable renewable energy like, solar, wind etc. Advanced cooling equipment should be used to reduce emissions. Waste water treatment and its recycling should be practiced. Proper waste disposal and treatment should be followed.
		<ul style="list-style-type: none"> Transportation 	<ul style="list-style-type: none"> Vehicular emissions to the ambient atmosphere. Cracking of roads due to over weighing vehicles. Poor temperature management, loading and unloading practices 	<ul style="list-style-type: none"> BS-IV vehicles with valid emission certificate should be used for transportation. Overweighing Vehicles carrying loads exceeding those permissible without proper permission should not be allowed to pass through the constructed roads. Create awareness on proper transport system management
		<ul style="list-style-type: none"> Marketing. 	<ul style="list-style-type: none"> Market waste generation, both solid and liquid. 	<ul style="list-style-type: none"> Proper waste disposal techniques should be followed in the market. The market should have proper drainage facility. Hygiene should be maintained at the market.

2. Dairy Sector

Sl. No.	Project Stage	Project Activity	Environmental / Operational Impacts	Mitigation Measures
1.	Pre-Construction Stage Impacts	<ul style="list-style-type: none"> Land requirement. Land filling Establishment of grazing land. 	<ul style="list-style-type: none"> Loss of land and properties. Loss of residential places like house. Habitat modification. Impact to the local flora and fauna. 	<ul style="list-style-type: none"> Provision of compensation for the affected people (PAP's) as per the proposed Entitlement Matrix. In the worst case, there should be a provision for Resettlement and Rehabilitation (R&R) Use of participatory methods to include affected people in decision making process. Compensatory measures for restoring the affected flora and fauna should be explored. Provision should be made as per the existing landuse policies, laws and land rights
			<ul style="list-style-type: none"> Site Clearance 	<ul style="list-style-type: none"> Site clearance shall be carried out in such a way that the clearance and grubbing waste are disposed immediately in the designated dumping site identified for the project.
2.	Construction Stage Impacts (Infrastructure Requirements)	<ul style="list-style-type: none"> Upgradation of roads and culverts. 	<ul style="list-style-type: none"> Generation of noise from heavy machineries. Air pollution from the emission of dust particles and vehicular emissions. Effect on the ground water quality. Degradation of soil quality. 	<ul style="list-style-type: none"> Advanced machineries with quieter, less vibration and air pollutants emitting, should be used. Performance of noisy work during less sensitive time periods. Application of water sprays to reduce dust emission. Collection of any wastewater generated from site activities in settlement tanks and should be disposed according to environmental regulations. No burning of materials should be carried out on site. Proper handling and care should be taken of the wastes generated at the site to avoid run off.
		<ul style="list-style-type: none"> Construction of cold storages (BMC unit) and installation of AMCs and DPMCU's at village level collection centers. 	<ul style="list-style-type: none"> Generation of construction and demolition wastes like, metal scrapers, bricks, cement, stones etc. 	<ul style="list-style-type: none"> Reusing and recycling of the wastes rather than hazardous wastes which will be removed and managed by appropriately licensed contractors. For wastes which could not be reused or recycled, a reputable collector should be employed by the contractor to remove this waste to landfill. Implementation of Solid Waste Management Practice.
		<ul style="list-style-type: none"> Setting up new milk processing plant at 	<ul style="list-style-type: none"> Generation of construction and 	<ul style="list-style-type: none"> Reusing and recycling of the wastes rather than hazardous

Sl. No.	Project Stage	Project Activity	Environmental / Operational Impacts	Mitigation Measures
		Jorhat and Silchar.	demolition wastes like, metal scrapers, bricks, cement, stones etc.	wastes which will be removed and managed by appropriately licensed contractors. <ul style="list-style-type: none"> For wastes which could not be reused or recycled, a reputable collector should be employed by the contractor to remove this waste to landfill. Implementation of Solid Waste Management Practice.
		<ul style="list-style-type: none"> Engagement of labours for construction purpose and their settlement. 	<ul style="list-style-type: none"> Waste generation from human settlement. Exploitation of land and water resources. Modification of land for their establishment. 	<ul style="list-style-type: none"> Proper toilets and wastes disposal areas should be provided to the labours residing at the site. Water should be supplied in order to reduce exploitation of water resources. Uncultivable land should be used as temporary settlement of the labours.
3.	Operation Stage Impact (Farm Impacts)	<ul style="list-style-type: none"> Selection of breed 	<ul style="list-style-type: none"> Ensuring proper selection of breeds. Breeds that cannot adapt to the local climatic conditions will lead to loss of cattle or results in low productivity and health issues. 	<ul style="list-style-type: none"> Suitable breed selection should be done with respect to climate adaptability. Indigenous species should be promoted for artificial insemination. Interaction with technicians of artificial insemination would be helpful to select a good cattle breed.
		<ul style="list-style-type: none"> Rearing more number of cows than the holding capacity. 	<ul style="list-style-type: none"> Resource competition with other livestock. 	<ul style="list-style-type: none"> Limit number of dairy cows per household to a manageable size. Encourage sale of excess dairy cows and assist farmers to access markets.
		<ul style="list-style-type: none"> Grazing land requirement and Tackling the fodder scarcity 	<ul style="list-style-type: none"> Due to the increase in number of cattle, the requirement for more fodder is inevitable and if grazing lands are located near to the forest area, it may even cause a direct threat to the forest eco system by creating an environmental Risk. 	<ul style="list-style-type: none"> A climate resilient method should be adopted for fulfilling the demand of fodder Community based grazing land cultivation should be done on the waste/ barren land to fulfill the fodder demand. Improve productivity of pasturelands by introducing improved fodder seeds and increase the use of waste lands for fodder production. Community should get proper permission from nearby forest department, if the grazing land is located near protected areas.
		<ul style="list-style-type: none"> Activities like grazing, farm manure storage and spreading and cattle urine disposal. 	<ul style="list-style-type: none"> Release of NH₃, CH₄, NO₂, Non Methane VOCs, fine particulates and heavy metals to atmosphere. 	<ul style="list-style-type: none"> Supply and access to improved cattle feeds which reduces the emissions to atmosphere. Supply of well adapted genetically modified cattle breeds.

Sl. No.	Project Stage	Project Activity	Environmental / Operational Impacts	Mitigation Measures
				<ul style="list-style-type: none"> • Training to the farmers for better management practices for cattle, shed and waste.
		<ul style="list-style-type: none"> • Manure and wastewater storage, feed storage areas, livestock housing (such as calf rearing sheds or free stall sheds), and the cows themselves. 	<ul style="list-style-type: none"> • Generation of odour. 	<ul style="list-style-type: none"> • Feed storage areas should be constructed so that feed is kept dry. • Training and following best practice guidelines for the siting, design, management and maintenance of dairy waste.
		<ul style="list-style-type: none"> • Use of chemical fertilizer and pesticides 	<ul style="list-style-type: none"> • overuse of fertilizer and other chemicals in fodder production 	<ul style="list-style-type: none"> • Promotion of farming methods; by use of bio-manure, compost material and bio fertilizer as much as possible so as to minimize the introduction of chemicals into the food chain. These methods are cost friendly and eco-friendly . • Preference to be given for green fodder as much as possible.
			<ul style="list-style-type: none"> • Agricultural chemicals used on dairy farms include herbicides, pesticides and veterinary medications which have potential risks for users, consumers, the community and the environment. 	<ul style="list-style-type: none"> • Trainings for handling, storage and disposal of the chemicals should be provided to the farmers. • Use of personal protective equipment like gloves, masks, boots. • Veterinary medicines used should be appropriate for the identified problem, are used according to label instructions within the expiry date and have been stored correctly from purchase to use. • Minimisation of chemical use and chemicals with the lowest potential for natural environment toxicity and water contamination should be chosen. • The target pest, disease or weed should be correctly identified, and an appropriate chemical, application rate and application method should be followed.
		<ul style="list-style-type: none"> • Unhygienic farming practice. 	<ul style="list-style-type: none"> • Introduction and spread of diseases (including leptospirosis, salmonellosis and toxoplasmosis) on farm from pests. • Decrease in milk production, and result in livestock losses through direct attack or injury and can also be a nuisance and a 	<ul style="list-style-type: none"> • Management and strategic application of appropriate chemicals or other extermination measures. • Feed spills should be cleaned up immediately, to minimize breeding sites or attractants. • Vegetation and rubbish around buildings and yards are removed or controlled, in order to reduce habitat for insects and vermin.

Sl. No.	Project Stage	Project Activity	Environmental / Operational Impacts	Mitigation Measures
			health hazard for farm workers and neighbours.	
		<ul style="list-style-type: none"> Vaccination and artificial insemination facility 	<ul style="list-style-type: none"> Inappropriate vaccination and insemination may create problem in overall health of cattle and negatively affect the production. 	<ul style="list-style-type: none"> Develop a regular interaction with the Providers/ technician of Artificial Insemination and veterinary facility (a doorstep facility can be provided under the Project APART). A sensitization workshop for producers would be helpful to create awareness among them about the precautions and probable health risk in cattle, which will also pose a negative impact on overall milk production.
		<ul style="list-style-type: none"> Enhancing the Milk Yield 	<ul style="list-style-type: none"> Injecting hormonal substances like oxytocin under misconception that it would increase milk yield will result in negative impact on animal health and will make the animal go dry early. 	<ul style="list-style-type: none"> Practice of injecting hormones should be strictly avoided. Creating an awareness among producers would help us to solve this issue Sensitisation by the veterinarians on this subject would be helpful to the producers
		<ul style="list-style-type: none"> Milking 	<ul style="list-style-type: none"> Unhygienic milking practice may cause contamination of milk and pose a health risk for human 	<ul style="list-style-type: none"> Beneficiaries should be trained on hygienic milking practices. Sterilisation of utensils and other equipment's must be emphasized by conducting an awareness training Proper sanitization methods to be adopted before milking
		<ul style="list-style-type: none"> Shed spacing, sanitation and waste management 	<ul style="list-style-type: none"> Shed Spacing and Sanitation problem (Congested and unclean shed without proper facilities for urine drainage, lack of ventilation etc.) will lead to outbreak and spread of diseases. 	<ul style="list-style-type: none"> Selection of sheds should be such that it should avoid areas that are close to waterways or those with shallow groundwater. The shed should be clean and should provide sufficient ventilation, enough space to animals must be provided to avoid overcrowding, allow free movement of the cattle. Proper waste drainage system should be provided . Awareness on alternate use of waste such as use of cow dung as bio fuel, as organic manure etc must be provided cattle shed management measures has been presented in Annexure 6 as a reference
		<ul style="list-style-type: none"> Dairy shed cleaning, yard and pad wash down and stock drinking. 	<ul style="list-style-type: none"> Transfer of organic matter (such as manure, milk, nutrients, salts, micro-organisms and 	<ul style="list-style-type: none"> An irrigation and drainage management plan should be developed. Spills of effluent, feed, chemicals and other potential pollutants

Sl. No.	Project Stage	Project Activity	Environmental / Operational Impacts	Mitigation Measures
			chemicals) to surface water, groundwater and soil.	should be cleaned up promptly.
		<ul style="list-style-type: none"> Emission of GHGs 	<ul style="list-style-type: none"> Emission of noxious gases like methane, nitrous oxides is possible due to the enteric fermentation of manure when it is stored in the anaerobic condition, Ammonia gas would be released from the cattle wastes. 	<ul style="list-style-type: none"> Adoption of better manure management practices can substantially reduce the emission Promotion of Community base or individual level biogas plant. Climate resilient options to reduce the GHG emission ensuring power saving option should be promoted. A training program on biogas development and bio manure management for community or individual level well shall be beneficial. An integrated farming system should be adopted to increase the fodder farm production capacity by using the wastes from cattle shed as manure. Sensitization of farmers to adopt the traditional ways would result in eco-friendly techniques to enhance overall productivity and achieve cost effective benefits.
	Dairy Processing Impacts - (Industries)	<ul style="list-style-type: none"> Operation of the dairy processing plant Biological decomposition of milk derived organic matter. 	<ul style="list-style-type: none"> Air pollution due to odours and particle emissions. 	<ul style="list-style-type: none"> Maintenance of aerobic conditions for wastewater processing. Use of filters or scrubbers to eliminate or reduce particles. Use of automatic process control. Continuous routine monitoring of emission points using audible, visible alarms.
		<ul style="list-style-type: none"> Air discharges from drier stacks, Heater fans, Air supply fans, Ventilation, Boilers, and Pumps. 	<ul style="list-style-type: none"> Generation of noise. 	<ul style="list-style-type: none"> Concrete construction for buildings. Sound silencers on air intake fans and air discharges. Acoustic enclosure of outdoor mechanical plant such as pumps. Restricted operating hours. Mufflers on transport vehicles.
		<ul style="list-style-type: none"> Product losses from leaking equipment and pipelines, spills caused by equipment overflows and malfunctions and by poor Handling procedures. The washing and cleaning out of 	<ul style="list-style-type: none"> Generation of waste water and other liquid wastes. 	<ul style="list-style-type: none"> Wastes generated should be disposed after treatment. The plant should have proper drainage system. Use of chemicals in cleaning and washing purposes should be reduced.

Sl. No.	Project Stage	Project Activity	Environmental / Operational Impacts	Mitigation Measures
		<ul style="list-style-type: none"> product remaining in the tank, trucks, cans, piping. Splashing and container breakage in automatic packaging equipment. 		
		<ul style="list-style-type: none"> Pumping of ground water for the complete processing. 	<ul style="list-style-type: none"> This activity leaves less water available for downstream uses, such as municipal water supply and agriculture. 	<ul style="list-style-type: none"> Soil-water balance should be maintained. Recycling of the water used for processing.
		<ul style="list-style-type: none"> Plant operation. 	<ul style="list-style-type: none"> Excess use of energy 	<ul style="list-style-type: none"> Reduction of heat loss by using continuous, instead of batch, pasteurizers, partially homogenizing milk to reduce the size of heat exchangers, using multistage evaporators, insulating steam, water, and air pipes / tubes. Improvement of cooling efficiency by insulating refrigerated room / areas. Employment of heat recovery for both heating and cooling operations in milk pasteurizers and heat exchangers. Installation of renewable energy sources.
		<ul style="list-style-type: none"> Slippery conditions, the use of machines and tools and collisions with internal transport equipment. Exposure to biological and microbiological agents. Chemical- handling activities related to cleaning operations and disinfection of process areas, in addition to the maintenance of heating (thermal oils) and cooling systems. 	<ul style="list-style-type: none"> Physical hazards. Biological hazards. Chemical hazards. 	<ul style="list-style-type: none"> Maintaining walking and working surfaces clean and dry and provide workers with antiskid footwear. Providing workers with training in the proper use of equipment (including the proper use of machine safety devices) and personal protective equipment. Proper ventilation of enclosed or semi-enclosed areas to reduce or eliminate exposure to dust and aerosols. Installation of exhaust ventilation equipped with filters and / or cyclones, at sources of dust.
4.	Post Construction and Operation Stage Impacts	<ul style="list-style-type: none"> Packaging of the dairy products. 	<ul style="list-style-type: none"> Packaged wastes generated at community level. 	<ul style="list-style-type: none"> Use of biodegradable packaging materials. Recycling of the packing covers.
		<ul style="list-style-type: none"> Storage of the products at cold storages/cooling units. 	<ul style="list-style-type: none"> High consumption of electricity. Gas emissions from the unit. 	<ul style="list-style-type: none"> Use of suitable renewable energy like, solar, wind etc. Advanced cooling equipment should be used to reduce

Sl. No.	Project Stage	Project Activity	Environmental / Operational Impacts	Mitigation Measures
				emissions.
		<ul style="list-style-type: none"> Transportation 	<ul style="list-style-type: none"> Vehicular emission to the ambient atmosphere. Cracking of roads by over weighing vehicles. 	<ul style="list-style-type: none"> BS-IV vehicles with valid emission certificate should be used for transportation. Heavy weighing vehicles without proper permission should not be allowed to pass through the constructed roads.
		<ul style="list-style-type: none"> Marketing. 	<ul style="list-style-type: none"> Market waste generation, both solid and liquid. Generation of foul and noise from the fish market. 	<ul style="list-style-type: none"> Proper waste disposal techniques should be followed in the market. The market should have proper drainage facility. Hygiene should be maintained at the market.

3. Fishery Sector

Sl. No.	Project Stage	Project Activity	Environmental / Operational Impacts	Mitigation Measures
1.	Pre-Construction Stage Impacts	<ul style="list-style-type: none"> Land requirement Excavation activities for creating artificial waterbodies (ponds, tanks etc..) 	<ul style="list-style-type: none"> Loss of land and properties. Habitat modification. Effect to the local flora and fauna. Change in landuse pattern 	<ul style="list-style-type: none"> Provision of compensation for the affected people (PAP's) as per the proposed Entitlement Matrix. In the worst case, there should be a provision for Resettlement and Rehabilitation (R&R) Use of participatory methods to include affected people in decision making process. Compensatory measures for restoring the affected flora and fauna should be explored. Provision should be made as per the existing landuse policies, laws and land rights
			<ul style="list-style-type: none"> Site Clearance 	<ul style="list-style-type: none"> Site clearance shall be carried out in such a way that the clearance and grubbing waste are disposed immediately in the designated dumping site identified for the project.
2.	Construction Stage Impacts	<ul style="list-style-type: none"> Upgradation of roads and culverts (for the link/ approach roads) 	<ul style="list-style-type: none"> Generation of noise from construction machineries. Air pollution (dust and emission) resulting from the movement of construction vehicles and from the construction site. Surface water quality may get deteriorated due to the runoff from the construction site Degradation of soil quality. Loss of Top soil Transportation of construction materials 	<ul style="list-style-type: none"> Construction machineries should be fitted with acoustic proof to reduce noise levels. . Construction activities should be avoided near environmental sensitive areas. Construction activities which causes high noise levels should be performed during the day time Application of water sprays should be carried out to reduce dust emission. All the vehicles must have valid PUC certificates at all the time during construction phase of the project wastewater that are generated from site activities should be collected in settlement tanks / soak pit and should be disposed according to environmental regulations (as per CPCB wastewater discharge standards). No burning of materials should be carried out on site. Proper handling and care should be taken of the wastes that are generated at the site to avoid run off. Top soil should be preserved and it shall be reused for landscaping/ horticulture etc.,

Sl. No.	Project Stage	Project Activity	Environmental / Operational Impacts	Mitigation Measures
				<ul style="list-style-type: none"> The contractor should obtain the construction material only from approved quarries / sites. All vehicles transporting construction material shall be covered with Tarpaulin to avoid fugitive dust during transportation
		<ul style="list-style-type: none"> Construction of cold storages and development of infrastructure for electronic trading. Development of Rural Haats near production clusters- Providing platforms with sheds for producers/retailers, pathways etc. Construction of modern auction platform with sheds, trader sheds and Loading/unloading area 	<ul style="list-style-type: none"> Generation of construction and demolition wastes like, metal scrapers, bricks, cement, stones etc. Generation of excavated soils Habitat modification. Transportation of construction materials 	<ul style="list-style-type: none"> Reusing and recycling of the wastes are to be adopted for those other than hazardous wastes which will be removed and managed by licensed vendors. For wastes which could not be reused or recycled, a reputable collector should be employed by the Contractor to remove this waste to landfill. Construction spoils shall be reused to the extent possible as a filling material/ construction purposes. Implementation of Solid Waste Management Plan/Practice. The contractor should obtain the construction material only from approved quarries / sites. All vehicles transporting construction material shall be covered with Tarpaulin to avoid fugitive dust during transportation
		<ul style="list-style-type: none"> Engagement of labours for construction purpose and their settlement (construction labour camps). 	<ul style="list-style-type: none"> Waste generation from labour camp. Exploitation of land and water resources. Modification of land for their establishment. 	<ul style="list-style-type: none"> Proper toilets and waste disposal areas should be provided to the labours residing at the site. Water for drinking and sanitation purposes should be supplied in order to reduce exploitation of water resources. Uncultivable / barren land should be used as temporary settlement (construction labour camps) for the labours.
3.	Operation Stage Impact			
	<ul style="list-style-type: none"> Fish productivity enhancement Establishment of Fish Mill and Hatcheries Enhancement of production of formulated fish feed Establishment 	<ul style="list-style-type: none"> Selection of fish species 	<ul style="list-style-type: none"> Selection of fish species that cannot adapt to the local climatic conditions will lead to loss or results in low productivity. 	<ul style="list-style-type: none"> Selection of fish species suitable to the climate is a key factor in fish cultivation. Hence those species that promises climate adaptability shall be selected. Native species have greater adaptability Indigenous species should be promoted through artificial insemination facility Interactions with the technicians of the fish seed provider would

Sl. No.	Project Stage	Project Activity	Environmental / Operational Impacts	Mitigation Measures
	of Common Service Center <ul style="list-style-type: none"> • Refrigerated Fish carrying van • Road • Capacity Building 			<p>be helpful to make a suitable choice of fish species as per climate and season requirement.</p> <ul style="list-style-type: none"> • Refer the Aquaculture management plan which guides / recommends the fish species/ variety which is suitable under local conditions.
		Indigenous species	<ul style="list-style-type: none"> • Threaten to biodiversity loss as well as loss of Indigenous species; in order to have higher yield farmers may introduce exotic species or more productive fish species which may create competition to the indigenous species and as a consequence, a threat to local species may arise 	<ul style="list-style-type: none"> • Select local fish species / varieties that would respond and adapt well to the local climatic conditions • The selected fish species/ variety should reduce external inputs and maintenance costs • Refer the Aquaculture management plan which can be used as a guide and it recommends the fish species/ variety that are suitable for local conditions.
		Use of chemical fertilizer and pesticides	<ul style="list-style-type: none"> • Use of Chemicals/fertilizer for obtaining better production may lead to bioaccumulation in the fish body and later it get transferred into food chain 	<ul style="list-style-type: none"> • Conducting trainings/ workshops to the farmers about the health hazards with respect to the use of chemicals/ pesticides, the bio accumulation process in the fish and its implications. . • Promoting the use of bio manure, bio food for agriculture practices and use of traditional fish feed like Mustard Oil cake, by-products of polished rice etc. as fish feed • Promote Integrated farming practices so as to encourage the use of farm waste, livestock manure in fish farming as a fertilizer. • Use of agriculture by-product such as rice bran and mustard oil cake in the ratio of 70:30 at 2-3% of the body weight of fishes can be provided.
		Oxygen Depletion	<ul style="list-style-type: none"> • Oxygen Depletion may occur due to the enhanced production of fish in the same cultivated area (water body/pond/tank) and over crowding may lead to oxygen stress 	<ul style="list-style-type: none"> • Provision of oxygen supplementation • Changing feeding regimes, Recirculating water/ aeration and De-stocking are some of the measures that are to be taken care of • Creating an awareness among the cultivators shall help them to understand and act proactively
		Natural Calamities	<p>Natural Calamities</p> <ul style="list-style-type: none"> • Flood • Drought 	<ul style="list-style-type: none"> • Proper embankment should be constructed to tackle the flood situation.

Sl. No.	Project Stage	Project Activity	Environmental / Operational Impacts	Mitigation Measures
				<ul style="list-style-type: none"> Shallow areas of derelict water bodies/ponds/lakes/ can be made use of for raising fishes and prawns in enclosure (pens) Awareness must be provided to calculate water loss due to evaporation. For instance, for a minimum of five feet total depth allow at least two feet of water loss resulting from evaporation and seepage during the drought . Select fish species which has better acclimatization with higher temperature (in drought)
		<ul style="list-style-type: none"> Excess input of feed materials. Water Quality Problem 	<ul style="list-style-type: none"> Eutrophication may occur due to the use of fertilizer, other feeds (rich in nutrients) for increasing the yield will lead to the water quality problem and nutrient enrichment 	<ul style="list-style-type: none"> Nutrients rich fish feed should be used in limited / required quantity. The dosage limit must be arrived at with the help of technicians Prohibit use of unwanted and lethal chemicals without proper awareness and lack of knowledge of related hazards. Establishment of water quality testing for various parameters at least four times a year should be followed. Testing the suitability of the water and other environmental conditions for the chosen fish species must be done before cultivation Creating an Awareness of the various problems with the help of technicians Knowledge on the toxicity must be provided, If possible, LCA shall be carried out as part of APART project. LD50 & LD100 must also be determined
		<ul style="list-style-type: none"> Climate Change 	<ul style="list-style-type: none"> Release of noxious gases 	<ul style="list-style-type: none"> Adoption of Climate resilient options to reduce the GHG emission should be promoted through training programs. Fish - livestock farming systems is a highly assured technology where predetermined quantum of livestock waste obtained by rearing the livestock in the pond area is applied in the pond to raise the fish crop without any other additional supply of nutrients. The byproducts generated from the production and processing of livestock can be used as a feed for aquaculture. Integrated Fish Farming practices such as Pig - Fish

Sl. No.	Project Stage	Project Activity	Environmental / Operational Impacts	Mitigation Measures
				Farming should be promoted, where urine, excreta of pig and spilled pig feeds can be applied manually to the pond water at a pre-determined dose.
	Intervention in Beel Fisheries	<ul style="list-style-type: none"> Disturbance to the Physiochemical parameters of the water quality 	<ul style="list-style-type: none"> The water quality in the Beel (water body) may deteriorate due to the increase in suspended particles from the aquaculture wastes. Due to this, there will be a raise in the nutrient concentration which leads to the turbidity resulting in depletion of Dissolved Oxygen (DO) 	<ul style="list-style-type: none"> Monitoring the Feeding material regularly that are used in the beel fisheries. Feed shall be calculated based on fish density and the same amount should be let into the system. Establishment of a proper water quality monitoring at least once in every season (4 times in year) Beel committee should compile the records of water quality monitoring of each beel and shall be maintained as per Beel Act Auto stock practice should be made mandatory in beel Other Climate resilient Options are as follows: <ul style="list-style-type: none"> Popularize low impact aquaculture and Resource efficient production system through Community-based management (Cluster) Bio-floc technology- Accumulation of nitrogenous waste in fish ponds can be converted into feed through environment friendly bio-floc technology. While feeding fishes with good quality feed, feed quantity needs to be assessed according to the fish biomass at recommended feeding rate; this will reduce the amount of feed and loss during feeding. This would result in oxygen demand
			<ul style="list-style-type: none"> Inadequate using of chemicals in aquaculture 	<ul style="list-style-type: none"> Ensure control on the dosage of chemicals, fertilizer or any medicines etc. that have been used in aquaculture system, Performance and method of administration must be determined.
		<ul style="list-style-type: none"> Accidental events/spills (e.g. fuel, hydraulic fluid and lubricants). 	<ul style="list-style-type: none"> Degradation of water quality. Release of hazardous materials. 	<ul style="list-style-type: none"> Minimization of leaks from boat engines, water pumps and generators. Proper drainage should be provided to reduce the contamination of hazardous

Sl. No.	Project Stage	Project Activity	Environmental / Operational Impacts	Mitigation Measures
	Awareness		<ul style="list-style-type: none"> Lack of awareness among small beneficiaries for sustainable fish farming will lead to problems for productivity enhancement urging the need to select exotic breed, chemicals and other unhygienic practices that might have a negative impact may arise. 	<p>materials.</p> <ul style="list-style-type: none"> Providing awareness and capacity building on promising approaches having low impact of aquaculture amongst the farmers, participating communities, local authorities, extension agents, development practitioners etc to protect the environment.
4.	Post Construction and Operation Stage Impacts	<ul style="list-style-type: none"> Storage of the products at cold storages/cooling units. 	<ul style="list-style-type: none"> High consumption of electricity. Gas emissions from the unit. Excess use of water for cleaning and cooling purposes. Waste disposal. 	<ul style="list-style-type: none"> Use of suitable renewable energy like, solar, wind etc. Advanced cooling equipment should be used to reduce emissions. Waste water treatment and its recycling should be practiced. Proper waste disposal and treatment should be followed.
		<ul style="list-style-type: none"> Transportation 	<ul style="list-style-type: none"> Vehicular emissions to the ambient atmosphere. Cracking of roads due to over weighing vehicles. 	<ul style="list-style-type: none"> BS-IV vehicles with valid emission certificate should be used for transportation. Overweighing Vehicles carrying loads exceeding those permissible without proper permission should not be allowed to pass through the constructed roads.
		<ul style="list-style-type: none"> Cleaning and de-watering of the pond. 	<ul style="list-style-type: none"> Water quality degrades when pond water is discharged into freshwater bodies, consisting of excess nutrients and pollutants. 	<ul style="list-style-type: none"> Discharged Water can be treated for irrigation in agricultural field. Recycling of the water so that it be used in another fishery pond after proper treatment.
		<ul style="list-style-type: none"> Improper disposal of diseased dead fishes/ fish wastes. 	<ul style="list-style-type: none"> Fouling and contamination leading to diseases to the predators and scavengers, along with deterioration of the natural habitat. 	<ul style="list-style-type: none"> Proper waste disposal techniques should be followed. Bio degradable waste should be separated out and can be used as bio fertilizers. Dumping grounds should have proper treatment facility they should be free from leaching and fouling.
		<ul style="list-style-type: none"> Marketing 	<ul style="list-style-type: none"> Market waste generation, both solid and liquid. Generation of foul and noise from the fish market. 	<ul style="list-style-type: none"> Proper waste disposal techniques should be followed in the market. The market should have proper drainage facility. Hygiene should be maintained at the market.

4. Piggery Sector

Sl. No.	Project Stage	Project Activity	Environmental / Operational Impacts	Mitigation Measures
1.	Pre-Construction Stage Impacts	<ul style="list-style-type: none"> Land requirement 	<ul style="list-style-type: none"> Permanent/ temporary loss of agricultural land and other assets at the project site and its influence area Effect to the local ecology (flora and fauna) Change in landuse pattern 	<ul style="list-style-type: none"> Provision of compensation for the affected people (PAP's) as per the proposed Entitlement Matrix. In the worst case, there should be a provision for Resettlement and Rehabilitation (R&R) Use of participatory methods to include affected people in decision making process. Compensatory measures for restoring the affected flora and fauna should be explored. Provision should be made as per the existing landuse policies, laws and land rights
			<ul style="list-style-type: none"> Site Clearance 	<ul style="list-style-type: none"> Site clearance shall be carried out in such a way that the clearance and grubbing waste are disposed immediately in the designated dumping site identified for the project.
2.	Construction Stage Impacts	<ul style="list-style-type: none"> Upgradation of roads and culverts (for the link/ approach roads) 	<ul style="list-style-type: none"> Generation of noise from construction machineries. Air pollution (dust and emission) resulting from the movement of construction vehicles and from the construction site. Surface water quality may get deteriorated due to the runoff from the construction site Degradation of soil quality. Loss of Top soil Transportation of construction materials 	<ul style="list-style-type: none"> Construction machineries should be fitted with acoustic proof to reduce noise levels. Construction activities should be avoided near environmental sensitive areas. Construction activities which causes high noise levels should be performed during the day time Application of water sprays should be carried out to reduce dust emission All the vehicles must have valid PUC certificates at all the time during construction phase of the project Wastewater that is generated from site activities should be collected in settlement tanks / soak pit and should be disposed according to environmental regulations (as per CPCB wastewater discharge standards). No burning of materials should be carried out on site. Proper handling and care should be taken of the wastes that are generated at the site to avoid run off. Top soil should be preserved and it shall be reused for landscaping/ horticulture etc., The contractor should obtain the construction material only from approved quarries / sites.

Sl. No.	Project Stage	Project Activity	Environmental / Operational Impacts	Mitigation Measures
				<ul style="list-style-type: none"> All vehicles transporting construction material shall be covered with Tarpaulin to avoid fugitive dust during transportation
		<ul style="list-style-type: none"> Construction of cold storages and development of infrastructure for electronic trading. Development of Rural Haats near production clusters- Providing platforms with sheds for producers/ retailers, pathways etc. Construction of modern auction platform with sheds, trader sheds and Loading/ unloading area 	<ul style="list-style-type: none"> Generation of construction and demolition wastes like, metal scrapers, bricks, cement, stones etc. Generation of excavated soils Habitat modification. Transportation of construction materials 	<ul style="list-style-type: none"> Reusing and recycling of the wastes are to be adopted for those other than hazardous wastes which will be removed and managed by licensed vendors. For wastes which could not be reused or recycled, a reputable collector should be employed by the Contractor to remove this waste to landfill. Construction spoils shall be reused to the extent possible as a filling material/ construction purposes. Implementation of Solid Waste Management Plan/Practice. The contractor should obtain the construction material only from approved quarries / sites. All vehicles transporting construction material shall be covered with Tarpaulin to avoid fugitive dust during transportation
		<ul style="list-style-type: none"> Engagement of labours for construction purpose and their settlement (construction labour camps). 	<ul style="list-style-type: none"> Waste generation from labour camp. Exploitation of land and water resources. Modification of land for their establishment. 	<ul style="list-style-type: none"> Proper toilets and waste disposal areas should be provided to the labours residing at the site. Water for drinking and sanitation purposes should be supplied in order to reduce exploitation of water resources. Uncultivable / barren land should be used as temporary settlement (construction labour camps) for the labours.
		<ul style="list-style-type: none"> Impact on Surface Water 	<ul style="list-style-type: none"> Sediment accumulation in runoff 	<ul style="list-style-type: none"> Erosion and sediment control best practices should be adopted. Disturbed areas will be re-vegetated
		<ul style="list-style-type: none"> Soil Quality Impact 	<ul style="list-style-type: none"> Disposal of construction wastes 	<ul style="list-style-type: none"> Wastes will be gathered and periodically hauled to the local disposal site
3.	Operation Stage Impact (Selection of Proper Breed)	<ul style="list-style-type: none"> Pig Rearing 	<ul style="list-style-type: none"> Adoption of Bad practices in Pig rearing 	<ul style="list-style-type: none"> Prohibition of use of antibiotics to 'prevent' an early death of the pigs without proper medical guidance used Injection of growth hormones to accelerate the growth of pigs to attain higher body mass ratio to meet the market demand should be avoided. .
		<ul style="list-style-type: none"> Indigenous species 	<ul style="list-style-type: none"> Selection of breeds that cannot adapt to the local climatic conditions will lead to loss of livestock or 	<ul style="list-style-type: none"> Selection of suitable breed in order to have increased adaptability.

Sl. No.	Project Stage	Project Activity	Environmental / Operational Impacts	Mitigation Measures
			results in low productivity and might have health issues.	<ul style="list-style-type: none"> Indigenous species should be promoted in artificial insemination facility. Provide awareness to the farmers about significance of the indigenous pig species
		<ul style="list-style-type: none"> Use of chemical fertilizer and pesticides 	<ul style="list-style-type: none"> Use of Chemicals/fertilizer in fodder production 	<ul style="list-style-type: none"> Sensitization workshop should be conducted for the farmers about the bio-accumulation of chemicals in the pork meat and its implication on the human health. Promoting the use of bio manure for farming, and use of bio food and traditional feed such Mustard Oil cake, by-product of polished rice, maize etc., for pigs.
		<ul style="list-style-type: none"> Shortage of Food 	<ul style="list-style-type: none"> Shortage of food may occur due to rearing of more number of pigs for more yields. 	<ul style="list-style-type: none"> Water Hyacinth is abundant in Assam which can be used as a food for pigs. This can reduce cost of pig rearing. Integrated farming practices should be promoted so as to promote the use of farm waste (kitchen waste, by-products of food grains etc.) as food for pigs.
		<ul style="list-style-type: none"> Infectious disease 	<ul style="list-style-type: none"> The traditional farmers have little knowledge on food safety, public health risk and zoonotic issues in pig rearing. 	<ul style="list-style-type: none"> An awareness program to farmer on precaution measures that needs to be adopted during epidemic/ spreading of infectious diseases in pig should be made available. Knowledge on the possible diseases that could be transmitted from pig to humans such as H1N1 should be provided. Awareness on the disposal techniques and safety measures to be adopted while handling contaminated / infectious meat
		<ul style="list-style-type: none"> Storage of Meat 	<ul style="list-style-type: none"> Poor/improper cold storage (refrigeration) facilities 	<ul style="list-style-type: none"> Meat is a perishable item. So in order to protect it from being contamination; deep freezers should be used by the farmers. The awareness about the precaution measures that are to be taken during storage and transportation of pork should be shared with the farmers. Knowledge of public hygiene among traders and producers should be facilitated. Proper gloves, apron should be used in handling and storage of pork. Cross contamination must be prevented
			<ul style="list-style-type: none"> Food Safety Issue- Excess use of Antibiotics 	<ul style="list-style-type: none"> Provide training to the farmers regarding Food safety standard

Sl. No.	Project Stage	Project Activity	Environmental / Operational Impacts	Mitigation Measures
			for increase in body mass may lead to unwanted chemical residue in the Food Chain	<ul style="list-style-type: none"> and regulation of GOI. • Provide awareness about human health hazards due to the use of antibiotics. • Periodic Testing of pork samples to ensure quality and safety must be in place.
		<ul style="list-style-type: none"> • Poor Hygienic Practice 	<ul style="list-style-type: none"> • Poor Hygienic Practice from farming to handling and marketing of pork 	<ul style="list-style-type: none"> • Provide awareness about precaution measures that are to be taken during storage and transportation of pork meat from the processing area. • Knowledge of public hygiene among traders and producers should be facilitated. • Awareness on Cross contamination by food handlers must be provided. • Lack of sanitation facilities for food handlers. • Improper / Inadequate storage facilities leading to contamination
			<ul style="list-style-type: none"> • Unpleasant odour 	<ul style="list-style-type: none"> • Ensure proper design construction and operation of the farm • Regular monitoring of waste handling practices • Ventilate sensitive work environments
		<ul style="list-style-type: none"> • Cattle shed 	<ul style="list-style-type: none"> • Poor manure management, Solid Waste management and discharge of Effluent • Backyard pig rearing practices induce or spreading of foul smell in the surrounding area. 	<ul style="list-style-type: none"> • Effluent and manure by-products that have been generated in a piggery are valuable sources of water, nutrients and organic matter. Hence it shall be re-used in number of ways such that it will not harm the environment. • The animal dung should be dumped in proper manure pit which can be used as manure or can be used in bio-gas production. • Sheds should have proper ventilation. • Keeping drains clean & flushing the sheds twice daily will control the spread of dirty smell to the nearby areas. • Weeping or hosing lanes and pens should be cleaned regularly to avoid manure build-up. • Providing deep litter pens. • Dumping static-pit sheds weekly, or more often. • covering anaerobic ponds with straw and permeable polypropylene • Avoiding ponding and effluent

Sl. No.	Project Stage	Project Activity	Environmental / Operational Impacts	Mitigation Measures
				irrigation during wet periods. <ul style="list-style-type: none"> Cover the carcasses immediately with soil.
		<ul style="list-style-type: none"> Climate Change 	<ul style="list-style-type: none"> Release of noxious gases 	<ul style="list-style-type: none"> Promotion of Climate resilient options to reduce the GHG emission thus resulting in power saving option through development of training program on biogas development and bio manure management for community or individual level Integrated Farming practices, such Pig Fish Farming should be promoted, where urine, excreta of pig and spilled pig feeds can be applied manually into the pond water containing fish at a pre-determined dose.
		<ul style="list-style-type: none"> Soil Pollution 	<ul style="list-style-type: none"> Soil pollution is another delicate issue when coming to spills and leaks of manure from pig farm. 	<ul style="list-style-type: none"> Applying manure to the soil has positive impacts on the soil it supplies nutrients, especially Nitrogen and Potassium and improves the fertility of the soil; Manure should not to be disposed near the water bodies and the human settlements. Manure from the pig farm should be disposed/ applied at different locations, so as to maintain uniformity. It should not be dispersed at one location as it may lead to accumulation
		<ul style="list-style-type: none"> Water Pollution 	<ul style="list-style-type: none"> Water Pollution (liquid waste from shed can leak into groundwater or mix with surface water it may lead to an increase of nitrogen and phosphorous component which is likely to result in algal bloom and other toxic effect. 	<ul style="list-style-type: none"> Cleaning the waste water storage pit or lagoon frequently, a limited amount of waste water can be used in the nearby fish ponds which in turn can act as a source of fish feed.
		<ul style="list-style-type: none"> Air Pollution 	<ul style="list-style-type: none"> Air Pollution- Storage of Pig manure may lead to emanation of toxic gases such as hydrogen sulphide and ammonia that leads to respiratory problems in human. 	<ul style="list-style-type: none"> Manure should be used as bio compost material in agricultural field after decomposition. Establishment of biogas plant could a best way to manage the toxic gas and it generates the energy to fulfil the demand of day to day cooking fuel. A family having 2-5 pigs can have a biogas establishment.
			<ul style="list-style-type: none"> Biodiversity Threat More Introduction of exotic breed of pig which is threatening indigenous species. 	<ul style="list-style-type: none"> Provide awareness to the farmers about importance, adaptability and long term benefits of indigenous pig species.
		Health and Hygiene	<ul style="list-style-type: none"> Health and Disease Vaccination 	<ul style="list-style-type: none"> Provision of mobile veterinary services to be offered during emergency period for critical and

Sl. No.	Project Stage	Project Activity	Environmental / Operational Impacts	Mitigation Measures
				<p>emergency care.</p> <ul style="list-style-type: none"> • Following proper Vaccination and deworming schedule. • Provide mandatory health Checkups • Provide Pig Health calendar depicting season and disease relationship and related preventive measures to check disease occurrence. • Regular interaction with medical service provider about pig health and precautions that are to be followed.
			<ul style="list-style-type: none"> • Unhygienic Practices in Poor Slaughter House (in open air / on the floor with no waste disposal system) 	<ul style="list-style-type: none"> • Slaughter House should be operated with proper slaughter license. • Legal formulation should be maintained in community based slaughter house as per Slaughter House Act, 2000. • Slaughter House should be located far from residential and commercial areas. • Slaughter house should have good ventilation system, provided with closed and proper drainage system. • Waste water should not be flushed/ discharged in the open area. • FIFO or other food handling practices must be practiced • Food handlers must be aware of possibilities of cross contamination
			<ul style="list-style-type: none"> • Lack of awareness among small beneficiaries for sustainable pig farming (will lead to problem while applying the project intervention of productivity enhancement), 	<ul style="list-style-type: none"> • Providing awareness and capacity building to the farmers, participating communities, local authorities, extension agents, development practitioners etc., on the promising approaches to minimise environmental impacts due to pig farming.
	Awareness		<ul style="list-style-type: none"> • Lack of awareness among small beneficiaries for sustainable pig farming (will lead to problem while applying the project intervention of productivity enhancement), 	<ul style="list-style-type: none"> • Providing awareness and capacity building to the farmers, participating communities, local authorities, extension agents, development practitioners etc., on the promising approaches to minimise environmental impacts due to pig farming.
4.	Post Construction and Operation Stage Impacts	<ul style="list-style-type: none"> • Public health, amenity and hygiene 	<ul style="list-style-type: none"> • Attraction of vermin, rodents, scavengers, and breeding sites for mosquito and other vectors borne diseases 	<ul style="list-style-type: none"> • Ensure provision of proper drainage of facilities (ensure there is no stagnant water in the project site and its vicinities) • Waste storages, sludge collection facilities controlled regularly to

Sl. No.	Project Stage	Project Activity	Environmental / Operational Impacts	Mitigation Measures
			<ul style="list-style-type: none"> Hygiene 	<p>prevent insect attraction and breeding;</p> <ul style="list-style-type: none"> Insure hygiene of equipment's and tools, machine and over all farm and slaughter house sanitation to eliminate bacteria host Inspect regularly workers health and hygiene
		<ul style="list-style-type: none"> Storage of the products at cold storages/ cooling units. 	<ul style="list-style-type: none"> High consumption of electricity. Gas emissions from the unit Excess use of water for cleaning and cooling purposes Waste disposal 	<ul style="list-style-type: none"> Use of suitable renewable energy like, solar, wind etc. Advanced cooling equipment should be used to reduce emissions Waste water treatment and its recycling should be practiced. Proper waste disposal and treatment should be followed.
		<ul style="list-style-type: none"> Transportation 	<ul style="list-style-type: none"> Vehicular emissions to the ambient atmosphere. Cracking of roads due to over weighing vehicles. 	<ul style="list-style-type: none"> BS-IV vehicles with valid emission certificate should be used for transportation. Overweighing Vehicles carrying loads exceeding those permissible without proper permission should not be allowed to pass through the constructed roads.
		<ul style="list-style-type: none"> Waste disposal and pollution 	<ul style="list-style-type: none"> un safe handling and disposal of waste 	<ul style="list-style-type: none"> Provide sanitation facilities and ensure collection of all solid waste from all sites and dispose to authorized site and by using authorized method Waste handling and disposal must comply with the CPCB Environmental Standards Skins and hides should be transferred to respective bodies timely and ensure proper handling and transportation Disposal of dead stock, condemned carcasses and other solid wastes should be disposed as per the CPCB-Comprehensive Industrial document for slaughter house, meat and seafood processing Contingency plan for mass disposal of animal carcass in the event of disease or disaster
		<ul style="list-style-type: none"> Wastewater discharge 	<ul style="list-style-type: none"> Inadequate drainage facilities and improper waste handling 	<ul style="list-style-type: none"> Ensure provision of adequate drainage facilities Ensure use of proper (leak free) containers to transfer sludge and sewage to authorized disposal

Sl. No.	Project Stage	Project Activity	Environmental / Operational Impacts	Mitigation Measures
				site
			<ul style="list-style-type: none"> • Ground water pollution from leachate and percolations from septic tanks and waste sites 	<ul style="list-style-type: none"> • Ensure adequate design, installation, and maintenance of holding tanks, septic systems and wastewater soak pits
		<ul style="list-style-type: none"> • Marketing 	<ul style="list-style-type: none"> • Market waste generation, both solid and liquid. • Generation of foul and noise from the market area. 	<ul style="list-style-type: none"> • Proper waste disposal techniques should be followed in the market. • The market should have proper drainage facility. • Hygiene should be maintained at the market.

5. Sericulture, Handloom and Textile Sector

Sl. No.	Project Stage	Project Activity	Environmental / Operational Impacts	Mitigation Measures
1.	Pre-Construction Stage Impacts	<ul style="list-style-type: none"> Land requirement Land filling Establishment of Village Grazing Reserve (VGR). 	<ul style="list-style-type: none"> Permanent/ temporary loss of agricultural land and other assets at the project site and its influence area Impact to the local ecology (flora and fauna) Change in landuse pattern 	<ul style="list-style-type: none"> Provision of compensation for the affected people (PAP's) as per the proposed Entitlement Matrix. In the worst case, there should be a provision for Resettlement and Rehabilitation (R&R) Use of participatory methods to include affected people in decision making process. Compensatory measures for restoring the affected flora and fauna should be explored. Provision should be made as per the existing landuse policies, laws and land rights
2.	Construction Stage Impacts	<ul style="list-style-type: none"> Upgradation of roads and culverts. 	<ul style="list-style-type: none"> Generation of noise from construction machineries. Air pollution (dust and emission) resulting from the movement of construction vehicles and from the construction site. Surface water quality may get deteriorated due to the runoff from the construction site Degradation of soil quality. Loss of Top soil Transportation of construction materials 	<ul style="list-style-type: none"> Construction machineries should be fitted with acoustic proof to reduce noise levels. Construction activities should be avoided near environmental sensitive areas. Construction activities which causes high noise levels should be performed during the day time Application of water sprays should be carried out to reduce dust emission All the vehicles must have valid PUC certificates at all the time during construction phase of the project Wastewater that is generated from site activities should be collected in settlement tanks / soak pit and should be disposed according to environmental regulations (as per CPCB wastewater discharge standards). No burning of materials should be carried out on site. Proper handling and care should be taken of the wastes that are generated at the site to avoid run off. Top soil should be preserved and it shall be reused for landscaping/ horticulture etc., The contractor should obtain the construction material only from approved quarries / sites. All vehicles transporting construction material shall be covered with Tarpaulin to avoid fugitive dust during transportation
		<ul style="list-style-type: none"> Construction of Community Jali 	<ul style="list-style-type: none"> Generation of construction and demolition wastes like, 	<ul style="list-style-type: none"> Reusing and recycling of the wastes are to be adopted for

Sl. No.	Project Stage	Project Activity	Environmental / Operational Impacts	Mitigation Measures
		House, Community Resting House, Well-acquainted Grainage House, Mounting cum Cocoon House and Reshom Huts.	<ul style="list-style-type: none"> metal scrapers, bricks, cement, stones etc. • Generation of excavated soils • Habitat modification. • Transportation of construction materials 	<ul style="list-style-type: none"> those other than hazardous wastes which will be removed and managed by licensed vendors. • For wastes which could not be reused or recycled, a reputable collector should be employed by the Contractor to remove this waste to landfill. • Construction spoils shall be reused to the extent possible as a filling material/ construction purposes. • Implementation of Solid Waste Management Plan/Practice. • The contractor should obtain the construction material only from approved quarries / sites. • All vehicles transporting construction material shall be covered with Tarpaulin to avoid fugitive dust during transportation
		<ul style="list-style-type: none"> • Engagement of labours for construction purpose and their settlement (construction labour camps) 	<ul style="list-style-type: none"> • Waste generation from labour camp. • Exploitation of land and water resources. • Modification of land for their establishment. 	<ul style="list-style-type: none"> • Proper toilets and waste disposal areas should be provided to the labours residing at the site. • Water for drinking and sanitation purposes should be supplied in order to reduce exploitation of water resources. • Uncultivable / barren land should be used as temporary settlement (construction labour camps) for the labours.
3.	Operation Stage Impact Production Enhancement	<ul style="list-style-type: none"> • Indigenous species 	<ul style="list-style-type: none"> • Selection of silkworm species that cannot adapt to the local climatic conditions will lead to economical loss or will result in low productivity. 	<ul style="list-style-type: none"> • Suitable silkworm species should be selected with respect to the climate adaptability. • Indigenous species should be promoted by Seed provider centers • Promoting interaction with technician of seed provider would be helpful to make a suitable choice as per climate and season requirement. • Provide awareness to the farmers about the importance of climate adaptability benefits of ingenious silkworm species
		<ul style="list-style-type: none"> • Use of chemical fertilizer and pesticides 	<ul style="list-style-type: none"> • Use of Chemicals/fertilizer as a disinfectant for destroying pests shall have impact on the quality of the silk and also it has indirect impact on the farmers health over a period of time 	<ul style="list-style-type: none"> • Use of pesticide on mulberry tree to protect it from other pests should be used in limits as per technical guidance • Proper monitoring should be carried out to maintain the proper use of chemicals. • Unlicensed shop dealing with the fertilizers, pesticides and chemicals should be banned.
		<ul style="list-style-type: none"> • Problem due to 	<ul style="list-style-type: none"> • Problem from animals and 	<ul style="list-style-type: none"> • The entire feed plant should be

Sl. No.	Project Stage	Project Activity	Environmental / Operational Impacts	Mitigation Measures
		the birds and animals	birds in the farming areas (In case of Muga silk worms some insect eating birds often target the silk worms as their prey. Monkeys damage the feed plant cultivated by the farmers)	covered with mosquito net to prevent insect eating birds and to protect the feed plant from animals like monkeys and other night dwellers
		<ul style="list-style-type: none"> Maintaining hygienic conditions. 	<ul style="list-style-type: none"> Adoption of Sericulture techniques inside the farmer's house leads to allergic diseases to both adults and children. Unhygienic conditions also lead to contamination of microbes to the pupa and silk worms. 	<ul style="list-style-type: none"> Proper training on precaution measures to be practiced during sericulture farming should be provided. The culture area should be kept away from the common living area and it should be away from children.
		<ul style="list-style-type: none"> Rearing and boiling of cocoons. 	<ul style="list-style-type: none"> Skin infections due to boiling and handling of the worms. Exposure to biological and microbiological agents. Asthma, cough, lung infections. 	<ul style="list-style-type: none"> Use of personal protective equipment like gloves, goggles, masks, boots, earplugs. Medical checkup after a certain interval of time.
		<ul style="list-style-type: none"> Waste disposal 	<ul style="list-style-type: none"> Disposal of waste water generated after boiling of cocoons is a common problem. Wastewater containing chemicals dyes and detergents are harmful to the aquatic and terrestrial environment, when disposed in the ponds/ waterbodies or nearby areas Depletion of DO in the waterbodies Destruction of soil microbes and reduction in the natural soil fertility with alteration in permeability of soils. Persistence of pollutants in soil over longer period also contaminates the ground water. 	<ul style="list-style-type: none"> Awareness program should be conducted to the farmers for managing solid waste and waste water. Awareness must be provided to farmers as not to dispose/ drain the waste water in the nearby areas. Promoting the use of pupae which is left over after reeling (it is rich in protein) as poultry and fish food. Proper waste management techniques should be followed. Adequate drainage facilities should be provided to both farm and industry. Training program on ecofriendly culturing techniques and practices.
		<ul style="list-style-type: none"> Reeling, boiler, and grainage. 	<ul style="list-style-type: none"> Release of Sulphur, Carbon, Volatile Organic solvents, dust and soot. Toxic to environment and cause occupational health problems. 	<ul style="list-style-type: none"> The unit should have adequate ventilation system. Use of filters or scrubbers to eliminate or reduce particles.
		<ul style="list-style-type: none"> Shortage of Storage facilities 	<ul style="list-style-type: none"> The enhanced production of silk may need more storage area/space with reeling / weaving unit and if the demand is not 	<ul style="list-style-type: none"> Proper ventilation must be available at the storage house so that temperature would be in control.

Sl. No.	Project Stage	Project Activity	Environmental / Operational Impacts	Mitigation Measures
			properly met the quality may deteriorate in due course of time	
		<ul style="list-style-type: none"> Power Requirement for Weaving and Unit operation 	<ul style="list-style-type: none"> Requirement of energy for controlling the room temperature and for boiling operations may lead to power shortage problems 	<ul style="list-style-type: none"> Alternate energy options such as solar energy, biomass energy should be promoted to meet the energy demand.
		<ul style="list-style-type: none"> Weaving and production of cloths. 	<ul style="list-style-type: none"> Generation of noise. 	<ul style="list-style-type: none"> Restricted operating hours. Use of personal protective equipment like ear plugs while weaving.
		<ul style="list-style-type: none"> Awareness 	<ul style="list-style-type: none"> Lack of awareness among small beneficiaries for sustainable Sericulture practices. 	<ul style="list-style-type: none"> Provision of awareness and capacity building to the farmers, participating communities, local authorities, extension agents, development practitioners etc., on the promising approaches to minimise environmental impacts due to sericulture practices
4.	Post Construction and Operation Stage Impacts	<ul style="list-style-type: none"> Packaging of the silk products. 	<ul style="list-style-type: none"> Packaged wastes generated at community level. 	<ul style="list-style-type: none"> Use of biodegradable packaging materials. Recycling of the packing covers.
		<ul style="list-style-type: none"> Transportation 	<ul style="list-style-type: none"> Vehicular emission to the ambient atmosphere. 	<ul style="list-style-type: none"> BS-IV vehicles with valid emission certificate should be used for transportation.
		<ul style="list-style-type: none"> Marketing. 	<ul style="list-style-type: none"> Market waste generation. 	<ul style="list-style-type: none"> Proper waste disposal techniques should be followed in the market.

Annex 8

Annexure 8: Environmental Clause for Bid Document

Environmental Clauses to be included in the Bid document (under Technical Specification) for Construction/ upgradation of Roads

1. Protection of Environment

1.1 General

- 1.1.1 The Contractor shall be responsible for implementation of environmental provisions outlined in the Environmental Management Plan (refer **Annexure – 11b**), in addition to adhering to all environmental provisions in the applicable specifications for the works will be adhered to as part of good engineering practices.
- 1.1.2 All works undertaken towards protection of environmental resources as part of the EMP and as part of good engineering practices while adhering to relevant specifications will be deemed to be incidental to works being carried out and no separate payment will be made unless otherwise specified explicitly. The costs towards environmental management as per EMP unless otherwise provided as a separate head, will be deemed to be part of the BoQ of the project. The scope of works of the contractor towards the implementation of the environmental provisions shall be as follows.
- a. Abide by all existing environmental regulations and requirements of the Government of India and State Government of Assam, during implementation,
 - b. Compliance with all mitigation measures and monitoring requirements set out in the EMP
 - c. Submission of a method statement detailing how the EMP will be complied with. This shall include methods and schedule of monitoring.
 - d. Monitoring of project environmental performance and periodic submission of monitoring reports
 - e. Compliance with all measures required for construction activities in sensitive areas (if any), including protected areas, in line with the regulatory requirements adopted by MoEF&CC, GoI.
 - f. Compliance of all safety rules at work, and provision of adequate health and safety measures such as water, food, sanitation, personal protective equipment, workers insurance, and medical facilities.

1.2 Quarry and Borrowing

- 1.2.1 The Contractor will identify and seek prior approval of the Engineer (Line Department) for quarrying and borrowing operations. Quarry and borrowing will be carried only from locations approved by the Engineer. Quarrying, if required in the project will be only from approved quarries and no new quarries will be opened for the purpose of the project. Any deviation from the provisions will be immediately notified and approval of the Engineer is to be sought
- 1.2.2. The Contractor shall maintain all borrow sites, stockpiles, and spoil disposal areas so as to assure the stability and safety of the works and that any adjacent feature is not endangered, and to assure free and efficient natural and artificial drainage, and to prevent erosion. Stockpiling of materials (topsoil, fill material, gravel, aggregates, and other construction materials) shall not be allowed during rainy season unless covered by a suitable material. Storage on private property will be allowed if written permission is obtained from the owner or authorized lessee
- 1.2.3 Borrow areas and quarries shall be sited, worked, and restored in accordance with the specifications. Spoils shall be disposed of at approved disposal sites

prepared, filled, and restored in accordance with the related specification requirements

- 1.2.3 Following excavation for the works, the Contractor shall take all steps necessary to complete drainage and slope protection works in advance of each mining season. Erosion or instability or sediment deposition arising from operations not in accordance with specifications shall be made good immediately by the Contractor at the Contractor's expense. The Contractor shall take all steps necessary to complete drainage in advance of each rainy season in the areas excavated for borrow materials

1.3 Protection of Environmental Resources

- 1.3.1 The Contractor shall ensure that construction activities do not result in any contamination of land or water by polluting substances.
- 1.3.2 Unless otherwise provided in the specifications, the Contractor shall ensure that no trees or shrubs or waterside vegetation are felled or harmed except those required to be cleared for execution of the works. The Contractor shall protect trees and vegetation from damage to the satisfaction of the Engineer (Line Department).
- 1.3.3 The Contractor shall not use or permit the use of wood as a fuel for the execution of any part of the works and to the extent practicable, shall ensure that fuels other than wood are used for cooking and heating in all camps and living accommodations. Any wood so used must be harvested legally, and the Contractor shall provide the Engineer with copies of the relevant permits, if required.
- 1.3.4 The Contractor shall take all precautions necessary to ensure that vegetation existing adjacent to the project site is not affected by fires arising from the execution of the contract. Should a fire occur in the natural vegetation or plantation adjacent to the project site for any reason, the Contractor shall immediately suppress it. Areas of forest, shrub, or plantation damaged by fire considered by the Engineer to have been initiated by the Contractor's staff or laborers shall be replanted or otherwise restored.
- 1.3.5 The Contractor shall confine operations to the dry season, use silt traps and dispose spoils/ debris in locations approved by the Engineer that will not promote instability and result in destruction of property, vegetation, irrigation and water supply. Disposal near wetlands/ beels, protected areas, and other areas that will cause inconvenience or deprive local residents of their livelihood shall not be allowed. Acidic and saline spoils shall not be spread into agricultural land.
- 1.3.6 The Contractor shall consult with local residents and local government before locating project offices, sheds, and construction plant. The work camps shall not be located near settlements, near drinking water supply intakes, protected areas, or wildlife habitats.
- 1.3.7 The Contractor shall maintain ecological balance by preventing felling of trees, water pollution and defacing of natural landscape. The Contractor shall, so conduct his cleaning operations, as to prevent any avoidable destruction, scarring or defacing of natural surroundings. In respect of ecological balance, the Contractor shall observe the following instructions.
- 1.3.8 In the conduct of cleaning activities and operation of equipment, the Contractor shall utilize such practicable methods and devices as reasonably available to control, prevent and otherwise minimize air/noise pollution.

1.4 Noise and Air Pollution

- 1.4.1 All works shall be carried out without unreasonable noise and air pollution. Subject and without prejudice to any other provision of the Contract and the law of the land and its obligation as applicable, the Contractor shall take all precautions outlined in the EMP to avoid the air and noise pollution.

- 1.4.2 The Contractor shall monitor the environmental parameters periodically as specified in the monitoring plan and report to the Engineer.
- 1.4.3 The Contractor shall indemnify and keep indemnified the Employer from and against any liability for damages on account of noise or other disturbance created while carrying out the work, and from and against all claims, demands, proceedings, damages, costs, charges, and expenses, whatsoever, in regard or in relation to such liability

1.5 Occupational Health and Safety During Construction

- 1.5.1 The Contractor shall, in accordance with the safety and health provisions specified in the EMP, provide workers with a safe and healthy working environment, in the work areas, through application of preventive and protective measures consistent with international good practice, as reflected in internationally recognized standards such as **the World Bank Group's Environment, Health and Safety Guidelines** (http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/our+approach/risk+management/ehsguidelines). The borrower/client will take steps to prevent accidents, injury, and disease arising from, associated with, or occurring during the course of work by
- providing preventive and protective measures, including modification, substitution, or elimination of hazardous conditions or substances;
 - providing appropriate equipment to minimize risks and requiring and enforcing its use;
 - training workers and providing them with appropriate incentives to use and comply with health and safety procedures and protective equipment;
 - documenting and reporting occupational accidents, diseases, and incidents; and
 - having emergency prevention, preparedness, and response arrangements in place.

1.6 Post Construction Clearance

- 1.6.1 On completion of work, wherever applicable, the Contractor shall clear away and remove from the sites all constructional plant, surplus materials, rubbish, scaffoldings and temporary works of every kind and leave the whole of the site and works in a clean condition to the satisfaction of the Engineer.
- 1.6.2 Construction camp sites post construction shall be cleared as specified in the EMP and handed over to the Owner. It will be ensured by the contractor that the site handed over is in line with the conditions of temporary acquisition signed by both parties.

Environmental Clauses to be included in the Bid document (under Technical Specification) for Construction/ upgradation of Warehouses, Markets and Community Service Centres (CSC)

1. Protection of Environment

1.1 General

- 1.1.1 The Contractor shall be responsible for implementation of environmental provisions outlined in the Environmental Management Plan (refer **Annexure – 11b**), in addition to adhering to all environmental provisions in the applicable specifications for the works will be adhered to as part of good engineering practices.
- 1.1.2 All works undertaken towards protection of environmental resources as part of the EMP and as part of good engineering practices while adhering to relevant specifications will be deemed to be incidental to works being carried out and no separate payment will be made unless otherwise specified explicitly. The

costs towards environmental management as per EMP unless otherwise provided as a separate head, will be deemed to be part of the BoQ of the project. The scope of works of the Contractor towards the implementation of the environmental provisions shall be as follows.

- g. Abide by all existing environmental regulations and requirements of the Government of India and State Government of Assam, during implementation,
- h. Compliance with all mitigation measures and monitoring requirements set out in the EMP
- i. Submission of a method statement detailing how the EMP will be complied with. This shall include methods and schedule of monitoring.
- j. Monitoring of project environmental performance and periodic submission of monitoring reports
- k. Compliance with all measures required for construction activities in sensitive areas (if any), including protected areas, in line with the regulatory requirements adopted by MoEF&CC, Gol.
- l. Compliance of all safety rules at work, and provision of adequate health and safety measures such as water, food, sanitation, personal protective equipment, workers insurance, and medical facilities.

1.2 Construction Materials

- 1.2.1 The Contractor should procure construction materials from the licensed/ authorized agents/ dealers. Procurement of materials from the unauthorized sources shall be considered as illegal and appropriate measures shall be taken.
- 1.2.2 Quarrying, if required in the project will be only from approved quarries and no new quarries will be opened for the purpose of the project. Any deviation from the provisions will be immediately notified and approval of the Engineer is to be sought
- 1.2.2. The Contractor shall maintain all borrow sites, stockpiles, and spoil disposal areas so as to assure the stability and safety of the works and that any adjacent feature is not endangered, and to assure free and efficient natural and artificial drainage, and to prevent erosion. Stockpiling of materials (topsoil, fill material, gravel and other construction materials) shall not be allowed during rainy season unless covered by a suitable material. Storage on private property will be allowed if written permission is obtained from the owner or authorized lessee
- 1.2.3 Spoils shall be disposed of at approved disposal sites prepared, filled, and restored in accordance with the related specification requirements

1.3 Protection of Environmental Resources

- 1.3.1 The Contractor shall ensure that construction activities do not result in any contamination of land or water by polluting substances.
- 1.3.2 Unless otherwise provided in the specifications, the Contractor shall ensure that no trees or shrubs or waterside vegetation are felled or harmed except those required to be cleared for execution of the works. The Contractor shall protect trees and vegetation from damage to the satisfaction of the Engineer (Line Department).
- 1.3.3 The Contractor shall not use or permit the use of wood as a fuel for the execution of any part of the works and to the extent practicable, shall ensure that fuels other than wood are used for cooking and heating in all camps and living accommodations. Any wood so used must be harvested legally, and the Contractor shall provide the Engineer with copies of the relevant permits, if required.
- 1.3.4 The Contractor shall take all precautions necessary to ensure that vegetation

existing adjacent to the project site is not affected by fires arising from the execution of the contract. Should a fire occur in the natural vegetation or plantation adjacent to the project site for any reason, the Contractor shall immediately suppress it. Areas of forest, shrub, or plantation damaged by fire considered by the Engineer to have been initiated by the Contractor's staff or laborers shall be replanted or otherwise restored.

- 1.3.5 The Contractor shall confine operations to the dry season, use silt traps and dispose spoils/ debris in locations approved by the Engineer that will not promote instability and result in destruction of property, vegetation, irrigation and water supply. Disposal near wetlands/ beels, protected areas, and other areas that will cause inconvenience or deprive local residents of their livelihood shall not be allowed. Acidic and saline spoils shall not be spread into agricultural land.
- 1.3.6 The Contractor shall consult with local residents and local government before locating project offices, sheds, and construction plant. The work camps shall not be located near settlements, near drinking water supply intakes, protected areas, or wildlife habitats.
- 1.3.7 The Contractor shall maintain ecological balance by preventing felling of trees, water pollution and defacing of natural landscape. The Contractor shall, so conduct his cleaning operations, as to prevent any avoidable destruction, scarring or defacing of natural surroundings. In respect of ecological balance, the Contractor shall observe the following instructions.
- 1.3.8 In the conduct of cleaning activities and operation of equipment, the Contractor shall utilize such practicable methods and devices as reasonably available to control, prevent and otherwise minimize air/noise pollution.

1.4 Noise and Air Pollution

- 1.4.1 All works shall be carried out without unreasonable noise and air pollution. Subject and without prejudice to any other provision of the Contract and the law of the land and its obligation as applicable, the Contractor shall take all precautions outlined in the EMP to avoid the air and noise pollution.
- 1.4.2 The Contractor shall monitor the environmental parameters periodically as specified in the monitoring plan and report to the Engineer.
- 1.4.3 The Contractor shall indemnify and keep indemnified the Employer from and against any liability for damages on account of noise or other disturbance created while carrying out the work, and from and against all claims, demands, proceedings, damages, costs, charges, and expenses, whatsoever, in regard or in relation to such liability

1.5 Occupational Health and Safety During Construction

- 1.5.1 The Contractor shall, in accordance with the safety and health provisions specified in the EMP, provide workers with a safe and healthy working environment, in the work areas, through application of preventive and protective measures consistent with international good practice, as reflected in internationally recognized standards such as **the World Bank Group's Environment, Health and Safety Guidelines** (http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/our+approach/risk+management/ehsguidelines). The borrower/client will take steps to prevent accidents, injury, and disease arising from, associated with, or occurring during the course of work by
 - f. providing preventive and protective measures, including modification, substitution, or elimination of hazardous conditions or substances;
 - g. providing appropriate equipment to minimize risks and requiring and enforcing its use;
 - h. training workers and providing them with appropriate incentives to use and comply with health and safety procedures and protective equipment;

- i. documenting and reporting occupational accidents, diseases, and incidents; and
- j. having emergency prevention, preparedness, and response arrangements in place.

1.6 Post Construction Clearance

- 1.6.1 On completion of work, wherever applicable, the Contractor shall clear away and remove from the sites all constructional plant, surplus materials, rubbish, scaffoldings and temporary works of every kind and leave the whole of the site and works in a clean condition to the satisfaction of the Engineer.
- 1.6.2 Construction camp sites post construction shall be cleared as specified in the EMP and handed over to the Owner. It will be ensured by the contractor that the site handed over is in line with the conditions of temporary acquisition signed by both parties.

Annex 9

ANNEXURE 9: ENVIRONMENTAL GUIDELINES

1. AGRICULTURE/HORTICULTURE

Project intervention in term of **crop productivity enhancement in agriculture/horticulture sector** has an aim to benefit the farmers, small & medium entrepreneurs and overall agribusiness enhancement of the state, but immense involvement in agriculture practices may generate some environmental complications, if not accomplished carefully.

Preconstruction stage of the project

1.1 Site Selection

For the development and generation of more efficient **Farm-Market Infrastructure Development**, Site selection criteria are different for agricultural cropping and harvesting purpose, construction of road, common service centre, upgradation of warehouse and the following sections provide selection criteria for sites with different infrastructure facility:

Agricultural Product

Inappropriate Site selection may lead to lesser production and ultimately lead to loss. For agricultural production, suitable site should be chosen crop wise. Specific soil condition should be opted for particular crop. For e.g. Flood tolerant species of crop should be selected for water logged area. General criteria for site selection are as detailed below:

- Suitability of site should be based on amount of rainfall, average rainy days, length of the day and field temperature.
- Site should be free from hazardous materials, contamination, water logging, or not be an industrial waste prone area
- Past trend of harvested crop is also a best measure to appropriately identify the nutrient level of the soil.
- A well-drained and irrigated soil should be chosen. Site should have good pH balance, soil type, moisture level etc.
- Before selection, soil fertility level testing would support a great way to estimate the required and type of manure required for the soil and for particular crop.
- Domestic animals and human beings should not contaminate water that would be used for irrigation and in harvest of medicinal plants.
- Site should have no wild life movement, no frequenting animals and not be a protected area.

For Road

Transportation plays a vital role in agriculture sector. In APART Project, provision of road has been of primary focus as it is a way to connect the agriculture production cluster, Common service centre, market areas, Rural Haats and nearby possible Storage areas (warehouse) to provide a better market led enhancement production, more resilient way of marketing and value addition. Following guideline shall help in choosing the site for road development.

- Choice of location should be done so as to support the ecosystem. In cases if the sensitivity is severe, alternatives should be opted.
- Minimize impacts to ecosystem that may provide an important buffer to climate change impacts, especially in areas where those buffers will be needed

- Selection of site shall be done preferably on government land. Effort shall be taken such that site is free from public conflicts.
- Site should not be located near any critical wild life habitats (those mentioned in natural habitat management Plan)
- Site should not be chosen near Natural Protected areas. If site is located near or less than 1 km distance from protected area, then a proper consent shall be obtained from forest department.
- The area should not be located in flood prone areas.
- While selecting the site, care should be taken such that it shall not disturb any dense habitations.
- Preference would be given to develop roads that are already in use, to make it more efficient and smooth instead of proposing a new one. This will save the environment and also prevent unnecessary nuisance.
- New road will be selected only after having a proper need based assessment of the site.
- After identification of Site, necessary permission as applicable from Gram Panchayat, revenue Department shall be procured.
- Prior approval of the ES, PMU/PCU is required in case of any innovations in design and identification of sites.

For Common Service centre/ Upgradation services

- Selection of site shall be done preferably on government land. Effort shall be taken such that the selected sites are free from public conflicts.
- Site should not be located near critical wild life habitats (as mentioned in natural habitat management Plan).
- Site should not be chosen near Natural Protected areas. If site is located near or less than 1 km distance from protected area, then a proper consent shall be obtained from forest department.
- The area should not be located in flood prone areas, low lying areas or steep slopes.
- The site should be free of contamination, storage of industrial waste etc.
- While selecting the site, care should be taken such that it shall not disturb any dense habitations.
- Preference to be given to develop the structures which are already in use, to make it more efficient and smooth instead of proposing a new one. This will save the environment and also prevent unnecessary nuisance. Like if an area has been already using for community development purposes then the same can be used for the proposed activities.
- Criteria shall enforce that new site will be selected only after having a proper need based assessment of the site.
- After identification of Site, necessary permission as applicable from Gram Panchayat, revenue Department shall be procured.
- Prior approval of the ES, PMU/PCU is required in case of any innovations in design and identification of sites.

Construction Stage of the project

1.2 Land Preparation and construction activities

Land preparation stage involves site clearance, transportation of construction material, handling of construction machineries, construction activities for development of Agricultural Market Infrastructure facilities such as road, Common service centre. While modernization and upgradation will involve only limited construction activities, furnishing, refurbishment of interior structures etc. Following points shall be taken into consideration for maintaining an environmental health of the area while carrying out activities of land preparation and other construction activities.

Site Clearance

- During land preparation, care shall be taken to avoid destruction site vegetation to minimum extent as possible. Effort shall be taken that construction activity should not disturb the nearby local vegetation unnecessarily.

Sourcing of Material

- Construction material such as sand, aggregates and other quarry material should only be sourced from licensed quarries as per consent from PWD.
- This necessitates them to maintain the number and the relevant details, such as license issue and expiration dates, status report, etc.
- Borrow pits shall be prohibited where there are chances for interference with the natural or designed drainage patterns.
- Sourcing of any material from within or from any Protected Areas/Sanctuaries, tank beds and/or designated natural areas is strictly prohibited.

Transportation of Construction Material

- All materials should be transported in fully covered trucks. Overloading of vehicles with materials should be controlled and done in a manner based on the trucks capacity.
- The unloading of materials at construction sites those that are close to settlements shall be restricted to daytime only.
- Provide traffic signs (including paint, easel, sign material, etc.), road marking, and guard rails to maintain pedestrian safety during construction.
- Vehicle should comply with the rules.

Protection of environment

- Special emphasis shall be given to protect the fertile top Soil and would be emphasised to be restored at the site after completion of construction.
- During construction phase necessary soil protection measure shall be adopted. All affected areas should be landscaped and any necessary remedial works should be undertaken without delay, including grassing and reforestation;
- **Apply erosion control** measures before the rainy season begins preferably immediately following construction. Install erosion control measures at each construction site after it is completed.
- Storage of Oil and chemicals that are to be used during construction work shall be stored at a designated confined place on a impervious layer so no leakage could occur such that contamination of water bodies and soil is prevented.
- To evade the **degradation of water quality** of water bodies in the vicinity of the construction sites, it is ideal to avoid construction works close to the streams or water bodies during monsoon season. All precautionary measures shall be taken to prevent the wastewater that is generated during construction from entering into streams, water bodies or the irrigation channels.
- To prevent the **degradation of surface water quality** arising due to equipment and material piling on the site, it is advisable to store Construction pile, Soil stockpile and other debris at designated place. Cover the stock pile with tarpaulin sheet to prevent contamination of the nearby water body and agricultural field.
- To reduce the soil compaction rising due to movement of heavy machineries, it is advisable to use environment friendly Machinery e.g. Subsoilers and rippers.
- Water Sprinkling shall be done regularly on dirt roads, cut areas and soil stockpiles or fill material to reduce the dust pollution arising due to construction activities.
- Permission for the extraction of water should be obtained prior to the commencement of the project, from the relevant authority.

Construction Management

- All construction equipment that are used for project activities shall conform to pollution control norms as stipulated by SPCB and hold valid license.
- The unloading of materials at construction sites that are located close to settlements shall be restricted to daytime only.

- All plants and equipment that are used in construction by the Contractor shall strictly conform to the CPCB noise standards.
- Noisy construction activities (such as crushing, concrete mixing, batching etc.) shall be stopped during the night time between 9.00 pm to 6.00 am if there are habitation/ educational institutes/health centers (silence zones) located within 150m of construction site.
- Proper maintenance of the machineries shall be carried out to control the air and noise pollution caused by these machineries.
- Debris that are generated due to the dismantling of the existing structures shall be suitably reused, to the extent feasible, in the proposed construction (used as a fill material for embankment).
- Ensure that the asbestos-containing materials or other toxic substances are removed and disposed of by specially trained workers as per Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.
- Never dispose of spent oils on the ground, in water courses, drainage canals or in sewer systems.

Waste management

- Separation of Construction waste from the source as to be practised so to minimize the volume of waste and to increase the recyclable and reuse probability. Items such as aluminum, wood, plastic, paper packaging, copper, used oil can be reused. The other construction debris such concrete, bricks, sands can be used in backfilling in other location as per demand.
- Hazardous waste must be handled as per hazardous waste management rule 2016.
- Contractor should ensure that workers practice waste management options and recycle the wastes during site works.
- Contractor should ensure appropriate storage and handling of construction materials to minimise waste generation resulting from damaged materials/waste e.g. keeping deliveries packaged until they are ready to be used;
- Contractor should ensure that all disturbed area are restored after completion of construction.

Construction Worker

- A good sanitation plan shall be developed and provided by the contractor for construction camps and shall ensure that pollution of nearby water bodies is avoided. Plan must be in place to avoid construction within 500 m of dense habitation.
- Provide personal protective equipment and clothing (goggles, gloves, respirators, dust masks, hard hats, steel-toed and –shanked boots, etc.) for construction workers and enforce the use of the PPEs.
- The contractor should arrange adequate supply of water throughout the construction period from an agreed source.
- Provision of temporary toilet facilities for worker; contractors can identify suitable locations in close proximity to construction site.
- Provide traffic signs (including paint, easel, sign material, etc.), road marking, and guard rails to maintain pedestrian safety during construction.

Operation stage of the project

In Agriculture/ Horticulture sector, Operation stage of the project involves activities such as production of different crops, vegetable, fruit (as introduced in the project), and other activities like input supply for seed.

1.3 Input Supply

With respect to this activity, input and supply which will involve seed vendor, dealer etc. After selection of particular crop, farmer should procure a good quality seed from licensed vendor. Rationale and preventive measures has been described here to understand the verital importance of the crop:

- While selecting the particular seed or sapling, care should be taken to promote more indigenous species. Inappropriate selection of crop those which are not suitable for climate may create problem for farmer and affect the overall productivity.
- Introduction of exotic and non-native plant species or promotion of particular crop variety may lead to loss of indigenous other than the local varieties of crops which has generally more climate adaptability and are less susceptible for disease. So Agro climatic zone wise and particular season wise suitable seed or crop varieties should be selected (please refer annexure 5 for verital selection of crop).
- Proliferation of genetic homogenization of crop species may replace the non-farm diversity / varieties) with uniform genetic stock. This homogentic strands may become more vulnerable to catastrophic disease outbreak and may need more effort to produce it well. Subsequently, farmers may remove endemic and native plant and animal species to prevent the negative impact of predator, pest and weed. Due to overuse and misuse of pesticides, pollinators may be harmed and this will have an impact on the crop reproduction as well.

1.4 Production and Operation

In production step of value chain, farmers are more involved. Activities like good cultivation practices and post-harvest management needs to be considered in production stage. Rationale and preventive measures that are to be considered to support the environmental guidelines for production stage as well as climate resilient agricultural methods are described in this section.

- **Appropriate time for cropping:** every crop variety has its own time and season to grow and mature to a certain level. So crop should be selected based on sowing time and particular season and harvesting of crop should also be done at appropriate stage to get a good market price. Immature harvesting of crop may become more susceptible for infection and disease due to high moisture content and which will create problem during storage and selling stage.
- **Cropping Pattern:** To manage the soil nutrient efficiency, crop rotation practice should be followed such as before sowing of paddy, any crop related to legume family (pea, pulse, lentil) should be practiced so as to restore the nitrogen and other micronutrient.
- **Irrigation:** drought-tolerant crop varieties and low-cost drip-and-trickle systems would be supportive. As a support to irrigation department, monitoring and licensed bore wells may reduce the overuse of irrigation water. Equitable sharing of irrigation water among the farmers may benefit the Farmers. All Irrigation facilities should be carried out after obtaining legal consent from irrigation department.

Treatment techniques respecting to soil type:

The entire project area has new and old alluvial soil. While the old alluvium soils are slightly acidic (which are generally on flood plains) and rich in organic materials, the new alluvium soils (cited along the river bank area) are less acidic and are not saline. They are generally rich in phosphate, potash, calcium, nitrogenous material and organic substances. Soil amendment measures shall be selected accordingly by applying

- Applying lime (application of lime just prior to soil preparation is usually most appropriate.)
- Fertilizer management
- Choosing acid tolerant species

Adopting climate resilient methods of agriculture

- By application of bio manure in agricultural field may reduce the generation of GHS gas (methane production occurs during storage of manure).
- Combine agriculture practices with forestry to reduce the overall carbon footprint and changes that occur due to change of landuse.

- Implementing **integrated farming practice** to avoid generation of GHG gas through inclusion of agricultural farming with livestock management, fishing etc, where by product of one the commodities could be a resource material 'for another commodity such as fish cum paddy farming, livestock cum fish farming, application of bio manure, farming with fodder plants etc.
- Rhizobium inoculum mixed with soil should be used for soil treatment.
- Use Azolla as a good alternative for Nitrogen dosage to prevent the formation of GHGs in water logged paddy fields.
- Planting native trees in pasture. Trees provide shade for cattle, habitats for insect eating birds, erosion control on sloped landscapes, prevents run-off of excess nutrients and can provide fruit, timber, firewood and other products for farmers.

Good Cultivation Practices:

A good cultivation practice has better prospects with sustainable management of soil and water, this can protect many anomalies of soil such as erosion, nutrient loss, etc. Adoption of vegetative and best management practice claims better management of agricultural field and improve productivity.

- Use of living barriers: grass strips planted along the contour to trap and/or filter runoff and to retain soil
- Using of leguminous cover crop as green manures or mulches, to fix nitrogen, raise organic matter content, cover the soil and protect it from raindrop impact.
- Minimum Tillage: Low- and zero-tillage techniques reduce soil compaction, improve conditions for beneficial organisms such as earthworms, and use a cover crop to replenish soil nutrients, create channels in the soil for crop roots, and prevent erosion. So crop residues should be left after harvest on the site, and the next crop is sown with minimum disturbance to soils.
- Conserve the soil moisture by using mulching, covering soil with crop residue wastes.
- Inclusion of agronomic practices such as intercropping, improved plant spacing and appropriate crop rotation.
- Application of compost to improve organic matter content and texture of the soil and its ability to infiltrate rainfall. Organic manure such as cow dung, crop residue etc., should be used to keep the soil healthy.
- applying rock phosphate, planting nitrogen-fixing trees or cover crops in fallow land
- Agroforestry Practices: practises involving planting a mixture of tree crops to crop and/or livestock farming system.
- Practice of alley cropping in which annual crops are cultivated between rows or contour plantings of trees grown for their fruit or timber.
- Allowing fields to lie fallow to replenish soil nutrients. Planting fast-growing fruit trees and shrubs in fallow fields.

Integrated Pest Management Practice:

it is endorsed to adopt integrated pest management system in the agricultural practice. Which follows the hierarchy of using bio fertilizer, bio pesticides first and then use of certain pesticides in case of acute problem. The pesticides recommended by WHO and those prescribed by the Govt. of India are only allowed and should be procured from licensed vendor. (Please refer Integrated Pest Management Plan)

Safety:

Use of disinfectants and personal protective equipment like boots, gloves during the farming practices reduces the contamination and infection to some extent.

Post construction and Operation stage of the project

Project component interventions such as storage management, post-harvest management, transportation, grading, packaging, processing etc of agricultural products has been included. Following environmental guidelines shall be considered on the post operational construction activities and management.

1.5 Post-harvest care

After cropping and harvesting of the agricultural produce, post-harvest care plays a key role in preservation and maintaining the actual quality and monetary value of the agriculture produce.

An estimated 10 to 40% of the food that is grown are never eaten due to damage, rotting, pests, and the consumers' demand for "perfect" produce. Generally, fresh produce losses are higher than those of processed food. These losses are often higher in warmer, more humid climates as in Assam. The climate makes it more difficult to control diseases in the field, and take out field heat. Long transport distances also make it more challenging to maintain adequate cool chain. Post-harvest losses mean that production resources such as land, water, energy, fertilisers, labour and effort are wasted, and ultimately, profitability for growers is reduced.

- Vegetables are living, breathing parts of plants and contain 65 to 95% water. Acceleration of deterioration can be due to high temperature, low humidity, incorrect atmosphere and/ or physical damage. So storage of these commodities should be done in cool places.
- Water loss after harvest can occur through the supply chain, so maintain adequate humidity during storage. Avoid stresses due to handling, damage, or incorrect storage temperatures
- Mechanical damage due to Careless handling of vegetables and containers causing splitting, internal staining, superficial grazing, and crushing of soft produce leading to entry points for diseases, increased water loss and increased respiration. Therefore adequate harvest method that "no over or under trimming and Grading line design" with minimum drop heights, no sharp corners or points should be provided.
- Ageing shall be promoted. Good ventilation in normal storage (including leaving gaps between pallets and walls for sufficient ventilation/head space in packaging). Correct use of modified atmosphere packaging and maintenance of the cool chain.
- Grains should be dried in such a manner that damage to the grain is minimized and moisture levels are lower than those required to support mold growth during storage (usually below 13-15%). This is necessary to prevent further growth of fungal species that may be present on fresh grains.
- Rotting and contamination of surrounding produce may result due to use of dirty, contaminated field boxes or insufficiently sanitized washing water. Do not pack damaged, over mature or diseased produce in the same packaging as healthy produce.
- Raw materials should be inspected at regular intervals and any spoiled materials should be safely discarded.
- Traditional pest control methods like neem leaves, dry chillies etc. can be used for storing the raw materials.
- **Waste generated from harvesting**, collecting and initial processing of cereals should be used as an alternative source for feed material for livestock, fertilizer for field and also shall be used for organic mulching of soil.
- Composting of biodegradable waste on site is an effective means of significantly reducing the volume of waste to be disposed of, and produce a potentially useful soil conditioner.
- No byproducts of harvesting activity in agricultural field shall be burnt.

1.6 Transportation

As per project component, the Farm market infrastructure development involves the activities of facilitating Enterprise cluster production improvement and market support in terms of Access, warehouse and other services.

In post operation stage of the project, transportation service shall be required to store, manage, and post-harvest care, marketing and further value addition in the product. So in term of transportation up gradation of existing roads, strengthening existing culverts and bridges, road construction leading to the Agro-based industries to facilitate the cluster development and for ensuring better connectivity to market centres has been intervened. In preconstruction and construction phases the precautions / guidelines to be carried out under project, has already been mentioned in previous sections of this document. Following points details the environmental precautions that are to be taken while transporting the agri products.

- While transporting the agri cultural products, Vehicular emissions to the ambient atmosphere is anticipated, so it is recommended to use only BS-IV vehicles with valid emission certificate should be used for transportation.
- Overweighing Vehicles carrying loads exceeding those permissible without proper permission should not be allowed to pass through the constructed roads.
- Create awareness on proper transport system management.
- Roads which are dedicated to be used for / or infrequently used shall have proper road signage and breakers to prevent the accident in the road.
- While constructing the road, road safety measures as prescribed by GOI shall be followed.
- Lorries used for transport for chemicals should not be used for transport of edible produce. The vehicle should be cleaned and dried before transportation of food grains.
- Road workers should wear reflective vests to avoid accidents by moving vehicular traffic.
- All material should be transported in fully covered trucks. Overloading of vehicles with materials should be controlled and done in a manner to suit the trucks capacity.

1.7 Trading

With reference to the project component of Farm market infrastructure development, provision of market area, Rural Haat facility has been envisaged. It is proposed to develop and upgrade market area/ Rural Haats with common amenities close to production clusters. Following environmental guideline envisages the care that has to be taken in the market area / Rural Haat of the agricultural Produce.

Storage of products for sale:

Inappropriate storage of the ingredients, cereals will lead to contact with moisture, exposure to pests like rats etc. which will spoil the quality there by having an impact on health. Therefore the storage area should be clean and dry consisting of tightly packed containers or containers with lids, covers.

Waste Management:

Open disposal of decomposable wastes leads to contamination of surroundings though decomposition, attracting insects, leaving chemical residues etc

- Waste should be properly disposed on the designated place only.
- The waste should be separated from its source (dry & wet waste) so that it can be reused.
- Dry waste particularly such as paper, plastic etc, can be recycled or collected and disposed to recycling vendor.
- Alternate use of biodegradable food waste by integrating with bio compost formation and agricultural farming practices.
- Waste disposal area should not be near to water bodies, dense settlement area or low lying area.
- Waste disposal shall not be done in open area.

Basic Amenities:

Lack of required basic amenities will affect health of workers, vendors and will negatively affect the area and surroundings. Therefore,

- The work space should be ventilated to the extent possible. Drinking water and toilet facilities should be made available.
- Proper sanitation and drainage system shall be designed and maintained to keep the area free from contamination and reduce the disease risk.

License and registration:

Machineries used in market area should hold proper license. Vendors selling chemicals, fertilizer shall hold proper registration.

Any activities which are not legal to GOI shall be strictly prohibited.

1.8 Storage

As per Project Implementation Plan of APART, **Upgradation and modernization of warehouses** (39 nos.) arises under component B of farm Market Infrastructure development. This value chain development step will cater to many Commodities of Agriculture sector which is introduced under the project. Storage facility in Warehouse and upgradation may have a major issue of storage and construction and upgradation. The aim of developing environmental guideline is to provide scientific storage and preservation of agricultural products, seeds. Following section details about major environment issues and preventive measures to be adopted while handling and storage of agricultural commodities.

Construction Design Specific

- Effective and suitable provision shall be made to ensure that every enclosed workplace is ventilated by a sufficient quantity of fresh or purified air.
- The floor or surface shall not have a hole or slope, or be uneven or slippery so as to expose a person to a risk to his health or safety and shall have effective means of drainage as appropriate.
- Suitable and sufficient handrails and guards shall be provided on all traffic routes which have staircases.
- Doors and gates shall be suitably constructed and fitted with necessary safety devices.

Regarding Loading / Unloading, Transportation

- Enough space should be provided in loading areas for vehicles to move safely and for people to move around.
- Anyone who are not involved in loading or unloading should be kept away from loading areas.
- There should be sufficient turning space to allow an adequate turning circle for tractor and trailer.
- Any area of the site that is used for manoeuvring, vehicle parking or open storage should be adequately surfaced for the intended purpose.
- Transportation of material shall be covered, overloading is barred to avoid accidents and it is also a risk to workers and local traffic.
- Avoid truck traffic during morning and evening rush hours.

Energy efficient Building

- Promotion shall be done to develop energy efficient building with Integrated daylighting with the electric lighting system. Thus allowing natural lighting where possible.
- Provide lighting controls that turn off lights when sufficient daylight exists. Consider dimming controls that continuously adjust lighting levels to respond to daylight conditions.
- Energy consumption monitoring should be followed regularly.
- Use of LED lighting can reduce the electricity consumption drastically.

Occupational health and Safety

- For maintaining the health and safety of workers, design shall provide local exhaust for restrooms, kitchens, copy rooms, battery-charging areas, clean drinking water facility etc.
- Worker should be provided with proper Duster, Mask, Gloves, Boot, high visibility jackets, Fumigation cover, Foot sprayer, Hand sprayer etc.
- Design equipment and furnishings such that they aid in healthy work practices in an effort to eliminate repetitive motions as well as prevent strains and sprains.
- Provision of First aid facility to provide help for occupational injuries and illness
- Provide sufficient training to worker for handling weighbridge, multiutility conveyer loading and unloading, trolley, fork lift etc.
- Fire proof design of warehouse should be promoted.
- Every workplace shall be organised in such a way that pedestrians and vehicles can move around safely.

Waste management

Waste from the storage area shall be disposed off carefully at a designated place. Effort should be taken to use waste as an alternative.

Storage related

- Adequate integrated pest management control measures should be provided, especially for food storage.
- Mix leaves of Neem, Karanj, Custard apple, Adathoda and Tulsi to protect grains from insects.
- The storage area should be located in clean and dry places consisting of tightly packed containers or containers with lids, covers.
- Food products should not be stored along with any products of chemical nature.
- Obsolete raw materials or raw materials stored for long periods should not be used.
- Raw materials should be inspected at regular intervals and any spoilt materials should be safely discarded.
- Avoid using chemical pest management methods like neem leaves, dry chillies etc. can be used for storing the raw materials

Management

- Every workplace, furniture, furnishings and fittings therein shall be kept sufficiently clean.
- Surfaces of floors, walls and ceilings shall be kept sufficiently clean. As far as it is reasonable, waste materials shall not be allowed to be accumulated except in small receptacles. It will prevent the occurrence of infections.
- Use ceiling mounted fans to reduce heat stratification and provide air movement, thus increasing worker comfort during both summer and winter. Mount fans above highest forklift level for worker safety
- Waste from the storage area shall be disposed off carefully at a designated place. Effort should be taken to use waste as an alternative.
- Doors and gates (e.g. cargo doors) shall not be left open when not in use.
- Vegetation and grass close to the warehouse needs to be cut regularly and managed.
- Regular upkeep should be followed as per the prescribed standards.

1.9 Processing, Grading, Value Addition

As per project component, the Farm market infrastructure development involves the facility of common service center (CSC). CSCs are conceived as commercially viable basic infrastructure for marketing of agriculture inputs and agriculture produce, built around farmer producer companies (FPC) and are proposed to be located in production locations. Activities like, grading, packaging, small processing shall be detailed here, so hereby provisions of following precaution measures shall support the sustainable constancy of Common Service Centres.

Registration, licenses and permissions:

every processing units for seed production, value addition items and other machinery if not in line with legal frame will create a problem

- Processing unit, seed production units, and other equipment required for value addition purposes will be legally complied with respected rules.

Maintenance and repairs of machinery:

Irregular cleaning or maintenance will lead to contamination and improper functioning therefore regular upkeep should be followed as per the prescribed standards.

Storage of ingredient:

Inappropriate storage of the ingredients, cereals will lead to contact with moisture, exposure to pests like rats etc. which will spoil the quality there by having an impact on health.

- The storage area should be located in clean and dry places consisting of tightly packed containers or containers with lids, covers.
- Food products should not be stored along with any products of chemical nature.
- obsolete raw materials or raw materials stored for long periods should not be used.
- Raw materials should be inspected at regular intervals and any spoilt materials should be safely discarded.

Use of additives, preservatives:

While in processing section, use of non permitted additives and preservatives is illegal and pose health risks to the workers and consumers. Therefore only the permitted additives and preservatives shall be used in food items as prescribed in FSSAI Act.

Commercial Seed production:

More emphasis should be given to preserve the seed and germplasm of indigenous species, which will be beneficial in long run and thereby less resources would be required to upkeep and maintain.

Packaging:

in packaging of agri products, Use of packaging material that cannot be decomposed causes soil Pollution, while plastic bags having a thickness of below 20 microns is not allowed for packaging due to their non-recyclable nature and potential negative impact on environment.

- Bio degraded able ingredients and re-useable packaging should be promoted.
- Use news paper wrapping or cloth bags for handing over to consumers. Encourage the consumers to bring cloth bags.
- Handling the food products with bare hands or un washed hands will contaminate the products through microbial attack.
- Local material should be used for packaging instead of imported material , plastics etc. Jute sacks or other available material can be used for transport purposes. This can reduce the unnecessary use of packaging materials and containers.
- To avoid food and vegetable wastes during post-harvest phase, the packaging material should be made of perforated biodegradable material so as to prevent the oxygen deprivation and congestion of the Food and Vegetable items.

Basic Amenities:

The work space should be ventilated to the extent possible. It should have drinking water and toilet facilities.

Occupation health and Safety to maintain the safety of workers following measure shall be adopted:

- Person using these machines must wear mask for preventing the problem related to inhalation.
- Noise protective equipment should be provided to the machine operators.
- Ensure only experienced and well trained workers are used for the handling of machinery, equipment and material processing plants.
- Ensure all persons, including managers, are trained and are able to carry out their work without risk to the safety or health of themselves, other workers or the public.
- To maintain the safety of equipment as well as worker, Inspections should look for evidence of wear and tear, frays, missing parts and mechanical or electrical problems.
- Ensure an emergency aid service is in place in the work zone.

Waste management:

Waste materials produced during the operation of completed facilities must be carefully managed. If not, these wastes can cause disease, injury, and/or environmental damage within the local community. It should be put into practice to reduce, reuse, recycle and recover options for the generated waste. Recycling of waste that can be adopted in case of agriculture sector is composting and land application as manure and recovery of waste is accomplished with the recovery of methane. Composting of biodegradable waste on site is an effective means of significantly reducing the volume of waste that are to be disposed of, and produces a potentially useful soil conditioner.

- The waste should be separated from it source into dry & wet waste so that it can be reused.
- Dry waste particularly from common service center such as paper, plastic etc, can be recycled or collected and disposed off to recycling vendor.
- The waste storage area should not be located near to water stream, drain or low lying area.
- Biodegradable waste shall be managed separately.
- Reuse and recycling of waste shall be promoted as far as possible to minimize the total waste.
- Integration of biodegradable waste from nearest farm field can be used as a manure.

- Integration of food processing, grading waste for use as cattle feed shall be promoted.

Power use:

power requirement has been anticipated in heating, boiling, grinding, extraction, drying, packaging etc. so Energy efficient device should be used, Biomass or solar devices should be promoted to conserve energy, Energy consumption monitoring should be followed regularly.

2. FISHERY

The project intervention in term of **productivity enhancement in production cluster** has an aim to benefit the fish farmers, small medium entrepreneurs and overall agribusiness enhancement of the state, but immense involvement into the fish farming practice may generate some environmental complications, if not accomplished carefully. The present section details out the environmental guidelines to be followed during preconstruction, construction, operation and post operation stage under fishery Sector.

Preconstruction stage of the project

2.1 Site Selection

For the development and generation of more efficient **Farm-Market Infrastructure Development**, Site selection criteria for fish farming, harvesting purpose, construction of road, common service centre, upgradation of storage shall be different. So in Fishery sector following sections provide selection criteria for site for different infrastructure facility:

Fish Pond/ Beel Selection

Inappropriate Site selection may lead to lesser production and ultimately lead to loss. General criteria for site selection are as under:

- Suitability of site should be based on amount of rainfall, average rainy days, length of the day and field temperature.
- Site should not be located in protected wetland area, important bird area.
- If site is located near to protected area, proper permission from forest department shall be required.
- Site should not be located in heavy flooded area or other climate risk prone area.
- Site should not be very close or downstream area to agricultural field because chance of mixing chemicals and fertilizer in pond will be higher and that will lead to eutrophication in the water body.
- Site should be free from hazardous materials, contamination, water logged, or other industrial waste prone area
- Past trend of land use is also a best measure to appropriately identify the nutrient level of the soil.
- Before selection, testing of water quality level would support a great way to estimate the required type of amendment techniques.
- Domestic animals and human beings should not contaminate water for irrigation and harvest of medicinal plants.
- Site should have no wild life movement, no frequenting animals and not be a protected area.

For Road

Transportation plays a vital role in agribusiness sector. In Project APART, provision of road has been focused as it is a way to connect the fish / Beel production cluster, Common Service Centre, Market areas, Rural Haats and near possible Storage areas to give it better market led enhancement production, more resilient way of marketing and value addition. Following guideline shall help in choosing the site for road.

- Choice of location should be done so as to support the ecosystem. In cases if the sensitivity is severe, alternatives should be opted.
- Minimize impacts to ecosystem that may provide an important buffer to climate change impacts, especially in areas where those buffers will be needed

- Selection of site shall be done preferably on government land. Effort shall be taken such that site is free from public conflicts.
- Site should not be located near any critical wild life habitats (those mentioned in natural habitat management Plan)
- Site should not be chosen near Natural Protected areas. If site is located near or less than 1 km distance from protected area, then a proper consent shall be obtained from forest department.
- The area should not be located in flood prone areas.
- While selecting the site, care should be taken such that it shall not disturb any dense habitations.
- Preference would be given to develop roads that are already in use, to make it more efficient and smooth instead of proposing a new one. This will save the environment and also prevent unnecessary nuisance.
- New road will be selected only after having a proper need based assessment of the site.
- After identification of Site, necessary permission as applicable from Gram Panchayat, revenue Department shall be procured.
- Prior approval of the ES, PMU/PCU is required in case of any innovations in design and identification of sites.

For Common Service centre/ Upgradation services

- Selection of site shall be done preferably on government land. Effort shall be taken such that the selected sites are free from public conflicts.
- Site should not be located near critical wild life habitats (as mentioned in natural habitat management Plan).
- Site should not be chosen near Natural Protected areas. If site is located near or less than 1 km distance from protected area, then a proper consent shall be obtained from forest department.
- The area should not be located in flood prone areas, low lying areas or steep slopes.
- The site should be free of contamination, storage of industrial waste etc.
- While selecting the site, care should be taken such that it shall not disturb any dense habitations.
- Preference to be given to develop the structures which are already in use, to make it more efficient and smooth instead of proposing a new one. This will save the environment and also prevent unnecessary nuisance. Like if an area has been already using for community development purposes then the same can be used for the proposed activities.
- Criteria shall enforce that new site will be selected only after having a proper need based assessment of the site.
- After identification of Site, necessary permission as applicable from Gram Panchayat, revenue Department shall be procured.
- Prior approval of the ES, PMU/PCU is required in case of any innovations in design and identification of sites.

Construction Stage of the project

2.1 Land Preparation and construction activities

Land preparation stage involves site clearance, transportation of construction material, handling of construction machineries, construction mechanical activities for development of Market Infrastructure facilities such as road, Common service centre, Construction of cold storages and development of infrastructure for electronic trading, Development of Rural Haats near production clusters- providing platforms with sheds for producers/retailers, pathways, Construction of modern auction platform with sheds, trader sheds and Loading/unloading area. While modernization and upgradation will involve interior construction activities, furnishing, refurbishment of interior structures etc. Following points shall be taken into consideration for maintaining an environmental health of the area while carrying out activities of land preparation and other construction activities.

Site Clearance

- During land preparation, care shall be taken to avoid destruction site vegetation to minimum extent as possible. Effort shall be taken that construction activity should not disturb the nearby local vegetation unnecessarily.
- Site clearance shall be carried out in such a way that the clearance and grubbing waste are disposed immediately in the designated dumping site identified for the project.

Sourcing of Material

- Construction material such as sand, aggregates and other quarry material should only be sourced from licensed quarries as per consent from PWD.
- This necessitates them to maintain the number and the relevant details, such as license issue and expiration dates, status report, etc.
- Borrow pits shall be prohibited where there are chances for interference with the natural or designed drainage patterns.
- Sourcing of any material from within or from any Protected Areas/Sanctuaries, tank beds and/or designated natural areas are strictly prohibited.

Transportation of Construction Material

- All materials should be transported in fully covered trucks. Overloading of vehicles with materials should be controlled and done in a manner based on the trucks capacity.
- The unloading of materials at construction sites those that are close to settlements shall be restricted to daytime only.
- Provide traffic signs (including paint, easel, sign material, etc.), road marking, and guard rails to maintain pedestrian safety during construction.
- Vehicle should comply with the rules.

Protection of environment

- Special emphasis shall be given to protect the fertile top Soil and would be emphasised to be restored at the site after completion of construction.
- During construction phase necessary soil protection measure shall be adopted. All affected areas should be landscaped and any necessary remedial works should be undertaken without delay, including grassing and reforestation;
- **Apply erosion control** measures before the rainy season begins preferably immediately following construction. Install erosion control measures at each construction site after it is completed.
- To avoid **Contamination of soil** by oil and chemicals discharged by construction vehicles and from material storage site, Storage of Oil and chemicals that are to be used during construction work shall be stored at a designated confined place on a impervious layer so no leakage could occur such that contamination of water bodies and soil is prevented.
- To evade the **degradation of water quality** of water bodies in the vicinity of the construction sites, it is ideal to avoid construction works close to the streams or water bodies during monsoon season. All precautionary measures shall be taken to prevent the wastewater that are generated during construction from entering into streams, water bodies or the irrigation channels.
- To prevent the **degradation of surface water quality** arising due to equipment and material piling on the site, it is advisable to store Construction pile, Soil stockpile and other debris at designated place. Cover the stock pile with tarpaulin sheet to prevent contamination of the nearby water body and agricultural field.
- Water Sprinkling shall be done regularly on dirt roads, cut areas and soil stockpiles or fill material to reduce the dust pollution arising due to construction activities.
- Permission for the extraction of water should be obtained prior to the commencement of the project, from the relevant authority.

Construction Management

- All construction equipment that are used for project activities shall conform to pollution control norms as stipulated by SPCB and hold valid license.
- The unloading of materials at construction sites that are located close to settlements shall be restricted to daytime only.
- All plants and equipment that are used in construction by the Contractor shall strictly conform to the CPCB noise standards.
- Noisy construction activities (such as crushing, concrete mixing, batching etc.) shall be stopped during the night time between 9.00 pm to 6.00 am if there are habitation/ educational institutes/health centers (silence zones) located within 150m of construction site.
- Proper maintenance of the machineries shall be carried out to control the air and noise pollution caused by these machineries.
- Debris that are generated due to the dismantling of the existing structures shall be suitably reused, to the extent feasible, in the proposed construction (used as a fill material for embankment).
- Ensure that the asbestos-containing materials or other toxic substances are removed and disposed of by specially trained workers as per Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.
- Never dispose of spent oils on the ground, in water courses, drainage canals or in sewer systems.

Waste management

- Separation of Construction waste from the source as to be practised so to minimize the volume of waste and to increase the recyclable and reuse probability. Items such as aluminum, wood, plastic, paper packaging, copper, used oil can be reused. The other construction debris such concrete, bricks, sands can be used in backfilling in other location as per demand.
- Hazardous waste must be handled as per hazardous waste management rule 2016.
- Contractor should ensure that workers practice waste management options and recycle the wastes during site works.
- Contractor should ensure appropriate storage and handling of construction materials to minimise waste generation resulting from damaged materials/waste e.g. keeping deliveries packaged until they are ready to be used;
- Contractor should ensure that all disturbed area are restored after completion of construction.

Construction Worker

- A good sanitation plan shall be developed and provided by the contractor for construction camps and shall ensure that pollution of nearby water bodies is avoided. Plan must be in place to avoid construction within 500 m of dense habitation.
- Provide personal protective equipment and clothing (goggles, gloves, respirators, dust masks, hard hats, steel-toed and –shanked boots, etc.) for construction workers and enforce the use of the PPEs.
- The contractor should arrange adequate supply of water throughout the construction period from an agreed source.
- Provision of temporary toilet facilities for worker; contractors can identify suitable locations in close proximity to construction site.
- Provide traffic signs (including paint, easel, sign material, etc.), road marking, and guard rails to maintain pedestrian safety during construction.

Operation stage of the project

In Fishery, Operation stage of the project involves activities such as input supply for quality fish seed and sustainable fish production.

2.2 Input Supply

With respect to this activity, input and supply which will involve seed vendor, dealer etc. the project has also special emphasis on adoption of high quality seed. Therefore after selection of particular site, farmer should procure a good quality seed from licensed vendor.

The fish seed production technology can be described as a) Broodstock collection and management, (b) Artificial breeding, (c) Hatchery and nursery management. From the observation from site visits and consultation, the most hatchery operators in the region produce seeds from the same brood stock repeatedly for several years resulting in poor quality seeds. The basic input for the production of quality fish seeds is good, healthy and matured brood fish.

To develop genetically improved brood fish for the production of quality seed, systematic selective breeding programme may be one of the alternatives. Individual selection should be based on the basis for collecting young brood fish. In the individual selection, it is necessary to know about the

- Origin of population
- Performance of the given strain
- Typical external characteristics of species

After selection, the young brood, should be kept under optimal conditions before choosing the most appropriate female and male individuals for hatchery operation and try to include the following measures as given below:

- Mixed spawning of fish should be promoted in the seed producer centers. If this does not happen, conservation of the native fish species shall be extremely difficult.
- Induced breeding of undersized matured fish should not be practiced.
- good brood stock management and planned cross breeding of different species should be endorsed.

The farmer seed producers should be educated through massive awareness camps. Local network has to be formed to exchange brood stocks among the farmers. Fish farmers may be motivated and educated to culture only the pure varieties of a particular fish species, say: Rohu, Mrigal, Catla, Silver, Grass and Common carps.

Rationale and preventive measures has been described here to understand the vertical importance of the Fish Species:

- While selecting the particular seed or fingerling, care should be taken to promote more indigenous species. Inappropriate selection of fingerlings which might not be suitable for climate may create problem for farmer and badly affect the overall productivity.
- **Preservation of native species:** Optimum and efficient use of freshwater resources and the restoration & management of "Wild Fish stock " so as to preserve the "Native" qualities and to save the Native gene pools from terminal decline to secure for the future especially in the wetland /beels.
- Proliferation of genetic homogenization of species may replace local varieties with uniform genetic stock. This homogenic strands may be more vulnerable to catastrophic disease outbreak and may need more efforts to produce it well.

2.3 Production and Operation

In production step of value chain, farmers are more involved. Activities like good cultivation practices and post-harvest management needs to be considered in production stage. Rationale and preventive

measures that are to be considered to support the environmental guidelines for production stage as well as climate resilient methods are described in this section.

Ecological Fisheries:

- Conservation of native species shall be done.
- **Culture of Alien fish species shall be ban**, such as Thai magur (*Clariasgariepineus*), Tilapia, hybrid Kawoi (*Anabas testudineus*), Roopchanda (*Colossoma macropomum*), Bighead carp (*Arichthichthysnobilis*) *Pangasiussutchi* etc. pose threat to native fish species and gene pool and may result in ecological imbalance and may lead to loss of bio-diversity
- Restriction shall be made mandatory that do not culture banned fish in pond and beels.
- **Beels** are the store house of many indigenous species. Environmentally sound habitat and stock enhancement programme to safeguard the ecological diversity should be promoted. For **stock enhancement programme**, several of the indigenous high value small fish species such as **Mola (Amblypharyngodonmola)**, **Puntius sp.**, **Gudusiachapra (Karati)**, **Mystussp** shall be introduced in the beels for large-scale production through auto-stocking. The availability of these species in the natural water bodies has drastically declined in the past decades; therefore this needs immediate conservation strategies through inoculation of the species in their preferred habitats eg. Beel /wetlands.
- **Deweeding of Beel:** 100% removal of aquatic weeds is not recommended especially in the open beel which provides shelter and also acts as a breeding ground to many of the indigenous fish species. The best environment friendly method for deweeding is through manual operation or through introduction of Chinese grass carp, ducks, geese etc.
- Water hyacinth is an alternate food source for pig so, pig cum fish farming may use water hyacinth as a food source for pig and manure from pig can be used as feeding material in fish pond (but to a limited extent).
- Integrated farming along with fishery should be promoted to make it more climate resilient by adopting Pig cum fish farming, Livestock cum Fish farming, paddy fish farming etc,
- **For management of nutrients in winter:** when the water temperature in the pond/ mini-barrage falls below the optimal range during winter months, the rate of application of artificial feed and fertilizers /manure should be reduced.
- **Water Quality management:** Domestic waste and human intervention should not contaminate water body for harvest of fish crop. Feed material must be applied as per available population density of the fish. Use of Biofloc technology⁶⁸ to clean the water is advisable. Avoid doing agriculture practice near the pond to prevent fertilizer, chemical runoff into the pond.
- To balance oxygen level, change in feeding regimes, recirculating water/ aeration and De-stocking, provision of oxygen supplements are some of the measures that shall be taken care of.
- Proper embankment should be constructed to tackle the flood situation.
- **Tackle Water stress:** In semi intensive aquaculture, the fish farms can be prepared for approaching high water temperatures by:
 - Providing oxygen supplementation,
 - Changing feeding regimes, Recirculating water/ aeration, and De-stocking
 - Concentrate fish in deeper pools
 - Allow for at least two feet of water loss from evaporation and seepage during the drought, and plan a minimum depth of three feet of water during the drought for a minimum of five feet total depth.

Pond management during drought

⁶⁸Bioflocs are aggregates (flocs) of algae, bacteria, protozoans, and other kinds of particulate organic matter such as feces and uneaten feed. Each floc is held together in a loose matrix of mucus that is secreted by bacteria, bound by filamentous microorganisms. Biofloc community also includes zooplankton and nematodes. **Biofloc technology (BFT)** may be one the most reasonable method of increasing the fish production in Assam through intensification with minimum feed cost and least impairment to the animals and environment.

- Grow-out ponds with 1.5- 2.0 m water depth and with good water holding capacity is ideal for withstanding the temperature shock during summer.
- Common dyke and flood wall construction in aquaculture farms location, where floods are common would help reduce loss.
- In case of ponds with lower water depth, biomass needs to be reduced proportionately through partial harvesting.
- Cautious approach should be adopted while using manure and fertilizer (to avoid algal blooms and eutrophication.)
- Rising water temperature may reduce the upwelling of food supplies that might result the fish in upper layers, this increases the carbon di oxide in the atmosphere which will increase the acidity of water bodies adversely affecting the fish.
- Allow for at least two feet of water loss from evaporation and seepage during the drought, and plan a minimum depth of three feet of water during the drought for a minimum of five feet total depth

Short- term culture of alternate species due to water stress.

- Adoption of short-term (August/September to February/March) species culture having rapid initial growth.
- Medium carps like **silver barb (*Puntius gonionotus*)**, **Olive barb (*Puntius sarana*)**, **Bata (*Labeobata*)**, **Gonius(*Labeogonius*)** and ***Labeofimbriatus*** are ideal species for summer season due to their rapid initial growth and market preference even at smaller size (200- 250 g).
- Culture of the **minor carp *Amblypharyngodonmola*** is another summer option for utilizing the small shallow ponds. Being an auto-breeder that breeds two to three times a year, this fish helps in auto-stocking of the pond during summer.
- Pen culture of fish and prawn in derelict water bodies/ lakes/ floodplain wetlands during flood (More water).
- Shallow areas can be made use of for raising table size fishes and prawns in enclosure (pens).
- However, assessment of water depth, (at least 1 m water depth for 3-4 months), duration of water availability and seed availability, (IMC:1 0-15cm length @ 10,000-15,000/ha) are required.
- Erecting pens of suitable size and shape, depending on the capacity of water bodies and topography of the area may result in higher production. Pens of 0.1 to 0.2 ha size is economical and ideal for easy operation.
- Cage culture can also be established in any suitable body of water, including lakes, ponds, mining pits, streams or rivers with optimum water quality.
- to build a skilled workforce for the sector at every stage through training, demonstration, exposure visits etc shall be facilitated

Safety:

Use of disinfectants and personal protective equipment like boots, gloves during the farming practices reduces the contamination and infection to some extent.

- To prevent the unhygienic farming practices and improper maintenance of the fishery pond , Dewatering, liming, exposure to sunlight, repairing of dykes should be carried in fishery pond after a certain interval of time.

Post construction and Operation stage of the project

Project component interventions such as storage management, post-harvest management, transportation, grading, packaging, processing etc of fish products has been included. Following environmental guidelines shall be considered on the post operational construction activities and management.

2.3 Post-harvest care

After harvesting of the fish produce, post-harvest care plays a key role in preservation and maintaining the actual quality and monetary value of the agriculture produce. Therefore storage of the products at cold storages/cooling units should be done immediately. For emergency case, effort shall be taken that harvesting products should be sold as early as possible.

2.4 Transportation

As per project component, the Farm market infrastructure development involves the activities of facilitating Enterprise cluster production improvement and market support in terms of Access and other services.

In post operation stage of the project, transportation service shall be required to store, manage, and post-harvest care, marketing and further value adding in the product. So in term of transportation up gradation of existing roads, strengthening existing culverts and bridges, road construction leading to the Agro-based industries to facilitate the cluster development and for ensuring better connectivity to market centres has been intervened. In preconstruction and construction phases the precautions / guidelines to be carried out under project, has already been mentioned in previous sections of this document. Following points details the environmental precautions that are to be taken while transporting the products.

- While transporting the products, Vehicular emissions to the ambient atmosphere is anticipated, so it is recommended to use only BS-IV vehicles with valid emission certificate should be used for transportation.
- Refrigerated van shall be promoted to transport the fish produce. While loading the produce proper gloves, apron should be provided to worker to maintain the hygiene.
- Overweighing Vehicles carrying loads exceeding those permissible without proper permission should not be allowed to pass through the constructed roads.
- Create awareness on proper transport system management.
- Roads which are dedicated to be used for / or infrequently used shall have proper road signage and breakers to prevent the accident in the road.
- All material should be transported in fully covered trucks. Overloading of vehicles with materials should be controlled and done in a manner to suit the trucks capacity.

2.5 Trading

With reference to the project component of Farm market infrastructure development, provision of market area, Rural Haat facility has been envisaged. It is proposed to develop and upgrade market area/ Rural Haats with common amenities close to production clusters. Following environmental guideline envisages the p care that has to be taken in the market area / Rural Haat of the fish Produce.

Storage of products for sale:

Inappropriate storage of the fish produce will lead to contact with moisture and contamination. Therefore the storage area should be in clean, cool containers or containers with lids, covers. Refrigerated containers shall be used for fish storage to make it fresh and safe.

Waste Management:

Open disposal of decomposable wastes leads to contamination of surroundings though decomposition, attracting insects, leaving chemical residues etc

- Waste should be properly disposed on the designate place only.
- Fish Cutting, processing place should be properly cleaned and waste arrived from that shall be stored safely which can be used as alternatively in farm.
- The waste should be separated from it source itself into dry, wet material so that it can be reused.
- Dry waste particularly such as paper, plastic etc, can recycled or collected and disposed to recycling vendor.
- Alternate use of biodegradable fish waste should be integrated with agricultural farming practices.
- Waste dispose area should not be near to water bodies and dense settlement area or low lying area.

Basic Amenities:

Lack of required basic amenities will affect health of workers, vendors and will negatively affect the area and surroundings. Therefore,

- The work space should be ventilated to the extent possible. Drinking water and toilet facilities should be made available.
- Proper sanitation and drainage system shall be designed and maintained to keep the area free from contamination and reduce the disease risk.

License and registration:

Machineries used in market area should hold proper license. Vendors selling chemicals, fertilizer shall hold proper registration.

Any activities which are not legal to GOI shall be strictly prohibited.

Storage

2.6 Processing & Value Addition

As per project component, the Farm market infrastructure development involves the facility of common service center (CSC). CSCs are conceived as commercially viable basic infrastructure for marketing of Fish produce, built around farmer producer companies (FPC) and are proposed to be located in production locations. Activities like, grading, packaging, small processing, Milling shall be prescribed here, so hereby provisions of following precaution measure shall support the sustainable constancy of Common Service Centres.

Registration, licenses and permissions:

every processing units for production, value addition items and other machinery if not be line with legally frame will create a problem

- Processing unit, seed production units, and other equipment required for value addition purposes will be legally complied with respected rules.

Maintenance and repairs of machinery:

Irregular cleaning or maintenance will lead to contamination and improper functioning therefore regular upkeep should be followed as per the prescribed standards.

Storage of ingredient:

Inappropriate storage of the ingredients will lead to contact with moistures, exposure to pests like rats etc. will spoil the quality there by having impact on health.

- The storage area should be located in clean, cool and dry places comprising of tightly packed refrigerated containers with lids, covers.
- Food products should not be stored along with any products of chemical nature.
- obsolete raw materials or raw materials stored for long periods should not be used.
- Raw materials should be inspected at regular intervals and any spoiled materials should be safely discarded.

Use of additives, preservatives:

While in processing section, using of non-permitted additives and preservatives is illegal and pose health risks to the workers and consumers. Therefore only the permitted additives and preservatives shall be used in food items as per prescribed in FSSAI Act.

Commercial Hatchery Plant:

More emphasis should be given to preserve the local and indigenous species, which will be beneficial in long run and less resources would be required to upkeep and maintain.

Packaging:

in packaging of Fish products, use of indecomposable packaging material further causes the soil Pollution, while plastic bags under thickness of 20 microns is not allowed for packaging due to their non-recyclable nature and potential negative impact on environment.

- Bio degraded able ingredients and re-useable packaging should be promoted.
- Use newspaper wrapping or cloth bags for supplying the provision to the consumer encourage the consumers to bring cloth bags.
- Handling the food products with bare hands or unwashed hands will contaminate the products through microbial attack.
- Local material should be used for packaging instead of imported material, plastics etc. Jute sacks or other available material can be used for transport purposes. This can reduce the unnecessary use of packaging and containers.
- To avoid the wastes in post-harvest phase, the packaging should be in a perforated biodegradable material so to prevent the oxygen deprivation and congestion of the Food items.

Basic Amenities:

The work space should be ventilated to the extent possible. It should have drinking water and toilet facilities.

Occupation health and Safety to maintain the safety of worker following measure shall be adopted:

- Person using these machines must wear mask for preventing the problem related to inhalation.
- Noise protective equipment should be provided to the machine operators.
- Ensure only experienced and well trained workers are used for the handling of machinery, equipment and material processing plants.
- Ensure all persons, including managers, are trained and are able to carry out their work without risk to the safety or health of themselves, other workers or the public.

- To maintain the safety of equipment as well as worker, Inspections should look for evidence of wear and tear, frays, missing parts and mechanical or electrical problems.
- Ensure an emergency aid service is in place in the work zone.

Waste management:

Waste materials produced during the operation of completed facilities must be also carefully managed. If not, these wastes can cause disease, injury, and/or environmental damage within the local community. It should be put into practice the reduce, reuse, recycle and recover options for waste generated. Recycling of waste in case of agriculture sector is composting and land application as manure and in recovery of waste is satisfied with the recovery of methane. Composting of biodegradable waste on site is an effective means of significantly reducing the volume of waste to be disposed of, and produces a potentially useful soil conditioner.

- The waste should be separated from its source itself into dry, wet material so that it can be reused.
- Dry waste particularly from common service center such as paper, plastic etc, can be recycled or collected and disposed to recycling vendor.
- The waste storage area should not be located near to water stream, drain or low lying area.
- Biodegradable waste shall be managed separately.
- Reuse and recycling of waste shall be promoted as far as possible to minimize the total waste.
- Intergradation of biodegradable waste to nearest farm field to use as manure should be done.
- Intergradation of fish processing, grading waste to farmer for use as cattle feed shall be promoted.

Power use:

Power requirement has been anticipated in heating, boiling, grinding, extraction, drying, packaging etc. so Energy efficient device should be used, Biomass or solar devices should be promoted to conserve energy, Energy consumption monitoring should be followed regularly.

3. DAIRY

Project intervention in term of **productivity enhancement in Dairy sector** has an aim to benefit the farmers, small medium entrepreneurs and overall agribusiness enhancement of the state, but immense involvement in the Dairy practices may generate some environmental complications, if not accomplished carefully.

Preconstruction stage of the project

3.1 Site Selection

For the development and generation of more efficient **Farm-Market Infrastructure Development**, Site selection criteria for milk production purpose, construction of road, common service centre, BMC plant, processing units shall be different. So in Dairy sector following sections provide selection criteria for site for different infrastructure facility:

For Road

Transportation plays a vital role in agriculture sector. In APART Project, provision of road has been of primary focus as it is a way to connect the agriculture production cluster, Common service centre, market areas, Rural Haats and nearby possible Storage areas (warehouse) to provide a better market led enhancement production, more resilient way of marketing and value addition. Following guideline shall help in choosing the site for road development.

- Choice of location should be done so as to support the ecosystem. In cases if the sensitivity is severe, alternatives should be opted.
- Minimize impacts to ecosystem that may provide an important buffer to climate change impacts, especially in areas where those buffers will be needed
- Selection of site shall be done preferably on government land. Effort shall be taken such that site is free from public conflicts.
- Site should not be located near any critical wild life habitats (those mentioned in natural habitat management Plan)
- Site should not be chosen near Natural Protected areas. If site is located near or less than 1 km distance from protected area, then a proper consent shall be obtained from forest department.
- The area should not be located in flood prone areas.
- While selecting the site, care should be taken such that it shall not disturb any dense habitations.
- Preference would be given to develop roads that are already in use, to make it more efficient and smooth instead of proposing a new one. This will save the environment and also prevent unnecessary nuisance.
- New road will be selected only after having a proper need based assessment of the site.
- After identification of Site, necessary permission as applicable from Gram Panchayat, revenue Department shall be procured.
- Prior approval of the ES, PMU/PCU is required in case of any innovations in design and identification of sites.

For Common Service centre/ BMC/ Processing Plant services

- Selection of site shall be done preferably on government land. Effort shall be taken such that the selected sites are free from public conflicts.
- Site should not be located near critical wild life habitats (as mentioned in natural habitat management Plan).
- Site should not be chosen near Natural Protected areas. If site is located near or less than 1 km distance from protected area, then a proper consent shall be obtained from forest department.
- The area should not be located in flood prone areas, low lying areas or steep slopes.

- The site should be free of contamination, storage of industrial waste etc.
- While selecting the site, care should be taken such that it shall not disturb any dense habitations.
- Preference to be given to develop the structures which are already in use, to make it more efficient and smooth instead of proposing a new one. This will save the environment and also prevent unnecessary nuisance. Like if an area has been already using for community development purposes then the same can be used for the proposed activities.
- Criteria shall enforce that new site will be selected only after having a proper need based assessment of the site.
- After identification of Site, necessary permission as applicable from Gram Panchayat, revenue Department shall be procured.
- Prior approval of the ES, PMU/PCU is required in case of any innovations in design and identification of sites.

Construction Stage of the project

3.2 Land Preparation and construction activities

Land preparation stage involves site clearance, transportation of construction material, handling of construction machineries, construction mechanical activities for development of Market Infrastructure facilities such as road, Common service centre, BMC, dairy processing Plants. While modernization and upgradation will involve interior construction activities, furnishing, refurbishment of interior structures etc. Following points shall be taken into consideration for maintaining an environmental health of the area while carrying out activities of land preparation and other construction activities.

Site Clearance

- During land preparation, care shall be taken to avoid destruction site vegetation to minimum extent as possible. Effort shall be taken that construction activity should not disturb the nearby local vegetation unnecessarily.

Sourcing of Material

- Construction material such as sand, aggregates and other quarry material should only be sourced from licensed quarries as per consent from PWD.
- This necessitates them to maintain the number and the relevant details, such as license issue and expiration dates, status report, etc.
- Borrow pits shall be prohibited where there are chances for interference with the natural or designed drainage patterns.
- Sourcing of any material from within or from any Protected Areas/Sanctuaries, tank beds and/or designated natural areas are strictly prohibited.

Transportation of Construction Material

- All materials should be transported in fully covered trucks. Overloading of vehicles with materials should be controlled and done in a manner based on the trucks capacity.
- The unloading of materials at construction sites those that are close to settlements shall be restricted to daytime only.
- Provide traffic signs (including paint, easel, sign material, etc.), road marking, and guard rails to maintain pedestrian safety during construction.
- Vehicle should comply with the rules.

Protection of environment

- Special emphasis shall be given to protect the fertile top Soil and would be emphasised to be restored at the site after completion of construction.
- During construction phase necessary soil protection measure shall be adopted. All affected areas should be landscaped and any necessary remedial works should be undertaken without delay, including grassing and reforestation;
- **Apply erosion control** measures before the rainy season begins preferably immediately following construction. Install erosion control measures at each construction site after it is completed.
- Storage of Oil and chemicals that are to be used during construction work shall be stored at a designated confined place on a impervious layer so no leakage could occur such that contamination of water bodies and soil is prevented.
- To evade the **degradation of water quality** of water bodies in the vicinity of the construction sites, it is ideal to avoid construction works close to the streams or water bodies during monsoon season. All precautionary measures shall be taken to prevent the wastewater that are generated during construction from entering into streams, water bodies or the irrigation channels.
- To prevent the **degradation of surface water quality** arising due to equipment and material piling on the site, it is advisable to store Construction pile, Soil stockpile and other debris at designated place. Cover the stock pile with tarpaulin sheet to prevent contamination of the nearby water body and agricultural field.
- Water Sprinkling shall be done regularly on dirt roads, cut areas and soil stockpiles or fill material to reduce the dust pollution arising due to construction activities.
- Permission for the extraction of water should be obtained prior to the commencement of the project, from the relevant authority.

Construction Management

- All construction equipment that are used for project activities shall conform to pollution control norms as stipulated by SPCB and hold valid license.
- The unloading of materials at construction sites that are located close to settlements shall be restricted to daytime only.
- All plants and equipment that are used in construction by the Contractor shall strictly conform to the CPCB noise standards.
- Noisy construction activities (such as crushing, concrete mixing, batching etc.) shall be stopped during the night time between 9.00 pm to 6.00 am if there are habitation/ educational institutes/health centers (silence zones) located within 150m of construction site.
- Proper maintenance of the machineries shall be carried out to control the air and noise pollution caused by these machineries.
- Debris that is generated due to the dismantling of the existing structures shall be suitably reused, to the extent feasible, in the proposed construction (used as a fill material for embankment).
- Ensure that the asbestos-containing materials or other toxic substances are removed and disposed of by specially trained workers as per Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.
- Never dispose of spent oils on the ground, in water courses, drainage canals or in sewer systems.

Waste management

- Separation of Construction waste from the source as to be practised so to minimize the volume of waste and to increase the recyclable and reuse probability. Items such as aluminum, wood, plastic, paper packaging, copper, used oil can be reused. The other construction debris such concrete, bricks, sands can be used in backfilling in other location as per demand.
- Hazardous waste must be handled as per hazardous waste management rule 2016.
- Contractor should ensure that workers practice waste management options and recycle the wastes during site works.
- Contractor should ensure appropriate storage and handling of construction materials to minimise waste generation resulting from damaged materials/waste e.g. keeping deliveries packaged until they are ready to be used;

- Contractor should ensure that all disturbed area are restored after completion of construction.

Construction Worker

- A good sanitation plan shall be developed and provided by the contractor for construction camps and shall ensure that pollution of nearby water bodies is avoided. Plan must be in place to avoid construction within 500 m of dense habitation.
- Provide personal protective equipment and clothing (goggles, gloves, respirators, dust masks, hard hats, steel-toed and –shanked boots, etc.) for construction workers and enforce the use of the PPEs.
- The contractor should arrange adequate supply of water throughout the construction period from an agreed source.
- Provision of temporary toilet facilities for worker; contractors can identify suitable locations in close proximity to construction site.
- Provide traffic signs (including paint, easel, sign material, etc.), road marking, and guard rails to maintain pedestrian safety during construction.

Operation stage of the project

In dairy sector, operation stage of the project involves activities such as milk production. The productivity enhancement intervention will involve cattle rearing whose yield will be more. Thus cattle rearing, species balance, cattle shed waste, Cattle health issue, quality, feed are the major issues that are encountered.

3.3 Input Supply

With respect to this activity, input and supply will involve Artificial Insemination facility under the project. The project has also special emphasis on adoption of high quality breed. Therefore rationale and preventive measures has been described here to understand the varietal importance of the breed:

- While selecting the particular Breed, care should be taken to promote more indigenous species. Inappropriate selection of species which might be not suitable for climate may create problem for famer and affect the overall productivity.
- If artificial insemination facility is carried out without technical guidance productive exotic breeds may be used, this will create problems like homogeneity in the breed, loss of indigenous species, increased susceptibility to diseases and less adaptability to existing climate. Proliferation of genetic homogenization of livestock species may create uniform genetic stock therefore for protection of local variety, inspect if local breeds can meet specified needs, strongly consider their use. Even if a local breed is a relatively low producer, consider this drawback against the breed's disease resistance and endurance in the local environment. Consider whether the breed will be well-suited to meet expected climate changes.
- Proliferation of genetic homogenization of species may replace the local varieties with uniform genetic stock. This homogentic strands may more vulnerable to catastrophic disease outbreak and may need more effort to produce it well.
- Careful interaction with technicians of artificial insemination would be helpful to make the good choice of cattle breed.

3.4 Production and Operation

In production step of value chain, farmers are more involved. Activities like good cattle rearing, milking practices needs to be considered in production stage. Rationale and preventive measures that are to be considered to support the environmental guidelines for production stage as well as climate resilient methods are described in this section.

Mixed farming systems integrate cattle and crop production

By adding cattle to their farms helps farmers to minimize risk through more diversified production systems and they extract value from otherwise valueless or low-value by-products of each activity such as crop residue becoming as a feed, manure becomes fertilizer. A sensitization will be provided for farmers to adopt their traditional way as well as climate friendly techniques to overall manage and get cost effective benefits.

For protection of local variety, inspect if local breeds can meet specified needs, strongly consider their use. Even if a local breed is a relatively low producer, consider this drawback against the breed's disease resistance and hardiness in the local environment. Consider whether the breed will be well-suited to meet the expected climate changes.

Practice of injecting hormones to increase the milk yield should be strictly avoided.

Fodder

- Conservation of Village grazing reserve, community and farmer group should initiate the protection of existing village grazing reserves to suffice the demand of livestock feed.
- Community based grazing land cultivation should be done on the waste/ barren land to fulfill the fodder demand.
- Community should get proper permission from nearby forest department, if the grazing land is located near protected areas.
- Preference should be given in farming for the use of biomanure, compost material and bio fertilizers as much as possible so as to minimize the introduction of chemicals into the food chain. This will be economical and climate friendly also.

Climate Change effect:

Following mitigation measures should be adopted

- avoid deforestation and degradation of forest land associated with an increase in grazing
- Adoption of Biogas plant: Using of renewable energy such as bio gas may also give significant improvement in overall Carbon sequestration through reducing the use of fuel wood and production of methane from cattle shed. Energy generated from biogas runs on the basis of available cattle manure, biodegradable waste can be used as cooking fuel and heating purposes.
- Better animal nutrition (more concentrate feed and nutritional supplements) will low the methane emission in waste.
- Manure Management: Avoid anaerobic manure decomposition by applying manure directly as fertilizer.

Cattle Shed Care:

Due to rearing more number of cows than the holding capacity will require more intensive care. Therefore:

- Limit the number of dairy cows per household to a manageable size according to per cattle required area.
- Feed storage areas should be constructed so that feed is kept dry.
- The shed should be clean and should provide sufficient ventilation and enough space to animal.
- Proper waste drainage system should be provided with alternate use of wastes
- Better manure management which substantially reduce the emissions, Community basis or individual level biogas plant should be promoted.
- Climate resilient options to reduce the GHG emission consequently power saving option should be promoted through training program on biogas development and bio manure management for community or individual level should be promoted.

- Vegetation and rubbish around buildings and yards are removed or controlled, in order to reduce habitat for insects and vermin.
- Spills of effluent, feed, chemicals and other potential pollutants should be cleaned up promptly.

Please refer Annexure- 6 for Cattle Shed Management

Cattle health care:

Awareness among farmer about precaution measures for diseased cattle, good hygienic milking habit, importance of vaccination etc shall be provided. A regular interaction should be developed with the providers/ technician for Artificial Insemination and veterinary facility (a doorstep facility to be provided under the Project APART).

Training for stakeholders, small entrepreneurs and farmers for good hygienic method of cattle rearing, vaccination, milking habit etc. would be helpful to make dairy business more profitable.

Safety:

- To avoid accidents passages should be kept clean and the workers should use slip-resistant footwear. The shed or the working place should also have proper ventilation to avoid suffocation.
- While mixing and pumping manure, workers and animals may be exposed to high concentrations of poisonous gases like Hydrogen Sulfide (H₂S), Carbon Dioxide (CO₂), Ammonia (NH₃), methane (CH₄) etc. which causes eye and nose irritation, anxiety disorder, headache, eye irritation and numbing of the sense of smell by hydrogen sulfide (H₂S) so, personal protective measure such as marks, Gloves, should be used.
- While handling the diseased cattle also protective measure such as glove, masks, apron should be used.

Post construction and Operation stage of the project

Project component interventions such as milk storage management, transportation, packaging, processing etc of Dairy products has been included. Following environmental guidelines shall be considered on the post operational construction activities and management.

3.5 Transportation

As per project component, the Farm market infrastructure development involves the activities of facilitating Enterprise cluster production improvement and market support in terms of Access, BMC, Processing Plant other services.

In post operation stage of the project, transportation service shall be required to store, manage, marketing and further value addition in the product. So in term of transportation up gradation of existing roads, strengthening existing culverts and bridges, road construction leading to the Agro-based industries to facilitate the cluster development and for ensuring better connectivity to market centres has been intervened. In preconstruction and construction phases the precautions / guidelines to be carried out under project, has already been mentioned in previous sections of this document. Following points details the environmental precautions that are to be taken while transporting the dairy products.

- Containers used for carrying the Dairy Products should be properly cleaned and Sterilized before transportation.

- Care should be taken that the hauling area should be in cool place.
- Effort of transporting milk to Market, BMC, Processing plant shall be done as quick as possible to avoid the spoilage of milk.
- While transporting the Dairy products, Vehicular emissions to the ambient atmosphere is anticipated, so it is recommended to use only BS-IV vehicles with valid emission certificate should be used for transportation.
- Overweighing Vehicles carrying loads exceeding those permissible without proper permission should not be allowed to pass through the constructed roads.
- Create awareness on proper transport system management.
- Roads which are dedicated to be used for / or in frequently used shall have proper road signage and breaker to prevent the accident in the road.

3.6 Trading

With reference to the project component of Farm market infrastructure development, provision of **market area, Rural Haat** facility has been envisaged. It is proposed to develop and upgrade market area/ Rural Haats with common amenities close to production clusters. Following environmental guideline envisages the care that has to be taken in the market area / Rural Haat of the agricultural Produce.

Storage of products for sale

Inappropriate storage of the dairy products will lead to contact with moistures and contamination, will spoil the quality there by having impact on health. Therefore the storage area should be in clean, cool places with tightly packed refrigerated containers with lids, covers.

Waste Management:

Open disposal of decomposable wastes leads to contamination of surroundings though decomposition, attracting insects, leaving chemical residues etc

- Waste should be properly disposed on the designate place only.
- The waste should be separated from its source (dry & wet waste) so that it can be reused.
- Dry waste particularly such as paper, plastic etc, can recycled or collected and disposed to recycling vendor.
- Alternate use of biodegradable waste should be integrated with bio compost formation and agricultural farming practices.
- Waste water coming from washing area shall be disposed safely and should be alternately used in other tasks.
- Waste dispose area should not be near to water bodies and dense settlement area or low lying area.
- Waste disposal shall not be done in open area

Basic Amenities:

Lack of required basic amenities will affect health of workers, vendors and will negatively affect the area and surroundings. Therefore,

- The work space should be ventilated to the extent possible. Drinking water and toilet facilities should be made available.
- Proper sanitation and drainage system shall be designed and maintained to keep the area free from contamination and reduce the disease risk.

License and registration:

Machineries used in market area should be properly licensed.

Any activities which are not legal to GOI shall be strictly prohibited

3.7 Storage

As per Project Implementation Plan of APART, Upgradation and modernization and new construction of Bulk Milk Cooler arises under farm Market Infrastructure development. The aim of developing environmental guideline is to provide scientific storage methods and preservation of products. Following section details about major environment issues and preventive measures to be adopted while handling and storage of dairy products.

- Effective and suitable provision shall be made to ensure that every enclosed workplace is ventilated by a sufficient quantity of fresh or purified air.
- The floor or surface shall not have a hole or slope, or be uneven or slippery so as to expose a person to a risk to his health or safety and shall have effective means of drainage as appropriate.
- Doors and gates shall be suitably constructed and fitted with necessary safety devices.
- Milk testing kit should be provided to monitor the milk to be stored.
- Handling and managing the milk, it should ensure that hygiene of the place is maintained. By providing sufficient Gloves, marks, apron for worker.
- Energy Efficient Device should be used to minimize the power use.
- All equipment, appliances should be properly licensed.
- Ensure that only trained workers handle the equipment and appliances.
- Promotion shall be done to develop energy efficient building with Integrated daylighting with the electric lighting system. Thus allow for natural lighting wherever possible.
- Use of LED lighting can reduce the electricity consumption drastically.
- For maintaining the health and safety of workers, design shall provide local exhaust for restrooms, kitchens, copy rooms, battery-charging areas, clean drinking water facility etc.
- Design equipment and furnishings reflective of healthy work practices in an effort to eliminate repetitive motions as well as prevent strains and sprains.
- Provision of First aid facility to provide help for occupational injuries and illness
- Provide sufficient training to workers who are handling, loading and unloading, trolley, fork lift etc.
- Waste water from the BMC shall be used alternatively in the other operations such as in farm field etc. It should be in such manner that water could not get logged and not disturb the natural land use of the area.
- Continuous routine monitoring of water and waste should be done.
- Waste water shall not be flushed openly in the field.
- Proper permission shall be required to use of water in plant.
- Waste from the storage area shall be disposed off carefully at designated place. Effort should be taken to use of waste as an alternative
- Every workplace, and the furniture, furnishings and fittings therein shall be kept sufficiently clean.
- Regular upkeep should be followed to maintain the BMC plant efficiently.

3.8 Processing, Grading, Value Addition

As per project component, the Farm market infrastructure development involves the facility of **common service center (CSC)** and **dairy processing Plant**. CSCs are conceived as commercially viable basic infrastructure for marketing of dairy products, built around farmer producer companies (FPC) and are proposed to be located in production locations. Activities like sale, packaging, processing shall be

carried out here, so hereby provisions of following precaution measure shall support the sustainable installation of Common Service Centres.

Registration, licenses and permissions:

Every processing units for dairy production, value addition items and other machinery if not be line with legally frame will create a problem

- Processing unit, production units and other equipment required for value addition purposes will be legally complied with respected rules.

Maintenance and repairs of machinery:

Irregular cleaning or maintenance will lead to contamination and improper functioning therefore regular upkeep should be followed as per the prescribed standards.

Storage of ingredient:

Inappropriate storage of the ingredients will lead to contact with moistures, exposure to contaminants will spoil the quality there by having impact on health.

- The storage area should be in clean, cool places with tightly packed containers or refrigerated containers with lids, covers.
- Food products should not be stored along with any products of chemical nature.
- Raw materials should be inspected at regular intervals and any spoiled materials should be safely discarded.

Use of additives, preservatives:

While in processing section, using of non-permitted additives and preservatives is illegal and pose health risks to the workers and consumers. Therefore only the permitted additives and preservatives shall be used in food items as per prescribed in FSSAI Act.

Processing Plant operation

- In Processing plant Maintenance of aerobic conditions for wastewater processing.
- To control the noise of the plant, acoustic enclosure of outdoor mechanical plant such as pumps, sound silencers on air intake fans and air discharges, restricted operating hours should be done.
- Waste generated from the plant shall be disposed safely. Alternate use of wastes should be done.
- Plant shall be equipped with proper testing kit for food items.
- All the processed and product shall ensure the quality as per FSSAI of India.
- Personal Hygiene (such as cleaning hand, use of gloves, apron, mask etc.) should be maintained while handling the processed dairy products.
- All equipment used in the processing plant shall be properly licensed. Effort shall be taken to use only energy efficient devices within the plant.
- Reduction of heat loss by using continuous, instead of batch, pasteurizers, partially homogenizing milk to reduce the size of heat exchangers, using multistage evaporators, insulating steam, water, and air pipes / tubes.
- Improvement of cooling efficiency by insulating refrigerated room / areas.
- Installation of renewable energy sources shall be promoted.
- Regular upkeep to maintain the machineries, equipment with the help of technical expert.
- Permission should be required from central Ground water authority for usage of water.

Packaging:

in packaging, Use of indecomposable packaging material further causes the soil Pollution, while plastic bags under thickness of 20 microns is not allowed for packaging due to their non-recyclable nature and potential negative impact on environment.

- Bio degraded able ingredients and re-useable packaging should be promoted.
- Use newspaper wrapping or cloth bags for supplying the provision to the consumer encourage the consumers to bring cloth bags.
- Handling the food products with bare hands or unwashed hands will contaminate the products through microbial attack.
- Local material should be used for packaging instead of imported material, plastics etc. Jute sacks or other available material can be used for transport purposes. This can reduce the unnecessary use of packaging and containers.

Basic Amenities:

The work space should be ventilated to the extent possible. It should have drinking water and toilet facilities.

Occupation health and Safety to maintain the safety of worker following measure shall be adopted:

- Person using these machines must wear mask for preventing the problem related to inhalation.
- Noise protective equipment should be provided to the machine operators.
- Ensure only experienced and well trained workers are used for the handling of machinery, equipment and material processing plants.
- Ensure all persons, including managers, are trained and are able to carry out their work without risk to the safety or health of themselves, other workers or the public.
- To maintain the safety of equipment as well as worker, Inspections should look for evidence of wear and tear, frays, missing parts and mechanical or electrical problems.
- Ensure an emergency aid service is in place in the work zone.

Waste management:

Waste materials produced during the operation of completed facilities must be also carefully managed. If not, these wastes can cause disease, injury, and/or environmental damage within the local community. It should be put into practice the reduce, reuse, recycle and recover options for waste generated. Recycling of waste in case of agriculture sector is composting and land application as manure and in recovery of waste is satisfied with the recovery of methane. Composting of biodegradable waste on site is an effective means of significantly reducing the volume of waste to be disposed of, and produces a potentially useful soil conditioner.

- The waste should be separated from it source itself into dry, wet material so that it can be reused.
- Dry waste particularly from common service center such as paper, plastic etc, can recycled or collected and disposed to recycling vendor.
- The waste storage area should not be located near to water stream, drain or low lying area.
- Biodegradable waste shall be managed separately.
- Reuse and recycling of waste shall be promoted as far as possible to minimize the total waste.
- Integration of biodegradable waste to nearest farm field to use as manure should be done.
- Integration of food processing by grading the waste to farmer for use as cattle feed shall be promoted.

Power use:

power requirement has been anticipated in heating, boiling, grinding, extraction, drying, packaging etc. so Energy efficient device should be used, Biomass or solar devices should be promoted to conserve energy, Energy consumption monitoring should be followed regularly.

4. PIGGERY

Project intervention in term of **productivity enhancement in Piggery sector** has an aim to benefit the farmers, small medium entrepreneurs and overall agribusiness enhancement of the state, but immense involvement into the Pig farming may need special care to accomplish it sustainably.

Preconstruction stage of the project

4.1 Site Selection

For the development and generation of more efficient **Farm-Market Infrastructure Development**, site selection criteria are different for construction of road, common service centre, Slaughter house and the following sections provide selection criteria for site for different infrastructure facility:

For Road

Transportation plays a vital role in agriculture sector. In APART Project, provision of road has been of primary focus as it is a way to connect the agriculture production cluster, Common service centre, market areas, Rural Haats and nearby possible Storage areas (warehouse) to provide a better market led enhancement production, more resilient way of marketing and value addition. Following guideline shall help in choosing the site for road development.

- Choice of location should be done so as to support the ecosystem. In cases if the sensitivity is severe, alternatives should be opted.
- Minimize impacts to ecosystem that may provide an important buffer to climate change impacts, especially in areas where those buffers will be needed
- Selection of site shall be done preferably on government land. Effort shall be taken such that site is free from public conflicts.
- Site should not be located near any critical wild life habitats (those mentioned in natural habitat management Plan)
- Site should not be chosen near Natural Protected areas. If site is located near or less than 1 km distance from protected area, then a proper consent shall be obtained from forest department.
- The area should not be located in flood prone areas.
- While selecting the site, care should be taken such that it shall not disturb any dense habitations.
- Preference would be given to develop roads that are already in use, to make it more efficient and smooth instead of proposing a new one. This will save the environment and also prevent unnecessary nuisance.
- New road will be selected only after having a proper need based assessment of the site.
- After identification of Site, necessary permission as applicable from Gram Panchayat, revenue Department shall be procured.
- Prior approval of the ES, PMU/PCU is required in case of any innovations in design and identification of sites.

For Common Service centre/ Upgradation services

- Selection of site shall be done preferably on government land. Effort shall be taken such that the selected sites are free from public conflicts.
- Site should not be located near critical wild life habitats (as mentioned in natural habitat management Plan).
- Site should not be chosen near Natural Protected areas. If site is located near or less than 1 km distance from protected area, then a proper consent shall be obtained from forest department.
- The area should not be located in flood prone areas, low lying areas or steep slopes.
- The site should be free of contamination, storage of industrial waste etc.

- While selecting the site, care should be taken such that it shall not disturb any dense habitations.
- Preference to be given to develop the structures which are already in use, to make it more efficient and smooth instead of proposing a new one. This will save the environment and also prevent unnecessary nuisance. Like if an area has been already using for community development purposes then the same can be used for the proposed activities.
- Criteria shall enforce that new site will be selected only after having a proper need based assessment of the site.
- After identification of Site, necessary permission as applicable from Gram Panchayat, revenue Department shall be procured.
- Prior approval of the ES, PMU/PCU is required in case of any innovations in design and identification of sites.

Construction Stage of the project

4.2 Land Preparation and construction activities

Land preparation stage involves site clearance, transportation of construction material, handling of construction machineries, construction mechanical activities for development of Market Infrastructure facilities such as road, Common service centre, slaughter house. While modernization and upgradation will involve interior construction activities, furnishing, refurbishment of interior structures etc. Following points shall be taken into consideration for maintaining an environmental health of the area while carrying out activities of land preparation and other construction activities.

Site Clearance

During land preparation, care shall be taken to avoid destruction site vegetation to minimum extent as possible. Effort shall be taken that construction activity should not disturb the nearby local vegetation unnecessarily.

Sourcing of Material

- Construction material such as sand, aggregates and other quarry material should only be sourced from licensed quarries as per consent from PWD.
- This necessitates them to maintain the number and the relevant details, such as license issue and expiration dates, status report, etc.
- Borrow pits shall be prohibited where there are chances for interference with the natural or designed drainage patterns.
- Sourcing of any material from within or from any Protected Areas/Sanctuaries, tank beds and/or designated natural areas are strictly prohibited.

Transportation of Construction Material

- All materials should be transported in fully covered trucks. Overloading of vehicles with materials should be controlled and done in a manner based on the trucks capacity.
- The unloading of materials at construction sites those that are close to settlements shall be restricted to daytime only.
- Provide traffic signs (including paint, easel, sign material, etc.), road marking, and guard rails to maintain pedestrian safety during construction.
- Vehicle should comply with the rules.

Protection of environment

- Special emphasis shall be given to protect the fertile top Soil and would be emphasised to be restored at the site after completion of construction.
- During construction phase necessary soil protection measure shall be adopted. All affected areas should be landscaped and any necessary remedial works should be undertaken without delay, including grassing and reforestation;
- **Apply erosion control** measures before the rainy season begins preferably immediately following construction. Install erosion control measures at each construction site after it is completed.
- Storage of Oil and chemicals that are to be used during construction work shall be stored at a designated confined place on a impervious layer so no leakage could occur such that contamination of water bodies and soil is prevented.
- To evade the **degradation of water quality** of water bodies in the vicinity of the construction sites, it is ideal to avoid construction works close to the streams or water bodies during monsoon season. All precautionary measures shall be taken to prevent the wastewater that are generated during construction from entering into streams, water bodies or the irrigation channels.
- To prevent the **degradation of surface water quality** arising due to equipment and material piling on the site, it is advisable to store Construction pile, Soil stockpile and other debris at designated place. Cover the stock pile with tarpaulin sheet to prevent contamination of the nearby water body and agricultural field.
- To reduce the soil compaction rising due to movement of heavy machineries, it is advisable to use environment friendly machinery.
- Water Sprinkling shall be done regularly on dirt roads, cut areas and soil stockpiles or fill material to reduce the dust pollution arising due to construction activities.
- Permission for the extraction of water should be obtained prior to the commencement of the project, from the relevant authority.

Construction Management

- All construction equipment that are used for project activities shall conform to pollution control norms as stipulated by SPCB and hold valid license.
- The unloading of materials at construction sites that are located close to settlements shall be restricted to daytime only.
- All plants and equipment that are used in construction by the Contractor shall strictly conform to the CPCB noise standards.
- Noisy construction activities (such as crushing, concrete mixing, batching etc.) shall be stopped during the night time between 9.00 pm to 6.00 am if there are habitation/ educational institutes/health centers (silence zones) located within 150m of construction site.
- Proper maintenance of the machineries shall be carried out to control the air and noise pollution caused by these machineries.
- Debris that are generated due to the dismantling of the existing structures shall be suitably reused, to the extent feasible, in the proposed construction (used as a fill material for embankment).
- Ensure that the asbestos-containing materials or other toxic substances bare removed and disposed of by specially trained workers as per Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.
- Never dispose of spent oils on the ground, in water courses, drainage canals or in sewer systems.

Waste management

- Separation of Construction waste from the source as to be practised so to minimize the volume of waste and to increase the recyclable and reuse probability. Items such as aluminum, wood, plastic, paper packaging, copper, used oil can be reused. The other construction debris such concrete, bricks, sands can be used in backfilling in other location as per demand.
- Hazardous waste must be handled as per hazardous waste management rule 2016.
- Contractor should ensure that workers practice waste management options and recycle the wastes during site works.

- Contractor should ensure appropriate storage and handling of construction materials to minimise waste generation resulting from damaged materials/waste e.g. keeping deliveries packaged until they are ready to be used;
- Contractor should ensure that all disturbed area are restored after completion of construction.

Construction Worker

- A good sanitation plan shall be developed and provided by the contractor for construction camps and shall ensure that pollution of nearby water bodies is avoided. Plan must be in place to avoid construction within 500 m of dense habitation.
- Provide personal protective equipment and clothing (goggles, gloves, respirators, dust masks, hard hats, steel-toed and –shanked boots, etc.) for construction workers and enforce the use of the PPEs.
- The contractor should arrange adequate supply of water throughout the construction period from an agreed source.
- Provision of temporary toilet facilities for worker; contractors can identify suitable locations in close proximity to construction site.
- Provide traffic signs (including paint, easel, sign material, etc.), road marking, and guard rails to maintain pedestrian safety during construction.

Operation stage of the project

In piggery sector, operation stage of the project involves activities such as pig rearing and meat production. The productivity enhancement intervention will involve more production based pig rearing. Thus pig rearing, species balance, shed waste, health issue, quality, feed are the major issues that are encountered.

4.3 Input Supply

With respect to this activity, inputs and supply which will involve artificial Insemination facility under the project. The project has also special emphasis on adoption of high quality breed. Rationale and preventive measures has been described here to understand the varietal importance of the breed:

- While selecting the particular breed, care should be taken to promote more indigenous species. Inappropriate selection of species which might be not suitable for climate may create problem for farmer and affect the overall productivity.
- If artificial insemination facility is carried out without technical guidance productive exotic breeds may be used, this will create problems like homogeneity in the breed, loss of indigenous species, increased susceptibility to diseases and less adaptability to existing climate. Proliferation of genetic homogenization of livestock species may create uniform genetic stock therefore for protection of local variety, inspect if local breeds can meet specified needs, strongly consider their use. Even if a local breed is a relatively low producer, consider this drawback against the breed's disease resistance and endurance in the local environment. Consider whether the breed will be well-suited to meet expected climate changes.
- Proliferation of genetic homogenization of species may replace the local varieties with uniform genetic stock. This homogenetic strands may more vulnerable to catastrophic disease outbreak and may need more effort to produce it well.
- Careful interaction with technicians of artificial insemination would be helpful to make the good choice of pig breed.

Production and Operation

In production step of value chain, farmers are more involved. Activities like good pig rearing needs to be considered in production stage. Rationale and preventive measures that are to be considered to support the environmental guidelines for production stage as well as climate resilient methods are described in this section.

Mixed farming systems integrate livestock and crop production

By adding livestock to the farms helps farmers to minimize the anticipated risks by adopting more diversified production systems and extract value from otherwise valueless or low-value by-products of each activity: by-products of each activity such as crop residue becoming as a feed, manure becomes fertilizer

Integration farming practice such as pig cum fish farming, where pig manure can be used as a feed for pond and water hyacinth in pond can be used as food for pig.

Integration of silk waste to pig farming is also a good option. Since sericulture rearing waste are also good source of nutrients it can be used as feed.

Climate Change effect:

Following mitigation measures should be adopted

- Avoid deforestation and forest degradation associated by opening new land for grazing
- Adoption of Biogas plant
- Manure Management: Avoid anaerobic manure decomposition by applying manure directly as fertilizer.

Training to stakeholders, small entrepreneurs and farmers for good hygienic methods for pig rearing, vaccination and maintain hygiene in meat handling, quality control. etc. would be beneficial.

Fodder

- Conservation of Village grazing reserve, community and farmer group should initiate the protection of existing village grazing reserves to suffice the demand of livestock feed.
- Community based grazing land cultivation should be done on the waste/ barren land to fulfill the fodder demand. Avoid using fertilizer, use traditional feed material such as farm by products for feed.
- Water Hyacinth is abundant in Assam which can be used as a food for pigs. This can reduce cost of pig production
- Preference should be given in farming to use biomanure, compost material and bio fertilizer as much as possible so as to minimize the introduction of chemicals into the food chain and it will be economical and climate friendly also.
- Integrated farming practices should be promoted so as to promote the use of farm waste as food for pigs such as kitchen waste, by-products of food grains etc.

Climate Change effect:

Following mitigation measure should be adopted

- avoid deforestation and forest degradation associated by opening new land for grazing
- Adoption of Biogas plant: Use of renewable energy such as bio gas may also give significant improvement in overall Carbon sequestration through reduction in the use of fuel wood as well as production of methane from cattle shed. Energy generated from biogas runs on the basis of available cattle manure, biodegradable waste can also be used as cooking fuel and heating purposes.
- Better animal nutrition (more concentrate feed and nutritional supplements) will lower the methane emission in waste.
- Manure Management: Avoid anaerobic manure decomposition by applying manure directly as fertilizer.
- Integrated Farming practices such Pig Fish Farming should be promoted, where urine, excreta of pig and spilled pig feeds can be applied manually into the pond water at a pre-determined dose.

- Applying manure to the soil has a positive impact on the soil as it gives nutrients, especially Nitrogen and Potassium, back and improves the fertility of the soil, so manure should be managed properly, it should not be disposed off near water and near settlements.
- Applying of manure in farm field should be done on different location so as not to accumulate on one location.

Shed Care:

Due to rearing of more number of pigs than the holding capacity will require more intensive care, therefore:

- Limit the number of Pigs per household to a manageable size so shed should be managed according to per cattle required area. (given in Shed Management Annexure- 6)
- Feed storage areas should be constructed so that feed is kept dry.
- The shed should be clean with sufficient ventilation and have enough space to animal.
- Proper waste drainage system should be provided with alternate use of wastes
- Better manure management which substantially reduce the emissions, Community basis or individual level biogas plant should be promoted.
- Climate resilient options to reduce the GHG emission consequently power saving option should be promoted through training program on biogas development and bio manure management for community or individual level should be promoted.
- Vegetation and rubbish around buildings and yards are to be removed or controlled, in order to reduce the menace from insects and vermin.
- Spills of effluent, feed, chemicals and other potential pollutants should be cleaned up promptly.
- Keeping drains clean & flushing sheds twice daily.
- Weeping or hosing lanes and pens regularly to avoid manure build-up. Providing deep litter pens.
- Covering anaerobic ponds with straw and permeable polypropylene, avoiding ponding and effluent irrigation during wet periods.

Cattle health care:

Awareness among farmer about precaution measures for diseased pig, good hygienic meat handling habit, importance of vaccination etc shall be provided. A regular interaction should be developed with the Providers/ technician of Artificial Insemination and veterinary facility.

Training of stakeholders, small entrepreneurs and farmers for good hygienic method of piggery, vaccination etc. would be helpful to make pork business more profitable.

Safety:

- To avoid accidents passages should be kept clean and the workers should use slip-resistant footwear. The shed or the working place should also have proper ventilation to avoid suffocation.
- While mixing and pumping manure, workers and animals are to be exposed to high concentrations of poisonous gases like Hydrogen Sulfide (H₂S), Carbon Dioxide (CO₂), Ammonia (NH₃), methane (CH₄) etc. which causes eye and nose irritation, anxiety disorder, headache, eye irritation and numbing of the sense of smell by hydrogen sulfide (H₂S) so, personal protective measures such as marks, Gloves, should be used.
- While handling the diseased pig also, protective measure such as glove, masks, apron should be used.
- Awareness for disease transmission form pig to human shall be facilitated.
- Zoonotic infections can be prevented by using good personal hygiene methods, i.e., primarily good hand washing. If possible, all animals that are sick should be isolated from healthy animals and special attention shall be paid while handling these animals.

Post construction and Operation stage of the project

Project component interventions such as storage management, transportation, packaging, processing etc of meat products has been included. Following environmental guidelines shall be considered on the post operational construction activities and management.

4.4 Transportation

As per project component, the Farm market infrastructure development involves the activities of facilitating Enterprise cluster production improvement and market support in terms of Access and other services.

In post operation stage of the project, transportation service shall be required to store, manage, marketing and further value addition in the product. So in term of transportation up gradation of existing roads, strengthening existing culverts and bridges, road construction leading to the Agro-based industries to facilitate the cluster development and for ensuring better connectivity to market centres has been intervened. In preconstruction and construction phases the precautions / guidelines to be carried out under project, has already been mentioned in previous sections of this document. Following points details the environmental precautions that are to be taken while transporting the pork products.

- Containers used for carrying the products should be properly cleaned and Sterilized before transportation.
- Care should be taken that the hauling area is located in cool place.
- Effort of transporting the meat to Market, Processing plant shall be done as quick as possible to avoid the spoilage of milk. Inclusion of Cold Chain should be promoted.
- While transporting the products, Vehicular emissions to the ambient atmosphere is anticipated, so it is recommended to use only BS-IV vehicles with valid emission certificate should be used for transportation.
- Overweighing Vehicles carrying loads exceeding those permissible without proper permission should not be allowed to pass through the constructed roads.
- Create awareness on proper transport system management.
- Roads which are dedicated to be used for / or in frequently used shall have proper road signage and breaker to prevent the accident in the road.
- While constructing the road, road safety measures as prescribed by GOI shall be followed.

4.5 Trading

With reference to the project component of Farm market infrastructure development, provision of **market area, Rural Haat** facility has been envisaged. It is proposed to develop and upgrade market area/ Rural Haats with common amenities close to production clusters. Following environmental guideline envisages the care that has to be taken in the market area / Rural Haat of the agricultural Produce.

Storage of products for sale

Inappropriate storage of the pork products will lead to contact with moisture and contamination which will spoil the quality there by having an impact on health. Therefore the storage area should be located in a clean and cool places with tightly packed refrigerated containers with lids, covers.

Waste Management:

Open disposal of decomposable wastes leads to contamination of surroundings though decomposition, attracting insects, leaving chemical residues etc

- Waste should be properly disposed on the designate place only.
- The waste should be separated from its source (dry & wet waste) so that it can be reused
- Dry waste particularly such as paper, plastic etc, can recycled or collected and disposed to recycling vendor.
- Alternate use of biodegradable waste should be integrated with bio compost formation and agricultural farming practices.
- Waste water coming from washing area shall be disposed safely and should be alternately used in other tasks.
- Waste dispose area should not be near to water bodies and dense settlement area or low lying area.
- Waste disposal shall not be done in open area.

Basic Amenities:

Lack of required basic amenities will affect health of workers, vendors and will negatively affect the area and surroundings. Therefore,

- The work space should be ventilated to the extent possible. Should have drinking water and toilet facilities.
- Proper sanitation and drainage system shall be designed and maintained to keep the area free from contamination and reduce the disease risk.

License and registration:

- Machineries used in market area should be properly licensed.
- Any activities which are not legal to GOI shall be strictly prohibited

Storage

The aim of developing environmental guideline is to provide scientific storage and preservation of pig products. Following section entails about major environmental issues and preventive measures that are to be adopted while handling and storage of products.

- Effective and suitable provision shall be made to ensure that every enclosed workplace is ventilated by a sufficient quantity of fresh or purified air.
- The floor or surface shall not have a hole or slope, or be uneven or slippery so as to expose a person to a risk to his health or safety and shall have effective means of drainage as appropriate.
- Doors and gates shall be suitably constructed and fitted with necessary safety devices.
- In Cold Storage area, an efficient testing kit should be provided to monitor the quality of product to be stored.
- While Handling and managing the meat, it is necessary to ensure the hygiene of the place by providing Gloves, marks, apron for workers.
- Energy Efficient Device Should be used so to minimize the power use.
- All equipment, appliances should be properly licensed.
- Ensure that only trained worker handles the equipment and appliances.
- Promotion shall be done to develop energy efficient building with Integrated daylighting with the electric lighting system. Thus allow for natural lighting where possible.
- Use of LED lighting can reduce the electricity consumption drastically.
- For maintaining the health and safety of workers, design shall provide local exhaust for restrooms, clean drinking water facility etc.
- Provision of First aid facility to provide help for occupational injuries and illness shall be done.

- Provide sufficient training to workers for handling equipment, testing etc..
- Waste water shall be used alternatively in the other operations such as in farm field etc. It should be in such a manner that water does not log and does not disturb the natural land use of the area.
- Waste water shall not be flushed openly in the field.
- Regular upkeep should be followed as per the prescribed standards.

Processing, Grading, Value Addition

As per project component, the Farm market infrastructure development involves the facility of **common service center** (CSC) and small slaughter units. CSCs are conceived as commercially viable basic infrastructure for marketing of agri products, built around farmer producer companies (FPC) and are proposed to be located in production locations. Activities like sale, packaging, small processing shall be prescribed here, so hereby provisions of following precaution measure shall support the sustainable constancy of Common Service Centres.

Registration, licenses and permissions:

every processing units for production, value addition items and other machinery if not be line with legally frame will create a problem

- Processing unit, production units and other equipment required for value addition purposes will be legally complied with respected rules.

Maintenance and repairs of machinery:

Irregular cleaning or maintenance will lead to contamination and improper functioning therefore regular upkeep should be followed as per the prescribed standards.

Storage of ingredient:

Inappropriate storage of the ingredients will lead to contact with moistures, exposure to pests etc. which will spoil the quality there by having impact on health.

- The storage area should be in clean, cool places consisting of tightly packed containers or refrigerated containers with lids, covers.
- Food products should not be stored along with any products of chemical nature.
- Raw materials should be inspected at regular intervals and any spoiled materials should be safely discarded.

Use of additives, preservatives:

While in processing section, using of non-permitted additives and preservatives is illegal and pose health risks to the workers and consumers. Therefore only the permitted additives and preservatives shall be used in food items as per prescribed in FSSAI Act.

Small Slaughter Area

- Maintenance of aerobic conditions for wastewater processing should be done.
- To control the noise of the plant, acoustic enclosure of outdoor mechanical plant such as pumps, sound silencers on air intake fans and air discharges, restricted operating hours should be done.

- Waste generated from the plant shall be disposed safely. Alternate use of wastes should be done. No waste shall be disposed openly.
- Plant shall be equipped with proper testing kit.
- All the processed product shall ensure the quality as per FSSAI of India.
- Personal Hygiene (such as cleaning hand, use of gloves, apron, mask etc.) should be maintained while handling the processed products.
- All equipment used in the plant shall be properly licensed. Effort shall be taken to use only energy efficient devices within the plant. Use of renewable energy such as solar, biomass should be given more weightage.
- Regular upkeep to maintain the machineries, equipment shall be done with the help of technical expert.
- Permission should be required from central Ground water authority for usage of water.
- Processing area shall have good drainage and sanitation plan.
- Training for worker shall be provided to keep the area uncontaminated and hygienic.
- Proper liquid and solid waste disposal facility should be provided in the plant.
- Slaughter area shall not be in open place.
- Ensure that plant be in legal parity with Prevention of Cruelty to Animals (Slaughter House) Rules, 2001.
- Slaughter House should be far from residential and commercial areas. It should have good ventilation, but have closed proper drainage system

Packaging:

in packaging, use of indecomposable packaging material that cannot decomposed causes the soil Pollution, while plastic bags under thickness of 20 microns is not allowed for packaging due to their non-recyclable nature and potential negative impact on environment.

- Bio degraded able ingredients and re-useable packaging should be promoted.
- Use newspaper wrapping or cloth bags for handing over to the consumer. encourage the consumers to bring cloth bags.
- Handling the food products with bare hands or un washed hands will contaminate the products through microbial attack.
- Local material should be used for packaging instead of imported material, plastics etc. Jute sacks or other available material can be used for transport purposes. This can reduce the unnecessary use of packaging and containers.

Basic Amenities:

The work space should be ventilated to the extent possible. It should have drinking water and toilet facilities.

Occupation health and Safety to maintain the safety of worker following measure shall be adopted:

- Person using these machines must wear mask for preventing the problem related to inhalation.
- Noise protective equipment should be provided to the operator of the machine.
- Ensure only experienced and well trained workers are used for the handling of machinery, equipment and material processing plants.
- Ensure all persons, including managers, are trained and able to carry out their work without risk to the safety or health of themselves, other workers or the public.
- To maintain the safety of equipment as well as worker, Inspections should look for evidence of wear and tear, frays, missing parts and mechanical or electrical problems.
- Ensure an emergency aid service is in place in the work zone.

Waste management:

Waste materials produced during the operation of completed facilities must be also carefully managed. If not, these wastes can cause disease, injury, and/or environmental damage within the local community. It should be put into practice the reduce, reuse, recycle and recover options for waste generated. Recycling of waste in case of agriculture sector is composting and land application as manure and in recovery of waste is satisfied with the recovery of methane. Composting of biodegradable waste on site is an effective means of significantly reducing the volume of waste to be disposed of, and produces a potentially useful soil conditioner.

- The waste should be separated from its source itself into dry, wet material so that it can be reused.
- Dry waste particularly from common service center such as paper, plastic etc, can be recycled or collected and disposed to recycling vendor.
- The waste storage area should not be located near to water stream, drain or low lying area.
- Biodegradable waste shall be managed separately.
- Reuse and recycling of waste shall be promoted as far as possible to minimize the total waste.
- Integration of biodegradable waste to nearest farm field to use as manure should be done.
- Integration of food processing by grading the waste to farmer for use as cattle feed shall be promoted.

Power use:

Power requirement has been anticipated in heating, boiling, grinding, extraction, drying, packaging etc. so Energy efficient device should be used, Biomass or solar devices should be promoted to conserve energy, Energy consumption monitoring should be followed regularly.

5. SERICULTURE AND HANDLOOM

Project intervention in term of **productivity enhancement in Sericulture farming** has an aim to benefit the farmers, small medium entrepreneurs and overall agribusiness enhancement of the state, but immense involvement into the Silk farming may need special care to accomplish it sustainably.

Preconstruction stage of the project

5.1 Site Selection

For the development and generation of more efficient **Farm-Market Infrastructure Development**, Site selection criteria are different for construction of road, common service centre, grainage house and the following sections provide selection criteria for site for different infrastructure facility:

For Road

Transportation plays a vital role in Agribusiness sector. In Project APART, provision of road has been focused as it is a way to connect the production cluster, Common service centre, market areas, Rural Haats to give it better market led enhancement production, more resilient way of marketing and value addition. Following guideline shall help in choosing the site for road.

- Choice of location should be done so as to support the ecosystem. In cases if the sensitivity is severe, alternatives should be opted.
- Minimize impacts to ecosystem that may provide an important buffer to climate change impacts, especially in areas where those buffers will be needed
- Selection of site shall be done preferably on government land. Effort shall be taken such that site is free from public conflicts.
- Site should not be located near any critical wild life habitats (those mentioned in natural habitat management Plan)
- Site should not be chosen near Natural Protected areas. If site is located near or less than 1 km distance from protected area, then a proper consent shall be obtained from forest department.
- The area should not be located in flood prone areas.
- While selecting the site, care should be taken such that it shall not disturb any dense habitations.
- Preference would be given to develop roads that are already in use, to make it more efficient and smooth instead of proposing a new one. This will save the environment and also prevent unnecessary nuisance.
- New road will be selected only after having a proper need based assessment of the site.
- After identification of Site, necessary permission as applicable from Gram Panchayat, revenue Department shall be procured.
- Prior approval of the ES, PMU/PCU is required in case of any innovations in design and identification of sites.

For Common Service centre / other services

- Selection of site shall be done preferably on government land. Effort shall be taken such that the selected sites are free from public conflicts.
- Site should not be located near critical wild life habitats (as mentioned in natural habitat management Plan).
- Site should not be chosen near Natural Protected areas. If site is located near or less than 1 km distance from protected area, then a proper consent shall be obtained from forest department.
- The area should not be located in flood prone areas, low lying areas or steep slopes.
- The site should be free of contamination, storage of industrial waste etc.
- While selecting the site, care should be taken such that it shall not disturb any dense habitations.

- Preference to be given to develop the structures which are already in use, to make it more efficient and smooth instead of proposing a new one. This will save the environment and also prevent unnecessary nuisance. Like if an area has been already using for community development purposes then the same can be used for the proposed activities.
- Criteria shall enforce that new site will be selected only after having a proper need based assessment of the site.
- After identification of Site, necessary permission as applicable from Gram Panchayat, revenue Department shall be procured.
- Prior approval of the ES, PMU/PCU is required in case of any innovations in design and identification of sites.

Construction Stage of the project

5.2 Land Preparation and construction activities

Land preparation stage involves site clearance, transportation of construction material, handling of construction machineries, construction mechanical activities for development of Market Infrastructure facilities such as road, Common service centre, Grainage House etc. While modernization and upgradation will involve only limited construction activity, furnishing, refurbishment of interior structures etc. Following points shall be taken into consideration for maintaining an environmental health of the area while carrying out activities of land preparation and other construction activities.

Site Clearance

During land preparation, care shall be taken to avoid destruction site vegetation to minimum extent as possible. Effort shall be taken that construction activity should not disturb the nearby local vegetation unnecessarily.

Sourcing of Material

- Construction material such as sand, aggregates and other quarry material should only be sourced from licensed quarries as per consent from PWD.
- This necessitates them to maintain the number and the relevant details, such as license issue and expiration dates, status report, etc.
- Borrow pits shall be prohibited where there are chances for interference with the natural or designed drainage patterns.
- Sourcing of any material from within or from any Protected Areas/Sanctuaries, tank beds and/or designated natural areas are strictly prohibited.

Transportation of Construction Material

- All materials should be transported in fully covered trucks. Overloading of vehicles with materials should be controlled and done in a manner based on the trucks capacity.
- The unloading of materials at construction sites those that are close to settlements shall be restricted to daytime only.
- Provide traffic signs (including paint, easel, sign material, etc.), road marking, and guard rails to maintain pedestrian safety during construction.
- Vehicle should comply with the rules.

Protection of environment

- Special emphasis shall be given to protect the fertile top Soil and would be emphasised to be restored at the site after completion of construction.

- During construction phase necessary soil protection measure shall be adopted. All affected areas should be landscaped and any necessary remedial works should be undertaken without delay, including grassing and reforestation;
- **Apply erosion control** measures before the rainy season begins preferably immediately following construction. Install erosion control measures at each construction site after it is completed.
- Storage of Oil and chemicals that are to be used during construction work shall be stored at a designated confined place on a impervious layer so no leakage could occur such that contamination of water bodies and soil is prevented.
- To evade the **degradation of water quality** of water bodies in the vicinity of the construction sites, it is ideal to avoid construction works close to the streams or water bodies during monsoon season. All precautionary measures shall be taken to prevent the wastewater that are generated during construction from entering into streams, water bodies or the irrigation channels.
- To prevent the **degradation of surface water quality** arising due to equipment and material piling on the site, it is advisable to store Construction pile, Soil stockpile and other debris at designated place. Cover the stock pile with tarpauline sheet to prevent contamination of the nearby water body and agricultural field.
- To reduce the soil compaction rising due to movement of heavy machineries, it is advisable to use environment friendly machinery.
- Water Sprinkling shall be done regularly on dirt roads, cut areas and soil stockpiles or fill material to reduce the dust pollution arising due to construction activities.
- Permission for the extraction of water should be obtained prior to the commencement of the project, from the relevant authority.

Construction Management

- All construction equipment that are used for project activities shall conform to pollution control norms as stipulated by SPCB and hold valid license.
- The unloading of materials at construction sites that are located close to settlements shall be restricted to daytime only.
- All plants and equipment that are used in construction by the Contractor shall strictly conform to the CPCB noise standards.
- Noisy construction activities (such as crushing, concrete mixing, batching etc.) shall be stopped during the night time between 9.00 pm to 6.00 am if there are habitation/ educational institutes/health centers (silence zones) located within 150m of construction site.
- Proper maintenance of the machineries shall be carried out to control the air and noise pollution caused by these machineries.
- Debris that are generated due to the dismantling of the existing structures shall be suitably reused, to the extent feasible, in the proposed construction (used as a fill material for embankment).
- Ensure that the asbestos-containing materials or other toxic substances are removed and disposed of by specially trained workers as per Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.
- Never dispose of spent oils on the ground, in water courses, drainage canals or in sewer systems.

Waste management

- Separation of Construction waste from the source as to be practised so to minimize the volume of waste and to increase the recyclable and reuse probability. Items such as aluminum, wood, plastic, paper packaging, copper, used oil can be reused. The other construction debris such concrete, bricks, sands can be used in backfilling in other location as per demand.
- Hazardous waste must be handled as per hazardous waste management rule 2016.
- Contractor should ensure that workers practice waste management options and recycle the wastes during site works.
- Contractor should ensure appropriate storage and handling of construction materials to minimise waste generation resulting from damaged materials/waste e.g. keeping deliveries packaged until they are ready to be used;

- Contractor should ensure that all disturbed area are restored after completion of construction.

Construction Worker

- A good sanitation plan shall be developed and provided by the contractor for construction camps and shall ensure that pollution of nearby water bodies is avoided. Plan must be in place to avoid construction within 500 m of dense habitation.
- Provide personal protective equipment and clothing (goggles, gloves, respirators, dust masks, hard hats, steel-toed and –shanked boots, etc.) for construction workers and enforce the use of the PPEs.
- The contractor should arrange adequate supply of water throughout the construction period from an agreed source.
- Provision of temporary toilet facilities for worker; contractors can identify suitable locations in close proximity to construction site.
- Provide traffic signs (including paint, easel, sign material, etc.), road marking, and guard rails to maintain pedestrian safety during construction.

Operation stage of the project

In Silk farming sector, operation stage of the project involves activities such as Silk rearing, reeling, weaving, printing, dying etc. The productivity enhancement intervention will involve more production based worm rearing. Thus worm rearing, species balance, waste, health issue, quality, feed, handloom are the major issues that are encountered.

5.3 Input Supply

With respect to this step of value chain, input and supply will involve seed supplier, vendor etc. under the project. The project has also special emphasis on adoption of high quality worms. Rationale and preventive measures has been described here to understand the varietal importance of the breed:

- While selecting the particular species, care should be taken to promote more indigenous species. Inappropriate selection of species which might not be suitable for climate may create problem for famers and affect the overall productivity.
- Careful interaction with technician of worm, seed provider would be helpful to make a good choice.
- Seed (silkworm) should only be procured from registered vendors.

5.4 Production and Operation

In production step of value chain farmers are more involved. Activities like good worm rearing practices, handloom practices needs to be considered in production stage. Rationale and preventive measures has been described here to support the environmental guidelines for production stage as well as climate resilient methods are described in this section

For Sericulture farming

Fodder shortage: Establishment of a systematic Eri, Muga& Mulberry food plantation are very much essential for conducting Silkworm rearing as a sustainable economic activity. Eri silkworm, Muga Silk Worm and Mulberry Silk Worm rearing requires food plant namely Eri food plants (Kesseru) & Castor, “Som” & Soalu plants and Mulberry plants. For better silk production, rearing of worm will require more food (as leaves from particular plant), so problem in change of landscape may arise while using more land for mulberry, kesseru, Soalu plantation. Therefore to mitigate the problem of fodder shortage

- Identified village grazing reserves should be protected;

- Plantation should be done in an agroforestry manner to minimize the negative impact of land use change.

Public Health: Knowledge about health risk related to silk rearing, reeling activities should be disseminated among farmers.

- Awareness about precautionary measures that are to be taken during working hours such as gloves, mask, apron, gum-shoes are suggested for use while disinfecting the rearing rooms and appliances.
- Good housekeeping practices, enough ventilation in room will minimize the chance of public health risk. So selection of site should be done accordingly.
- In reeling and Grainage room, care should be taken to avoid inhalation of acid fumes by providing proper exhaust and ventilation facilities in grainage and dyeing units which facilitates the quick dispersal of fumes. The presence of exhaust fans in the pairing/oviposition rooms reduces the concentration of scales in the given environment.
- In reeling room, good ventilation, proper drainage to ensure dampness, use of slipper and quick disposal of waste should be practiced to minimize health risks.

Alternate Use of Waste: reuse of silk rearing waste is a best option to form sustainable silk farming. Rearing waste such as dried cocoons, dead worms could be a good source of nutrients and can be used as fertilizer in farm field, fishing ponds etc. Separate disposal of biodegradable and non-biodegradable should be done. Reuse of reeling water for irrigation after appropriate cooling should be done to manage water.

- Minimum use of fertilizer and chemicals should be encouraged. Organic fertiliser and natural pesticides (such as neem plant) should be used.
- Alternative source of energy such as biogas should be promoted to meet the energy demand.
- Training for workers regarding health and safety aspects of handling chemicals and dyes and waste disposal and management should be facilitated.

In Handloom

- **Public Health:** Knowledge about health risks related to silk dying and printing activities should be disseminated among farmers. Awareness about precautionary measures that are to be taken during working hour such as gloves, mask, apron gum-shoes are suggested for use while working in disinfecting rearing rooms and appliances.
- **Disposal site of Water:** waste water from dying, printing, washing activities should be disposed in a designated place. While identifying the location, ensure that storage waste water does not mix with agricultural water or nearby fish pond.
- Alternative source of energy such as biogas should be promoted to meet the energy demand.
- In Handloom centres reuse of packaging waste, dry waste should be done.
- Training for workers regarding health and safety aspects of handling chemicals and dyes and waste disposal and management should be facilitated.

Post construction and Operation stage of the project

Project component interventions such as transportation, packaging, processing etc of silk products has been included. Following environmental guidelines shall be considered on the post operational construction activities and management.

5.5 Transportation

As per project component, the Farm market infrastructure development involves the activities of facilitating Enterprise cluster production improvement and market support in terms of Access and other services.

In post operation stage of the project, transportation service shall be required to store, manage, marketing and further value addition in the product. So in term of transportation upgradation of existing roads, strengthening existing culverts and bridges, road construction leading to the Agro-based industries to facilitate the cluster development and for ensuring better connectivity to market centres has been intervened. In preconstruction and construction phases the precautions / guidelines to be carried out under project, has already been mentioned in previous sections of this document. Following points details the environmental precautions that are to be taken while transporting the silk products.

- A vehicular emission to the ambient atmosphere is anticipated, so it is recommended to use only BS-IV vehicles with valid emission certificate should be used for transportation.
- Roads which are dedicated to be used for / or in frequently used shall have proper road signage and breaker to prevent the accident in the road.
- While constructing the road, road safety measures as prescribed by GOI shall be followed.

5.6 Trading

With reference to the project component of Farm market infrastructure development, provision of **market area, Rural Haat facility** has been envisaged. It is proposed to develop and upgrade market area/ Rural Haats with common amenities close to production clusters. Following environmental guideline envisages the care that has to be taken in the market area / Rural Haat of the agricultural produce.

Storage of products for sale

Inappropriate storage of the products will lead to contact with moisture and will spoil the quality there by having an impact on health. Therefore the storage area should be clean and dry.

Waste Management:

Open disposal of decomposable wastes leads to contamination of surroundings though decomposition, attracting insects, leaving chemical residues etc

- Waste should be properly disposed on the designate place only.
- The waste should be separated from its source (dry & wet waste) so that it can be reused.
- Dry waste particularly such as paper, plastic etc, can recycled or collected and disposed to recycling vendor.
- Alternate use of biodegradable waste should be integrated with bio compost formation and agricultural farming practices.
- Waste water coming from washing area shall be disposed safely and should be alternately used in other tasks.
- Waste dispose area should not be near to water bodies and dense settlement area or low lying area.
- Waste disposal shall not be done in open area.

Basic Amenities:

Lack of required basic amenities will affect health of workers, vendors and will negatively affect the area and surroundings. Therefore,

- The work space should be ventilated to the extent possible. Should have drinking water and toilet facilities.
- Proper sanitation and drainage system shall be designed and maintained to keep the area free from contamination and reduce the disease risk.

License and registration:

Machineries used in market area should be properly licensed.

Any activities which are not legal to GOI shall be strictly prohibited.

5.7 Processing, Grading, Value Addition

As per project component, the Farm market infrastructure development involves the facility of **common service center** (CSC) and Grainage House. CSCs are conceived as commercially viable basic infrastructure for marketing of silk products, built around farmer producer companies (FPC) and are proposed to be located in production locations. Activities like sale, packaging, small processing shall be prescribed here, so hereby provisions of following precaution measure shall support the sustainable constancy of Common Service Centres.

Registration, licenses and permissions : every processing units for production, value addition items and other machinery if not be line with legally frame will create a problem

- Processing unit, dying units and other equipment required for value addition purposes will be legally complied with respected rules.

Maintenance and repairs of machinery: Irregular cleaning or maintenance will lead to contamination and improper functioning therefore regular upkeep should be followed as per the prescribed standards.

Storage of ingredient: Inappropriate storage of the ingredients will lead to contact with moistures, exposure to pests etc. which will spoil the quality there by having impact on health. So, the storage area should be in clean, cool places with in tightly packed containers or containers with lids, covers.

Use of coloures, preservatives: While in processing section, dying units should prefer to use natural colors.

Packaging: in packaging, use of indecomposable packaging material that cannot be decomposed causes the soil Pollution, while plastic bags under thickness of 20 microns is not allowed for packaging due to their non-recyclable nature and potential negative impact on environment.

- Bio degraded able ingredients and re-useable packaging should be promoted.
- Use newspaper wrapping or cloth bags for handing over to the consumer encourage the consumers to bring cloth bags.
- Local material should be used for packaging instead of imported material, plastics etc. Jute sacks or other available material can be used for transport purposes. This can reduce the unnecessary use of packaging and containers.

Basic Amenities: The work space should be ventilated to the extent possible. It should have drinking water and toilet facilities.

Occupation health and Safety to maintain the safety of worker following measure shall be adopted:

- Person using these machines must wear mask for preventing the problem related to inhalation.
- Noise protective equipment should be provided to the machine operators.
- Ensure only experienced and well trained workers are used for the handling of machinery, equipment and material processing plants.

- Ensure all persons, including managers, are trained and are able to carry out their work without risk to the safety or health of themselves, other workers or the public.
- To maintain the safety of equipment as well as worker, Inspections should look for evidence of wear and tear, frays, missing parts and mechanical or electrical problems.
- Ensure an emergency aid service is in place in the work zone.

Waste management: Waste materials produced during the operation of completed facilities must be also carefully managed. If not, these wastes can cause disease, injury, and/or environmental damage within the local community. It should be put into practice the reduce, reuse, recycle and recover options for waste generated. Recycling of waste in case of agriculture sector is composting and land application as manure and in recovery of waste is satisfied with the recovery of methane. Composting of biodegradable waste on site is an effective means of significantly reducing the volume of waste to be disposed of, and produces a potentially useful soil conditioner.

- The waste should be separated from its source itself into dry, wet material so that it can be reused.
- Dry waste particularly from common service center such as paper, plastic etc, can be recycled or collected and disposed to recycling vendor.
- The waste storage area should not be located near to water stream, drain or low lying area.
- Biodegradable waste shall be managed separately.
- Reuse and recycling of waste shall be promoted as far as possible to minimize the total waste.
- Intergradation of biodegradable waste to nearest farm field to use as manure should be done.
- Alternate use of grainage house waste should be carried out. The rearing waste could be a substitute for fertilizer for farm field and also for fish pond. So it is recommended to use as an alternate.
- Waste water coming from handloom area should be encouraged to recycle and reuse.
- Water used for boiling should be promoted to be used in agriculture after cooling it.

Power use: power requirement has been anticipated in heating, boiling, reeling, weaving, drying, packaging etc. so Energy efficient device should be used, Biomass or solar devices should be promoted to conserve energy, Energy consumption monitoring should be followed regularly.

Annex 10

ANNEXURE 10: STAKEHOLDER CONSULTATION

1. Introduction

APART is a multi-stakeholders project and it is important to identify each of the key stakeholders of the project. The stakeholder analysis is the process of identifying and analysing stakeholders, and plan for their participation. It is crucial to assess any potential conflicts among the different stakeholders for project benefits. This would help in defining their roles and responsibilities and accordingly facilitate for formulating project information dissemination plans, stakeholder management and communication plans.

APART has entrusted the execution responsibility to ARIASS at state level which will coordinate its functions with line departments at various levels. Apart from such government level arrangements, the project has imbued involvement of several community level institutions. APART aims at involving these grassroots level institutions in a planned manner with an objective to get them graduated to a formal positioning for sustainable delivery of project benefits. The section reviews the functioning of various institutions

2. Identification of key Stakeholders

Participatory planning requires the involvement of concerned stakeholders. This includes identifying public concerns and values and developing a broad consensus on planned initiatives. It is also about utilising the vast amount of information and knowledge that stakeholders hold to find workable, efficient and sustainable solutions. The key stakeholders of APART has been identified and presented in **Figure 1**.

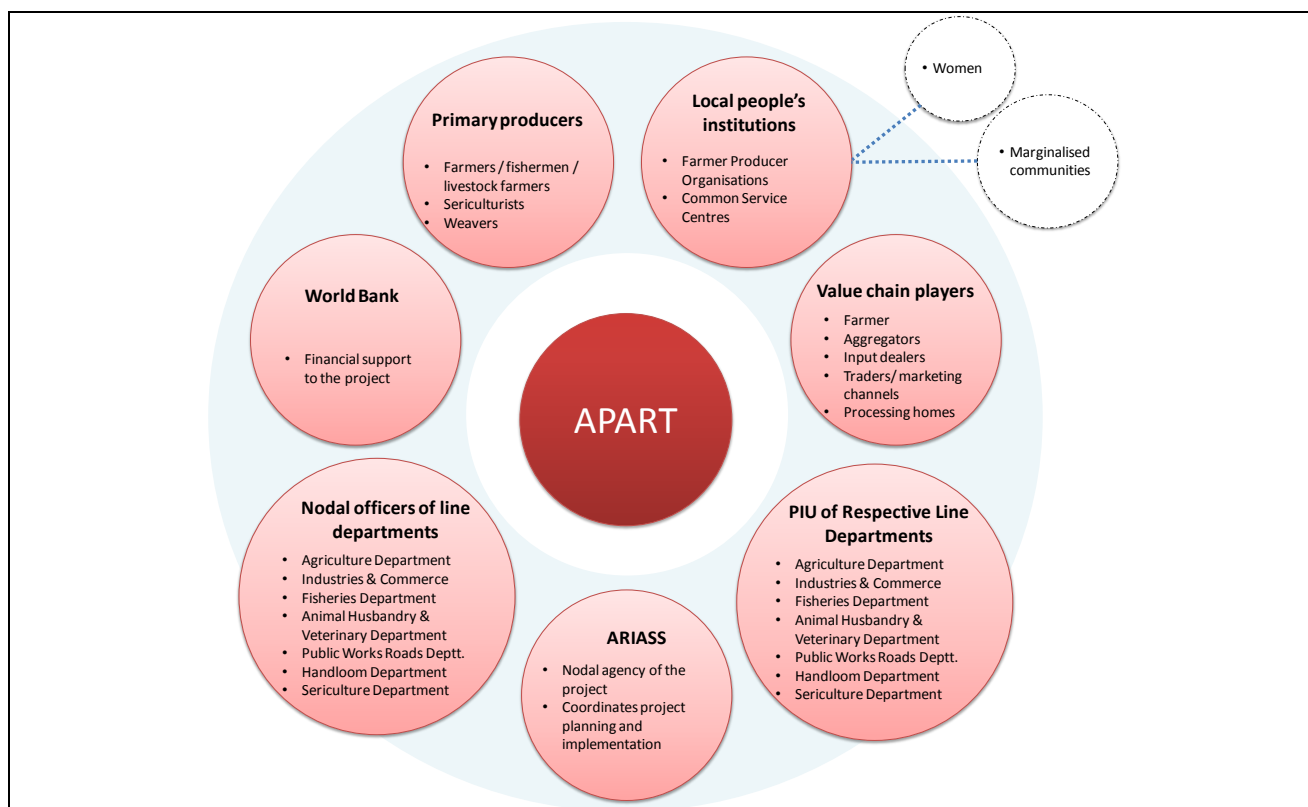


Figure 1: Key Stakeholder of APART

3. Identification of Roles and Responsibilities

The social assessment entailed discussions with all relevant stakeholders at different levels for each project component. The analysis of different stakeholders, their roles, responsibilities and relationships with the project in planning and implementing project interventions is summarized in the Table below.

Sl. No.	Stakeholders	Roles & responsibility	Relationship
1.	Primary producers	Main beneficiaries of the project <ul style="list-style-type: none"> • Core part of value chain sole responsible person for agriculture produce either for livelihood or for commercial purpose • as owners & managers of the common market infrastructure participate in the project activities • take management responsibilities in running the businesses 	<ul style="list-style-type: none"> • Synergistic with the project – while the primary producers stand to gain the maximum from the project, the project's success is also critically dependent on the active participation by primary producers • Major value chain development work is to link farmers to processing companies and end-users
2.	Local Peoples' Institutions – participants		
(i)	Women	<ul style="list-style-type: none"> • Play an important role in production, aggregation, preliminary processing and local sales, esp. in fisheries sector, but often marginalized in organized set up 	<ul style="list-style-type: none"> • Potentially synergistic if the project makes special provisions to ensure women's participation in the decision making process at the ground level; can turn negative if project institutions are biased against women. Stand to gain indirectly from the income increase to the primary producers; potential conflicts if the project supported institutions neglect their representation and/or their interests not addressed. Stand to benefit the maximum from the project supported market linkages, but need to make special provisions for their equitable participation in the project activities and share in the benefits
(ii)	ST and SC Communities	<ul style="list-style-type: none"> • Play an important role in production, aggregation, preliminary processing and local sales, esp. in piggery (ST) and fisheries (SC) sector, but often marginalized in organized set up 	
(iii)	Marginalized communities	<ul style="list-style-type: none"> • Often landless or subsistence farmers – linkage to markets very weak and very limited role in current value chain except as labourers. 	
(iv)	Small scale players	<ul style="list-style-type: none"> • Most exploited in the value chain, have limited access to market and also fail to have a significant say in the current institutional set up. 	
3.	Value chain players		
(i)	Traders / Aggregators / marketing channels	<ul style="list-style-type: none"> • Play a critical role in value chain, provide informal financing to small farmers and take working capital risk. 	<ul style="list-style-type: none"> • Potentially conflicting role as they may see project created institutions as rivals.
(ii)	Transporters	<ul style="list-style-type: none"> • Critical for the fresh produce to reach market on time, for loss in 	<ul style="list-style-type: none"> • Potential conflicting role as infrastructure created by project

Sl. No.	Stakeholders	Roles & responsibility	Relationship
		transit and in providing market access.	may eat into their margin.
(iii)	Processing homes	<ul style="list-style-type: none"> Processes agriculture produce to various forms for end-use and play as the major router for production 	<ul style="list-style-type: none"> Important link in the value chain which contributes to the economic growth of the sector
4.	Community based organizations (Farmer groups, cluster groups, producer company, etc.)	<ul style="list-style-type: none"> Play their role in produce aggregation, storage and preliminary processing and thus could provide bargaining power to the primary producer through collective action. 	<ul style="list-style-type: none"> Synergistic with the project , as the key project component would be implemented through them, the success of many of the interventions critically dependent on the strength of these groups.
5.	Line department personnel	<ul style="list-style-type: none"> Provide guidance and information at ground level, play the role of administrator and key contact point at ground level for accessing various government schemes and funds 	<ul style="list-style-type: none"> Play a critical role to ensure smooth implementation of project interventions. Coordination between the nodal agency and participating line departments at ground level critical for project success.

4. Community Level Consultation

Community consultations are carried out with the objective of (i) improved coordination and integration, (ii) reduced complexity, (iii) better communication and participation, (iv) effective land use controls, and (v) development of efficient processes for plan making and review.

Sector-specific consultations have been planned to capture the response from various identified stakeholders in the value chain. Checklists for Consultations / Focus Group Discussions have been developed. Details of the consultation carried out are presented in **Table 1** to **Table 5**.

Table 1: Community Consultation - Fisheries

Sl. No.	Issues raised by the farmers	Suggestive Measures
1	<p>Poor condition of roads:</p> <p>The condition of the roads connecting the Godaimari cluster is very poor. The cost of transportation of fish to the market, and transportation costs of feeds, fertilizers, pesticides and other inputs are very high due to poor connectivity. Due to this problem the cost of production of fish becomes high and the profit margin for farmers gets reduced.</p>	<ul style="list-style-type: none"> The link roads to clusters shall be improved under APART The formation of FPO and establishment of CSC will contribute to reduction of transportation costs.
2	<p>Non-availability of quality seeds:</p> <p>The quality of seeds procured by the farmers from nearby sources is not good. So they procure seeds from Hojai, Neelbagan and Hajo. The cost of transportation of seeds from these locations is high and the mortality rate is also high due to longer duration of transportation.</p>	<ul style="list-style-type: none"> The Department of Fishery will identify more sources of quality seeds for the farmers
3	<p>Poor transportation facility:</p> <p>The farmers face lot of problems in transporting fishes alive to the market. The water in the containers where fishes are carried needs</p>	<ul style="list-style-type: none"> The PIU will find out the low cost mechanized options available in the

Date: 15th September, 2016 **Total Participants:** 97
Venue: Godaimari [Male: 89, Female: 8]

Date: 15 th September, 2016		Total Participants: 97
Venue: Godaimari		[Male: 89, Female: 8]
Sl. No.	Issues raised by the farmers	Suggestive Measures
	to be stirred continuously manually to maintain the oxygen level. This is a difficult task and it impacts the health condition of the labourers engaged in this work, especially during winter.	market and share the information with the farmers.
4	Low quality of seeds: The local hatcheries practice interbreeding, mixed breeding and use undersized brood fish for breeding. As a result the quality of seeds produced is very low. Low quality seeds affect the productivity of fishes and the farmers do not get the desired returns.	<ul style="list-style-type: none"> The PIU will monitor the local hatcheries regularly.
5	Problems in long distance transportation: Due to unorganized mode of production and marketing the farmers often face problems in transportation of their products to outside markets. The authorities ask for challan and other documents required for transporting agricultural commodities. The farmers end up paying lot of money as fine due to non-availability of the documents.	<ul style="list-style-type: none"> This issue may be addressed properly by adopting organized trading under FPO.
6	Knowledge Gap of the farmers: <ul style="list-style-type: none"> The farmers do not know how and when to use the fertilizers, pesticides and other inputs. There are cases of death of fishes in large numbers due to excessive use of fertilisers. The farmers do not know what amount of seeds to be stocked per hectare of water area. There are cases of death of fishes due to decrease in oxygen level in the ponds as a result of over stocking. The farmers seek advice from the inputs suppliers on the use of various inputs. As a result they sometimes face problems of over dose and less dose of inputs. They end up spending more on inputs but do not get the expected output. 	<ul style="list-style-type: none"> The PIU will organize training on various aspects of fish farming.
7	Unscientific disposal of wastes: The farmers throw dead fishes in the paddy fields or any unused barren lands. There are chances of germs getting spread from the rotten fishes and this may impact the health of the farmers.	<ul style="list-style-type: none"> The PIU will cover these issues in the training programs.
8	Lack of awareness: The farmers are not aware of any Government scheme for fish farmers. The farmers take loan from money lenders, aggregators, traders at higher interest rates to meet their capital requirements.	<ul style="list-style-type: none"> Awareness programs will be organized and efforts will be made to facilitate easy access of the farmers to banking services.
9	Poor extension service: There are 22 Gram Panchayats in the Juria Development Block. From the Department of Fishery, Nagaon only one Fishery Demonstrator looks after the entire block. As a result the farmers do not get the required technical support from the department.	<ul style="list-style-type: none"> The number of staffs in the department is inadequate. The department has proposed for engagement of more staffs.
10	Obstruction in natural drainage system: With the intensification of fishery activities in the Godaimari area the farmers converted majority of the cultivable and uncultivable lands into fish ponds. In the process the natural drains and outlets were narrowed down and some were totally blocked. As a result flash flood started occurring every year during monsoon.	<ul style="list-style-type: none"> The community has been advised to persuade the farmers encroaching drains to give the encroached land to ensure free flow of storm water during monsoon.



Table 2: Community Consultation - Fisheries

Date: 23 rd October, 2016		Total Participants: 25
Venue: Charipunia, Morigaon		[Male: 25, Female: 0 ⁶⁹]
Sl. No.	Issues raised by the BDC Members	Suggestive Measures
1	<p>High cost of feed:</p> <ul style="list-style-type: none"> The BDC members informed that the cost of feeds procured by them is very high. They have proposed for setting up rice cum mustard processing mill in Charipunia village. The villagers will be able to process their rice and mustard at a comparatively lower cost and the rice polish and mustard oil cake generated as waste shall be used as fish feed. 	<ul style="list-style-type: none"> The Department of Fisheries has assured them to provide support in setting up the processing unit.
2	<p>Financial support for cleaning the Beel:</p> <ul style="list-style-type: none"> According to the BDC members one part of the Beel is yet to be cleaned properly. Productivity is lesser by 50% in the uncleaned part than that of the cleaned part. They requested the visiting officials and the consultants to support them in cleaning the Beel. 	<ul style="list-style-type: none"> The issue shall be brought to the notice of the project authority for consideration of possible support to the BDC.
3	<p>Poor quality of seeds:</p> <ul style="list-style-type: none"> The productivity is sometimes hampered due to poor quality of seeds. The BDC is planning to set up a hatchery to produce good quality seeds on its own. They requested the Department of Fisheries to provide support in setting up the hatchery. 	<ul style="list-style-type: none"> The issue shall be brought to the notice of the project authority for consideration of possible support to the BDC.
4	<p>Renewal of registration:</p> <ul style="list-style-type: none"> The renewal of registration of the BDC under Co-operative 	<ul style="list-style-type: none"> The officials present during the

⁶⁹An FGD has been carried out with the female members of the BDC

Date: 23 rd October, 2016		Total Participants: 25
Venue: Charipunia, Morigaon		[Male: 25, Female: 0 ⁶⁹]
Sl. No.	Issues raised by the BDC Members	Suggestive Measures
	Societies Act is yet to be done as the documents of the BDC have been spoilt in the flood. The BDC members requested the Department of Fisheries to help them in the renewal of the registration.	consultation assured the BDC of all possible help.
5	Need for training: <ul style="list-style-type: none"> The BDC members feel the need for training on seed production, feeding, stocking etc. 	<ul style="list-style-type: none"> There are provisions for training in APART.
6	Value addition: <ul style="list-style-type: none"> The BDC members are not aware of any value added products of fishes like pickles, sauces, ready to eat items etc. They requested for training on this aspect for their members, especially for women. 	<ul style="list-style-type: none"> There are provisions for exposure visit of entrepreneurs in APART.
7	Participation of women: <ul style="list-style-type: none"> 30% of the total executive members of the BDC are women. Women are involved only in the periodic cleaning of the Beel. They are not involved in procurement and marketing related works. 	<ul style="list-style-type: none"> BDC has been advised to encourage women to participate in all the aspects of Beel management.
8	Sharing of profits among the members: <ul style="list-style-type: none"> After spending on development activities like providing scholarships to needy students, uniforms to school kids belonging to BPL category, support to needy households, the residual profit is distributed equally among all the BDC members every year in the month of April. 	<ul style="list-style-type: none"> BDC has been advised to invest the profit in other allied activities to generate more employment opportunities for the members.

Figure 3: Consultation Snapshots



Consultation with the BDC members of CharipuniaBeel at Charipunia

Table 3: Community Consultation in Kamrup – Dairy

Date: 19 th September, 2016		Total Participants: 28
Venue: Rangia		[Male: 24, Female: 4]
Sl. No.	Issues Raised By The Farmers	Suggestive Measures

Date: 19 th September, 2016		Total Participants: 28
Venue: Rangia		[Male: 24, Female: 4]
Sl. No.	Issues Raised By The Farmers	Suggestive Measures
1	<p>Poor condition of roads:</p> <ul style="list-style-type: none"> The condition of roads connecting the cluster with the markets and veterinary dispensaries is very poor. 	<ul style="list-style-type: none"> The issue has been recorded and will be discussed with the PWD nodal officer for APART.
2	<p>Lack of access to veterinary services:</p> <ul style="list-style-type: none"> The facilities at veterinary dispensary at Rangia are inadequate. The dispensary does not have any stool examining machine. The doctors charge very high fees for their visits. Animal health camps are not organized regularly. 	<ul style="list-style-type: none"> The issue will be discussed with the Department of AH & VD.
3	<p>Fluctuation of prices:</p> <ul style="list-style-type: none"> The price of milk is not fixed. It varies quite frequently. During festival season the farmers get good price for their products. Sometimes prices fall so low that the farmers do not even get back their production cost. 	<ul style="list-style-type: none"> The farmers were advised to concentrate more on value added products.
4	<p>Non-availability of modern veterinary facilities:</p> <ul style="list-style-type: none"> Though the farmers were being trained, they were not able to implement those in farming practices. The DVO (District Veterinary Officer) did not provide catheter, LN container and other necessary items required for modern dairy practices. 	<ul style="list-style-type: none"> Design and development/ adaptation of customized training materials will be carried out under this project. The farmers are also requested to contact the DVO for their presently available materials.
5	<p>High cost of fodder:</p> <ul style="list-style-type: none"> There are very few fodder suppliers near the cluster and the price of fodder is very high in comparison to other states of the country. Moreover the price fluctuates quite frequently. The farmers requested the Dairy Department officials to help them avail the subsidy on fodder under the existing scheme for the same. The farmers requested for supporting them to set up mini grinding mills within the cluster. 	<ul style="list-style-type: none"> The issue will be discussed with the concerned authorities.
6	<p>Transportation problem:</p> <ul style="list-style-type: none"> Milk perishes very often while transporting to distant markets. The communities requested for supporting them procure insulated tankers to enable them to transport their milk to the distant market. 	<ul style="list-style-type: none"> There is proposal for establishment of BMCs under APART.
7	<p>Utilisation of excess cow dung:</p> <ul style="list-style-type: none"> The farmers informed that they sell their cow dung at a very low rate to fish farmers of other villages. They sought advice about how to use it for bio-gas generation. 	<ul style="list-style-type: none"> The issue will be discussed with the concerned departments.
8	<p>Encroachment of grazing land:</p> <ul style="list-style-type: none"> The milk producers were not aware of the scheme for cultivation of fodder in the village grazing reserve. The VGR has been encroached upon by some of the villagers. The milk producers are willing to avail the scheme and would approach the district administration to make the VGR free of encroachment. 	



Consultation with the DCS members at Rangia

Table 4: Community Consultation in Morigaon – Dairy

Date: 20 th September, 2016		Total Participants: 41
Venue: Khanajan, Morigaon		[Male: 35, Female: 06]
Time: 9.30 am to 11.30 am		
Sl. No.	Issues Raised By The Farmers	Suggestive Measures
1	<p>Inadequate Veterinary Services:</p> <ul style="list-style-type: none"> The veterinary sub-centre located in the village is in a very dilapidated condition. There is one Veterinary Field Assistant (VFA) in the sub-centre who rarely visits the center. The farmers need to consult with private doctors who charge high fee for their service. The area is flood affected and hence the cattle need special care after flood. There are cases of calves dying after each flood due to lack of proper care. 	<ul style="list-style-type: none"> The issue will be discussed with the AH & Vety. Department.
2	<p>High cost of fodder:</p> <ul style="list-style-type: none"> The cost of fodder procured by the farmers is very high. The small farmers who buy feeds on credit need to pay higher rates than those who buy in cash. This increases their cost of production. 	<ul style="list-style-type: none"> The farmers have been advised to shift to organized way of farming and procure inputs collectively.
3	<p>Delay in payment by WAMUL:</p> <ul style="list-style-type: none"> The farmers are presently supplying milk to WAMUL. It takes more than 15 days for the farmer to receive the payment from WAMUL. The farmers requested the WAMUL to make the payment within one week. 	<ul style="list-style-type: none"> WAMUL will try to reduce the payment period.
4	<p>Knowledge gap:</p> <ul style="list-style-type: none"> Very few farmers have been imparted training on dairy farming. The farmers requested for training and demonstration at site on crucial aspects of dairy farming. 	<ul style="list-style-type: none"> WAMUL will organize more training for the farmers.



Interaction with milk producers at Khanajan, Morigaon

Table 5: Community Consultation in Kamrup – Dairy

Date: 19 th September, 2016		Total Participants: 8
Venue: Hajo		[Male: 6, Female: 2]
Sl. No.	Issues Raised By The Farmers	Suggestive Measures
1	<p>29. Inadequate veterinary service:</p> <ul style="list-style-type: none"> The farmers do not have access to proper veterinary service with respect to AI and other need based health care of their cattle. Only one VAS from the nearby dispensary looks after the entire cluster and he charges fee according to the distance he travels. His visit fee ranges from Rs.200 to Rs. 300 per cow. 	<ul style="list-style-type: none"> The issue has been recorded and will be discussed with the project team.
2	<p>30. Death of cattle due to flood:</p> <ul style="list-style-type: none"> The grazing lands get submerged due to flood. The farmers suffer due to the scarcity of locally available fodder for their cattle during flood. Cattle die in large numbers due to lack of proper feeds and outbreak of water borne diseases in the aftermath of flood. 	<ul style="list-style-type: none"> The issue will be discussed with the Department of AH & VD.
3	<p>31. Delay in payment by WAMUL:</p> <ul style="list-style-type: none"> The producers complained about the time taken by WAMUL to make payment. It takes at least 15 days for a producer to receive the payment. It affects them a lot as they need money to purchase fodder regularly. 	<ul style="list-style-type: none"> WAMUL will be requested to expedite the process of payment.
4	<p>32. Dissatisfaction over the price determination mechanism:</p> <ul style="list-style-type: none"> The producers complained about the WAMUL's practice of imposing penalty on the farmers if the milk is found to have lower than permissible limit of SNF and Fat contents. 	<ul style="list-style-type: none"> WAMUL representative has been requested to communicate properly to the producers regarding the pricing mechanism.
5	<p>33. Penalty being imposed on producers:</p> <ul style="list-style-type: none"> WAMUL has been imposing penalty on the producers on the ground of contamination in their milk. The farmers are surprised when they get less payment in spite of the high contents of SNF and Fat in their milk. The level of contamination has not been mentioned anywhere in the day wise statements of procurement details shared with them by 	<ul style="list-style-type: none"> WAMUL representative has been requested to disclose the contamination level, if any, to the producers after proper testing of milk

Date: 19 th September, 2016		Total Participants: 8
Venue: Hajo		[Male: 6, Female: 2]
Sl. No.	Issues Raised By The Farmers	Suggestive Measures
	WAMUL.	
6	34. Conflict between MPI and DCS: <ul style="list-style-type: none"> The producers informed that many of the DCS members joined the MPI promoted by WAMUL in their area and stopped supplying milk to the society. This has happened due to the difference of price paid by WAMUL and the price paid by DCS and provision of commission made by WAMUL for the MPI leader. 	<ul style="list-style-type: none"> The issue will be discussed with the project team.
7	35. Procurement of poor quality of calves: <ul style="list-style-type: none"> The DCS run by women group informed that poor quality calves were supplied to their DCS by the Department of Animal Husbandry & Veterinary, Govt. of Assam. Majority of the calves died after 2-3 months of procurement. They did not complain to the department as they were unaware of the procedure for registering complaints. 	<ul style="list-style-type: none"> The DCS members have been suggested to consult with the experienced farmers/doctors while procuring calves.
8	36. Supply of stainless milk cans: <ul style="list-style-type: none"> The DCS run by women group was not provided stainless milk cans under government scheme though other DCSs have received the same. 	<ul style="list-style-type: none"> The DCS members have been requested to inform the concerned authorities/departments in case of such anomalies.
9	37. Lack of knowledge of institutional functioning: <ul style="list-style-type: none"> The Secretary and President of the women DCS are not aware of the mandatory requirements for the proper functioning of cooperative societies like proper maintenance of accounts, auditing of accounts, holding of AGM etc. 	<ul style="list-style-type: none"> The DCS members have been advised to play proactive roles and work hard to strengthen the DCS.



Consultation with the DCS members at Hajo

Table 6: Community Consultation Jorhat – Sericulture

Date: 28 th September, 2016		Total Participants: 24
Venue: Deoghoria, Titabor, Jorhat		[Male: 22, Female: 02]
Sl. No.	Issues Raised By The Farmers	Suggestive Measures
1	<p>Non-availability of Reeling machine:</p> <ul style="list-style-type: none"> Manual reeling without machine takes much longer time with decrease in production rate. So the farmers requested for the reeling machine so that they can enhance their production. 	<ul style="list-style-type: none"> CSB (Central Silk Board) has designed and developed a reeling cum twisting machine and spinning machines for converting Muga&Eri cocoons to reel/spun silk respectively. This new machine is likely to be provided under this project.
2	<p>Non-availability of Fund:</p> <ul style="list-style-type: none"> The farmers have to spend money for plantation of feed trees as well as for the complete farming process, including rearing appliances. Receiving loan or any kind of fund will help the farmers to fulfill their needs at the time of farming. 	<ul style="list-style-type: none"> Support for raising of Kissan nursery and plantation of worm plants, procuring machines, infrastructural support, shall be provided under this project, which will solve the funding issue to some extent.
3	<p>Absence of proper market facility:</p> <ul style="list-style-type: none"> The products are sold at Farmer's mini fair and home. Majority of the buyers are villagers. Some wholesalers procure the products from the farmer's houses. The farmers do not get proper prices for their products due to non-availability of proper markets. They requested for the provision of permanent markets for their products in their areas. 	<ul style="list-style-type: none"> Establishment of Reshom Huts under this project is likely to solve the issue. Besides, the farmers were suggested to sell their products collectively under their SHG or co-operative society till the implementation of this project.
4	<p>Disturbances from animals and insects:</p> <ul style="list-style-type: none"> Animals, birds and insects often attack the feed plants. Insects like caterpillars eat the leaf of the feed plants. Monkeys often target the mulberry trees for food. 	<ul style="list-style-type: none"> The farmers may be provided with mosquito nets under this project. Mosquito net protects the plant from this kind of disturbances.

Table 7: Community Consultation Jorhat – Handloom

Date: 28 th September, 2016		Total Participants: 45
Venue: Liet N-Changi, Titabor, Jorhat		[Male: 03, Female: 42]
Sl. No.	Issues Raised By The Farmers	Suggestive Measures
1	<p>Lack of proper training:</p> <ul style="list-style-type: none"> As per the farmers' information, they follow the traditional methods which are less productive and time consuming. They expressed that they need training on use of modern looms. Some of them received training at Suwalkuchi for one month but they feel the period is too less. Further the training programs were designed for the graduates, hence many of them could not attend the training. 	<ul style="list-style-type: none"> The proposed activities under APART include training of the weavers. The training for handloom and textile should be designed in such a way that weavers are properly trained on use of modern looms and designing. The duration and eligibility criteria should be need based as well as on principle of inclusiveness.
2	<p>Non-availability of quality feed plants and nursery:</p> <ul style="list-style-type: none"> The farmers in this area cultivate all three varieties of silk, 	<ul style="list-style-type: none"> Establishment of Kishan Nursery

Date: 28 th September, 2016		Total Participants: 45
Venue: Liet N-Changi, Titabor, Jorhat		[Male: 03, Female: 42]
Sl. No.	Issues Raised By The Farmers	Suggestive Measures
	i.e., eri, mulberry and muga. They have their own land for plantation of worm trees with quality saplings. They requested for nursery of worm plants which they can use at community level and earn some money by selling the saplings.	<p>proposed under APART is most likely to solve this issue.</p> <ul style="list-style-type: none"> The capacity of the weavers/rearers is to be developed to manage these nurseries.
3	<p>Functioning of the SHGs:</p> <ul style="list-style-type: none"> The consultation was attended by the office bearers and members of twelve SHGs of the village. Most of the SHGs are having 10-12 members. They collect Rs.10 per week/Rs.50 per month from the members and keep the money in bank. They provide loan to its members at an interest rate of 2%-5% and maximum loan given amounts to Rs.15000. however it was found that none of the members of any SHGs ever requested loan for handloom related activities but for social and health related needs. 	<ul style="list-style-type: none"> The SHGs need further orientation on institution building. Awareness program is required for SHGs so that they can use their own money for commercialization of their activity.
4	<p>Absence of proper market facility:</p> <ul style="list-style-type: none"> The farmers rarely sell their products commercially. Generally they take up weaving for their own use and the surplus they sell at home to the villagers. They are not educated enough to fix the rate of their product for marketing and cost of their own labour is not counted while fixing the rate. They informed that demand for their <i>gamosa</i> (Assamese towel) is very high at the time of election and other cultural occasions. 	<ul style="list-style-type: none"> The training design for weaver should include session on how to rate their products including labour costs for competitive pricing. The representative of handloom and textile department told that he will explore the marketing options after fixing the rate of their products.

Figure 4: Consultation Snapshots



Interaction with the members of weaver's self help groups at Titabor, Jorhat

Figure 4: Consultation Snapshots



Consultation with Sericulture farmers at Titabor, Jorhat

Table 8: Community Consultation – Entrepreneurs at Tezpur

Sl. No.	Issues raised by the Entrepreneurs	Suggestive Measures
1	<p>Erratic power supply:</p> <ul style="list-style-type: none"> The entrepreneurs, particularly the owners of rice, mustard and spice processing units, are suffering a lot due to erratic power supply. Their machineries are under-utilized, labourers are under-utilised and they fail to deliver products to the customers in time due to the power problem. 	<ul style="list-style-type: none"> The issue shall be brought to the notice of the project authority for consideration of possible support to the entrepreneurs.
2	<p>Lack of Government support in terms of raw materials supply:</p> <ul style="list-style-type: none"> The rice mill owners informed that the state govt. used to supply wheat to them on PDS till the year 1989. Thereafter the government stopped supplying wheat to small processing units and as a result they have to close down their wheat processing units as wheat is not locally available in adequate quantity. 	<ul style="list-style-type: none"> The issue shall be brought to the notice of the project authority for consideration of possible support to the entrepreneurs.
3	<p>Poor quality of packaging:</p> <ul style="list-style-type: none"> The quality of packaging of the products like pickles, jam, jelly, snacks, squash etc. is not good in comparison to the popular branded products available in the market. This is due to lack of better packaging machine and necessary skills. 	<ul style="list-style-type: none"> The PIU will find out the low cost mechanized options available in the market and share the information with the entrepreneurs.
4	<p>Lack of easy access to finance:</p> <ul style="list-style-type: none"> The entrepreneurs need financial support for expansion and up-gradation of their units. It is very difficult and time consuming to avail loans from financial institutions. 	<ul style="list-style-type: none"> Assam Bureau of Investment Promotion (ABIP) shall be set up under APART to promote investment by streamlining and simplifying the procedures.
5	<p>Lack of training:</p> <ul style="list-style-type: none"> The entrepreneurs need training on skill up-gradation, packaging, labour management, accounting etc. 	<ul style="list-style-type: none"> There are provisions for training of entrepreneurs in APART.

Date: 26 th October, 2016		Total Participants:18
Venue: DICC office, Tezpur		[Male: 15, Female: 3]
Sl. No.	Issues raised by the Entrepreneurs	Suggestive Measures
6	Lack of exposure: <ul style="list-style-type: none"> The participants of the consultation feel the need to visit the successful enterprises to experience how these units are being run, how cleanliness and safety concerns are addressed, to know about labour management and marketing strategies. 	<ul style="list-style-type: none"> There are provisions for exposure visit of entrepreneurs in APART.
7	Lack of trademark: <ul style="list-style-type: none"> The entrepreneurs do not have registered trademarks for their products. They are not able to popularize their products in the absence of a trademark. Most of them are not aware of the procedures. They need support in this regard. 	<ul style="list-style-type: none"> The entrepreneurs shall be supported under APART in obtaining trademarks.
8	Lack of awareness: <ul style="list-style-type: none"> The entrepreneurs are not aware of new Government schemes. They need guidance for expansion of the existing units and setting up of new units. 	<ul style="list-style-type: none"> DICC shall organize awareness programs among the entrepreneurs on various schemes of the government.
9	Poor extension service: <ul style="list-style-type: none"> The participants informed that the extension officers of the DICC seldom visit their units. They request the officials to visit their units regularly so that they can understand the issues related to the day to day operations of the enterprises. 	<ul style="list-style-type: none"> Entrepreneurs' Meet shall be organized every month at the DICC, Sonitpur.
10	Lack of Business Plan: <ul style="list-style-type: none"> The entrepreneurs are not capable of preparing BPs required by the financial institutions and govt. departments. The financial institutions fund the projects based on the rationale of BPs only. So the entrepreneurs are not able to avail financial supports and govt. schemes in the absence of a good BP. 	<ul style="list-style-type: none"> The entrepreneurs shall be provided support under APART on the preparation of BPs.



Consultation with the entrepreneurs

5. Institution Level Consultation

Consultations with officials of various government departments and others were done to understand aspects such as, (i) farming practices followed in project districts, (ii) functional mechanism of line departments wings at grassroots level, (iii) land acquisition practices followed for road development,

and (iv) ownership pattern and user rights over community land – village grazing land. Outcome of the consultations are given in

Table 9: outcomes of Consultation with Officials of Government and Others

Sl. No	Details of Institution Consulted	Issues Discussed / Details Shared
1	Department of Sericulture – on sericulture related activities in Assam	<ul style="list-style-type: none"> Department implements Central Government Schemes and State Government Schemes in decentralized manner with District Level offices managed by officer at the rank of Assistant Director, Sub-Divisional offices managed by Superintendent, and Inspectors at Field Level. Seed plantation, rearing, reeling, spinning are the major activities. Major markets are located at Boko (Kamrup), Udalguri, Kokrajhar (established in 2010) and Lakimpur (established in 2014). Muga and Mulberry cultivation is largely concentrated in Lakhimpur district and Eri cultivation is largely in Sonitpur district.
2	Department of Handloom & Textiles – existing practices in Handloom and Textile sector	<ul style="list-style-type: none"> Department implements Central Government Schemes and State Government Schemes in decentralized manner with District Level offices managed by officer at the rank of Assistant Director, Sub-Divisional offices managed by Superintendent, and Inspectors at Field Level. Director has been declared as Ex-officio Additional Registrar of Cooperative Societies for Handloom and Power loom Cooperatives and exercise all powers of Registrar Cooperative Societies. Central Government Schemes generally are implemented stage-wise, wherein the assistance is disbursed based on progress of respective stages. State government schemes are usually one-time lump-sum based disbursement of assistance.
3	Fisheries Department - on preparation of PIP as part of APART	<ul style="list-style-type: none"> Criteria followed in selection of clusters, beels, etc. Various economic agents in fishery value chain Formation of farmer-producer organisations Areas in which capacity building required for farmers Establishment of common service centres
4	Division of Fisheries, ICAR Research Complex for North East Hill Region - on fishery related interventions	<ul style="list-style-type: none"> Climatic changes which should be taken into consideration while formulating any intervention related to fishery development Need for developing a code of practice for beel fisheries Involvement of communities in species selection and auto-stocking Need for awareness building among fishers regarding techno-interventions and beel management
6	Public Works Department, Guwahati on land acquisition for road development	<ul style="list-style-type: none"> PWD acquires land following Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013, for which the Rules are in place. Some of the Corridors under Assam State Road Project, funded by World Bank have acquired land under RFCTL and R&R Act 2013 and disbursement is being paid. Process followed under Land Acquisition Act takes almost 2 years for the whole process. Roads identified under APRT do not trigger additional land acquisition, provided road strengthening is limited to 5.5m formation width as minimum option.
7.	Revenue Department on Village Grazing Reserve	<ul style="list-style-type: none"> Village Grazing Reserves (VGR) is owned by Revenue Department and is exclusively utilized as community grazing land. Transfer of grassing land is not permitted as per the directives of honorable supreme court. Any agriculture land used for non-agriculture purpose should be declassified by

Sl. No	Details of Institution Consulted	Issues Discussed / Details Shared
		<p>the user as per the procedures of revenue department.</p> <ul style="list-style-type: none"> All the land received from the community or from individual in the form of donation or acquisition shall be registered by the user agencies. the notification of the fisheries as sanctuary is done by the department of forest by the MoEF, not by the state Most of the VGRs in the State are encroached by adjacent community, hence any intervention in which VGR is involved, would require a consultation with the local community. VGRs being used for sericulture plantation do not have any formal agreement in place.
8	Department of Handloom & Textiles and Sericulture, Jorhat, Assam	<ul style="list-style-type: none"> Two handloom training centers in Jorhat district, one at Madhavpur and the other is at Khatawal, where weavers are given training on weaving and designing. Willing weavers were sent for further level of training at Handloom Training Institutes located at Nagaon, Barpeta, Lakhimpur and Musalpur. After this training the weavers become eligible for applying as demonstrator in Handloom and Textile Department. More than 90% female are involved in this sector. Male are involved basically in marketing of the products. Generally the weavers use traditional loom. However the progressive weavers now a day use advanced looms like, Jacquar Loom, Tip Loom and Fly Shuttle Loom with Wrapping Drum. The farmers have both SHG and Co-operative societies. But as per their information SHGs are functioning better than the co-operatives. The Department has started online marketing for sale of products via, Mahila E-Haat (http://mahilaehaatrmk.gov.in/en/index.php) web page.
9	District Industries & Commerce Centre, Tezpur	<ul style="list-style-type: none"> Entrepreneurs' Meet is held every month at the office of the General Manager, DICC, Tezpur Erratic power supply is the major problem faced by the entrepreneurs Capacity building of the DICC staffs required Investment summits for the entrepreneurs should be organized
10	Department of Animal Husbandry and Veterinary, KarbiAnglong	<ul style="list-style-type: none"> Inadequate marketing facility, traditional marketing; Unhygienic waste disposal practice at slaughter houses leading to health hazard; Traditional way of farming; and Use of locally available cheaper feeds. Revamp of the existing slaughter house constructed under RashtriaSamaVikasYojna with additional equipments Additional slaughter houses shall be promoted to other parts of the district Need for capacity building of formers in commercial breeding
11	Department of Dairy Development, Govt. of Assam	<ul style="list-style-type: none"> Functioning of DCS and MPIs Non-availability of low cost fodder Need for capacity building of farmers Challenges in bringing the value chain players of unorganized sector to organized sector Inadequate veterinary service Requirement of storage facility in the production clusters

Sl. No	Details of Institution Consulted	Issues Discussed / Details Shared
12	WAMUL, Guwahati	<ul style="list-style-type: none"> • Shortage of milk in the state for running the plant • Formation of DCS and MPIs • Establishment of BMCs in the production clusters • Capacity building of milk producers • Supply of fodder, medicines etc. • Establishment of new plants in Jorhat and Cachar
13	KarbiAnglong Autonomous council	<ul style="list-style-type: none"> • Piglets should not be given free of cost to the farmers for the second time • Training should be given to the farmers to upgrade their entrepreneurship skill in big breeding and value addition. • Farmers should be encouraged to undertake pig rearing on commercial basis • The price difference in the local market and rest of the region (including nearer states) shall be tapped for the better price of the formers. • Logistics for marketing channels should be explored on private participation • Awareness on clean meat production shall be promoted among the formers by the Department.

6. On-site Observations

Visit by respective Experts to various agri-horti-fishery-dairy-piggery related activities has been done. These site-visits were aimed at (i) understanding the present farming practices, (ii) observing the likely social impacts, (iii) capturing the views of farmers, and (iv) reviewing the project implementation plans for their adherence to existing farming practices. Summary of the on-site observations are given in **Table 10**.

Table 10: Summary of On-Site Observations

Sector	Observations
Fishery	<ul style="list-style-type: none"> • The farmers need training on all the aspects of fish farming; • Lack of storage facility in the markets impacts the price of products; • Cost of inputs and transportation is high; • Cost of fund for capital is higher due to lack of access to formal banking; and • Traditional way of farming and un-organised mode of trading leading to high cost of production and hence low margin.
Dairy	<ul style="list-style-type: none"> • Lack of access to veterinary services; • High cost of fodder; • Lack of storage facility; • Poor condition of road leading to high cost of transportation; and • Non-utilisation of excess cow dung.
Sericulture	<ul style="list-style-type: none"> • Use of residence for rearing of mulberry and eri worms due to space constraint leads to health hazard; • Traditional way of farming and un-organised mode of trading leading to high cost of production and hence low margin; and • Manual use of spinning machine for muga by women due to erratic power supply leads to health problems;
Handloom	<ul style="list-style-type: none"> • Lack of assured market; • Use of modern looms requires special skills. Skill development training required on the use of modern looms;

Sector	Observations
Piggery	<ul style="list-style-type: none"> • Mortality rate among species is very high; • Inadequate extension service by AH &V Department; • Inadequate marketing facility, traditional marketing; • Unhygienic waste disposal practice at slaughter houses leading to health hazard; • Traditional way of farming; and • Use of locally available cheaper feeds.

Figure 5: Photos of site visit (Fishery Sector)



Fish ponds of (Juria) Godaimari cluster

Figure 6: Photos of site visit (DairySector)



Female farmer with her cattle at Khanajan, Morigaon

Visit to BMC at Amlighat, Morigaon

Figure 7: Photos of site visit (SericultureSector)



Interaction at sericulture farm of a JFMC at Atkheli Grant, Sivasagar



Visit to a Muga Farm at Nazira, Sivasagar

Figure 8: Photos of site visit (PiggerySector)



Interaction with pig harmer at Gobardhan, Kamrup



Slaughter house at Gobardhan, Kamrup

Annex 11

ANNEXURE 11a: COMPONENT A - ENVIRONMENTAL GUIDELINE FOR INVESTMENT FUND (AGRIBUSINESS FUND)

The environmental guideline is intended to ensure that the proposed Component – A and its project subcomponents activities (investment Fund) do not result in unreasonable environmental impacts. The environmental guideline allows the line departments to identify and manage the environmental impacts of their activities, by assessing potential environmental impacts and then by identifying and implementing steps to avoid, minimize, or mitigate those impacts.

I. Environmental Commitments

Environmental guideline is fundamental in ensuring that the Investment fund does not support Component – A and its project subcomponents activities that unnecessarily harm the environment. As part of the project implementing bodies, all the line departments shall

- (i) Adopt the Environmental Management Framework (EMF) that ensures environmental impacts are identified and assessed at the earliest possible stage of the project/ project design,
- (ii) Adopt measures to avoid or where avoidance is impossible try to minimize or mitigate those risks during implementation, and
- (iii) Monitor and report on the status of those measures during and at the end of implementation.

II. Environmental Legislations

Project components supported by the Investment fund shall be designed and implemented to meet the following environmental regulations (*Refer Chapter 2 EMF*).

(i) Compliance with the Environmental Rules and Regulations

Project components supported by the Investment fund shall be in compliance with applicable State (GoA), Centre (GoI) and World Bank Policies

(ii) Protection of Natural Habitats

The Investment fund shall not support Component – A and its project subcomponents that would involve significant conversion or degradation of critical natural habitats, including those that are (a) legally protected, (b) officially proposed for protection, (c) identified by authoritative sources for their high conservation value, or (d) recognized as protected by traditional local communities

(iii) Conservation of Biological Diversity

Component – A and its project subcomponents supported by the Investment fund shall be designed and implemented in a way that avoids any significant reduction or loss of biological diversity or the introduction of known invasive species

(iv) Climate Change

Component – A and its project subcomponents supported by the Investment fund shall not result in any significant increase in Greenhouse Gas (GHG) emissions or other drivers of climate change

(v) *Pollution Prevention and Resource Efficiency*

Component – A and its project subcomponents supported by the Investment fund shall be designed and implemented in a way that meets applicable national / international standards for maximizing energy efficiency and minimizing material resource use, waste production and the release of pollutants

(vi) *Public Health*

Component – A and its project subcomponents supported by the Investment fund shall be designed and implemented in a way that avoids significant negative impacts on public health

(vii) *Agricultural Lands and Soil Conservation*

Component – A and its project subcomponents supported by the Investment fund shall be designed and implemented in a way that promotes soil conservation and avoids degradation or conversion of productive agricultural lands

III. Environmental Management Approach

The Line departments shall be responsible for screening the project subcomponents to determine the extent of environmental impacts. The anticipated impacts are thoroughly assessed; the measures are identified for avoiding or reducing environmental and social impacts, and that the implementation of such measures is monitored and reported throughout the life of the project.

(i) *Screening of Environmental Impacts*

Project Component – A and its project subcomponents shall be screened by the Line departments to determine their potential to cause environmental impact. The screening process shall seek to identify potential environmental impacts and risks, taking into consideration the environmental legislations outlined above. The screening process shall consider all potential direct, indirect and cumulative impacts that could result from the project components. The screening will determine whether the project component requires further environmental assessment, mitigation and management.

The results of the environmental screening shall be included in the project component proposal that would be submitted to the ARIAS. If during the review process the ARIAS determine that further information on the environmental assessment, mitigation and management of impact is required, the line department can be asked to provide it. If appropriate, this will be reflected in the agreement between the ARIAS and the line departments. Regardless of the outcome of the screening procedure, all proposed project components shall comply with the environmental legislations and applicable rules and regulations.

(ii) *Environmental Assessment*

For Project Component – A and its project subcomponents that have the potential to cause environmental impact, the line department shall prepare an environmental assessment (as suggested in the EMF) that identifies any environmental impacts, including any potential impacts associated with the environmental legislations set forth above. The assessment shall

- Consider all potential direct, indirect and cumulative impacts and risks that could result from the proposed project components;
- Assess alternatives to the project components; and
- Assess possible measures to avoid, minimize, or mitigate environmental impacts of the proposed project component.

(iii) *Environmental Management Plan (EMP)*

Where the environmental assessment identifies environmental impacts, the assessment shall be accompanied by an environmental management plan (as suggested in the EMF) that identifies those measures necessary to avoid, minimize, or mitigate the potential environmental impacts. A commitment to implement the management plan shall be a condition of the project component approval and reflected in the monitoring and reporting plan for that project component.

(iv) *Monitoring, Reporting, and Evaluation*

Monitoring and evaluation of project components supported by the Investment fund shall address all environmental impacts identified during environmental assessment, design, and implementation. The progress reports shall include a section on the status of implementation of environmental management plan, including those measures required to avoid, minimize, or mitigate environmental impacts. The reports shall also include, if necessary, a description of any corrective actions that are deemed necessary.

(v) *Public Disclosure and Consultation*

Stakeholders shall be identified and involved as early as possible in planning project components supported by the Investment fund. The results of the environmental screening and a draft environmental assessment, including any proposed management plan, shall be made available for public consultations that are timely, effective, inclusive, and held free of coercion and in an appropriate way for communities that are directly affected by the proposed project components.

**ANNEXURE 11b-1: ENVIRONMENTAL MANAGEMENT PLAN FOR ROADS
(WIDENING/ STRENGTHENING) UNDER APART**

Sl. No.	Activities	Potential Negative Impact/Concern	Management Measure	Location	Responsible Agency
40. A	41. Pre- construction Phase				
1.	Consents, permits, clearances, no objection certificate (NOC), etc	As per the legal requirements	<ul style="list-style-type: none"> Obtain all necessary consents, permits, clearance, NOCs, etc. prior to start of civil works 		OPIU, PWD and Contractor
2.	Land Requirement	Loss of land used by the people along the road alignment, loss of trees, structures, utilities and resources	<ul style="list-style-type: none"> No land acquisition will be carried out under this project. The road will be constructed within the existing Right of Way (RoW). Assistance will be provided to the affected people (if any) as per the proposed "Entitlement Matrix" prepared for the project. 	Corridor of Impact	OPIU, PWD and Contractor
3.	Clearing of Trees	Loss of vegetation and trees along the alignment.	<ul style="list-style-type: none"> Permission shall be obtained from the Forest Settlement Officer for the felling of trees. Avenue plantation should be carried out for both affected and non-affected areas according to the availability of the space. 42. Some of the native trees usually planted are: <ul style="list-style-type: none"> ✓ Baobab ✓ Kadam ✓ Jack-Fruit Tree ✓ Coconut Palm ✓ Jamun Tree ✓ Banyan Tree ✓ Ivy-Like Fig ✓ The Peepal etc. Monitoring and care should be taken for the planted trees. 	Along the alignment / road corridor	Dept. of Environment and Forest, Assam, OPIU/PWD and Contractor
4.	Utility Relocation, Common Property Resources (CPR's).	Severances to utilities/ temporary interruption to the power and water supply	<ul style="list-style-type: none"> Permission from respective departments (PWD, irrigation, electricity department) to shift utilities. 	Along the alignment	OPIU; Concerned Agencies/Departments ; Contractor

Sl. No.	Activities	Potential Negative Impact/Concern	Management Measure	Location	Responsible Agency
			<ul style="list-style-type: none"> Relocation sites for all CPRs shall be selected in consultation with concerned communities, local administrative authorities/departments. Assistance will be provided to the affected people (if any) for their loss as per the "Entitlement Matrix" prepared for the project. 		
5.	Alignment/ road passing through sensitive areas (Wetlands, Forests areas)	Potential impact to the ecosystem (Both biotic and abiotic) and migratory birds.	<ul style="list-style-type: none"> Noise generating construction activities shall be temporarily suspended during the migratory season (October till January). Hence the impact on the presence of wetlands/ forest area shall be managed with no harmful impacts to the avifauna. Proper care should be taken for disposal of construction based waste and leachate generated from it. 	Corridor of Impact	Dept. of Environment and Forest, Assam, OPIU/PWD/ Contractor
6.	Road connecting to junctions	High risks of accidents	<ul style="list-style-type: none"> Constructing roundabout at the junctions to ease traffic and accidents Roundabout shall be provided with landscaping options to improve road aesthetics. Cautionary sign boards, Speed breakers should be provided. 	Corridor of Impact	OPIU/PWD/Contractor
7.	Construction Camps	<ul style="list-style-type: none"> Temporary land requirement for the labours Labour influx from neighbouring district/ other state shall have direct 	<ul style="list-style-type: none"> As far as possible involve local peoples in the construction works. Prior permission from the local authority (labor department) Provision of sanitation facility to the engaged labours. Camp should be constructed at a minimum distance of 500m from 	Construction camps	OPIU/PWD/Contractor

Sl. No.	Activities	Potential Negative Impact/Concern	Management Measure	Location	Responsible Agency
		<p>conflict with the local communities</p> <ul style="list-style-type: none"> • Exploitation of resources. • Generation of domestic wastes. 	<p>water bodies (river, stream, lake and ponds)</p> <ul style="list-style-type: none"> • Facilities should be located in areas not affected by flooding and clear of any natural or storm water courses. • Collecting organic waste at separate bins and disposing of in a pit at designated area/s. 		
43. B	44. Construction Phase				
8.	Quarry / Borrow pits Operations	Spillage on the area.	<ul style="list-style-type: none"> • Adequate safety precautions should be ensured during transportation of quarry material from quarries to the construction site. • Vehicles transporting the material shall be covered to prevent spillage. 	Corridor of Impact	OPIU/PWD/Contractor
9.	Slope Cutting	Potential impact to the soil with high risk of erosion.	<ul style="list-style-type: none"> • Adequate slope protection measures shall be undertaken to avoid slope instability from cutting. • On sections with deep cutting the side slopes shall be graded and covered with bushes and grass etc., adopting suitable slope protection techniques. 	Corridor of Impact	OPIU/PWD/Contractor
10.	Dismantling of Culverts/ Clearing of waterways of cross drainage works including minor bridges and clearing of longitudinal side drains.	Alteration of the water channel with impact on the water ecosystem.	<ul style="list-style-type: none"> • All necessary measures shall be taken especially while working close to cross drainage channels to prevent earthwork, stonework, materials and appendage as well as the method of operation from impeding cross-drainage at rivers, streams, water canals and existing irrigation and drainage systems. • Clearance of waterway will be undertaken before onset of monsoon 	Corridor of Impact	OPIU/PWD/Contractor

Sl. No.	Activities	Potential Negative Impact/Concern	Management Measure	Location	Responsible Agency
			<ul style="list-style-type: none"> Debris generated due to clearing of longitudinal side drains and waterways of cross drainage will be stored above high flood level and away from waterway, and reused on embankment slope or disposed at designated areas. 		
11.	Any activities under the construction.	Loss of Access	<ul style="list-style-type: none"> The contractor shall provide safe and convenient passage for vehicles, pedestrians and livestock to and from side roads and property access connecting the project road. 	Corridor of Impact	OPIU/PWD/Contractor
12.	Operation of the construction machineries/ construction vehicles	Dust Pollution from Crushers and other sources.	<ul style="list-style-type: none"> All earthworks to be protected/covered in a manner acceptable to the satisfaction of the Engineer to minimize the dust generation. All crushers will obtain siting clearance from SPCB or only those crushers that have already have obtained license from SPCB shall be used (shall have valid licence). 	Corridor of Impact	OPIU/PWD/Contractor
		Emissions from batching plants	<ul style="list-style-type: none"> Batching plants shall be located at least 500m away from Environmentally Sensitive areas as Reserved Forests / National Parks and sensitive receptors i.e., Hospital and College. 	Corridor of Impact	OPIU/PWD/Contractor
		Emission from Construction Vehicles, Equipment and Machinery	<ul style="list-style-type: none"> All vehicles, equipment and machinery used for construction should conform to the relevant Bureau of Indian Standard (BIS) norms and should be regularly maintained to ensure that pollution emission levels comply with the relevant requirements of SPCB. 	Corridor of Impact	OPIU/PWD/Contractor

Sl. No.	Activities	Potential Negative Impact/Concern	Management Measure	Location	Responsible Agency
			<ul style="list-style-type: none"> Other measures to be factored in selection of location: <ul style="list-style-type: none"> ✓ 1.0 km away from settlement, school, hospital on downwind directions. ✓ 300m from any archaeological site ✓ 10 km from environmental sensitive areas i.e. national park, sanctuary ✓ 500m from water bodies (rivers, streams, lakes and ponds) 		
		Generation of noise from construction equipment.	<ul style="list-style-type: none"> All vehicles and equipment used for construction should be fitted with exhaust silencers. Noise limits for construction equipment used in this project (measured at one metre from the edge of the equipment in free field) should not exceed 75 dB (A), as specified in the Environment (Protection) Rules, 1986. 	Corridor of Impact	OPIU/PWD/Contractor
13.	Wastes generated from the constructional activities	Soil and Water Pollution due to fuel and lubricants, construction waste.	<ul style="list-style-type: none"> The fuel storage and vehicle cleaning area should be stationed such that runoff from the site does not drain into the waterbodies. 	Corridor of Impact	OPIU/PWD/Contractor
		Siltation of Rivers and streams due to spillage of construction wastes.	<ul style="list-style-type: none"> Silt fencing should be provided at all water bodies near construction sites to prevent sediments from the construction site to enter into the watercourses. Extraneous construction wastes should be transported to the pre-identified disposal site for safe disposal. 	Corridor of Impact	OPIU/PWD/Contractor
14.	Disposal of Bituminous	Potential impact on the disposed	<ul style="list-style-type: none"> Reuse of the wastes in road to the maximum 	Corridor of Impact	OPIU/PWD/Contractor

Sl. No.	Activities	Potential Negative Impact/Concern	Management Measure	Location	Responsible Agency
	wastes / Construction Waste / Debris / Cut Material	area with respect to its ecosystem.	<p>extent possible.</p> <ul style="list-style-type: none"> Safe disposal of the extraneous material shall be ensured in the pre-identified disposal locations. 		
15.	Material Handling at Site and camp.	Occupational health and safety of workers	<ul style="list-style-type: none"> Water supply, sanitation, drainage and medical health facilities at camp site. Providing and using PPEs(Personal Protective Equipment) Providing earth link circuit breaker (ELCB) for all electrical connections. Maintaining first aid at construction sites Conducting awareness campaign including dissemination of IEC materials on HIV/AIDS for all construction personnel. Conduct semi-annual health check-up of all construction personnel including testing for STDs. 	Corridor of Impact	OPIU/PWD/Contractor
16.	Construction activities	Impact on the environs like air, water, noise and soil	<ul style="list-style-type: none"> The Contractor should undertake seasonal monitoring (as per monitoring plan suggested in the Chapter 8 (EMF)) of air, water, noise and soil quality through an approved monitoring agency 	Corridor of Impact	OPIU/PWD/Contractor
17.	Post construction activities	Clearing of Construction of Camps & Restoration	<ul style="list-style-type: none"> On completion of the works, all temporary structures shall be cleared away, all rubbish burnt, excreta or other disposal pits or trenches filled in and effectively sealed off and the site left clean and tidy, at the Contractor's expense, to the entire satisfaction of the Engineer. 	Corridor of Impact	OPIU/PWD/Contractor
45. C	46. Post Construction Phase (Operation and Maintenance Impacts)				

Sl. No.	Activities	Potential Negative Impact/Concern	Management Measure	Location	Responsible Agency
18.	Environmental Conditions	Increased air and noise pollution due to increased traffic using the improved roads	<ul style="list-style-type: none"> The OPIU should undertake seasonal monitoring of air, water, noise and soil quality through an approved monitoring agency. Provision of vegetative barriers where ever possible. installation of no horn signs at educational institutes and at hospitals 	Corridor of Impact	OPIU/PWD/Contractor
		Drainage of roadsides	<ul style="list-style-type: none"> To ensure efficient flow of surface water and to prevent water logging along the side of the roads adequate size and number of cross-drainage structures and longitudinal drains are provided in the design. These should be adequately maintained by cleaning and avoiding clogging of openings. 	Corridor of Impact	OPIU/PWD/Contractor
19.	High movement of vehicles	Traffic and Accident Safety	<ul style="list-style-type: none"> If required, depending on the level of Congestion and traffic hazards, Traffic Management Plans shall be prepared. <ul style="list-style-type: none"> ✓ Traffic control measures including speed limits to be enforced strictly. ✓ Road control width to be enforced. ✓ Pedestrian Safety shall be ensured. ✓ Pedestrian circulation shall be demarcated prior to start & unsafe areas shall be cordoned off. 	Corridor of Impact	OPIU/PWD/Contractor
20.	Maintenance of Drainage	Flooding, Damage in Spurs.	<ul style="list-style-type: none"> OPIU shall ensure that all drains (side drains and all cross drainages) are periodically cleared especially before monsoon season to facilitate the quick 	Corridor of Impact	OPIU/PWD/Contractor

Sl. No.	Activities	Potential Negative Impact/Concern	Management Measure	Location	Responsible Agency
			<p>passage of rainwater and avoid flooding without damaging the spurs and check dams erected to stabilize the course and flow of all such drainage channels.</p> <ul style="list-style-type: none"> OPIU shall ensure that all the sediment/oil and grease traps set up at the waterbodies are cleared once in every three months. 		

ANNEXURE 11b-2: SUB-COMPONENT:B.2.2: Warehouse and warehouse receipts development for Agriculture and Community Jali Houses, Cocoon Houses, Eri Rearing Houses, Cocoon Drying Chambers, Grainage Houses for Sericulture

ENVIRONMENTAL IMPACT AND MITIGATION MEASURE

Sl. No	Project Activity	Potential Negative Impact/Concern	Mitigation Measures	Responsible for Implementation	Applicable sectors
A. Pre-Construction Stage					
1.	Approvals/NOC Licences and Permits/ Insurance.	As per the legal requirements	<ul style="list-style-type: none"> All necessary approvals, permits and licences required by the state and local legislation shall be obtained prior to commencing of the construction activity. All approvals, permits and licences shall be maintained and up dated before expiry, and complied with during the construction period. Should there be any changes to the project which would require additional permits or licences, these shall be obtained The contractor shall maintain Pollution Under Control (PUC's) Certificates for the construction vehicles and machineries used for this project. Contractors shall insure all workers covered under the group insurance or any other suitable insurance schemes against all forms of injuries sustained at the workplace. 	Line Department/ DLCC/Contractor.	Agriculture, Sericulture
2.	Designing the warehouse.	Violation of, the Warehousing (Development and Regulation) Act, 2007	<ul style="list-style-type: none"> The design of the warehouse for different sectors should follow the Warehousing ((Development and Regulation) Act, 2007. 	Line Department/ DLCC/Contractor.	Agriculture, Sericulture
3.	Land Requirement	<ul style="list-style-type: none"> Loss of land Socio economic Impacts 	<ul style="list-style-type: none"> No additional land will be required, as the construction will be carried out at Govt. land. 	Line Department/ DLCC/Contractor.	Agriculture, Sericulture
4.	Clearing of trees/Removal of	<ul style="list-style-type: none"> Loss of trees and vegetation 	<ul style="list-style-type: none"> All reasonable measures shall be undertaken to ensure that no native fauna is harmed or placed at risk during the 	Line Department/ DLCC/Contractor.	Agriculture, Sericulture

Sl. No	Project Activity	Potential Negative Impact/Concern	Mitigation Measures	Responsible for Implementation	Applicable sectors
	vegetation	<ul style="list-style-type: none"> Soil erosion and surface runoff 	<p>course of the clearing activities</p> <ul style="list-style-type: none"> Felling of trees is not envisaged at any stage of the project. However under unavoidable conditions if any of the trees are required to be cut/felled, then prior permission as per existing procedure from Forest, ensuring appropriate compensation including compensatory plantation as stipulated by the forest department shall be undertaken. Avoid earthworks/breaking of land during monsoon season. 		
5.	Water Requirement	<ul style="list-style-type: none"> Exploitation of the water bodies. (both ground water and surface water) 	<ul style="list-style-type: none"> The required water will be sourced from the PWD/ PHE. In absence of the water supply, permission is required from the Central Ground Water Authority (CGWA) to abstract ground water. Permission to abstract ground water through any energized means i.e. for digging / installation of a bore well water connection in the site for drinking water, in a notified / non notified area for household/ industrial / infrastructure projects as per guidelines dated 15/11/2012 under Environmental Protection Act (EPA) (1986). 	Line Department/ DLCC/Contractor.	Agriculture, Sericulture
6.	Drainage management	<ul style="list-style-type: none"> Drainage congestion due to garbage/waste dumping Water logging. Vector proliferation 	<ul style="list-style-type: none"> As per the topography of the project site, appropriate sediment control measures should be designed and implemented prior to commencement of construction. Design adequate drainage passage by following natural path Fill ditches/water logging in ware house premises. Discharge drainage flow with proper downstream protection. Silt Trap shall be provided to prevent sediment runoff from the construction zone from entering and adversely affecting the natural drainages or areas of native vegetation downstream from the construction zone 	Line Department/ DLCC/Contractor.	Agriculture, Sericulture
B.	Construction Phase				

Sl. No	Project Activity	Potential Negative Impact/Concern	Mitigation Measures	Responsible for Implementation	Applicable sectors
7.	Construction material requirement	Change in topography, land clearing etc.,	<ul style="list-style-type: none"> It is advised to procure construction materials from the authorised vendor. 	Line Department/ DLCC/Contractor.	Agriculture, Sericulture
8.	Slope stability	Landslide or gully erosion on slopes that may threaten ware house infrastructure.	<ul style="list-style-type: none"> Planning and designing the refurbishment/ upgrading of ware house keeping in mind the fragile natural environment and site specific geological conditions Avoid or maintain adequate distance from erosion prone areas Adopt right angle of cut on slopes Stabilize slopes by measures Measures taken to avoid undercutting of hill toes that may cause slides Do not exert excess load on slopes by disposing spoil 	Line Department/ DLCC/Contractor.	Agriculture, Sericulture
9.	Erosion and sediment	Loss of soil, water pollution	<ul style="list-style-type: none"> Temporary erosion and sediment controls like having vegetation, surface covering etc., shall be installed prior to the commencement of any works with the potential to cause soil erosion, including stockpiling of construction materials Wherever possible during the course of the works, exposed soil areas shall be progressively stabilized or protected by an appropriate method to minimize erosion potential. 4 cubic feet of Topsoil in the construction area shall be stripped and stockpiled later for re-spreading on all exposed areas when final shaping has been completed. Fill material shall not be placed around or pushed up against the base of the trees and shrubs that needs to be retained within the construction site. Ground filling shall be sufficiently compacted to minimize erosion potential. All exposed soil areas shall be stabilized and re-vegetated 	Line Department/ DLCC/Contractor.	Agriculture, Sericulture

Sl. No	Project Activity	Potential Negative Impact/Concern	Mitigation Measures	Responsible for Implementation	Applicable sectors
			as soon as possible on completion of works to prevent potential erosion.		
10.	Spoil Management	<ul style="list-style-type: none"> Drainage blockage causing localized ponding and/or slush/muddy runoff. Spoil tipped over slope may cause slide 	<ul style="list-style-type: none"> Minimize spoil disposal by balancing cut and fill wherever possible Manage spoil to reclaim land with proper landscaping and vegetation Do not dispose spoil on drainage path 	Line Department/ DLCC/Contractor.	Agriculture, Sericulture
11.	Water Pollution	<ul style="list-style-type: none"> Impact on existing water resources Contamination of ground water and other water bodies. Impact on drinking water sources. 	<ul style="list-style-type: none"> Domestic effluent/ Sewage shall be discharged into soak pits. Total prohibition on direct discharge of sewage/sullage/solid waste into drains, open spaces, water bodies to ensure downstream settlement are not affected at any cost. Assess capacity and structural integrity of existing septic tanks. Take appropriate measures for augmentation of septic as per additional sewage generation. Awareness session on handling and storage of materials and waste management to be conducted for the construction workers. Water quality monitoring should be performed for the parameters including pH, BOD, COD, DO coliform count, total suspended solids, total dissolved solids, Iron, etc. 	Line Department/ DLCC/Contractor.	Agriculture, Sericulture
12.	Transportation and storage of construction materials	<ul style="list-style-type: none"> Nuisance to the general public Fugitive emissions 	<ul style="list-style-type: none"> The vehicles carrying the materials should be covered and secured to prevent loss or re-suspension of materials during travel. Construction materials should be stored in covered areas to ensure protection of surrounding areas from dust and emissions Diesel and other lubricant oil shall be stored in a covered area provided with hard surface / paved surface to prevent 	Line Department/ DLCC/Contractor.	Agriculture, Sericulture

Sl. No	Project Activity	Potential Negative Impact/Concern	Mitigation Measures	Responsible for Implementation	Applicable sectors
			soil pollution. <ul style="list-style-type: none"> • Any transportation of materials on local roads shall be done during day time. • All vehicle movements or other construction activities shall be restricted to the delineated construction zone, the existing road network or previously disturbed areas. • Construction vehicles, personnel and machinery shall not enter fenced off areas or areas beyond the delineated construction zone • Appropriate signage should be given to the designated areas (storage/ restriction of entries/toilets etc.,) in the construction camp 		
13.	Air and noise pollution and fugitive emissions	<ul style="list-style-type: none"> • Dust nuisance from construction works. • Dust and noise generated by vehicles passing. • Loud noise during construction. • Gaseous Emissions. 	<ul style="list-style-type: none"> • Wherever feasible, dust generating type of work shall be done during off time. • Labourers' use of masks and safety gears • Water needs to be sprinkled on work areas • Vehicles transporting construction materials to site must be covered to prevent dust pollution • Cover fine grain construction materials with tarpaulin or sheets. • Cover construction debris and waste prior to disposal. • Newly exposed surface areas shall be mulched and replanted as soon as possible in order to reduce the potential for erosion and suppress dust • All vehicles, construction machineries and equipment should possess Pollution Under Control Certificates (PUC's). • With respect to NAAQS, air quality monitoring should be carried out for the key parameters: <ul style="list-style-type: none"> ○ Sulphur Dioxide(SO₂) ○ Oxides of Nitrogen (NO_x) 	Line Department/ DLCC/Contractor.	Agriculture, Sericulture

Sl. No	Project Activity	Potential Negative Impact/Concern	Mitigation Measures	Responsible for Implementation	Applicable sectors
			<ul style="list-style-type: none"> ○ Carbon Monoxide (CO) ○ Particulate matter (PM₁₀& PM_{2.5}). • Noise generation should be monitored with respect to Ambient Noise Quality standards. 		
14.	Hunting and Poaching activities by construction workers	Threat to wild animals/ fauna	<ul style="list-style-type: none"> • Construction workers should not be involved in any hunting, poaching or fishing activities and should not disturb any natural resources, plants and animals (Including avifauna). 	Line Department/ DLCC/Contractor.	Agriculture, Sericulture
15.	Waste management and minimization	Impacts on land, water and visual impacts showing poor housekeeping practices.	<ul style="list-style-type: none"> • Recycled materials shall be used to the extent possible. • Any construction waste generated from the construction site shall be contained within the boundary of the site and removed at regular intervals to an appropriate waste disposal or recycling facility. • The Municipal Solid Waste (MSW) generated in the construction and labour camp shall be separated as organic and inorganic wastes. • The worksite shall be left in a tidy and rubbish free state upon completion of the works • There should be no burning of waste. 	Line Department/ DLCC/Contractor.	Agriculture, Sericulture
16.	Occupational Health and Safety	<ul style="list-style-type: none"> • Lack of safety tools • Lack of safe construction practices. • Accidents occurring on site • Site and task specific hazards 	<ul style="list-style-type: none"> • Provide safety gears to workers working in hazardous areas and provide training in the use of these safety gears and compulsory use of PPE's as per as per EHS (IFC, World Bank Group) [Refer Sl.no. 29]. • Keep first aid box ready at work areas and camps • Provide adequate space with ventilation, clean toilets/ bio toilets (separate for Ladies and Gents), solid waste management, light. • Provide mosquito nets at labour camps • Separate covered / walled toilet rooms (including bathing platforms) shall be provided for male and female labours. 	Line Department/ DLCC/Contractor.	Agriculture, Sericulture

Sl. No	Project Activity	Potential Negative Impact/Concern	Mitigation Measures	Responsible for Implementation	Applicable sectors
			<ul style="list-style-type: none"> Keep camp and work area clean and without water logging Fire fighting equipment like fire extinguishers will be provided in the camp as per fire safety standards. Displays prominently telephone/contact number of nearest ambulance service, health units. Provision of safe drinking water with respect to IS 10500:2012. 		
17.	Use of wood as construction materials	Felling of trees	<ul style="list-style-type: none"> Minimize use of wood for construction Use local materials as much as possible 	Line Department/ DLCC/Contractor.	Agriculture, Sericulture
18.	Cooking and heating with firewood by construction workers.	Felling of trees	<ul style="list-style-type: none"> Contractor shall supply kerosene or LPG at camps and restrict cooking and heating using firewood. 	Line Department/ DLCC/Contractor.	Agriculture, Sericulture
19.	Influx of migrant Workers	<ul style="list-style-type: none"> Health and safety risks Chances of spread of sexually transmittable diseases like AIDS 	<ul style="list-style-type: none"> Local labourer's to be given preference for job opportunities and each contractor should be bound by this commitment Ensure labour-related regulations are met In case of hiring outside labour, ensure that their working conditions as well as camps meet local regulations. 	Line Department/ DLCC/Contractor.	Agriculture, Sericulture
C. Post Construction/ Operation phase – Sector Wise					
C.1. Warehouse, Community Jali Houses, Cocoon Houses, Eri Rearing Houses, Cocoon Drying Chambers, Grainage Houses					
20.	Storage of chemicals, fertilizers, pesticides.	<ul style="list-style-type: none"> Contamination of hazardous fertilizers, medicines, chemicals and pesticides with the feeds and. In sericulture improper storage of these chemicals is a potential threat to the silk worms 	<ul style="list-style-type: none"> Separate storage facility should be provided within the warehouse for storing chemicals, fertilizers, medicines and pesticides to avoid contamination. 	Line Department/ DLCC/Contractor.	Agriculture, Sericulture

Sl. No	Project Activity	Potential Negative Impact/Concern	Mitigation Measures	Responsible for Implementation	Applicable sectors
		as well as the farmers.			
21.	Storing equipment used for, spraying and applying pesticides and fertilizers.	<ul style="list-style-type: none"> Contamination with the crop products and feeds from the residues left over in the pesticides and fertilizers applying equipment. Health hazard to the farmers. 	<ul style="list-style-type: none"> Separate storage facility should be provided within the warehouse for storing chemicals, fertilizers and pesticides applying equipment. The equipment should be washed properly before and after use to avoid health hazards of the farmers. 	Line Department/ DLCC/Contractor.	Agriculture, Sericulture
22.	Use of Power	Over consumption of power used in various operations of the warehouse.	<ul style="list-style-type: none"> Installation of renewable energy sources wherever possible, like solar energy. Use of energy efficient electrical appliances 	Line Department/ DLCC/Contractor.	Agriculture, Sericulture
23.	Use of water	Exploitation of ground water resources.	<ul style="list-style-type: none"> Reusing the water used for various purposes in the warehouse to the possible extent. It is recommended that the rain water harvesting arrangements may be made in the complex to recharge the ground water level as per the practice in the local PHE and self-government department of the State. 	Line Department/ DLCC/Contractor.	Agriculture, Sericulture
24.	Hygiene practice	Generation of odour and dust from the stored goods.	<ul style="list-style-type: none"> Ample ventilation and cleaning of warehouse should be carried out. Warehouse official shall ensure that all the walls, pillars, partitions, ceilings, staircases inside the warehouse are white washed at defined interval (once in 3 years). Timely prophylactic and curative treatments (spraying of chemicals and fumigation for insect pest control) should be carried out in the warehouses. Similarly, rodent control operations in and around warehouses should also be carried out as and when required. 	Line Department/ DLCC/Contractor.	Agriculture
25.	Maintenance and	Misleading information	<ul style="list-style-type: none"> Equipment would be calibrated at least once in a year by 	Line Department/	Agriculture

Sl. No	Project Activity	Potential Negative Impact/Concern	Mitigation Measures	Responsible for Implementation	Applicable sectors
	calibration of equipment and items used in the warehouse	provided by the instrument used for various purposes in the warehouse.	<p>the approved calibration laboratories/institutions.</p> <ul style="list-style-type: none"> The equipment which is out of order or not functioning should be kept separately with clearly marked as “Out of Services” until these are repaired and become functional. 	DLCC/Contractor.	
26.	Maintenance of moisture level.	Growth of fungi and other microbes in the stored.	<ul style="list-style-type: none"> Mechanical damage, contamination before store should be avoided. The goods should be cleaned, dried to safe moisture level and cooled before storage. Insect infestation should be controlled during storage. Moisture content should be less than in equilibrium with 70% R.H. 	Line Department/ DLCC/Contractor.	Agriculture, Sericulture
27.	Basic amenities need for workers/ labours	Basic requirements.	<ul style="list-style-type: none"> Separate toilet for male and female should be provided. For the staff and labours working in the storage structure, facilities for safe drinking with respect to IS 10500:2012 shall be provided at suitable locations. It is recommended that the amenity of a canteen / tiffin room may be provided at each centre having a capacity of 5000 tonnes or more. The size of canteen may be proportionately increased for godowns of higher capacities. 	Line Department/ DLCC/Contractor.	Agriculture, Sericulture
28.	Generation of Waste	Leachate, run off by drains, contamination in the local water bodies and soil.	<ul style="list-style-type: none"> The waste generated should be stored in a designated place having impervious layer to prevent leachate. Separation of biodegradable and non-biodegradable wastes and options for recover, reuse and recycle shall be explored. The waste shall be disposed in the designated location as identified by the local panchayat / municipalities. 	Line Department/ DLCC/Contractor.	Agriculture, Sericulture
29.	Handling of the stored goods and maintenance of the warehouse/ Grainage house and other structures in	Occupational health hazards. (Asthma, allergy, cough, bronchitis etc. mostly occurs to rearers and weavers in Sericulture.)	<ul style="list-style-type: none"> Use of Personal Protective Equipment, as per EHS (IFC, World Bank Group): <ul style="list-style-type: none"> ✓ Safety Glasses with side-shields, ✓ Plastic Helmets with top and side impact protection. ✓ Hearing protectors (ear plugs or ear muffs), ✓ Safety shoes and boots for protection against moving & falling objects, liquids and chemicals, 	Line Department/ DLCC/Contractor.	Agriculture, Sericulture

Sl. No	Project Activity	Potential Negative Impact/Concern	Mitigation Measures	Responsible for Implementation	Applicable sectors
	sericulture.		<ul style="list-style-type: none"> ✓ Gloves made of rubber or synthetic materials (Neoprene), leather, steel, insulating materials, etc. ✓ Facemasks with appropriate filters for dust removal and air purification (chemicals, mists, vapours and gases). Single or multi-gas personal monitors, if available, ✓ Portable or supplied air (fixed lines). On-site rescue equipment, ✓ Insulating clothing, body suits, aprons etc. of appropriate materials. • First aid kits, flashlights, fire extinguishers and other fire-fighting equipment should be provided both inside and outside the warehouse. • Establishment of Do's and Don'ts chart in local language. • Training should be given to the employees handling warehouse operations. 		

Annexure 11b-3: SUB-COMPONENT:B.2.3: MARKET INFRASTRUCTURE DEVELOPMENT**ENVIRONMENTAL IMPACT AND MITIGATION MEASURE**

Sl. No	Project Activity	Potential Impact	Mitigation Measures	Responsible for Implementation	Applicable sectors
A. Pre-Construction Stage					
30.	Approvals/NOC Licences and Permits/ Insurance.	As per the legal requirements	<ul style="list-style-type: none"> All necessary approvals, permits and licences required by the state and local legislation shall be obtained prior to commencing of the construction activity. All approvals, permits and licences shall be maintained and up dated before expiry, and complied with during the construction period. Should there be any changes to the project which would require additional permits or licences, these shall be obtained. The contractor shall maintain Pollution Under Control (PUC's) Certificates for the construction vehicles and machineries used for this project. Contractors shall insure all workers covered under the group insurance or any other suitable insurance schemes against all forms of injuries sustained at the workplace. 	Contractor/Line Department/DLCC	Agriculture, Fishery and Piggery.
31.	Land Requirement	<ul style="list-style-type: none"> Loss of land Socio economic Impacts. 	<ul style="list-style-type: none"> No additional land will be required, as the construction will be carried out at Govt. land. 	Contractor/Line Department/DLCC	Agriculture, Fishery and Piggery.
32.	Clearing of trees/Removal of vegetation	<ul style="list-style-type: none"> Loss of trees and vegetation Soil erosion and surface runoff 	<ul style="list-style-type: none"> All reasonable measures shall be undertaken to ensure that no native fauna is harmed or placed at risk during the course of the clearing activities Felling of trees is not envisaged at any stage of the project. However under unavoidable conditions if any of the trees are required to be cut/felled, then prior permission as per existing procedure from Forest, 	Contractor/Line Department/DLCC	Agriculture, Fishery and Piggery.

Sl. No	Project Activity	Potential Impact	Mitigation Measures	Responsible for Implementation	Applicable sectors
			<p>ensuring appropriate compensation including compensatory plantation as stipulated by the forest department shall be undertaken.</p> <ul style="list-style-type: none"> Avoid earthworks/breaking of land during monsoon season. 		
33.	Water Requirement	<ul style="list-style-type: none"> Exploitation of the water bodies. (both ground water and surface water) 	<ul style="list-style-type: none"> The required water will be sourced from the PWD/ PHE. In absence of the water supply, permission is required from the Central Ground Water Authority (CGWA) to abstract ground water. Permission to abstract ground water through any energized means i.e. for digging / installation of a bore well water connection in the site for drinking water, in a notified / non notified area for household/ industrial / infrastructure projects as per guidelines dated 15/11/2012 under Environmental Protection Act (EPA) (1986). 	Contractor/Line Department/DLCC	Agriculture, Fishery and Piggery.
34.	Drainage management	<ul style="list-style-type: none"> Drainage congestion due to garbage/waste dumping Water logging. Vector proliferation 	<ul style="list-style-type: none"> As per the topography of the project site, appropriate sediment control measures should be designed and implemented prior to commencement of construction. Design adequate drainage passage by following natural path Fill ditches/water logging in building premises. Discharge drainage flow with proper downstream protection. Silt Trap shall be provided to prevent sediment runoff from the construction zone from entering and adversely affecting the natural drainages or areas of native vegetation downstream from the construction zone 	Contractor/Line Department/DLCC	Agriculture, Fishery and Piggery.
B.	Construction Phase				
35.	Construction material requirement	Change in topography, land clearing etc.,	<ul style="list-style-type: none"> It is advised to procure construction materials from the authorised vendor. 	Contractor/Line Department/DLCC	Agriculture, Fishery and Piggery.

Sl. No	Project Activity	Potential Impact	Mitigation Measures	Responsible for Implementation	Applicable sectors
36.	Slope stability	Landslide or gully erosion on slopes that may threaten market infrastructure.	<ul style="list-style-type: none"> Keeping in mind the fragile natural environment and site specific geological conditions Avoid or maintain adequate distance from erosion prone areas Adopt right angle of cut on slopes Stabilize slopes by engineering designs Measures taken to avoid undercutting of hill toes that may cause slides Do not exert excess load on slopes by disposing spoil 	Contractor/Line Department/DLCC	Agriculture, Fishery and Piggery.
37.	Erosion and sediment	Loss of soil, water pollution	<ul style="list-style-type: none"> Temporary erosion and sediment controls like having vegetation, surface covering etc., shall be installed prior to the commencement of any works with the potential to cause soil erosion, including stockpiling of construction materials Wherever possible during the course of the works, exposed soil areas shall be progressively stabilized or protected by an appropriate method to minimize erosion potential. 4 cubic feet of Topsoil in the construction area shall be stripped and stockpiled later for re-spreading on all exposed areas when final shaping has been completed. Fill material shall not be placed around or pushed up against the base of the trees and shrubs that needs to be retained within the construction site. Ground filling shall be sufficiently compacted to minimize erosion potential. All exposed soil areas shall be stabilized and re-vegetated as soon as possible on completion of works to prevent potential erosion 	Contractor/Line Department/DLCC	Agriculture, Fishery and Piggery.
38.	Spoil Management	<ul style="list-style-type: none"> Drainage blockage causing localized ponding and/or 	<ul style="list-style-type: none"> Minimize spoil disposal by balancing cut and fill wherever possible 	Contractor/Line Department/DLCC	Agriculture, Fishery and

Sl. No	Project Activity	Potential Impact	Mitigation Measures	Responsible for Implementation	Applicable sectors
		slush/muddy runoff. <ul style="list-style-type: none"> Spoil tipped over slope may cause slide 	<ul style="list-style-type: none"> Manage spoil to reclaim land with proper landscaping and vegetation Do not dispose spoil on drainage path 		Piggery.
39.	Water Pollution	<ul style="list-style-type: none"> Impact on existing water resources Contamination of ground water and other water bodies. Impact on drinking water sources. 	<ul style="list-style-type: none"> Domestic effluent/Sewage generated from the construction/ labour camp shall be discharged into soak pits. Total prohibition on direct discharge of sewage/sullage/solid waste into drains, open spaces, water bodies to ensure downstream settlement are not affected at any cost. Awareness session on handling and storage of materials and waste management to be conducted for the construction workers. Water quality monitoring should be performed for the parameters including pH, BOD, COD, DO coliform count, total suspended solids, total dissolved solids, Iron, etc. 	Contractor/Line Department/DLCC	Agriculture, Fishery and Piggery.
40.	Transportation and storage of construction materials	<ul style="list-style-type: none"> Nuisance to the general public Fugitive emissions 	<ul style="list-style-type: none"> The vehicles carrying the materials should be covered and secured to prevent loss or re-suspension of materials during travel. Construction materials should be stored in covered areas to ensure protection of surrounding areas from dust and emissions Diesel and other lubricant oil shall be stored in a covered area provided with hard surface / paved surface to prevent soil pollution. Any transportation of materials on local roads shall be done during day time. All vehicle movements or other construction activities shall be restricted to the delineated construction zone, the existing road network or previously disturbed areas. Construction vehicles, personnel and machinery shall not 	Contractor/Line Department/DLCC	Agriculture, Fishery and Piggery.

Sl. No	Project Activity	Potential Impact	Mitigation Measures	Responsible for Implementation	Applicable sectors
			<p>enter fenced off areas or areas beyond the delineated construction zone</p> <ul style="list-style-type: none"> • Appropriate signage should be given to the designated areas (storage/ restriction of entries/toilets/ laboratory etc.,) in the construction camp 		
41.	Air and noise pollution and fugitive emissions	<ul style="list-style-type: none"> • Dust nuisance from construction works. • Dust and noise generated by vehicles passing. • Loud noise during construction. • Gaseous Emissions. 	<ul style="list-style-type: none"> • Wherever feasible, dust generating type of work shall be done during off time. • Labourers' use of masks and safety gears • Water needs to be sprinkled on work areas • Vehicles transporting construction materials to site must be covered to prevent dust pollution • Cover fine grain construction materials with tarpaulin or sheets. • Cover construction debris and waste prior to disposal. • Newly exposed surface areas shall be mulched and replanted as soon as possible in order to reduce the potential for erosion and suppress dust • All vehicles, construction machineries and equipment should possess Pollution Under Control Certificates (PUC's). • With respect to NAAQS, air quality monitoring should be carried out for the key parameters: <ul style="list-style-type: none"> ✓ Sulphur Dioxide(SO₂) ✓ Oxides of Nitrogen (NO_x) ✓ Carbon Monoxide (CO) ✓ Particulate matter (PM₁₀& PM_{2.5}). • Noise generation should be monitored with respect to Ambient Noise Quality standards. 	Contractor/Line Department/DLCC	Agriculture, Fishery and Piggery.
42.	Hunting and Poaching activities by construction workers	Threat to wild animals/ fauna	<ul style="list-style-type: none"> • Construction workers should not be involved in any hunting, poaching or fishing activities and should not disturb any natural resources, plants and animals 	Contractor/Line Department/DLCC	Agriculture, Fishery and Piggery.

Sl. No	Project Activity	Potential Impact	Mitigation Measures	Responsible for Implementation	Applicable sectors
			(Including avifauna).		
43.	Waste management and minimization	Impacts on land, water and visual impacts showing poor housekeeping practices.	<ul style="list-style-type: none"> Recycled materials shall be used to the limits of design. Any construction waste generated from the construction site shall be contained within the boundary of the site and removed at regular intervals to an appropriate waste disposal or recycling facility. The Municipal Solid Waste (MSW) generated in the construction and labour camp shall be separated as organic and inorganic wastes. The worksite shall be left in a tidy and rubbish free state upon completion of the works There should be no burning of waste. 	Contractor/Line Department/DLCC	Agriculture, Fishery and Piggery.
44.	Occupational Health and Safety	<ul style="list-style-type: none"> Lack of safety tools Lack of safe construction practices. Accidents occurring on site Site and task specific hazards 	<ul style="list-style-type: none"> Provide safety gears to workers working in hazardous areas and provide training in the use of these safety gears and compulsory use of PPE's as per as per EHS (IFC, World Bank Group): <ul style="list-style-type: none"> ✓ Safety Glasses with side-shields, ✓ Plastic Helmets with top and side impact protection. ✓ Hearing protectors (ear plugs or ear muffs), ✓ Safety shoes and boots for protection against moving & falling objects, liquids and chemicals, ✓ Gloves made of rubber or synthetic materials (Neoprene), leather, steel, insulating materials, etc. ✓ Facemasks with appropriate filters for dust removal and air purification (chemicals, mists, vapours and gases). Single or multi-gas personal monitors, if available, ✓ Portable or supplied air (fixed lines). On-site rescue equipment, ✓ Insulating clothing, body suits, aprons etc. of appropriate materials. Keep first aid box ready at work areas and camps Provide adequate space with ventilation, clean toilets/ bio toilets (separate for Ladies and Gents), solid waste 	Contractor/Line Department/DLCC	Agriculture, Fishery and Piggery.

Sl. No	Project Activity	Potential Impact	Mitigation Measures	Responsible for Implementation	Applicable sectors
			<p>management, light.</p> <ul style="list-style-type: none"> • Provide mosquito nets at labour camps • Separate covered / walled toilet rooms (including bathing platforms) shall be provided for male and female labours. • Keep camp and work area clean and without water logging • Fire fighting equipment like fire extinguishers will be provided in the camp as per fire safety standards. • Displays prominently telephone/contact number of nearest ambulance service, health units. • Provision of safe drinking water with respect to IS 10500:2012. 		
45.	Cooking and heating with firewood by construction workers.	Felling of trees	<ul style="list-style-type: none"> • Contractor shall supply kerosene or LPG at camps and restrict cooking and heating using firewood. 	Contractor/Line Department/DLCC	Agriculture, Fishery and Piggery.
46.	Influx of migrant Workers	<ul style="list-style-type: none"> • Health and safety risks • Chances of spread of sexually transmittable diseases like AIDS 	<ul style="list-style-type: none"> • Local labourer's to be given preference for job opportunities and each contractor should be bound by this commitment • Ensure labour-related regulations are met • In case of hiring neighbouring village/ other state labour, ensure that their working conditions as well as camps meet local regulations. 	Contractor/Line Department/DLCC	Agriculture, Fishery and Piggery.
C.	Post Construction/ Operation phase				
47.	Increased in vehicles and machineries	<ul style="list-style-type: none"> • Increase in surface runoff from soil compaction • Generation of noise • Increased emission of GHG's to the ambient air 	<ul style="list-style-type: none"> • Use of techniques to minimize compaction of soil, such as restricting access during wet conditions, and using protective boarding and low ground pressure machinery • Setting the route and timing of goods carrying vehicles so as to avoid residential areas or other sensitive human receptors (e.g. schools, hospitals). • Vehicles used for any transportation purposes should be 	Contractor/Line Department/DLCC	Agriculture, Fishery and Piggery.

Sl. No	Project Activity	Potential Impact	Mitigation Measures	Responsible for Implementation	Applicable sectors
			of BS-IV emission standards.		
		Increased risk of accidents	<ul style="list-style-type: none"> Accessibility and road system conditions must be assessed during feasibility study, selecting the best routes to reduce impact and risk of accidents. 	Contractor/Line Department/DLCC	Agriculture, Fishery and Piggery.
48.	Increase in crowds with in the market area.	<ul style="list-style-type: none"> Impact on community events and natural environment. Unlawful practices like drinking, smoking etc. within the market area. 	<ul style="list-style-type: none"> Control crowds with clear signposting and barrier management to minimize impacts on the community and natural environment. Installation of no-smoking, drinking signboards within the market area. 	Contractor/Line Department/DLCC	Agriculture, Fishery and Piggery.
49.	Waste disposal	<ul style="list-style-type: none"> Contamination of soil from toxic or hazardous waste materials Decrease in water quality from sudden releases or gradual seepage of leachate into nearby water courses Generation of foul and odour. 	<ul style="list-style-type: none"> The waste generated should be stored in a designated place having impervious layer to prevent leachate. Separation of biodegradable and non-biodegradable wastes and options for recover, reuse and recycle shall be explored. The waste shall be disposed in the designated location as identified by the local panchayat / municipalities. Installation of dustbins for both biodegradable and non-biodegradable wastes within the market area. 	Contractor/Line Department/DLCC	Agriculture, Fishery and Piggery.
50.	Use of Lavatory (Toilets)	<ul style="list-style-type: none"> Contamination of excrement with the local water bodies and soil. Generation of odour. 	<ul style="list-style-type: none"> Maintenance of the lavatory septic tank and should be cleaned after a certain interval of time according to its capacity and disposal of the waste in recognized area as referred by the Gram Panchayat or Municipalities. Proper cleaning and maintenance of the lavatory. 	Contractor/Line Department/DLCC	Agriculture, Fishery and Piggery.
51.	Use of Power	Over consumption of power.	<ul style="list-style-type: none"> Use of Energy Efficient low loss – electrical ballast. Solar lighting is considered partly for external lighting. Use of energy efficient devices such as CFL and T5 bulbs instead of incandescent bulb. Installation of solar water heater. 	Contractor/Line Department/DLCC	Agriculture, Fishery and Piggery.

Sl. No	Project Activity	Potential Impact	Mitigation Measures	Responsible for Implementation	Applicable sectors
52.	Use of water	Exploitation of ground water resources.	<ul style="list-style-type: none"> Rain water harvesting units should be installed in suitable locations around the market vicinity. Minimize water consumption with water-efficient features in buildings and collecting rainwater for cleaning purposes. 	Contractor/Line Department/DLCC	Agriculture, Fishery and Piggery.
53.	Selling and buying of products	More use of polythene carry bags, packaging materials. More use of paper.	<ul style="list-style-type: none"> Involve the public in green marketing strategy through interactive social media updates and polls. Minimize paper consumption by enabling smart phone ticketing and viewing of event schedules and maps. Use recycled paper for all necessary printing and packaging purposes. 	Contractor/Line Department/DLCC	Agriculture, Fishery and Piggery.
54.	Accidents like, short circuit, fire, earthquake, flood etc.	<ul style="list-style-type: none"> Potential risk to the people, and loss of the goods/value added products. 	<ul style="list-style-type: none"> The building design must consist of fire detection systems, fire storage tanks, a specialized pumping system and a large network of pipes ending in either hydrants or sprinklers. Training for prevention, and control should be provided to the staff in case of emergencies. 	Contractor/Line Department/DLCC	Agriculture, Fishery and Piggery.
55.	Establishment of private shops and canteen nearby the market area.	<ul style="list-style-type: none"> Generation of waste. More use of packaged food and food products. 	<ul style="list-style-type: none"> Insist upon minimal and recyclable food and beverage packaging Use of reusable water bottles and installation of water fountains at necessary points within the market area to cut down on plastic bottle waste. Insist food vendors/ caterers to promote healthy, local, seasonal food and to minimize unrecyclable packaging. 	Contractor/Line Department/DLCC	Agriculture, Fishery and Piggery.

Annexure 11c-1: SUB-COMPONENT:B.2.3: COMMON SERVICE CENTRE DEVELOPMENT (INCLUDING FLAKE ICE MANUFACTURING UNIT& COLD STORAGE)

ENVIRONMENTAL IMPACT AND MITIGATION MEASURE

Sl. No	Project Activity	Potential Impact	Mitigation Measures	Responsible for Implementation	Applicable sectors
A. Pre-Construction Stage					
56.	Approvals/NOC Licences and Permits/ Insurance.	As per legal prevailing legal requirements	<ul style="list-style-type: none"> All necessary approvals, permits and licences required by the state and local legislation shall be obtained prior to commencing of the construction activity. All approvals, permits and licences shall be maintained and up dated before expiry, and complied with during the construction period. Should there be any changes to the project which would require additional permits or licences, these shall be obtained The contractor shall maintain Pollution Under Control (PUC's) Certificates for the construction vehicles and machineries used for this project. Contractors shall insure all workers covered under the group insurance or any other suitable insurance schemes against all forms of injuries sustained at the workplace. 	Line Department/ DLCC/Contractor.	Agriculture, Fishery, Piggery and Handloom & Textiles
57.	Land Requirement	<ul style="list-style-type: none"> Loss of land Socio economic Impacts 	<ul style="list-style-type: none"> No additional land will be required, as the construction will be carried out at in the government land. 	Line Department/ DLCC/Contractor.	Agriculture, Fishery, Piggery and Handloom & Textiles
58.	Clearing of trees/Removal of vegetation	<ul style="list-style-type: none"> Loss of trees and vegetation Soil erosion and surface runoff 	<ul style="list-style-type: none"> All reasonable measures shall be undertaken to ensure that no native fauna is harmed or placed at risk during the course of the clearing activities Felling of trees is not envisaged at any stage of the project. However under unavoidable conditions if any of the trees are required to be cut/felled, then prior permission as per existing 	Line Department/ DLCC/Contractor.	Agriculture, Fishery, Piggery and Handloom & Textiles

Sl. No	Project Activity	Potential Impact	Mitigation Measures	Responsible for Implementation	Applicable sectors
			<p>procedure from Forest, ensuring appropriate compensation including compensatory plantation as stipulated by the forest department shall be undertaken.</p> <ul style="list-style-type: none"> Avoid earthworks/breaking of land during monsoon season. 		
59.	Water Requirement	<ul style="list-style-type: none"> Exploitation of the water bodies. (both ground water and surface water) 	<ul style="list-style-type: none"> The required water will be sourced from the PWD/ PHE. In absence of the water supply, permission is required from the Central Ground Water Authority (CGWA) to abstract ground water. Permission to abstract ground water through any energized means i.e. for digging / installation of a bore well water connection in the site for drinking water, in a notified / non notified area for household/ industrial / infrastructure projects as per guidelines dated 15/11/2012 under Environmental Protection Act (EPA) (1986). 	Line Department/ DLCC/Contractor.	Agriculture, Fishery, Piggery and Handloom & Textiles
60.	Drainage management	<ul style="list-style-type: none"> Drainage congestion due to garbage/waste dumping Water logging. Vector proliferation 	<ul style="list-style-type: none"> As per the topography of the project site, appropriate sediment control measures should be designed and implemented prior to commencement of construction. Design adequate drainage passage by following natural path Fill ditches/water logging areas in the buliding premises. Discharge drainage flow with proper downstream protection. Silt Trap shall be provided to prevent sediment runoff from the construction zone from entering and adversely affecting the natural drainages or areas of native vegetation downstream from the construction zone 	Line Department/ DLCC/Contractor.	Agriculture, Fishery, Piggery and Handloom & Textiles
B.	Construction Phase				
61.	Construction material requirement	Change in topography, land clearing etc.,	<ul style="list-style-type: none"> It is advised to procure construction materials from the authorised vendor. 	Line Department/ DLCC/Contractor.	Agriculture, Fishery, Piggery and Handloom & Textiles
62.	Slope stability	Landslide or gully erosion on slopes that may threaten infrastructure.	<ul style="list-style-type: none"> keeping in mind the fragile natural environment and site specific geological conditions 	Line Department/ DLCC/Contractor.	Agriculture, Fishery, Piggery and

Sl. No	Project Activity	Potential Impact	Mitigation Measures	Responsible for Implementation	Applicable sectors
			<ul style="list-style-type: none"> • Avoid or maintain adequate distance from erosion prone areas • Adopt right angle of cut on slopes • Stabilize slopes by measures • Measures taken to avoid undercutting of hill toes that may cause slides • Do not exert excess load on slopes by disposing spoil 		Handloom & Textiles
63.	Erosion and sediment	Loss of soil, water pollution	<ul style="list-style-type: none"> • Temporary erosion and sediment controls like having vegetation, surface covering etc., shall be installed prior to the commencement of any works with the potential to cause soil erosion, including stockpiling of construction materials • Wherever possible during the course of the works, exposed soil areas shall be progressively stabilized or protected by an appropriate method to minimize erosion potential. • 4 cubic feet of Topsoil in the construction area shall be stripped and stockpiled later for re-spreading on all exposed areas when final shaping has been completed. • Fill material shall not be placed around or pushed up against the base of the trees and shrubs that needs to be retained within the construction site. • Ground filling shall be sufficiently compacted to minimize erosion potential. • All exposed soil areas shall be stabilized and re-vegetated as soon as possible on completion of works to prevent potential erosion. 	Line Department/ DLCC/Contractor.	Agriculture, Fishery, Piggery and Handloom & Textiles
64.	Spoil Management	<ul style="list-style-type: none"> • Drainage blockage causing localized ponding and/or slush/muddy runoff. • Spoil tipped over slope may cause slide 	<ul style="list-style-type: none"> • Minimize spoil disposal by balancing cut and fill wherever possible • Manage spoil to reclaim land with proper landscaping and vegetation • Do not dispose spoil on drainage path 	Line Department/ DLCC/Contractor.	Agriculture, Fishery, Piggery and Handloom & Textiles

Sl. No	Project Activity	Potential Impact	Mitigation Measures	Responsible for Implementation	Applicable sectors
65.	Water Pollution	<ul style="list-style-type: none"> Impact on existing water resources Contamination of ground water and other water bodies. Impact on drinking water sources. 	<ul style="list-style-type: none"> Domestic effluent/Sewage shall be discharged into soak pits. Total prohibition on direct discharge of sewage/sullage/solid waste into drains, open spaces, water bodies to ensure downstream settlement are not affected at any cost. Assess capacity and structural integrity of existing septic tanks. Take appropriate measures for augmentation of septic as per additional sewage generation. Awareness session on handling and storage of materials and waste management to be conducted for the construction workers. Water quality monitoring should be performed for the parameters including pH, BOD, COD, DO coliform count, total suspended solids, total dissolved solids, Iron, etc. 	Line Department/ DLCC/Contractor.	Agriculture, Fishery, Piggery and Handloom & Textiles
66.	Transportation and storage of construction materials	<ul style="list-style-type: none"> Nuisance to the general public Fugitive emissions 	<ul style="list-style-type: none"> The vehicles carrying the materials should be covered and secured to prevent loss or re-suspension of materials during travel. Construction materials should be stored in covered areas to ensure protection of surrounding areas from dust and emissions Diesel and other lubricant oil shall be stored in a covered area provided with hard surface / paved surface to prevent soil pollution. Any transportation of materials on local roads shall be done during day time. All vehicle movements or other construction activities shall be restricted to the delineated construction zone, the existing road network or previously disturbed areas. Construction vehicles, personnel and machinery shall not enter fenced off areas or areas beyond the delineated construction zone Appropriate signage should be given to the designated areas 	Line Department/ DLCC/Contractor.	Agriculture, Fishery, Piggery and Handloom & Textiles

Sl. No	Project Activity	Potential Impact	Mitigation Measures	Responsible for Implementation	Applicable sectors
			(storage/ restriction of entries/ toilets etc.,) in the construction camp		
67.	Air and noise pollution and fugitive emissions	<ul style="list-style-type: none"> Dust nuisance from construction works. Dust and noise generated by vehicles passing. Loud noise during construction. Gaseous Emissions. 	<ul style="list-style-type: none"> Labourers' use of masks and safety gears Water needs to be sprinkled on work areas Vehicles transporting construction materials to site must be covered to prevent dust pollution Cover fine grain construction materials with tarpaulin or sheets. Cover construction debris and waste prior to disposal. Newly exposed surface areas shall be mulched and replanted as soon as possible in order to reduce the potential for erosion and suppress dust All vehicles, construction machineries and equipment should possess Pollution Under Control Certificates (PUC's). With respect to NAAQS, air quality monitoring should be carried out for the key parameters: <ul style="list-style-type: none"> ✓ Sulphur Dioxide(SO₂) ✓ Oxides of Nitrogen (NO_x) ✓ Carbon Monoxide (CO) ✓ Particulate matter (PM₁₀& PM_{2.5}). Noise generation should be monitored with respect to Ambient Noise Quality standards. 	Line Department/ DLCC/Contractor.	Agriculture, Fishery, Piggery and Handloom & Textiles
68.	Hunting and Poaching activities by construction workers	Threat to wild animals/ fauna	<ul style="list-style-type: none"> Construction workers should not be involved in any hunting, poaching or fishing activities and should not disturb any natural resources, plants and animals (Including avifauna). 	Line Department/ DLCC/Contractor.	Agriculture, Fishery, Piggery and Handloom & Textiles
69.	Waste management and minimization	Impacts on land and water	<ul style="list-style-type: none"> Recycled materials shall be used to the extent possible. Any construction waste generated from the construction site shall be contained within the boundary of the site and removed at regular intervals to an appropriate waste disposal or recycling facility. 	Line Department/ DLCC/Contractor.	Agriculture, Fishery, Piggery and Handloom & Textiles

Sl. No	Project Activity	Potential Impact	Mitigation Measures	Responsible for Implementation	Applicable sectors
			<ul style="list-style-type: none"> The Municipal Solid Waste (MSW) generated in the construction and labour camp shall be separated as organic and inorganic wastes. The worksite shall be left in a tidy and rubbish free state upon completion of the works There should be no burning of waste. 		
70.	Occupational Health and Safety	<ul style="list-style-type: none"> Lack of safety tools Lack of safe construction practices. Accidents occurring on site Site and task specific hazard 	<ul style="list-style-type: none"> Provide safety gears to workers working in hazardous areas and provide training in the use of these safety gears and compulsory use of PPE's as per as per EHS (IFC, World Bank Group) [Refer Sl.no. 32]. Keep first aid box ready at work areas and camps Provide adequate space with ventilation, clean toilets/ bio toilets (separate for Ladies and Gents), solid waste management, light. Provide mosquito nets at labour camps Separate covered / walled toilet rooms (including bathing platforms) shall be provided for male and female labours. Keep camp and work area clean and without water logging Fire fighting equipment like fire extinguishers will be provided in the camp as per fire safety standards. Displays prominently telephone/contact number of nearest ambulance service, health units. Provision of safe drinking water with respect to IS 10500:2012. 	Line Department/ DLCC/Contractor.	Agriculture, Fishery, Piggery and Handloom & Textiles
71.	Use of wood as construction materials	Felling of trees	<ul style="list-style-type: none"> Minimize use of wood for construction Use local materials as much as possible 	Line Department/ DLCC/Contractor.	Agriculture, Fishery, Piggery and Handloom & Textiles
72.	Cooking and heating with firewood by construction workers.	Felling of trees	<ul style="list-style-type: none"> Contractor shall supply kerosene or LPG at camps and restrict cooking and heating using firewood. 	Line Department/ DLCC/Contractor.	Agriculture, Fishery, Piggery and

Sl. No	Project Activity	Potential Impact	Mitigation Measures	Responsible for Implementation	Applicable sectors
					Handloom & Textiles
73.	Influx of migrant Workers	<ul style="list-style-type: none"> Health and safety risks Chances of spread of sexually transmittable diseases like AIDS 	<ul style="list-style-type: none"> Local labourer's to be given preference for job opportunities and each contractor should be bound by this commitment Ensure labour-related regulations are met In case of hiring labour from neighbouring villages or other states, ensure that their working conditions as well as camps meet local regulations. 	Line Department/ DLCC/Contractor.	Agriculture, Fishery, Piggery and Handloom & Textiles
C. Post Construction/ Operation phase of CSC					
74.	Grading and Sorting of agricultural products.	<ul style="list-style-type: none"> Generation of wastes 	<ul style="list-style-type: none"> Separation of biodegradable and non-biodegradable wastes and options for recover, reuse and recycle shall be explored. Wastes like, leaves, roots and other biodegradable wastes can be used as feed cattle. The waste shall be disposed in the designated location as identified by the local panchayat / municipalities. 	Line Department/ DLCC/Contractor.	Agriculture
75.	Cleaning of products	<ul style="list-style-type: none"> Exploitation of water resources. Generation of liquid waste. 	<ul style="list-style-type: none"> Reusing the water used for various purposes in the CSC to the possible extent. Rain water harvesting units should be installed in suitable locations around the CSC vicinity. Safe disposal of waste water through adequate drainage to designated location as identified by the local panchayat / municipalities. 	Line Department/ DLCC/Contractor.	Agriculture
76.	Threshing/ Winnowing	<ul style="list-style-type: none"> Generation of Dust. Health hazard to the farmers. 	<ul style="list-style-type: none"> Threshing and winnowing activities should be carried out in house, provided with roof turbine air ventilators. Use of PPE's as per as per EHS (IFC, World Bank Group) [Refer Sl.no. 32], by the farmersinvolved in these activities. 	Line Department/ DLCC/Contractor.	Agriculture
77.	Storage of vaccines, Feeds, Semen.	<ul style="list-style-type: none"> Contamination and spoilage of the stored materials. 	<ul style="list-style-type: none"> Separate storage facilities should be designed at the planning stage. Vaccines and semen should be stored in temperature controlled unit like refrigerator. 	Line Department/ DLCC/Contractor.	Piggery

Sl. No	Project Activity	Potential Impact	Mitigation Measures	Responsible for Implementation	Applicable sectors
78.	Swine slaughter	<ul style="list-style-type: none"> Cruelty to animals 	<ul style="list-style-type: none"> Maintenance of the slaughter house and Slaughter of swine as per the provisions of <i>Prevention of Cruelty to Animals (Slaughter House) Rules, 2001</i>. 	Contractor/Line Department/DLCC	Piggery
79.	Storage of feeds, chemicals, pesticides, fertilizers etc.	<ul style="list-style-type: none"> Contamination and spoilage of the stored materials 	<ul style="list-style-type: none"> Separate storage facilities should be designed at the planning stage. Proper training should be provided to the farmers for storing and handling of the feeds, chemicals, pesticides, fertilizers etc. 	Line Department/DLCC/Contractor.	Fishery
80.	Use of machineries	<ul style="list-style-type: none"> Generation of noise Occupational health hazard Mishandling and health hazard to the farmers operating the CSC. 	<ul style="list-style-type: none"> The machineries should be operated in house. Separate in-house area should be provided for installation of the machines at the planning phase. Proper training should be provided to the farmers for the use and handling of machineries and equipment. Use of PPE's as per as per EHS (IFC, World Bank Group) [Refer Sl.no. 32], by the farmersinvolved in these activities. 	Line Department/DLCC/Contractor.	Agriculture, Handloom & Textiles
81.	Packaging of products	<ul style="list-style-type: none"> Use of non-biodegradable packing materials. 	<ul style="list-style-type: none"> Use of environmental friendly packing materials. 	Line Department/DLCC/Contractor.	Agriculture, Handloom & Textiles
82.	Increased in vehicles use for transportation of goods and products.	<ul style="list-style-type: none"> Generation of noise. Increased emission of GHG's to the ambient air. Increased risk of accidents. 	<ul style="list-style-type: none"> Setting the route and timing of goods carrying vehicles so as to avoid residential areas or other sensitive human receptors (e.g. schools, hospitals). Vehicles used for any transportation purposes should be of BS-IV emission standards. Accessibility and road system conditions must be assessed during feasibility study, selecting the best routes to reduce impact and risk of accidents. 	Line Department/DLCC/Contractor.	Agriculture, Handloom & Textiles, Piggery, Fishery
83.	Use of Power	Over consumption of power used in various operations of the CSC.	<ul style="list-style-type: none"> Use of Energy Efficient low loss – electrical ballast. Solar lighting is considered partly for external lighting. Use of energy efficient devices such as CFL and T5 bulbs instead of incandescent bulb. 	Line Department/DLCC/Contractor.	Agriculture, Handloom & Textiles, Piggery, Fishery
84.	Use of water	Exploitation of ground water	<ul style="list-style-type: none"> Reusing the water used for various purposes in the CSC to the 	Line Department/	

Sl. No	Project Activity	Potential Impact	Mitigation Measures	Responsible for Implementation	Applicable sectors
		resources.	possible extent.	DLCC/Contractor.	
85.	Use of Lavatory (Toilets)	<ul style="list-style-type: none"> Contamination of excrement with the local water bodies and soil. Generation of odour. 	<ul style="list-style-type: none"> Maintenance of the lavatory septic tank and should be cleaned after a certain interval of time according to its capacity and disposal of the waste in recognized area as referred by the Gram Panchayat or Municipalities. Proper cleaning and maintenance of the lavatory. 	Line Department/ DLCC/Contractor.	Agriculture, Handloom & Textiles, Piggery, Fishery
86.	Waste disposal	<ul style="list-style-type: none"> Contamination of soil from toxic or hazardous waste materials Decrease in water quality from sudden releases or gradual seepage of leachate into nearby water courses Generation of foul and odour. 	<ul style="list-style-type: none"> The waste generated should be stored in a designated place having impervious layer to prevent leachate. Separation of biodegradable and non-biodegradable wastes and options for recover, reuse and recycle shall be explored. The waste shall be disposed in the designated location as identified by the local panchayat / municipalities. 	Line Department/ DLCC/Contractor.	Agriculture, Handloom & Textiles, Piggery, Fishery
87.	Handling of the stored items and maintenance of the CSC.	Occupational health hazards.	<ul style="list-style-type: none"> Use of Personal Protective Equipment, as per EHS (IFC, World Bank Group): <ul style="list-style-type: none"> ✓ Safety Glasses with side-shields, ✓ Plastic Helmets with top and side impact protection. ✓ Hearing protectors (ear plugs or ear muffs), ✓ Safety shoes and boots for protection against moving & falling objects, liquids and chemicals, ✓ Gloves made of rubber or synthetic materials (Neoprene), leather, steel, insulating materials, etc. ✓ Facemasks with appropriate filters for dust removal and air purification (chemicals, mists, vapours and gases). Single or multi-gas personal monitors, if available, ✓ Portable or supplied air (fixed lines). On-site rescue equipment, ✓ Insulating clothing, body suits, aprons etc. of appropriate materials. First aid kits, flashlights, fire extinguishers and other fire-fighting equipment should be provided both inside and outside 	Line Department/ DLCC/Contractor.	Agriculture, Handloom & Textiles, Piggery, Fishery

Sl. No	Project Activity	Potential Impact	Mitigation Measures	Responsible for Implementation	Applicable sectors
			the CSC. • Establishment of Do's and Don'ts chart in local language. • Training should be given to the employees handling CSC operations. • Provision of quarterly health check-up.		
D. Post Construction/ Operation phase of Flake ice manufacturing unit					
88.	Installation of Flake ice manufacturing unit for Fishery.	Exploitation of ground water resources.	• Reuse of the water to the possible extent.	Line Department/ DLCC/Contractor.	Fishery
		Emission of GHGs.	• Proper monitoring of the ambient air quality. • Use of low carbon and other modern low GHG emitting technologies. • Limitation in operation period to the possible extent.	Line Department/ DLCC/Contractor.	Fishery
		High energy consumption,	• Use of Energy Efficient low loss – electrical ballast. • Solar lighting is considered partly for external lighting. • Use of energy efficient devices such as CFL and T5 bulbs instead of incandescent bulb.	Line Department/ DLCC/Contractor.	Fishery
		Generation of Wastes.	• The waste shall be disposed in the designated location as identified by the local panchayat / municipalities.	Line Department/ DLCC/Contractor.	Fishery
		Occupational health hazards	• Proper training should be provided to the operating staffs. • Use of PPE's as per EHS (<i>IFC, World Bank Group</i>). [Refer Sl No. 32] • Cleaning and washing should be carried out regularly.	Line Department/ DLCC/Contractor.	Fishery
E. Post Construction/ Operation phase of Cold Storage& BMC					
89.	Use of Power	Over consumption of power used in operations of the BMC.	• Installation of renewable energy sources wherever possible, like solar energy etc. • Use of energy efficient electrical appliances.	Line Department/ DLCC/Contractor.	Dairy
90.	Use of water	Exploitation of ground water resources.	• Reusing the water used to the possible extent.	Line Department/ DLCC/Contractor.	Dairy

SI. No	Project Activity	Potential Impact	Mitigation Measures	Responsible for Implementation	Applicable sectors
91.	Disposal of wastes	Leachate, Ground and surface water contamination, degradation of soil quality and generation of odour.	<ul style="list-style-type: none"> • Installation of small scale effluent treatment plant. • Proper disposal (both solid and liquid) and identification of disposal sites. 	Line Department/ DLCC/Contractor.	Dairy
92.	Emission of GHGs	Degradation of ambient air quality	<ul style="list-style-type: none"> • Proper monitoring of the ambient air quality. • Use of low carbon and other modern low GHG emitting technologies. • Limitation in operation period to the possible extent. 	Line Department/ DLCC/Contractor.	Dairy
93.	Operation of the Cold storage	Occupational health hazards	<ul style="list-style-type: none"> • Proper training should be provided to the famers. • Use of PPE's like Apron, Gloves, Goggles, Masks, Boots. 	Line Department/ DLCC/Contractor.	Dairy

ANNEXURE 11c-2: ENVIRONMENTAL MANAGEMENT MEASURES FOR AGRO - COMMODITIES**1. Paddy**

Rice occupies the majority of the crop yield in the state, amounting to two-third of the total crops in the state. There are 26 varieties of rice, which are suitable to grow under diverse eco-system (deep water, shallow water, irrigated and upland). Rice is traditionally-grown throughout the year viz. winter, autumn and summer seasons, with winter (kharif) rice as the main crop. The Lower Brahmaputra Valley Zone (LBVZ) contributes to the maximum production for rice in the state, whereas Hill Zone (HZ) contributes to lesser production.

Under APART, the project interventions for paddy shall include the productivity enhancement, value addition and development of market opportunity / infrastructure facility. Following **Table 1** illustrates the potential environmental issues with respect to paddy cultivation and value addition process.

Table 1: Potential Environmental risk and Management Measure due to project Intervention in Paddy

Interventions	Allied activities	Possible Risk	Management Measures
47. 1. Productivity Enhancement	Varietal Selection	Suitable variety of rice not being selected with respect to particular season and climatic zone	<ul style="list-style-type: none"> Selection of Suitable crop respect to area/season should be adopted. (Refer Annexure 13, for variety of rice recommended for particular season and climatic zone).
	Use of chemical fertilizer and pesticides	To enhance the productivity, overuse of fertilizer and other chemical problem may arise.	<ul style="list-style-type: none"> Selection of Suitable fertilizer after soil testing should be practiced. Use of bio-fertilizers (for eg. Azospirillum (200 ml/acre) as seed treatment shall be beneficial. Facilitation of awareness Training on IPMs to farmers for understanding the hazards of fertilizers and other alternative climate resilient methods. An Pest Management Plan (PMP) for the project has been enclosed (Annexure 12)
	Cultivation safety Measures	Use of chemicals in paddy field which is waterlogged may create GHG emission (N ₂ O)	<ul style="list-style-type: none"> Azolla is a good alternative of nitrogen fertilizer. It reduces the use of nitrogen fertilizer upto 50% therefore promotion among farmer to use more bio-fertilizer should be facilitated.
	Soil-Nutrients balance	Excessive use of chemical fertilizers leave residues in the soil which leads to salinity and alkalinity of the soil in turn affecting the soil structure	<ul style="list-style-type: none"> Adoption of Integrated Soil Fertility management using organic manures, bio-fertilizers. Crop rotation practice should be followed such as before sowing to paddy any crop related to legume family (pea, pulse, and lentil) should be cultivated so as to restore the nitrogen and other soil micronutrients.

Interventions	Allied activities	Possible Risk	Management Measures
			<ul style="list-style-type: none"> Adoption of Soil treatment measures such as Rhizobium inoculum mixed with soil shall be spread over the field. Organic manure such as cow dung, crop residue etc., should be used to keep the soil healthy.
	Crop rotation problem	Mono cropping of paddy may lead to depletion of certain kind of nutrients from the soil	<ul style="list-style-type: none"> Rice can be followed by short duration legumes such as Green gram, black gram to maintain the soil nutrient balance and overall production improvement.
	Irrigation	Demand for more irrigation facilities due to increase in production and farming	<ul style="list-style-type: none"> All Irrigation facilities should be done after obtaining legal consent with irrigation department. Promotion of more efficient methods of irrigation like drip irrigation etc.
48. 2. Infrastructure allied activities.	Storage	<ul style="list-style-type: none"> Inappropriate storage will lead to contact with moisture Pest menace from pests and rodents 	<ul style="list-style-type: none"> The storage area should be located in a clean, dry place and should be kept in tightly packed containers or containers with lids, covers. Food products should not be stored along with any products of chemical nature. Expired raw materials or raw materials stored for long periods (exceeding the shelf life) should not be used. Raw materials should be inspected at regular intervals and any spoiled materials should be safely discarded.
		Use of chemicals to control storage pests like cockroaches, rats etc. as they may contaminate the food.	<ul style="list-style-type: none"> Preference to use bio-pesticides like neem leaves, dry chillies etc. .
	Transportation	Transportation service is required to store, manage, and post-harvest care, marketing and further value addition in the product.	<ul style="list-style-type: none"> All material should be transported in fully covered trucks. Overloading of vehicles with materials should be avoided and shall be done in a manner to suit the trucks capacity. BS-IV vehicles with valid emission certificate should be used for transportation. Roads which are dedicated to be used for transportation or infrequently used shall have proper road signage's and breakers to prevent the accident in the road. Create awareness on proper transport system management.
49. 3. Processing, Grading, Value Addition	Registration, licenses and permissions	All processing units for seed production, value addition items and other machinery should hold valid licenses	<ul style="list-style-type: none"> Processing unit, seed production units and other equipment required for value addition purposes shall comply with legal requirements (Please refer chapter 2 for applicable legal requirements)
	Maintenance and	Irregular cleaning or maintenance will lead to contamination and improper functioning.	<ul style="list-style-type: none"> Regular upkeep should be followed as per the prescribed standards.

Interventions	Allied activities	Possible Risk	Management Measures
	upkeep of machinery	Possibility of accidents during handling machinery while Drying, milling etc.	<ul style="list-style-type: none"> Personnel should be well trained and first aid kit should be available.
	Use of additives, preservatives	In processing section, use of non-permitted additives and preservatives is illegal and pose health risks to the workers and consumers	<ul style="list-style-type: none"> Only the permitted additives and preservatives should be used in food items as per prescribed in FSSAI Act.
	Commercial Seedproduction	Inappropriate selection of species will lead to change in the pattern of biodiversity and may not be best fitted for climate.	<ul style="list-style-type: none"> More emphasis should be given to preserve the paddy seed and germplasm of indigenous species, which will be beneficial in long run and less resources would be required to upkeep and maintain.
	Rice Milling	<p>(i) Water pollution arising due to parboiling of rice</p> <p>(ii) Air pollution may arise due to dust arising from handling the products and milling processes.</p>	<ul style="list-style-type: none"> To control the pollution, proper drainage system should be followed to control the runoff and adapt recycling of waste water. A Regular inspection of storage tanks to minimize the risk of surface water pollution. Necessary care should be taken to ensure that milling area is separated from other areas of heavy operations and water related activities at the design stage itself. Floor and wall should be water proof to avoid moisture. Suitable ventilation should be provided to prevent dust pollution and reduce heat. Prevention of dust settling on machinery and in the building shall be ensured by timely cleaning operations.
	Packaging of Rice products	Use of indecomposable packaging material resulting in soil Pollution.	<ul style="list-style-type: none"> Bio degradedable ingredients and re-useable packaging should be promoted.
		Use of plastic bags with a thickness less than 20 microns for packaging due to their non-recyclable nature and potential negative impact on environment.	<ul style="list-style-type: none"> Use of newspapers wraps or cloth bags as packaging materials encouraging the consumers to bring cloth bags are some of the methods.
		Handling the food products with bare hands or un washed hands will contaminate the products through microbial attack.	<ul style="list-style-type: none"> Personnel involved in processing, packing etc. should wash hands with soap before and after work and use aprons, gloves, hair caps for handling, packing etc.
	Waste management	Disposal of decomposable wastes on open areas leads to contamination of surroundings through decomposition, attracting insects, leaving chemical residues etc.	<ul style="list-style-type: none"> Wastes should be properly disposed on the designated place only It should not be near to water bodies and dense settlement area. Alternate use of biodegradable food waste and the same shall be integrated it with bio compost formation and use it for

Interventions	Allied activities	Possible Risk	Management Measures
			agricultural farming practices.
	Power use	Energy is required for heating, boiling, grinding, extraction, drying, packaging etc.	<ul style="list-style-type: none"> • Energy efficient devices should be used. • Biomass or solar devices should be promoted to conserve energy. • Monitoring of Energy consumption regularly.
	Water Use	Water is required for cleaning, Washing, boiling etc. As the requirement is in large quantities this will have impact on local Water resources.	<ul style="list-style-type: none"> • Water efficient devices should be promoted. • Water intake and balance should be monitored regularly.
	Occupational health and Safety	<p>Fine dust during milling will lead to health issues like allergy, Asthma in long run.</p> <p>Problem of Noise problem</p>	<ul style="list-style-type: none"> • Person using these machines must wear masks as PPEs to prevent inhalation. • Noise protective equipment (PPEs) should be provided to the machine operators. • Ensure only experienced and well trained workers are used for the handling of machinery, equipment and material processing plants. • To maintain the safety of equipment as well as worker, Inspections should look for evidence of wear and tear, frays, missing parts and mechanical or electrical problems (Refer Annexure 15 for Food Safety). • Ensure an emergency aid service is in place in the work zone

Supporting Agency in Paddy Interventions under APART are:

1. Assam Rural Infrastructure And Agricultural Services (Arias) Society
2. Directorate of Agriculture, ASSAM,
3. Assam Agricultural University
4. District Agriculture Technology Management Agency (ATMA) Societies

2. Maize

Amongst the 33 districts of Assam, Darrang district contributes to the maximum cultivation area and highest production of maize, which is followed by KarbiAnglong district. It is a rainfed kharif crop and it is used as food and fodder in Assam. Maize (*Zea mays L*) is one of the most versatile emerging crops having wider adaptability under varied agro-climatic conditions. Maize industry creates opportunity for several other ancillary units in the region.

Therefore, executive governance acts as an exogenous influencer on maize value chain. Processed maize can be used as flour, flakes, semolina, and grits for bakery or food industry, also used as feed for poultry and livestock.

Under APART, the project intervention in term of **Maize** shall include the productivity enhancement, value addition and development of market opportunity / infrastructure facility. The following **Table 2** illustrates the potential environmental issues with respect to maizecultivation and value addition process.

Table 2: Potential Environmental risk and Management Measure due to project Intervention in Maize

Interventions	Allied activities	Possible Risk	Management Measures
50. 1. Productivity Enhancement	Varietal Selection	Suitable variety of Maize not being selected with respect to particular season and climatic zone	<ul style="list-style-type: none"> Selection of Suitable crop respect to area/season should be adopted. (Refer Annexure 13, for variety of maize recommended for particular season and climatic zone).
	Use of chemical fertilizer and pesticides	To enhance the productivity, overuse of fertilizer and other chemical problem may arise.	<ul style="list-style-type: none"> Selection of Suitable fertilizer after soil testing should be practiced. Use of bio-fertilizers (for eg. Azospirillum (200 ml/acre) as seed treatment shall be beneficial. Facilitation of awareness Training on IPMs to farmers for understanding the hazards of fertilizers and other alternative climate resilient methods. An Pest Management Plan (PMP)for the project has been enclosed as (Annexure 12)
	Site Selection	<ul style="list-style-type: none"> Selection of appropriate farm site for maize, due to its sensitivity to moisture stress and salinity stress 	<ul style="list-style-type: none"> Maize cultivation shall not becultivated in low lying area which possesses poor drainage system and resultant higher salinity.
	Soil Nutrient balance	<ul style="list-style-type: none"> Excessive use of chemicalfertilizers leave residues in the soil which leads to salinity andalkalinity of the soil which inturn affecting the soil structure 	<ul style="list-style-type: none"> Adoption of Integrated Soil Fertility management using organic manures, bio-fertilizers. Crop rotation practice should be followed to restore the nitrogen and other micronutrients. Organic manure such as cow dung, crop residue etc should be used to keep the soil healthy.
	Weed management	<ul style="list-style-type: none"> Weed Management during monsoon season. 	<ul style="list-style-type: none"> Mechanical weeding should be practiced at appropriate timing.
	Mono-cropping	Frequent cultivation of maize may affectthe soil productivity	<ul style="list-style-type: none"> Maize based sequential cropping such as Maize-potato-wheat, Maize wheat, Maize-mustard, Maize-legumes, Maize-groundnut, Maize + Pigeon pea, Maize- Caulifloweretc should

Interventions	Allied activities	Possible Risk	Management Measures
			be practiced to maintain the overall health of soil and also increases the productivity.
	Irrigation	Demand for more irrigation facilities due to increase in production and farming.	<ul style="list-style-type: none"> All Irrigation facilities should be done after obtaining legal consent with irrigation department. Promotion of more efficient methods of irrigation like drip irrigation etc.
51. 2. Infrastructure allied activities.	Storage	<ul style="list-style-type: none"> Inappropriate storage will lead to contact with moisture Pest menace 	<ul style="list-style-type: none"> The storage area should be located in a clean, dry place and material should be kept in tightly packed containers or containers with lids, covers. Food products should not be stored along with any products of chemical nature. Expired raw materials or raw materials stored for long periods (exceeding the shelf life) should not be used. Raw materials should be inspected at regular intervals and any spoiled materials should be safely discarded.
		Use of chemicals to control storage pests like cockroaches, rats etc. as they may contaminate the food.	Preference to use bio-pesticides like neem leaves, dry chillies etc.
	Transportation	Transportation service is required to store, manage, and post-harvest care, marketing and further value addition in the product	<ul style="list-style-type: none"> All material should be transported in fully covered trucks. Overloading of vehicles with materials should be avoided and shall be done in a manner to suit the trucks capacity. BS-IV vehicles with valid emission certificate should be used for transportation. Roads which are dedicated to be used for or infrequently used shall have proper road signage and breakers to prevent the accident in the road. Create awareness on proper transport system management.
52. 3. Processing, Grading, Value Addition	Registration, licenses and permissions	All processing units for seed production, value addition items and other machinery should hold valid licenses	<ul style="list-style-type: none"> Processing unit, seed production units and other equipment required for value addition purposes shall comply with legal requirements. (Please refer chapter 3 for applicable legal requirements)
	Maintenance and	Irregular cleaning or maintenance will lead to contamination and improper	<ul style="list-style-type: none"> Regular upkeep should be followed as per the prescribed

Interventions	Allied activities	Possible Risk	Management Measures
	upkeep of machinery	functioning.	standards.
		Possibility of accidents during handling machinery during Drying, milling etc.	<ul style="list-style-type: none"> Personnel should be well trained and first aid kit should be available.
	Use of additives, preservatives	In processing section, use of non-permitted additives and preservatives is illegal and pose health risks to the workers and consumers	<ul style="list-style-type: none"> Only the permitted additives and preservatives should be used in food items as per prescribed in FSSAI Act.
	Commercial Seed production	Inappropriate selection of species will lead to change the pattern of biodiversity and may not be best fitted for climate.	<ul style="list-style-type: none"> More emphasis should be given to preserve the maize seed and germplasm of indigenous species, which will be beneficial in long run and less resources would be required to upkeep and maintain.
	Milling	Air pollution may arise due to dust arising from handling the products and milling processes	<ul style="list-style-type: none"> The processing area should be hygienic. Sufficient space should be provided around the equipment's for maintenance and cleaning. To control the pollution, proper drainage system should be followed to control the runoff and adapt recycling of waste water. Necessary care should be taken to ensure that milling area is separated from other areas of heavy operations and water related activities at the design stage itself. Floor and wall should be water proof to avoid moisture. Suitable ventilation should be provided to prevent dust pollution and reduce heat. Prevention of dust settling on machinery and in the building shall be ensured by timely cleaning operations.
	Processing area	Basic and required amenities	<ul style="list-style-type: none"> The processing building should have sufficient space for the intended scale of operation which include: <ol style="list-style-type: none"> Sufficient space for weighing and inspecting incoming grain or flour, Raw material storage, Production area Packing and storage of products, Maintenance and repair of equipment, Cupboard for spare parts and tools,

Interventions	Allied activities	Possible Risk	Management Measures
			<ul style="list-style-type: none"> g. Hand-washing and toilet facilities, with space to store workers' clothes. h. First aid box and sand bucket or fire extinguisher; and i. Adequate supply of potable (safe for drinking) water
	Packaging of food product/ cereals	Use of non-biodegradable packaging material resulting in soil pollution.	<ul style="list-style-type: none"> • Bio degradable ingredients and re-useable packaging should be promoted.
		Use of plastic bags with a thickness less than 20 microns for packaging due to their non-recyclable nature poses a potential negative impact on environment.	<ul style="list-style-type: none"> • Use of newspapers wraps or cloth bags as packaging materials, encouraging the consumers to bring cloth bags are some of the methods that can be practiced.
		Handling the food products with bare hands or unwashed hands will contaminate the products.	<ul style="list-style-type: none"> • Personnel involved in processing, packing etc. should wash hands with soap before and after work and use aprons, gloves, hair caps for handling, packing etc.
	Waste management	Disposal of decomposable wastes on open areas leads to contamination of surroundings through decomposition, attracting insects, leaving chemical residues etc.	<ul style="list-style-type: none"> • Processing waste of Maize should be used as a feed for livestock, poultry, litter bed etc. • Wastes should be properly disposed off in the designate place only • It should not be done near to water bodies and dense settlement area. • Waste should be integrated with bio-compost formation and agricultural farming practices.
	Power use	Energy is required for heating, boiling, grinding, extraction, drying, packaging etc.	<ul style="list-style-type: none"> • Energy efficient devices should be used. • Biomass or solar devices should be promoted to conserve energy. • Energy consumption monitoring should be followed regularly.
	Water Use	Water is required for cleaning, Washing, boiling etc. As the requirement is in large quantities this will have impact on local Water resources.	<ul style="list-style-type: none"> • Water efficient devices should be promoted. • Water intake and balance should be monitored regularly. • Necessary permission from water resource department should be obtained.
	Occupational health and Safety	<ul style="list-style-type: none"> • Fine dust during milling will lead to health issues like allergy, Asthma in long run. • Noise problem 	<ul style="list-style-type: none"> • Person using these machines must wear masks as PPEs to prevent inhalation. • Noise protective equipment (PPEs) should be provided to the machine operators.

Interventions	Allied activities	Possible Risk	Management Measures
			<ul style="list-style-type: none"> • Ensure only experienced and well trained workers are allowed for the handling of machinery, equipment and material processing plants. • To maintain the safety of equipment as well as worker, Inspections should look for evidence of wear and tear, frays, missing parts and mechanical or electrical problems (Refer Annexure 15 for Food Safety). • Ensure an emergency aid service is in place in the work zone • Toilets should be separated from the processing area, storage area by two doors or shall be located in a separate building.

Supporting Agency in Maize Interventions under APART are:

1. Assam Rural Infrastructure And Agricultural Services (Arias) Society
2. Directorate of Agriculture, ASSAM,
3. Assam Agricultural University
4. District Agriculture Technology Management Agency (ATMA) Societies

3. Mustard

Mustard is the second major crop next to paddy cultivation in the state of Assam. The crop is suitable in sandy loam soil which is generally available in the medium upland areas. The riverside areas are also suitable for mustard cultivation. The crop is generally cultivated during the month of October-November.

Under APART, the project intervention in Mustard shall include the productivity enhancement, value addition and development of market opportunity / infrastructure facility etc. The following **Table 3** illustrates the potential environmental issues with respect to Mustard cultivation and value addition process.

Table 3: Potential Environmental risk and Management Measure due to project Intervention in Mustard

Interventions	Allied activities	Possible Risk	Management Measures
53. 1. Productivity	Varietal Selection	Suitable variety of Mustard not being	<ul style="list-style-type: none"> • Selection of Suitable crop respect to area/season should

Interventions	Allied activities	Possible Risk	Management Measures
Enhancement		selected with respect to particular season and climatic zone	be adopted. (Refer Annexure 13 , for variety of mustard recommended for particular season and climatic zone).
	Use of chemical fertilizer and pesticides	To enhance the productivity, overuse of fertilizer and other chemical problem may arise.	<ul style="list-style-type: none"> • Selection of Suitable fertilizers after soil testing should be used. • Use of bio-fertilizers (for e.g. Azotobacter (200 ml/acre) as seed treatment shall be beneficial. • Training on IPM should be facilitated to farmers to make them aware of hazards of fertilizer and other alternative climate resilient methods. • An Pest Management Plan (PMP) for the project has been enclosed as (Annexure 12)
	Soil Nutrient balance	Excessive use of chemical fertilizers leave residues in the soil which leads to salinity and alkalinity of the soil which in turn affecting the soil structure	<ul style="list-style-type: none"> • Adoption of Integrated Soil Fertility management using organic manures, bio-fertilizers. • Crop rotation practice should be followed to restore the nitrogen and other micronutrients. • Organic manure such as cow dung, crop residue etc should be used to keep the soil healthy.
	Weed management	Weed management during monsoon season.	<ul style="list-style-type: none"> • Mechanical weeding should be practiced at appropriate timing.
	Mono Cropping	Frequent cultivation of Mustard , may affect the soil productivity	<ul style="list-style-type: none"> • Mixed mustard cropping with wheat, gram, lentil etc should be practiced to maintain the overall health of soil and also increase the productivity.
	Irrigation	Demand for more irrigation facilities due to increase in production and farming	<ul style="list-style-type: none"> • All Irrigation facilities should be done after obtaining legal consent from irrigation department. • Promotion of more efficient methods of irrigation like drip irrigation etc.
54. Infrastructure allied activities.	Storage	<ul style="list-style-type: none"> • Inappropriate storage will lead to contact with moisture • Control of Pest menace 	<ul style="list-style-type: none"> • The storage area should be located in a clean, dry place and material should be kept in tightly packed containers or containers with lids and covers • Food products should not be stored along with products having chemical nature. • Expired materials or raw materials stored for long periods should not be used. • Raw materials should be inspected at regular intervals and

Interventions	Allied activities	Possible Risk	Management Measures
			any spoiled materials should be safely discarded.
		Use of chemicals to control storage pests like cockroaches, rats etc.	<ul style="list-style-type: none"> • Preference to use bio pesticides like neem leaves, dry chillies etc.
	Transportation	Transportation service is required to store, manage, and post-harvest care, marketing and further value addition in the product.	<ul style="list-style-type: none"> • All material should be transported in fully covered trucks. Overloading of vehicles with materials should be avoided and shall be done in a manner to suit the trucks capacity. • BS-IV vehicles with valid emission certificate should be used for transportation. • Roads which are dedicated to be used for or infrequently used shall have proper road signage and breakers to prevent the accident in the road. • Create awareness on proper transport system management.
55. Processing, Grading, Value Addition	Registration, licenses and permissions	All processing units for seed production, value addition items and other machinery should hold valid license.	<ul style="list-style-type: none"> • Processing unit, seed production units, and other equipment required for value addition purposes shall comply with legal requirements Please refer chapter 2 for applicable legal requirements
	Maintenance and upkeep of machinery	Irregular cleaning or maintenance will lead to contamination and improper functioning.	<ul style="list-style-type: none"> • Regular upkeep should be followed as per the prescribed standards.
		Possibility of accidents during handling of machinery while Drying, milling etc.	<ul style="list-style-type: none"> • Personnel should be well trained and first aid kit should be available.
	Use of additives, preservatives	In processing section, use of non-permitted additives and preservatives is illegal and pose health risks to the workers and consumers	<ul style="list-style-type: none"> • Only the permitted additives and preservatives should be used in food items as prescribed in FSSAI Act.
	Commercial Seed production	Inappropriate selection of species will lead to change in the pattern of biodiversity and may not be best fitted for climate.	<ul style="list-style-type: none"> • More emphasis should be given to preserve the mustard oil seed and germplasm of indigenous species, which will be beneficial in long run and less resources would be required to upkeep and maintain.
	Milling & Oil Extraction area	Air pollution may arise due to dust arising from handling the products and milling processes. Unhygienic oil storage tanks	<ul style="list-style-type: none"> • The processing area should be hygienic. • Sufficient space should be provided around the equipments for maintenance and cleaning. • To control the pollution, proper drainage system should be followed to control the runoff and adapt recycling of waste

Interventions	Allied activities	Possible Risk	Management Measures
			<p>water.</p> <ul style="list-style-type: none"> • Regular inspection of storage tanks to minimize the risk of contamination. • Necessary care should be taken to ensure thatmilling area is separated from other areas of heavy operations and water related activities. Floor and wall should be water proof to avoid moisture. • Suitable ventilation should be provided to prevent dust pollution and reduce heat. Prevention of dusts settling on machinery and in the building shall be ensured by timely cleaning operations. • Install cyclones and/or fabric filters or electrostatic precipitators on selected vents includingdryers, coolers, and grinders to remove particulate matter, dust and odor emissions.
	Processing area	Basic and required amenities	<ul style="list-style-type: none"> • The processing building should have sufficient space for the intended scale of operation which include: <ol style="list-style-type: none"> a. Sufficient space for weighing and inspecting incoming grain or flour, b. Raw material storage, c. Production area d. Packing and storage of products, e. Maintenance and repair of equipment, f. Cupboard for spare parts and tools, g. Hand-washing and toilet facilities, with space to store workers' clothes. h. First aid box and sand bucket or fire extinguisher; and i. Adequate supply of potable (safe for drinking) water
	Processing area and allied activity	Waste arisingfrom oilseed processing shall be having good commercial viability.	<ul style="list-style-type: none"> • Residue from the raw material should be stored carefully to avoid moisture and enhance its reuse capacity • Use by products as fuel for boilers, however area should be properly ventilated (provided with exhaust fan etc).
		Generation of Spent Bleach earth	<ul style="list-style-type: none"> • Spent bleach earth from oilseed processing unit should be used as fertilizer due to mustard's good disinfectant quality, but this should not be applied in agricultural field directly but mix it with other organic waste should be

Interventions	Allied activities	Possible Risk	Management Measures
			<p>practiced.</p> <ul style="list-style-type: none"> Spent bleach earth can also be sold to cement manufacturing industries.
		Wastewater process waste water generated during washing and neutralization might have high organic content.	<ul style="list-style-type: none"> Following measures to reduce the organic material inclusion in waste water should be followed such as Use spill collection tray in production area to reduce the inclusion of solid in water. Use grid to cover the production area to prevent solid waste addition in the waste water.
	Packaging of Oilseed and products	Use of non-biodegradable packaging material	<ul style="list-style-type: none"> Bio degradable ingredients and re-useable packaging should be promoted.
		Use of plastic bags with a thickness less than 20 microns for packaging due to their non-recyclable nature poses a potential negative impact on environment.	<ul style="list-style-type: none"> Use of newspapers wraps or cloth bags as packaging materials, encouraging the consumers to bring cloth bags are some of the methods that can be practiced.
		Handling the food products with bare hands or unwashed hands will contaminate the products.	<ul style="list-style-type: none"> Personnel involved in processing, packing etc. should wash hands with soap before and after work and use aprons, gloves, hair caps for handling, packing etc.
	Waste management	Disposal of decomposable wastes on open areas leads to contamination of surroundings through decomposition, attracting insects, leaving chemical residues etc	<ul style="list-style-type: none"> Process waste of mustard is of commercial value so it should be used as an alternate as feed for livestock, poultry, litter bed etc. Wastes should be properly disposed off in the designated places only It should not be done near to water bodies and dense settlement area. waste should be integrated with bio-compost formation and agricultural farming practices,
	Power use	Energy is required for heating, boiling, grinding, extraction, drying, packaging etc.	<ul style="list-style-type: none"> Energy efficient devices should be used. Biomass or solar devices should be promoted to conserve energy. Energy consumption monitoring should be followed regularly.

Interventions	Allied activities	Possible Risk	Management Measures
	Water Use	Water is required for cleaning, Washing, boiling etc. As the requirement is in large quantities this will have impact on local Water resources.	<ul style="list-style-type: none"> Water efficient devices should be promoted. Water intake and balance should be monitored regularly. Necessary permission from water resource department should be obtained.
	Occupational health and Safety	<ul style="list-style-type: none"> Fine dust during milling will lead to health issues like allergy, Asthma in long run. Noise problem 	<ul style="list-style-type: none"> Person using these machines must wear masks as PPEs to prevent inhalation. Noise protective equipment (PPEs) should be provided to the machine operators. Ensure only experienced and well trained workers are used for the handling of machinery, equipment and material processing plants. To maintain the safety of equipment as well as worker, Inspections should look for evidence of wear and tear, frays, missing parts and mechanical or electrical problems (Refer Annexure 15 for Food Safety). Ensure an emergency aid service is in place in the work zone Toilets should be separated from the processing area, storage area by two doors or shall be located in a separate building.

Supporting Agency in Mustard Interventions under APART are:

1. Assam Rural Infrastructure And Agricultural Services (Arias) Society
2. Directorate of Agriculture, ASSAM,
3. Assam Agricultural University
4. District Agriculture Technology Management Agency (ATMA) Societies
5. National Innovations on Climate Resilient Agriculture (NICRA)

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4. Pulses (Lentil, Black gram, Pea)

In Assam, pulses are generally grown in the Central and Lower Brahmaputra Valley Zone (LBVZ). Which embrace project districts of Nagaon, Morigaon, Kamrup, Goalpara, Kokarajhar, Barpeta and Nalbari. Pulses are grown as an alternative crop for shorter time/ duration after paddy harvest. The pulses are beneficial to the farmers as a cash crop as well as it helps in restoring soil nutrients aids in nitrogen fixation.

Under APART, the project intervention for pulse shall include the productivity enhancement, value addition and development of market opportunity / infrastructure facility. The following **Table 4** illustrates the potential environmental issues with respect to Pulse cultivation and value addition process.

Table 4: Potential Environmental risk and Management Measure due to project Intervention in Pulse

Interventions	Allied activities	Possible Risk	Management Measures
57. 1. Productivity Enhancement	Varietal Selection	Suitable variety of pulse not being selected with respect to particular season and climatic zone	<ul style="list-style-type: none"> Selection of Suitable crop respect to area/season should be adopted. (Refer Annexure 13, for variety of Pulse recommended for particular season and climatic zone).
	Use of chemical fertilizer and pesticides	To enhance the productivity, overuse of fertilizer and other chemical problem may arise.	<ul style="list-style-type: none"> Selection of Suitable fertilizer after soil testing should be practiced. Use of bio-fertilizers (for eg. Rhizobium (200 ml/acre)⁷⁰ as seed treatment shall be beneficial. Facilitation of awareness Training on IPMs to farmers for understanding the hazards of fertilizers and other alternative climate resilient methods. An Pest Management Plan (PMP) for the project has been enclosed (refer Annexure 12)
	Site Selection	Appropriate selection of farm site for pulses, due to its sensitivity to moisture stress and salinity stress, is required	<ul style="list-style-type: none"> Site should be sandy loamy for Pulse crop cultivation. Mid October to November should be followed as optimum timing for pulse cultivation. Well drained soil should be adopted for pulse cultivation.
	Soil Nutrient balance	Excessive use of chemical fertilizers leave residues in the soil which leads to salinity and alkalinity of the soil which in turn affecting the soil structure	<ul style="list-style-type: none"> Adoption of Integrated Soil Fertility management using organic manures, bio-fertilizers.. Crop rotation practice should be followed to restore the nitrogen and other micronutrients. Organic manure such as cow dung, crop residue etc should be used to keep the soil healthy. Use of rhizobium for N fixation VAM, PSB for P solubilizing biofertilizer in rainfed area.

⁷⁰As per AgritechTamilnadu online Portal

Interventions	Allied activities	Possible Risk	Management Measures
	Weed management	Weed Management in monsoon season.	<ul style="list-style-type: none"> Mechanical weeding should be practiced at appropriate timing.
	Mono Cropping	Frequent cultivation of maize may deplete the soil productivity	<ul style="list-style-type: none"> Intercropping of pulse with sugarcane, tomato, soyabean, vegetables should be practiced to maintain the overall health of soil and also increase the productivity.
	Irrigation	Demand for more irrigation facilities due to increase in production and farming	<ul style="list-style-type: none"> All Irrigation facilities should be done after legal consent with irrigation department. Promotion of more efficient method of irrigation like drip irrigation etc.
58. 2. Infrastructure allied activities.	Storage	<ul style="list-style-type: none"> Inappropriate storage will lead to contact with moisture. Pest menace 	<ul style="list-style-type: none"> The storage area should be located in clean, dry places and materials should be kept in tightly packed containers or containers with lids, covers. Pulses and seed should not be stored along with any products of chemical nature. Expired materials or raw materials stored for long periods should not be used. Raw materials should be inspected at regular intervals and any spoiled materials should be safely discarded.
		Use of chemicals to control storage pests like cockroaches, rats etc. as they may contaminate the food.	<ul style="list-style-type: none"> Preference to use bio pesticides methods like neem leaves, dry chillies etc.
	Transportation	Transportation service is required to store, manage, and post-harvest care, marketing and further value addition in the product.	<ul style="list-style-type: none"> All material should be transported in fully covered trucks. Overloading of vehicles with materials should be avoided and shall be done in a manner to suit the trucks capacity. BS-IV vehicles with valid emission certificate should be used for transportation. Roads which are dedicated to be used for / or in frequently used shall have proper road signage and breakers to prevent the accident in the road. Create awareness on proper transport system management.
59. 3. Processing, Grading, Value Addition	Registration, licenses and permissions	All processing units for seed production, value addition items and other machinery should hold valid license.	<ul style="list-style-type: none"> Processing unit, seed production units and other equipment required for value addition purposes shall comply with legal requirements. (Please refer chapter 2 for applicable legal requirements)

Interventions	Allied activities	Possible Risk	Management Measures
	Maintenance and upkeep of machinery	Irregular cleaning or maintenance will lead to contamination and improper functioning.	<ul style="list-style-type: none"> Regular upkeep should be followed as per the prescribed standards.
		Possibility of accidents during handling machinery during Drying, milling etc.	<ul style="list-style-type: none"> Personnel should be well trained and first aid kit should be available.
	Use of additives, preservatives	In processing section, use of non-permitted additives and preservatives is illegal and pose health risks to the workers and consumers	<ul style="list-style-type: none"> Only the permitted additives and preservatives should be used in food items as per prescribed in FSSAI Act.
	Commercial Seed production	Inappropriate selection of species will lead to change the pattern of biodiversity and may not be best fitted for climate.	<ul style="list-style-type: none"> More emphasis should be given to preserve the pulse seed and germplasm of indigenous species, which will be beneficial in long run and would be less resource required to upkeep and maintain.
	Milling (dry)	Air pollution may arise due to dust arises from handling the products and milling processes.	<ul style="list-style-type: none"> The processing area should be hygienic condition. Sufficient space should be provided around the equipment's for maintenance and cleaning. To control the pollution, proper drainage system should be followed to control the runoff and adapt recycling of waste water. Care should be taken to ensure that milling area is separated from other areas of heavy operations and water related activities. Floor and wall should be water proof to avoid moisture. Suitable ventilation should be provided to prevent dust pollution and reduce heat. Prevention of dusts settling on machinery and in the building shall be ensured by timely cleaning operations.
	Processing area	Basic and required amenities	<ul style="list-style-type: none"> The processing building should have sufficient space for the intended scale of operation which include: <ol style="list-style-type: none"> Sufficient space for weighing and inspecting incoming grain or flour, Raw material storage, Production area Packing and storage of products, Maintenance and repair of equipment, Cupboard for spare parts and tools,

Interventions	Allied activities	Possible Risk	Management Measures
			<ul style="list-style-type: none"> g. Hand-washing and toilet facilities, with space to store workers' clothes. h. First aid box and sand bucket or fire extinguisher; and i. Adequate supply of potable (safe for drinking) water
	Packaging of Value added / raw products of pulses	Use of non-biodegradable packaging material resulting in soil Pollution.	<ul style="list-style-type: none"> • Bio degradable ingredients and re-useable packaging should be promoted.
		Use of plastic bags with a thickness less than 20 microns for packaging due to their non-recyclable nature poses a potential negative impact on environment.	<ul style="list-style-type: none"> • Use of newspapers wraps or cloth bags as packaging materials, encouraging the consumers to bring cloth bags are some of the methods that can be practiced.
		Handling the food products with bare hands or unwashed hands will contaminate the products.	<ul style="list-style-type: none"> • Personnel involved in processing, packing etc. should wash hands with soap before and after work and use aprons, gloves, hair caps for handling, packing etc.
	Waste management	Disposal of decomposable wastes leads to contamination of surroundings though decomposition, attracting insects, leaving chemical residues etc.	<ul style="list-style-type: none"> • Processing waste of pulse should be alternate used as a feed for livestock, poultry etc. • Wastes should be properly disposed off in the designate place only • It should not be done near to water bodies and dense settlement area. • Waste should be integrated with bio compost formation and agricultural farming practices.
	Power use	Energy is required for heating, boiling, grinding, extraction, drying, packaging etc.	<ul style="list-style-type: none"> • Energy efficient devices should be used. • Biomass or solar devices should be promoted to conserve energy. • Energy consumption monitoring should be followed regularly.
	Water Use	Water is required for cleaning, Washing, boiling etc. As the requirement is in large quantities this will have impact on local Water resources.	<ul style="list-style-type: none"> • Water efficient devices should be promoted. • Water intake and balance should be monitored regularly.
	Occupational health and Safety	<ul style="list-style-type: none"> • Fine dust during milling will lead to health issues like allergy, Asthma in long run. • Noise problem 	<ul style="list-style-type: none"> • Person using these machines must wear masks as PPEs to prevent inhalation. • Noise protective equipment (PPEs) should be provided to the operators. • Ensure only experienced and well trained workers are used

Interventions	Allied activities	Possible Risk	Management Measures
			for the handling of machinery, equipment and material processing plants. <ul style="list-style-type: none"> To maintain the safety of equipment as well as worker, Inspections should look for evidence of wear and tear, frays, missing parts and mechanical or electrical problems (Refer Annexure 15 for Food Safety). Ensure an emergency aid service is in place in the work zone Toilets should be separated from the processing area, storage area by two doors or shall be located in a separate building.

Supporting Agency in Pulse Interventions under APART are:

1. Assam Rural Infrastructure And Agricultural Services (Arias) Society
2. Directorate of Agriculture, ASSAM,
3. Assam Agricultural University
4. District Agriculture Technology Management Agency (ATMA) Societies

5. Fruit and vegetable (tomato, cucurbits, banana, potato)

Assam is the largest producer of fruits and vegetables in the northeast region and contributes 60% to the total horticulture production in the north east region. Horticultural crops in the state occupy nearly 15% of the gross cultivated area and the state produces more than 15.0 lakh MT of fruits, 29.0 lakh MT of vegetables and 1.0 lakh MT of spices besides nut crops, flowers and medicinal & aromatic plants annually.

Under APART, the project intervention for **Fruit and Vegetable** shall include the productivity enhancement, value addition and development of market opportunity / infrastructure facility. The following **Table 5** illustrates the potential environmental issues with respect to cultivation and value addition process.

Table 5: Potential Environmental risk and Management Measure due to project Intervention in Fruit and vegetable

Interventions	Allied activities	Possible Risk	Management Measures
60. 1. Productivity Enhancement	Varietal Selection	Suitable variety of fruit / vegetables not being selected with respect to particular season and climatic zone	<ul style="list-style-type: none"> Selection of Suitable crop respect to area/season should be adopted. (Refer Annexure 13, for variety of fruit and vegetable recommended for particular season and climatic

Interventions	Allied activities	Possible Risk	Management Measures
			zone).
	Use of chemical fertilizer and pesticides	To enhance the productivity, overuse of fertilizer and other chemical problem may arise.	<ul style="list-style-type: none"> • Selection of Suitable fertilizer after soil testing should be practiced • Use of bio-fertilizers (for eg. Azotobacter (2-3 ml/ Plant) as soil treatment shall be beneficial. • Training on IPM should be facilitated to farmer to make aware of hazard of fertilizer and other alternative climate resilient methods. • An Pest Management Plan (PMP)for the project has been enclosed as (Annexure- 12)
	Soil Nutrient balance	Excessive use of chemical fertilizers leave residues in the soil which leads to salinity and alkalinity of the soil which in turn affecting the soil structure	<ul style="list-style-type: none"> • Adoption of Integrated Soil Fertility management using organic manures, bio-fertilizers. • Crop rotation practice should be followed to restore the nitrogen and other micronutrient. • Organic manure such as cow dung, crop residue etc., should be used to keep the soil healthy.
	Weed management	Weed management in monsoon season.	<ul style="list-style-type: none"> • Mechanical weeding should be practiced at appropriate timing
	Mono Cropping	Frequent cultivation of same variety of crops, may affect the soil productivity	<ul style="list-style-type: none"> • Mixed cropping with vegetable / fruit combination or other such as potato- mustard, mustard- cabbage, veg-pulse, fruit- vegetable crop etc should be practiced to maintain the overall health of soil and also increase the productivity.
	Irrigation	Demand for more irrigation facilities due to increase in production and farming	<ul style="list-style-type: none"> • All Irrigation facilities should be done after obtaining legal consent with irrigation department. • More efficient method of irrigation should be promoted like drip irrigation etc.
61. 2. Infrastructure allied activities.	Storage	Inappropriate storage of the ingredients, veg/ fruit will lead to contact with moistures, exposure to pests like rats etc. will spoil the quality there by having impact on health.	<ul style="list-style-type: none"> • Vegetables are living, breathing parts of plants and contain 65 to 95% water. Acceleration of deterioration can be due to high temperature, low humidity, incorrect atmosphere and/ or physical damage. So storage of these commodities should be done in cool places. • The storage area should be located in clean, dry places and material should be kept in tightly packed containers or containers with lids, covers.

Interventions	Allied activities	Possible Risk	Management Measures
			<ul style="list-style-type: none"> • Food Products should not be stored along with any products of chemical nature. • Expired materials/ raw materials stored for long periods should not be used. • Raw materials should be inspected at regular intervals and any spoiled materials should be safely discarded.
		Use of chemicals to control storage pests like cockroaches, rats etc. as they may contaminate the food.	Preference to use bio pesticide methods like neem leaves, dry chillies etc.
	Transportation	Transportation service is required to store, manage, and post-harvest care, marketing and further value addition in the product.	<ul style="list-style-type: none"> • All material should be transported in fully covered trucks. Overloading of vehicles with materials should be avoided and shall be done in a manner to suit the trucks capacity. • BS-IV vehicles with valid emission certificate should be used for transportation. • Roads which are dedicated to be used for / or in frequently used shall have proper road signage and breakers to prevent the accident in the road. • Create awareness on proper transport system management.
62. 3. Processing, Grading, Value Addition	Registration, licenses and permissions	All processing units for seed production, value addition items and other machinery should hold valid license.	<ul style="list-style-type: none"> • Processing unit, seed production units and other equipment required for value addition purposes shall comply with legal requirements. Please refer chapter 2 for applicable legal requirements.
	Maintenance and upkeep of machinery	Irregular cleaning or maintenance will lead to contamination and improper functioning.	<ul style="list-style-type: none"> • Regular upkeep should be followed as per the prescribed standards.
		Possibility of accidents during handling machinery during Drying, chopping etc.	<ul style="list-style-type: none"> • Personnel should be well trained and first aid kit should be available.
	Use of additives, preservatives	In processing section, use of non-permitted additives and preservatives is illegal and pose health risks to the workers and consumers	<ul style="list-style-type: none"> • Only the permitted additives and preservatives should be used in food items as per prescribed in FSSAI Act.
	Commercial Seed production	Inappropriate selection of species will lead to change the pattern of biodiversity and may not be best fitted for climate.	<ul style="list-style-type: none"> • More emphasis should be given to preserve the seed and germplasm of indigenous species, which will be beneficial in long run and less resource would be required to upkeep and maintain.

Interventions	Allied activities	Possible Risk	Management Measures
	Processing area	Basic and required amenities	<ul style="list-style-type: none"> The processing building should have sufficient space for the intended scale of operation which include: <ol style="list-style-type: none"> Sufficient space for weighing and inspecting incoming grain or flour, Raw material storage, Production area Packing and storage of products, Maintenance and repair of equipment, Cupboard for spare parts and tools, Hand-washing and toilet facilities, with space to store workers' clothes. First aid box and sand bucket or fire extinguisher; and Adequate supply of potable (safe for drinking) water
		Waste Water –processing waste water generated during washing and neutralization might have high organic content.	<ul style="list-style-type: none"> Following measure to reduce the organic material inclusion in waste water should followed such as Use spill collection tray in production area to reduce the inclusion of solid in water. Use grid to cover the production area to prevent solid waste addition in the waste water.
	Packaging	Use of non-biodegradable packaging material results in the soil pollution.	<ul style="list-style-type: none"> Bio degradable ingredients and re-useable packaging should be promoted.
		Use of plastic bags with a thickness less than 20 microns for packaging due to their non-recyclable nature poses a potential negative impact on environment.	<ul style="list-style-type: none"> Use of newspapers wraps or cloth bags as packaging materials, encouraging the consumers to bring cloth bags are some of the methods that can be practiced
		Handling the food products with bare hands or unwashed hands will contaminate the products,	<ul style="list-style-type: none"> Personnel involved in processing, packing etc. should wash hands with soap before and after work and use aprons, gloves, hair caps for handling, packing etc.
	Waste management	Disposal of decomposable wastes leads to contamination of surroundings though decomposition, attracting insects, leaving chemical residues etc.	<ul style="list-style-type: none"> Wastes should be properly disposed off in the designate place only It should not be done near to water bodies and dense settlement area. Waste should be integrated with bio compost formation and agricultural farming practices.

Interventions	Allied activities	Possible Risk	Management Measures
	Power use	Energy is required for heating, boiling, grinding, extraction, drying, packaging etc.	<ul style="list-style-type: none"> • Energy efficient devices should be used. • Biomass or solar devices should be promoted to conserve energy. • Energy consumption monitoring should be followed regularly.
	Water Use	Water is required for cleaning, Washing, boiling etc. As the requirement is in large quantities this will have impact on local Water resources.	<ul style="list-style-type: none"> • Water efficient devices should be promoted. • Water intake and balance should be monitored regularly. • Necessary permission from water resource department should be obtained for water supply in processing area and other purposes
	Occupational health and Safety	<ul style="list-style-type: none"> • Occupational health problem, allergies may affect the health of worker of processing area. • Noise problem 	<ul style="list-style-type: none"> • Person using these machines must wear masks as PPEs to prevent inhalation. • Noise protective equipment (PPEs) should be provided to the machine operators. • Ensure only experienced and well trained workers are used for the handling of machinery, equipment and material processing plants. • To maintain the safety of equipment as well as worker, Inspections should look for evidence of wear and tear, frays, missing parts and mechanical or electrical problems (Refer Annexure 15 for Food Safety). • Ensure an emergency aid service is in place in the work zone Toilets should be separated from the processing area, storage area by two doors or shall be located in a separate building.

Supporting Agency in interventions under APART are:

1. Assam Rural Infrastructure And Agricultural Services (Arias) Society
2. Directorate of Agriculture, Directorate of Horticulture, ASSAM,
3. Assam Agricultural University
4. District Agriculture Technology Management Agency (ATMA) Societies

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6. Spices and Condiments (Ginger, Turmeric)

Assam produced around 8% of India’s total spices and 57% of Ginger of very good quality. Among turmeric, Lahadong variety of turmeric is produced from Assam, which is one of best quality of turmeric found across the world.

Under APART, the project intervention for Spices shall include the productivity enhancement, value addition and development of market opportunity / infrastructure facility. The following **Table 6** illustrates the potential environmental issues with respect to cultivation and value addition process.

Table 6: Potential Environmental risk and Management Measure due to project Intervention in Spices and Condiments (Ginger and Turmeric)

Interventions	Allied activities	Possible Risk	Management Measures
64. 1. Productivity Enhancement	Varietal Selection	Suitable variety of rhizome of Ginger / Turmeric being not selected with respect to particular season and climatic zone.	<ul style="list-style-type: none"> Choice of suitable rhizome respecting to particular Agro climatic area should be in practice. (Please refer Annexure 13, for variety of seed recommended for particular season and climatic zone of Assam).
	Use of chemical fertilizer and pesticides	To enhance the productivity, overuse of fertilizer and other chemical problem may arise.	<ul style="list-style-type: none"> Selection of Suitable fertilizer after soil testing should be practiced. Training on IPM should be facilitated to farmer to make aware of hazard of fertilizer and other alternative climate resilient methods. An Pest Management Plan (PMP) for the project has been enclosed as (Annexure 12)
	Soil Nutrient balance	Excessive use of chemical fertilizers leave residues in the soil which leads to salinity and alkalinity of the soil which in-turn affecting the soil structure	<ul style="list-style-type: none"> Adoption of Integrated Soil Fertility management using organic manures, bio-fertilizers. Crop rotation practice should be followed to restore the nitrogen and other micronutrient. Organic manure such as cow dung, crop residue etc should be used to keep the soil healthy.
	Site Selection	Inappropriate site selection may affect negatively the production.	<ul style="list-style-type: none"> Spices propagated by rhizome generally prefers soil which is well drained and in shade. So waterlogging area should be avoided during site selection.
	Weed management	Weed management in spices	<ul style="list-style-type: none"> Mechanical weeding should be practiced at appropriate timing. Remove weeds by hand-weeding before each mulching. Repeat weeding according to weed growth during the fifth and sixth month after planting.
	Mono Cropping	Frequent cultivation of same crop species may affect the soil productivity	<ul style="list-style-type: none"> Mixed cropping with ginger- turmeric, ginger- areca nut should be practiced to maintain the overall health of soil and also increase the productivity. Rotation cropping practices such as ginger cultivation in rice fallow land, vegetable, ground nut would be beneficial for soil

Interventions	Allied activities	Possible Risk	Management Measures
			nutrient management.
	Irrigation	Demand for more irrigation facilities due to increase in production and farming	<ul style="list-style-type: none"> All Irrigation facilities should be done after obtaining legal consent with irrigation department. More efficient method of irrigation should be promoted like drip irrigation etc.
65. 2. Infrastructure allied activities.	Storage	<ul style="list-style-type: none"> Inappropriate storage will lead to contact with moisture Pest menace 	<ul style="list-style-type: none"> The storage area should be located in a clean, dry place and material should be kept in tightly packed containers or containers with lids, covers. Food products should not be stored along with any products of chemical nature. Expired materials/ raw materials stored for long periods should not be used. Raw materials should be inspected at regular intervals and any spoiled materials should be safely discarded.
		Use of chemicals to control storage pests like cockroaches, rats etc. as they may contaminate the food.	<ul style="list-style-type: none"> Preference to use bio-pesticides like neem leaves, dry chillies etc.,
	Transportation	Transportation service is required to store, manage, and post-harvest care, marketing and further value addition in the product.	<ul style="list-style-type: none"> All material should be transported in fully covered trucks. Overloading of vehicles with materials should be avoided and shall be done in a manner to suit the trucks capacity. BS-IV vehicles with valid emission certificate should be used for transportation. Roads which are dedicated to be used for / or in frequently used shall have proper road signage and breakers to prevent the accident in the road. Create awareness on proper transport system management.
66. 3. Processing, Grading, Value Addition	Registration, licenses and permissions	All processing units for seed production, value addition items and other machinery should hold valid license.	<ul style="list-style-type: none"> Processing unit, seed production units, and other equipment required for value addition purposes shall comply with legal requirements. Please refer chapter 2 for applicable legal requirements
	Maintenance and upkeep of machinery	Irregular cleaning or maintenance will lead to contamination and improper functioning.	<ul style="list-style-type: none"> Regular upkeep should be followed as per the prescribed standards.
		Possibility of accidents during handling machinery during Drying, milling etc.	<ul style="list-style-type: none"> Personnel should be well trained and first aid kit should be available.
	Use of additives, preservatives	In processing section, use of non-permitted additives and preservatives is illegal and pose	<ul style="list-style-type: none"> Only the permitted additives and preservatives should be used in food items as per prescribed in FSSAI Act.

Interventions	Allied activities	Possible Risk	Management Measures
		health risks to the workers and consumers	
	Commercial Seedproduction	Inappropriate selection of species will lead to change the pattern of biodiversity and may not be best fitted for climate.	<ul style="list-style-type: none"> • More emphasis should be given to preserve the seed and germplasm of indigenous species, which will be beneficial in long run and less resource would be required to upkeep and maintain.
	Processing area	Basic and required amenities	<ul style="list-style-type: none"> • The processing building should have sufficient space for the intended scale of operation which include: <ol style="list-style-type: none"> a. Sufficient space for weighing and inspecting incoming grain or flour, b. Raw material storage, c. Production area d. Packing and storage of products, e. Maintenance and repair of equipment, f. Cupboard for spare parts and tools, g. Hand-washing and toilet facilities, with space to store workers' clothes. h. First aid box and sand bucket or fire extinguisher; and i. Adequate supply of potable (safe for drinking) water • Sufficient space should be provided around the equipment's for maintenance and cleaning. • The processing area should be hygienic. • To control the pollution, proper drainage system should be followed to control the runoff and adapt recycling of waste water.
	Packaging of spices and other value added products	Use of non-degradable packaging material resulting the soil pollution.	<ul style="list-style-type: none"> • Bio degradable ingredients and re-useable packaging should be promoted.
		Use of plastic bags with a thickness less than 20 microns for packaging due to their non-recyclable nature poses a potential negative impact on environment	<ul style="list-style-type: none"> • Use of newspapers wraps or cloth bags as packaging materials, encouraging the consumers to bring cloth bags are some of the methods that can be practiced.
		Handling the food products with bare hands or unwashed hands will contaminate the products.	<ul style="list-style-type: none"> • Personnel involved in processing, packing etc. should wash hands with soap before and after work and use aprons, gloves, hair caps for handling, packing etc.
	Waste management	Disposal of decomposable wastes leads to contamination of surroundings though decomposition, attracting insects, leaving chemical residues etc.	<ul style="list-style-type: none"> • Wastes should be properly disposed off in the designate place only • It should not be done near to water bodies and dense settlement area. • Waste should be integrated with bio-compost formation and agricultural farming practices.

Interventions	Allied activities	Possible Risk	Management Measures
	Power use	Energy is required for heating, boiling, grinding, extraction, drying, packaging etc.	<ul style="list-style-type: none"> Energy efficient devices should be used. Biomass or solar devices should be promoted to conserve energy. Energy consumption monitoring should be followed regularly.
	Water Use	Water is required for cleaning, Washing, boiling etc. As the requirement is in large quantities this will have impact on local Water resources.	<ul style="list-style-type: none"> Water efficient devices should be promoted. Water intake and balance should be monitored regularly. Necessary permission from water resource department should be obtained for water supply in processing area and other purposes
	Occupational health and Safety	<p>Fine dust during milling will lead to health issues like allergy, Asthma in long run.</p> <p>Noise problem</p>	<ul style="list-style-type: none"> Person using these machines must wear masks as PPEs to prevent inhalation. Noise protective equipment (PPEs) should be provided to the machine operators. Ensure only experienced and well trained workers are used for the handling of machinery, equipment and material processing plants. To maintain the safety of equipment as well as worker, Inspections should look for evidence of wear and tear, frays, missing parts and mechanical or electrical problems (Refer Annexure 15 for Food Safety). Ensure an emergency aid service is in place in the work zone Toilets should be separated from the processing area, storage area by two doors or shall be located in a separate building.

Supporting Agency in interventions under APART are:

1. Assam Rural Infrastructure And Agricultural Services (Arias) Society
2. Directorate of Agriculture, Directorate of Horticulture, ASSAM,
3. Assam Agricultural University
4. District Agriculture Technology Management Agency (ATMA) Societies

7. Dairy

Dairy production in Assam is mostly characterized by rural smallholder production using indigenous cattle and buffalo, with pockets of more specialized dairy production.

Under APART, the project intervention in term of **dairy sector** shall include productivity enhancement, value addition and development of market opportunity / infrastructure facility. The following **Table 7** illustrates the potential environmental issues with respect to farming and value addition process.

Table 7: Potential Environmental risk and Management Measure due to project Intervention in Dairy

Interventions	Allied activities	Possible Risk	Management Measures
67. 1. Productivity Enhancement	Selection of breed	Selection of breeds that cannot adapt to the local climatic conditions will lead to loss of cattle or results in low productivity and increase in health issues.	<ul style="list-style-type: none"> • Selection of suitable breed should be done based on its climate adaptability. • Indigenous species⁷¹ should be promoted in artificial insemination. • Enhanced interaction with technicians of artificial insemination would be helpful to select suitable breed.
	Requirement of Grazing land and tackling the fodder scarcity	Due to the increase in number of cattle, the requirement for more fodder is inevitable and if grazing lands are located near the forest area, it may even cause a direct threat to the forest eco system.	<ul style="list-style-type: none"> • A climate resilient method should be adopted for fulfilling the demand of fodder. • Community based grazing land cultivation should be promoted on waste/ barren land to meet the fodder demand. • Improve productivity of pasture lands by introducing improved fodder seeds and increase the use of waste lands for fodder production. • Community should get proper permission from nearby forest department, if the grazing land is located near protected areas.
	Vaccination and artificial insemination facility	Inappropriate vaccination and insemination	<ul style="list-style-type: none"> • Develop a regular interaction with the Providers/ technician of Artificial Insemination and veterinary facility (a doorstep facility can be provided under the Project APART). • A sensitization workshop for producers would be helpful to create awareness among them about the precautions and probable health risk in cattle, which will also pose a negative impact on overall milk production.

⁷¹**Indigenous cattle breed:** Red Sindhi, Sahiwal, Gir: Deoni, Ongole, Karan fries, Karan swiss, Nimari, Hariana, Rathi or Rath, Mewati, Krishavalley, Tharparkar, Kankrej

Interventions	Allied activities	Possible Risk	Management Measures
	Activities like farm manure storage and disposal of urine.	Release of NH ₃ , CH ₄ , NO ₂ , Non Methane VOCs, fine particulates and to atmosphere.	<ul style="list-style-type: none"> Better management practices Training to the farmers shall be planned and conducted Organic manure such as cow dung, crop residue etc., should be used in agri-farming to keep the soil healthy.
	Manure and Waste Water.	Manure and wastewater storage, feed storage areas, livestock housing (such as calf rearing sheds or free stall sheds), and the cows themselves.	<ul style="list-style-type: none"> Storage areas should be dry. Training and adopting best practice guidelines for the siting, design, management and maintenance of dairy waste.
	Use of chemical fertilizer and pesticides for fodder production	overuse of fertilizer and other chemicals in fodder production	<ul style="list-style-type: none"> Promotion of farming methods; by use of bio-manure, compost material and bio fertilizer as much as possible so as to minimize the introduction of chemicals into the food chain. These methods are cost friendly and eco-friendly. The target pest, disease or weed should be correctly identified, and an appropriate chemical, application rate and application method should be followed. Preference to be given for green fodder as much as possible.
		Agricultural chemicals used on dairy farms and veterinary medications may have potential risks for users, consumers, the community and the environment.	<ul style="list-style-type: none"> Trainings for handling, storage and disposal of the chemicals should be provided to the farmers. Use of personal protective equipment like gloves, masks, boots. Veterinary medicines (antibiotics) used should be appropriate for the identified problem and shall be used according to label instructions within the expiry date, stored appropriately.
	Unhygienic farming practice.	<p>Introduction and spread of diseases (including leptospirosis, salmonellosis and toxoplasmosis) from pests.</p> <p>Decrease in milk production, and livestock losses through direct attack or injury can also be a</p>	<ul style="list-style-type: none"> Management and strategic application of appropriate chemicals or other extermination measures. Feed spills should be cleaned up immediately, to minimize breeding sites or attractants. Vegetation and rubbish around buildings and

Interventions	Allied activities	Possible Risk	Management Measures
		nuisance and a health hazard for farm workers and neighbours.	yards are to be removed or controlled, in order to prevent from insects and vermin.
	Milking	Adoption of Unhygienic milking practices may cause contamination of milk and pose a health risk for human	<ul style="list-style-type: none"> Beneficiaries should be trained on hygienic milking practices. Sterilization of utensils and other equipment's must be emphasized by conducting an awareness training Proper sanitization methods to be adopted before milking.
	Enhancing the Milk Yield	Injecting hormonal substances like oxytocin under misconception that it would increase milk yield will result in negative impact on animal health and will make the animal go dry early.	<ul style="list-style-type: none"> Practice of injecting hormones should be strictly avoided. Creating an awareness among producers Sensitization by the veterinarians on this subject would be helpful to the producers
	Shed spacing, sanitation and waste management	Shed Spacing and Sanitation problem (Congested and unclean shed without proper facilities for urine drainage, lack of ventilation etc.) will lead to outbreak and spread of diseases.	<ul style="list-style-type: none"> Selection of sheds should be such that they are not close to waterways or those with shallow groundwater. The shed should be clean and provide sufficient ventilation, enough space to animals to avoid overcrowding and allow free movement to cattle. Proper waste drainage system should be provided . Awareness on alternate use of waste such as use of cow dung as bio fuel, as organic manure etc must be provided Cattle shed management measures have been presented in annexure 6 as a reference.
68. 2. Infrastructure allied activities.	Storage of the products at cold storages/cooling units. – Bulk Milk cooling Units	<ul style="list-style-type: none"> Increased consumption of electricity. Gaseous emissions from the unit. 	<ul style="list-style-type: none"> Use of suitable renewable energy like, solar, wind etc. Energy Efficient Devices should be used to minimize the power use. Advanced cooling equipment should be used to

Interventions	Allied activities	Possible Risk	Management Measures
			reduce emissions.
		Inappropriate storage of the dairy products will lead to contact with moisture and result in contamination	<ul style="list-style-type: none"> • Milk testing kits should be provided to monitor the milk that is to be stored. • Proper PPEs must be provided to milk handlers • Training to be provided to workers who handle the equipment and appliances.
	Transportation (required for the carrying dairy products other dairy based derived items of market and fodder, other support to beneficiaries)	Transportation service (refrigerated milk vehicle) shall be required for, marketing Vehicular emission to the ambient atmosphere. Cracking of roads by over weighing vehicles.	<ul style="list-style-type: none"> • Containers used for carrying the Dairy Products should be properly cleaned and Sterilized before transportation. • Care should be taken that the hauling area should be in a cool place. • BS-IV vehicles with valid emission certificate should be used for transportation. • Roads which are dedicated to be used for or infrequently used shall have proper road signage's and breakers to prevent accidents in the road. • Create awareness on proper transport system management.
69. 3. Processing, Grading, Value Addition	Registration, licenses and permissions	All processing units should hold a valid license	<ul style="list-style-type: none"> • Dairy Processing unit, production units, and other equipment required for various other purposes shall comply with applicable legal and other statutory requirements. • (Please refer chapter 3 for applicable legal requirements)
	Maintenance andupkeep of machinery	Irregular cleaning or no maintenance will lead to contamination and improper functioning.	<ul style="list-style-type: none"> • Regular upkeep should be followed as per the prescribed standards. • Personnel should be well trained and first aid kit should be available. • Periodic preventive maintenance must be adopted for machineries
	Use of additives,preservatives	In processing section, use of non-permitted additives and preservatives shall pose health risks to the workers and consumers	<ul style="list-style-type: none"> • Only the permitted additives and preservatives should be used in food items as prescribed in FSSAI Act.

Interventions	Allied activities	Possible Risk	Management Measures
	Processing area	Basic and required amenities	<ul style="list-style-type: none"> • The processing building should have sufficient space for the intended scale of operation which include: <ol style="list-style-type: none"> a. Sufficient space for weighing and inspecting incoming grain or flour, b. Raw material storage, c. Production area d. Packing and storage of products, e. Maintenance and repair of equipment, f. Cupboard for spare parts and tools, g. Hand-washing and toilet facilities, with space to store workers' clothes. h. First aid box and sand bucket or fire extinguisher; and i. Adequate supply of potable (safe for drinking) water
	Processing area and allied activities	Operation wastes from the dairy processing plant and Biological decomposition of milk derived organic matter	<ul style="list-style-type: none"> • Maintenance of aerobic conditions for wastewater processing. • Use of filters or scrubbers to eliminate or reduce particles. • Use of automatic process control. • Continuous routine monitoring of emission points using audible, visible alarms.
	Air discharges from drier stacks, Heater fans, Air supply fans, Ventilation, Boilers, and Pumps.	Generation of noise.	<ul style="list-style-type: none"> • Concrete buildings reduce the noise level. • Installation of Sound silencers on air intake fans and air discharges. • Acoustic enclosures of outdoor mechanical plant such as pumps. • Adoption of Restricted operating hours. • Use of Mufflers on transport vehicles.
	<ul style="list-style-type: none"> • Product losses from leaking equipment and pipelines, spills caused by equipment overflows and malfunctions and by poor 	Generation of waste water and other liquid wastes.	<ul style="list-style-type: none"> • Wastes generated should be disposed off after treatment. • The plant should have proper drainage system. • Reduction in use of chemicals in cleaning and

Interventions	Allied activities	Possible Risk	Management Measures
	<p>Handling procedures.</p> <ul style="list-style-type: none"> Wastes arising due to washing and cleaning of products remaining in the tank, trucks, cans, piping. Splashing of milk and breakage of containers at the time of packing. 		<p>washing purposes</p> <ul style="list-style-type: none"> All outlets of plant should be regularly monitored and checked.
	Pumping of ground water for complete processing.	This activity leaves less water available for downstream uses, such as for municipal water supply and agriculture.	<ul style="list-style-type: none"> Soil-water balance should be maintained. Recycling of the water that is used for processing.
	<p>Physical hazards. Biological hazards. Chemical hazards</p>	<ul style="list-style-type: none"> Slippery conditions, the use of machines and tools and collisions with internal transport equipment. Exposure to biological and microbiological agents. Chemical- handling activities related to cleaning operations and disinfection of process areas, in addition to the maintenance of heating (thermal oils) and cooling systems. 	<ul style="list-style-type: none"> Provision of clean and dry walking and working surfaces and provide workers with antiskid footwear. Training of workers for the proper use of equipment's (including the proper use of machine safety devices) and personal protective equipment. Proper ventilation of enclosed or semi-enclosed areas to reduce or eliminate exposure to dust and aerosols. Installation of exhaust ventilator equipped with filters and or cyclones, at sources of dust.
	Packaging of the dairy products.	Use of non-biodegradable packaging material.	<ul style="list-style-type: none"> Promoting the use of Bio degradable ingredients and re-useable packaging.
		Use of plastic bags with a thickness less than 20 microns for packaging due to their non-recyclable nature poses a potential negative impact on environment.	<ul style="list-style-type: none"> Use of newspapers wraps or cloth bags as packaging materials, encouraging the consumers to bring cloth bags are some of the methods as alternatives.
		Handling the food products with bare hands or unwashed hands will contaminate the products	<ul style="list-style-type: none"> Personnel involved in processing, packing etc. should wash hands with soap before and after work and use proper PPEs such as aprons, gloves, hair caps while handling, packing etc.
	Waste management	Disposal of decomposable wastes on open areas	<ul style="list-style-type: none"> Wastes should be properly disposed off in the

Interventions	Allied activities	Possible Risk	Management Measures
		leads to contamination of surroundings through decomposition, attracting insects, leaving chemical residues etc.	designated place only <ul style="list-style-type: none"> • It should not be near to water bodies and dense settlement area. • Waste should be integrated with bio-compost formation and agricultural farming practices.
	Power use	Energy is required for heating, boiling, drying, packaging etc.	<ul style="list-style-type: none"> • Adoption of Process modifications such as Reduction of heat loss by using continuous, instead of batch, pasteurizers, partially homogenizing milk to reduce the size of heat exchangers, using multistage evaporators, insulating steam, water, and air pipes / tubes. • Increasing the cooling efficiency by insulating refrigerated room / areas. • Deployment of heat recovery for both heating and cooling operations in milk pasteurizers and heat exchangers. • Installation of renewable energy sources. • Energy efficient device should be used. • Biomass or solar devices should be promoted to conserve energy. • Monitoring of Energy consumption regularly.
	Water Use	Water is required for cleaning, Washing, boiling etc. As the requirement is in large quantities this will have an impact on local Water resources.	<ul style="list-style-type: none"> • Water efficient devices should be promoted. • Water intake and balance should be monitored regularly. • Necessary permission from water resource department should be obtained for water supply in processing area and for other purposes
	Occupational health and Safety	Occupational health problems to worker of processing units. Noise problem	<ul style="list-style-type: none"> • Person using machines must wear mask and gloves for preventing the problem related to inhalation and infections. • Toilets should be separated from the processing area and storage area by two doors or should be located in a separate building • Noise protective equipment should be provided to the machine operators.

Interventions	Allied activities	Possible Risk	Management Measures
			<ul style="list-style-type: none"> • Ensure only experienced and well trained workers are used for the handling of machinery, equipment and material processing plants. • To maintain the safety of equipment as well as worker, Inspections should be carried out to look for evidence of wear and tear, frays, missing parts and mechanical or electrical problems (Refer Annexure 15 for Food Safety). • Ensure an emergency aid service is in place in the work zone

Supporting Agency in interventions under APART are:

1. Assam Rural Infrastructure And Agricultural Services (Arias) Society
2. Director Dairy Development&Director AH &Vety., ASSAM,
3. West Assam Milk Producers' Cooperative Union Ltd,WAMUL
4. District Agriculture Technology Management Agency (ATMA) Societies
5. Assam Agricultural University

8. Fishery

Assam is one of the richest states in the country with good surface water resources where beel fisheries and pond & tank fisheries alone occupies about 1.40 lakh hectare area. Fish has been selected as one of the commodities in the APART for market led production with the objective of increasing fish productivity and production in a sustainable and climate resilient way with value addition and marketing.

Under APART, the project intervention in term of **Fishery sector** shall include the productivity enhancement, value addition and development of market opportunity / infrastructure facility. The following **Table 8** illustrates the potential environmental issues with respect to cultivation and value addition process.

Table 8: Potential Environmental risk and Management Measure due to project Intervention in Fishery

Interventions	Allied activities	Possible Risk	Management Measures
70. 1. Productivity Enhancement	Selection of Fish Species	Selection of fish species that cannot adapt to the local climatic conditions will lead to loss or will result in low productivity.	<ul style="list-style-type: none"> • Selection of suitable breed should be done based on its climate adaptability. • Indigenous species should be promoted hatchery units. • Refer the Aquatic management plan (Annexure 5) or Environmental guideline (Annexure 9) which recommends the fish species/ variety which is suitable for local conditions.
	Indigenous species	<p>biodiversity loss as well as loss of Indigenous species;</p> <p>In order to have higher yield, farmers may introduce exotic species or more productive fish species which may create competition to the indigenous species and as a consequence, a threat to local species may arise</p>	<ul style="list-style-type: none"> • Select local fish species / varieties that would respond and adapt well to the local climatic conditions • The selected fish species/ variety should reduce external inputs and maintenance costs • Refer the Aquatic management plan (Annexure 5) or Environmental guideline (Annexure 9) which recommends the fish species/ variety which is suitable for local conditions.
	Use of chemical fertilizer and pesticides	Use of Chemicals/fertilizer for obtaining better production may lead to bioaccumulation which is then transferred into food chain	<ul style="list-style-type: none"> • Conducting trainings/ workshops to the farmers about the health hazards with respect to the use of chemicals/ pesticides, the bio accumulation process in the fish and its implications. • Promoting the use of bio manure⁷², bio food for agriculture practices and use of traditional fish feed like Mustard Oil cake⁷³, by-products of polished rice etc. • Promote Integrated farming practices so as to encourage the use of farm waste, livestock manure in fish farming which acts as a fertilizer. • Use of agriculture by-products such as rice bran and mustard oil cake in the ratio of 70:30 at 2-3% of the body weight of fishes can be provided.
	Oxygen Depletion	Oxygen Depletion may occur due to the enhanced production of fish within the same cultivated area (water body/pond/tank)	<ul style="list-style-type: none"> • Provision of oxygen supplementation e.g. oxygen tablets, addition of Potassiumpermanganate application and application of lime at 200kg/ha⁷⁴. • Changing feeding regimes, Recirculating water/ aeration and

⁷²Cow dung 2000 kg / ha as initial dose & 1000 kg/ ha. As monthly dose(as per CIFRI)

⁷³200-400 kg. Of mustard oil cake/ha.of water surface area-suitable for stocking of spawn 15-20 days after manuring. (as per CIFRI)

⁷⁴As per CIFRI

Interventions	Allied activities	Possible Risk	Management Measures
		and overcrowding may lead to oxygen stress	<p>De-stocking are some of the measures that are to be taken care of</p> <ul style="list-style-type: none"> • Creating an awareness among the cultivators shall help them to understand and act proactively
	Natural Calamities	Natural Calamities Flood Drought	<ul style="list-style-type: none"> • Proper embankment should be constructed to tackle the flood situation. • Shallow areas of derelict water bodies/ponds/lakes/ can be made use of for raising fishes and prawns in enclosure (pens) • Awareness must be provided to calculate water loss due to evaporation. For instance, for a minimum of five feet total depth, allow at least two feet of water loss resulting from evaporation and seepage during the drought. • Select fish species⁷⁵ which has better acclimatization at higher temperatures (in drought)
	Excess input of feed materials. Water Quality deterioration	Eutrophication may occur due to the use of fertilizer, other feeds (rich in nutrients) for increasing the yield as it may lead to the water quality deterioration and nutrient enrichment	<ul style="list-style-type: none"> • Nutrients rich fish feed should be used in limited / required quantity. The dosage limit must be arrived at with the help of technicians • Prohibit use of unwanted and lethal chemicals without proper awareness and lack of knowledge of related hazards. • Establishment of water quality testing for various parameters at least four times a year should be followed. • Testing the suitability of the water and other environmental conditions for the chosen fish species must be done before cultivation • Creating an Awareness of the various problems that might be encountered shall be conducted with the help of technicians • Knowledge on the toxicity must be provided, If possible, LCA shall be carried out as part of APART project. LD50 & LD100 must also be determined.
	Intensive Fish Farming	Intensive fish farming may create problem of less resource availability in long run businesses.	<ul style="list-style-type: none"> • Fish - livestock farming systems is a highly assured technology where predetermined quantum of livestock waste obtained by rearing the livestock in the pond area is applied in the pond to raise the fish crop without any other additional

⁷⁵Refer aquaculture Management Plan of APART EMF Report

Interventions	Allied activities	Possible Risk	Management Measures
			<p>supply of nutrients. The byproducts generated from the production and processing of livestock can be used as a feed for aquaculture.</p> <ul style="list-style-type: none"> • Integrated Fish Farming practices such as Pig - Fish Farming should be promoted, where urine, excreta of pig and spilled pig feeds can be applied manually to the pond water at a pre-determined dose.
<p>2. Intervention in Beel fisheries</p>	<p>Disturbance to the Physiochemical parameters of the water quality</p>	<p>The water quality in the Beel (water body) may deteriorate due to an increase in suspended particles resulting from the aquaculture wastes. Due to this, there will be a raise in the nutrient concentration which leads to increase in turbidity resulting in depletion of Dissolved Oxygen (DO)</p>	<ul style="list-style-type: none"> • Monitoring the Feeding material regularly those are used in the beel fisheries. Feed shall be calculated based on fish density and the same amount should be let into the system. • Establishment of a proper water quality monitoring at least once in every season (4 times in a year) • Beel committee should compile the records of water quality monitoring of each beel and shall be maintained as per Beel Act • Auto stock practice should be made mandatory in beel. <p>Other Climate resilient Options are as follows:</p> <ul style="list-style-type: none"> • Popularize low impact aquaculture and Resource efficient production system through Community-based management (Cluster). • Bio-floc technology- Accumulation of nitrogenous waste in fish ponds can be converted into feed through environment friendly bio-floc technology. • While feeding fishes with good quality feed, feed quantity needs to be assessed according to the fish biomass at recommended feeding rate; this will reduce the amount of feed and loss during feeding. This would result in oxygen demand
	<p>Culture of Banned fishes</p>	<ul style="list-style-type: none"> • Lack of awareness among farmers of banned fish may lead to loss of overall fish productivity. • This poses a threat to native fish species and gene pool and may result in ecological imbalance and may lead to loss of bio-diversity. 	<ul style="list-style-type: none"> • Restrictions shall be made mandatory to prohibit culture of banned fish in pond and beels. • Culture of Alien fish species should be banned, such as Thai magur (<i>Clarias gariepinus</i>), Tilapia, hybrid Kawoi (<i>Anabastesteduneus</i>), Roopchanda (<i>Colossomacropomum</i>), Bighead carp (<i>Hypophthalmichthys nobilis Pangasiussutchi</i>) etc.

Interventions	Allied activities	Possible Risk	Management Measures
	Accidental events/spills (e.g. fuel, hydraulic fluid and lubricants).	Degradation of water quality.	<ul style="list-style-type: none"> Minimization of leaks from boat engines, water pumps and generators. Proper drainage should be provided to reduce the contamination of hazardous materials.
		Lack of awareness among small beneficiaries for sustainable fish farming will lead to productivity problems Enhancement urging the need to select exotic breed, chemicals and other unhygienic practices	<ul style="list-style-type: none"> Providing awareness and capacity building on promising approaches having low impact of aquaculture amongst the farmers, participating communities, local authorities, extension agents, development practitioners etc to protect the environment.
71. 3. Infrastructure allied activities.	Storage of the products at cold storages/cooling units.	<ul style="list-style-type: none"> High consumption of electricity. Excess use of water for cleaning and cooling purposes. 	<ul style="list-style-type: none"> Fish storage should be done in clean, cool containers or containers with lids, covers. Refrigerated containers shall be used for fish storage to keep it fresh and safe. Energy Efficient Devices should be used to minimize the power use. Use of suitable renewable energy like, solar, wind etc. may be adopted Advanced cooling equipment should be used to reduce emissions.
	Transportation	<ul style="list-style-type: none"> Transportation service is required to store, manage, and post-harvest care, marketing and further value addition in the product. Vehicular emissions to the ambient atmosphere. Cracking of roads by over weighing vehicles. 	<ul style="list-style-type: none"> Containers used for carrying the Products should be properly cleaned and Sterilized before transportation. BS-IV vehicles with valid emission certificate should be used for transportation. Roads which are dedicated to be used for transportation or infrequently used shall have proper road signage's and breakers to prevent the accident in the road. Create awareness on proper transport system management.
72. 4. Processing, Grading, Value Addition	Registration, licenses and permissions	All processing units for Fish seed production, value addition items and other machinery should hold valid licenses	<ul style="list-style-type: none"> Processing unit, seed production units and other equipment required for value addition purposes shall comply with legal requirements. (Please refer chapter 2 for applicable legal requirements)
	Maintenance and upkeep of machinery	Irregular cleaning or maintenance will lead to contamination and improper	<ul style="list-style-type: none"> Regular upkeep should be followed as per the prescribed standards.

Interventions	Allied activities	Possible Risk	Management Measures
		functioning.	<ul style="list-style-type: none"> Personnel should be well trained and first aid kit should be available.
	Use of additives, preservatives	In processing section, use of non-permitted additives and preservatives is illegal and pose health risks to the workers and consumers	<ul style="list-style-type: none"> Only the permitted additives and preservatives should be used in food items as per prescribed in FSSAI Act.
	Processing area	Basic and required amenities	<ul style="list-style-type: none"> The processing building should have sufficient space for the intended scale of operation which include: <ul style="list-style-type: none"> a. sufficient space for weighing and inspecting incoming products and raw material, b. raw material storage, c. production, d. packing and storage of products, e. maintenance and repairs of equipment, f. Cupboard for spare parts and tools, and g. Hand-washing and toilet facilities, with space to store workers' clothes; and First aid box and sand bucket or fire extinguisher.
		Establishment of fish processing unit	<ul style="list-style-type: none"> Fish Cutting, processing place should be properly cleaned Process waste arrived shall be stored safely which can be used as a feedin farm. Equipment's that are to be used for the processes should be sterilized and must be hygienic. Wastes generated should be disposed offafter treatment. The plant should have proper drainage system. Use of chemicals in cleaning and washing purposes should be reduced. Provision of Proper ventilation of enclosed or semi-enclosed areas to reduce or eliminate exposure to dust and aerosols. Installation of exhaust ventilators equipped with filters and or cyclones, at sources of dust. Training workers for the proper use of equipment's (including the proper use of machine safety devices) and personal protective equipment. .
	Establishment of Hatcheries	Haphazard selection of fish in hatchery plant may create problem to	<ul style="list-style-type: none"> Mixed spawning of fish should be promoted in the seed producer centers. If this does not happen, conservation of the

Interventions	Allied activities	Possible Risk	Management Measures
		overall production and loss of indigenous variety.	<p>native fish species shall be extremely difficult</p> <ul style="list-style-type: none"> Induced Breeding of Immature fish should not be practiced. It may results unhealthy fingerlings. Good brood stock management and planned cross breeding of different species should be endorsed.
	Packaging of the Fish products.	Use of non-biodegradable packaging material resulting in soil Pollution.	<ul style="list-style-type: none"> Bio degradable ingredients and re-useable packaging should be promoted.
		Use of plastic bags with a thickness less than 20 microns for packaging due to their non-recyclable nature poses a potential negative impact on environment.	<ul style="list-style-type: none"> Use of newspapers wraps or cloth bags as packaging materials, encouraging the consumers to bring cloth bags are some of the methods as alternatives.
		Handling the food products with bare hands or un washed hands will contaminate the products.	<ul style="list-style-type: none"> Personnel involved in processing, packing etc. should wash hands with soap before and after work and use PPES such as aprons, gloves, hair caps for handling, packing etc.
	Waste management	Disposal of decomposable wastes leads to contamination of surroundings through decomposition, increase in number of pests, leaving chemical residues etc.	<ul style="list-style-type: none"> Wastes should be properly disposed off in the designated place only It should not be near to water bodies and dense settlement area. waste should be integrated with biocompost formation and agricultural farming practices.
	Power use	Energy is required for, drying, packaging etc.	<ul style="list-style-type: none"> Improvement of cooling efficiency by insulating refrigerated room / areas. Energy efficient devices should be used. Installation of renewable energy sources may be promoted. Monitoring the Energy consumption should be followed regularly.
	Water Use	Water is required for cleaning, Washing, etc.	<ul style="list-style-type: none"> Water consumption should be monitored regularly. Necessary permission from water resource department should be obtained for water supply in processing area and other purposes
	Occupational health and Safety	Occupational health problems to worker of processing units.	<ul style="list-style-type: none"> Person using machines must wear mask and gloves for preventing the problem related to inhalation and infections. Toilets should be separated from the processing area and

Interventions	Allied activities	Possible Risk	Management Measures
		Noise problem	<p>storage area by two doors or should be located in a separate building</p> <ul style="list-style-type: none"> • Noise protective equipment should be provided to the machine operators. • Ensure only experienced and well trained workers are used for the handling of machinery, equipment and material processing plants (Refer Annexure 15 for Food Safety). • To maintain the safety of equipment as well as worker, Inspections should be carried out to look for evidence of wear and tear, frays, missing parts and mechanical or electrical problems. • Ensure an emergency aid service is in place in the work zone

Supporting Agency in interventions under APART are:

1. Assam Rural Infrastructure And Agricultural Services (Arias) Society
2. Directorate of Fisheries, ASSAM,
3. Assam Agricultural University
4. District Agriculture Technology Management Agency (ATMA) Societies
5. World Fish Centre (WFC)
6. Beel: Beel development Committee

9. Piggery

Pig farming requires low-external input, which shall be managed by a family (mainly women labourers). The by-product of the paddy and other crops shall be used as feed. The varieties of pig which are used in the farming are generally Hampshire, Large Black, Saddleback, Duroc, Large White Yorkshire and Crossbreed of local Doom variety.

Under APART, the project intervention in term of Piggery shall include the productivity enhancement, value addition and development of market opportunity / infrastructure facility. Following **Table 9** illustrates the potential environmental issues with respect to pig farming and value addition process.

Table 9: Potential Environmental risk and Management Measure due to project Intervention in Pork value Chain

Interventions	Allied activities	Possible Risk	Management Measures
73. 1. Productivity Enhancement	Selection of breed	Selection of breeds that cannot adapt to the local climatic conditions will lead to loss of cattle or results in low productivity and health issues.	<ul style="list-style-type: none"> Suitable breed selection should be done with respect to climate adaptability. Suitable breed⁷⁶ applicable to local climate should be promoted
	Fodder	Shortage of food may occur due to rearing of more number of pigs for more yields.	<ul style="list-style-type: none"> Conservation of Village grazing reserve, community and farmer group should initiate the protection of existing village grazing reserves to suffice the demand of livestock feed. Integrated farming practices should be promoted so as to promote the use of farm waste (kitchen waste, by-products of food grains etc.,) as food for pigs. Integration of silk waste to pig farming is also a good option. Since sericulture rearing waste are also good source of nutrients it can be used as feed. Water Hyacinth is abundant in Assam which can be used as a food for pigs⁷⁷.
	Health and Hygiene	<ul style="list-style-type: none"> Health and Disease Vaccination 	<ul style="list-style-type: none"> Provision of mobile veterinary services to be offered during emergency period for critical and emergency care. Proper Vaccination and deworming schedule to be followed. Provide mandatory health Checkups. Provide Pig Health calendar depicting season and disease relationship and related preventive measures Regular interaction with medical service provider about pig health and precautions that are to be followed.
	<ul style="list-style-type: none"> Infectious disease 	<ul style="list-style-type: none"> Traditional farmers have little knowledge on food safety, public health risk and zoonotic issues in pig rearing. 	<ul style="list-style-type: none"> An awareness program for farmers on precaution measures that needs to be adopted during epidemic/spreading of infectious diseases in pig should be made available. Knowledge on the possible diseases that could be transmitted from pig to humans such as H1N1 should

⁷⁶In India there are no recognized breed of pigs, in Assam only one local variety is found namely Doom, which is originally from Bangladesh. **Hampshire, Large black, Saddle back, Yorkshire, Landrace** are some exotic breed which are commonly used in piggery in Assam

⁷⁷ <http://www.fao.org/livestock/agap/FRG/APH132/chap2.htm>

Interventions	Allied activities	Possible Risk	Management Measures
			be provided. <ul style="list-style-type: none"> • Awareness on the disposal techniques and safety measures that are to be adopted while handling contaminated / infectious meat.
	Food Safety Issue	<ul style="list-style-type: none"> • Excess use of Antibiotics for increase in body mass may lead to unwanted chemical residue in the Food Chain 	<ul style="list-style-type: none"> • Prohibition of use of antibiotics without proper medical guidance to 'prevent' early death of the pigs . • Injection of growth hormones to accelerate the growth of pigs to attain higher body mass ratio to meet the market demand should be avoided. • Provide training to the farmers regarding Food safety standard and regulation of GOI. • Provide awareness about human health hazards due to the use of antibiotics. • Periodic Testing of pork samples to ensure quality and safety must be in place.
	Unhygienic pig farming practice.	<ul style="list-style-type: none"> • Poor manure management, Solid Waste management and discharge of Effluent • Backyard pig rearing practices results in foul smell of the surrounding area. 	<ul style="list-style-type: none"> • Effluent and manure by-products that have been generated in a piggery are valuable sources of water, nutrients and organic matter. Hence it shall be re-used in number of ways such that it will not harm the environment. • Pig manure should be dumped in proper manure pit which can be used as manure or can be used in bio-gas production. • Sheds should have proper ventilation. • Keeping drains clean & flushing the sheds twice daily will control the spread of dirty smell to the nearby areas. • Weeping or hosing lanes and pens should be cleaned regularly to avoid manure build-up. • Providing deep litter pens. • Dumping static-pit sheds weekly, or more often.
		<ul style="list-style-type: none"> • Soil pollution is another delicate issue when coming to spills and leaks of manure. 	<ul style="list-style-type: none"> • Applying manure to the soil has positive impacts on the soil, it gives nutrients, especially Nitrogen and Potassium back and improves the fertility of the soil, so manure should be managed properly, it should not be disposed off near to water and settlements. • Applying manure in farm field should be done indifferent

Interventions	Allied activities	Possible Risk	Management Measures
			locations so it does not accumulate in one location.
	<ul style="list-style-type: none"> Water Pollution 	<ul style="list-style-type: none"> Storage of waste water in pit or lagoon should be cleaned frequently, a limited amount of waste water can be used in fish pond, it will reduce the requirement of another fertilizer in fishing pond 	<ul style="list-style-type: none"> Water Pollution (liquid waste from shed can leak into ground water or mix with surface water and it may lead richness of nitrogen and phosphorous component. This may ultimately lead to algal bloom other toxic effect.
	<ul style="list-style-type: none"> Air Pollution- 	<ul style="list-style-type: none"> Storage of Pig manure may result in emanating toxic gases such as hydrogen sulphide and ammonia that leads to respiratory problems in human. 	<ul style="list-style-type: none"> Manure should be used as bio compost material in agricultural field after decomposition. Establishment of biogas could be a best way to manage the toxic gas and it generates the energy necessary to fulfil the daily demand of cooking fuel. A family having 2-5 pig can have a biogas establishment.
74. 2. Infrastructure allied activities.	Storage of the meat products at cold storages/cooling units	<ul style="list-style-type: none"> High consumption of electricity. Gas emissions from the unit. 	<ul style="list-style-type: none"> Use of suitable renewable energy like, solar, wind etc., to be adopted. Energy Efficient Device should be used to minimize the power use. Advanced cooling equipment should be used to reduce emissions.
		Inappropriate storage of the meat / products will lead to contact with moisture and results in contamination	<ul style="list-style-type: none"> Meat is a perishable item. So in order to protect it from contamination; deep freezers should be used by the farmers. The awareness about the precaution measures that are to be taken during storage and transportation of pork should be shared with the farmers. Knowledge of public hygiene among traders and producers should be facilitated. Proper gloves, apron should be used while handling and storage of pork. Cross contamination must be prevented
	Transportation of (Pork and pork products, fodder etc.)	Transportation service shall be required for, marketing Vehicular emission to the ambient atmosphere. Cracking of roads by over weighing	<ul style="list-style-type: none"> Containers used for carrying the meat Products should be properly cleaned and Sterilized before transportation. Care should be taken that the hauling area are located in cool place.

Interventions	Allied activities	Possible Risk	Management Measures
		vehicles.	<ul style="list-style-type: none"> • BS-IV vehicles with valid emission certificate should be used for transportation. • Roads which are dedicated to be used for or infrequently used shall have proper road signage's and breakers to prevent road accidents. • Create awareness on proper transport system management.
75. 3. Processing, Grading, Value Addition	Registration, licenses and permissions	All processing units for , value addition items and other machinery should hold valid license	<ul style="list-style-type: none"> • Processing unit, Slaughter units, and other equipment required for value addition purposes shall meet all legal requirements. • (Please refer chapter 3 for applicable legal requirements)
	Maintenance and upkeep of Machinery (slaughtering, processing etc)	Irregular cleaning or maintenance will lead to contamination and improper functioning.	<ul style="list-style-type: none"> • Regular upkeep should be followed as per the prescribed standards. • Personnel should be well trained and first aid kit should be available.
	Use of additives, preservatives (in meat products)	In processing section, use of non-permitted additives and preservatives is illegal and pose health risks to the workers and consumers	<ul style="list-style-type: none"> • Only the permitted additives and preservatives should be used in food items as per prescribed in FSSAI Act.
	Processing & packaging area	Basic and required amenities	<ul style="list-style-type: none"> • The processing building should have sufficient space for the intended scale of operation which include: <ol style="list-style-type: none"> a. Sufficient space for weighing and inspecting incoming grain or flour, b. Raw material storage, c. Production area d. Packing and storage of products, e. Maintenance and repair of equipment, f. Cupboard for spare parts and tools, g. Hand-washing and toilet facilities, with space to store workers' clothes. h. First aid box and sand bucket or fire extinguisher; and i. Adequate supply of potable (safe for drinking) water

Interventions	Allied activities	Possible Risk	Management Measures
		Small Slaughter Area	<ul style="list-style-type: none"> • Personal Hygiene (such as cleaning hand, use of gloves, apron, mask etc.) should be maintained while handling. • Slaughter house should have adequate facility of potable water, electricity, cold storage, quality control laboratory, space for antemortem and postmortem inspection, byproduct utilization system. • All equipment used in the plant shall be properly licensed. • Permission should be required from central Ground water authority for usage of water. • Processing area shall have good drainage and sanitation plan. • Slaughter area should not be operated in open place. • Ensure that plant be in legal parity with Prevention of Cruelty to Animals (Slaughter House) Rules, 2001. • Slaughter House should be far from residential and commercial areas. It should have good ventilation, but have proper drainage system. • Plant shall be equipped with proper testing kits. • Slaughter house should not be located in flood prone area. • An adequate supply of water should be facilitated for treatment and disposal. • Implementing an efficient effluent treatment plant and bio-composting has to be followed after treatment. • Flooring should be ceramic.
			<ul style="list-style-type: none"> • aerobic conditions should be maintained for wastewater processing. • Use of filters or scrubbers to eliminate or reduce particles. • Continuous routine monitoring of emission points using audible, visible alarms. • Proper ventilation of enclosed or semi-enclosed areas to reduce or eliminate exposure to dust and aerosols.

Interventions	Allied activities	Possible Risk	Management Measures
	Physical hazards. Biological hazards. Chemical hazards	<ul style="list-style-type: none"> Slippery conditions, the use of machines and tools and collisions with internal transport equipment. Exposure to biological and microbiological agents. Chemical- handling activities related to cleaning operations and disinfection of process areas, in addition to the maintenance of heating (thermal oils) and cooling systems. 	<ul style="list-style-type: none"> Provision of clean and dry walking and working surfaces and provide workers with antiskid footwear. Training of workers for the proper use of equipment's (including the proper use of machine safety devices) and personal protective equipment. Proper ventilation of enclosed or semi-enclosed areas to reduce or eliminate exposure to dust and aerosols. Installation of exhaust ventilators equipped with filters and or cyclones, at sources of dust.
	Packaging	Use of non-biodegradable packaging material.	<ul style="list-style-type: none"> Promoting the use of Bio degradable ingredients and re-useable packaging.
		Use of plastic bags with a thickness less than 20 microns for packaging due to their non-recyclable nature poses a potential negative impact on environment.	<ul style="list-style-type: none"> Use of newspapers wraps or cloth bags as packaging materials, encouraging the consumers to bring cloth bags are some of the methods as alternatives.
		Handling the food products with bare hands or un washed hands will contaminate the products	<ul style="list-style-type: none"> Personnel involved in processing, packing etc. should wash hands with soap before and after work and use proper PPEs such as aprons, gloves, hair caps while handling, packing etc.
	Waste management	Disposal of decomposable wastes on open areas leads to contamination of surroundings through decomposition, attracting insects, leaving chemical residues etc.	<ul style="list-style-type: none"> Wastes should be properly disposed off in the designated place only It should not be near to water bodies and dense settlement area. waste should be integrated with bio-compost formation and agricultural farming practices. Waste outlets must be regularly monitored
	Power use	Energy is required in processing area, storageroom. , cooling, , packaging etc.	<ul style="list-style-type: none"> Improvement of cooling efficiency by insulating refrigerated room / areas. Installation of renewable energy sources. Energy efficient device should be used. Biomass or solar devices should be promoted to conserve energy. Monitoring of energy consumption should be followed

Interventions	Allied activities	Possible Risk	Management Measures
			regularly.
	Water Use	Water is required for cleaning, Washing, boiling etc. As the requirement is in large quantities this will have impact on local Water resources.	<ul style="list-style-type: none"> Water efficient devices should be promoted. Water consumption should be monitored regularly. Necessary permission from water resource department should be obtained
	Occupational health and Safety	<p>Occupational health problems to worker of processing units.</p> <p>Noise problem</p>	<ul style="list-style-type: none"> Person using machines must wear mask and gloves for preventing the problem related to inhalation and infections. Toilets should be separated from the processing area and storage area by two doors or should be located in a separate building Noise protective equipment should be provided to the machine operators. Ensure only experienced and well trained workers are used for the handling of machinery, equipment and material processing plants. To maintain the safety of equipment as well as worker, Inspections should be carried out to look for evidence of wear and tear, frays, missing parts and mechanical or electrical problems (Refer Annexure 15 for Food Safety). Ensure an emergency aid service is in place in the work zone

Supporting Agency in interventions under APART are:

- Assam Rural Infrastructure And Agricultural Services (Arias) Society
- Director AH &Vety. AHVD, ASSAM,
- Assam Agricultural University
- District Agriculture Technology Management Agency (ATMA) Societies

10. Sericulture

Seri farming is an agro based cottage industry which continues to provide gainful employment to around 2.50 lakh persons in rural and semi- urban areas of Assam, of whom a sizeable number belong to the economically weaker section of the society and women.

Under APART, the project intervention in term of **Sericulture**, shall include productivity enhancement, value addition and development of market opportunity / infrastructure facility. Following **Table 10** illustrates the potential environmental issues with respect to sericulture and value addition process.

Table 10: Potential Environmental risk and Management Measure due to project Intervention in Seri Culture Value Chain

Interventions	Allied activities	Possible Risk	Management Measures
76. 1. Productivity Enhancement	Selection of silk species	<ul style="list-style-type: none"> • Selection of suitable silkworm species that cannot adapt to the local climatic conditions will lead to economical loss or will result in low productivity. 	<ul style="list-style-type: none"> • Selection of Suitable silkworm species with respect to the climate adaptability. • Indigenous species should be promoted by Seed provider centers⁷⁸ • Promoting interaction with technicians of seed provider would be helpful to make a suitable choice as per climate and season requirement. • Provide awareness to the farmers about the importance of climate adaptability benefits of indigenous silkworm species
	Protection of silk worms	<ul style="list-style-type: none"> • Problem due to birds and animals 	<ul style="list-style-type: none"> • Problem from animals and birds in the rearing areas (In case of Muga silk worms some insect eating birds often target the silk worms as their prey. Monkeys damage the feed plant cultivated by the farmers).
	Public health in reeling and Grainage room,	<ul style="list-style-type: none"> • Adoption of Sericulture techniques inside the farmer's house leads to development of allergic diseases to both adults and children. • Unhygienic conditions also lead to contamination of microbes to the pupa and silkworms. • Skin infections due to boiling and handling of the worms. • Asthma, cough, lung infections. 	<ul style="list-style-type: none"> • Good housekeeping practices, enough ventilation in room will minimize the chance of public health risk. So site selection should be done by keeping the issues in mind. • Awareness about use of PPEs and precautionary measures that are to be adopted during working hours such as wearing gloves, mask, apron, gum-shoes are suggested for use while disinfecting the rearing rooms and appliances. • Medical checkup after a certain interval of time is essential.

⁷⁸ Refer indigenous silk species cultured in Assam in Chapter 3 – section 3.1.6

Interventions	Allied activities	Possible Risk	Management Measures
	<ul style="list-style-type: none"> Reeling, boiler, and grainage 	<ul style="list-style-type: none"> Release of Sulphur, Carbon, Volatile Organic solvents, dust and soot. Toxic to environment and cause occupational health problems. 	<ul style="list-style-type: none"> Use of filters or scrubbers to eliminate or reduce particles. To minimize health risks in reeling rooms, good ventilation, proper drainage to ensure dampness, use of slipper and quick disposal of waste should be practiced.
77. 2. Infrastructure allied activities.	Storage	<ul style="list-style-type: none"> enhanced production of silk may need more storage area/space with reeling / weaving unit and if the demand is not properly met the quality may deteriorate in due course of time 	<ul style="list-style-type: none"> Proper ventilation must be available at the storage house so that temperature would be in control.
	Transportation service required for carrying silk products to market, cocoon from production centre to village rearing area, fodder, other required supporting operations.	Transportation service shall be required to store, manage,, marketing and further value addition in the product. Vehicular emission to the ambient atmosphere. Cracking of roads by over weighing vehicles.	<ul style="list-style-type: none"> BS-IV vehicles with valid emission certificate should be used for transportation. Roads which are dedicated to be used for / or in frequently used shall have proper road signage and breakers to prevent the accident in the road. Create awareness on proper transport system management.
78. 3. Processing, Grading, Value Addition	Registration, licenses and permissions	All processing units (equipment for textile weaving, reeling dyeing) for Silk seedproduction, value addition items and other machinery if not be line with legally frame will create a problem	<ul style="list-style-type: none"> Processing unit, silk dyeing units and other equipment required for value addition purposes shall comply with legal requirements.
	Maintenance and upkeep of machinery	Irregular cleaning or maintenance will lead to contamination and improper functioning.	<ul style="list-style-type: none"> Regular upkeep should be followed as per the prescribed standards. Personnel should be well trained and first aid kit should be available.
	Use of colors	Use of more chemicals in dyeing units shall affect the quality and also health of worker.	<ul style="list-style-type: none"> Use of natural colors in dyeing units should be promoted.
	Packaging of silk products.	Use of non-biodegradable packaging material resulting in soil Pollution.	<ul style="list-style-type: none"> Local material should be used for packaging instead of imported materials, plastics etc. Jute sacks or other available material can be used for transport purposes. This can reduce the unnecessary use of packaging waste.

Interventions	Allied activities	Possible Risk	Management Measures
	<ul style="list-style-type: none"> Power Requirement for Weaving and Unit operation 	<ul style="list-style-type: none"> Energy Requirement for controlling the room temperature and for boiling operations may lead to power shortage problems 	<ul style="list-style-type: none"> Alternate energy options such as solar energy, biomass energy should be promoted to meet the energy demand.
	Water Use	Water is required for cleaning, Washing, boiling etc. As the requirement is in large quantities this will have impact on local Water resources.	<ul style="list-style-type: none"> Water efficient devices should be promoted. Water consumption should be monitored regularly. Necessary permission from water resource department should be obtained for water supply in processing area and other purposes
	Waste	<ul style="list-style-type: none"> Disposal of waste water generated after boiling of cocoons is a common problem. Wastewater containing chemicals dyes and detergents that are harmful to the aquatic and terrestrial environment, when disposed off in the ponds/ waterbodies or nearby areas Depletion of DO in the waterbodies Destruction of soil microbes and reduction in the natural soil fertility which alter the permeability of soils. Persistence of pollutants in soil over longer period also contaminates the ground water. 	<ul style="list-style-type: none"> Awareness program should be conducted to the farmers for managing solid waste and waste water. Awareness must be provided to farmers as not to dispose/ drain the waste water in the nearby areas. Promoting the use of pupae which is left over after reeling (it is rich in protein) as poultry and fish food. Proper waste management techniques should be followed. Adequate drainage facilities should be provided . Training program on ecofriendly culturing techniques and practices. In Handloom centres reuse of packaging waste, dry waste should be adopted.
	Occupational health and Safety	<p>Occupational health problem to worker of processing units.</p> <p>Noise problem (continuous exposure of noise during reeling and weaving operation may have negative impact on worker)</p>	<ul style="list-style-type: none"> Person working in rearing, grainage and reeling room should wear mask and gloves for preventing inhalation of foreign particles and to prevent infections. Noise protective equipment should be provided to the machine operators. Ensure only experienced and well trained workers are used for the handling of machinery, equipment and material processing plants (in boiling, dyeing etc.). To maintain the safety of equipment as well as worker, Inspections should be carried out to look for evidence of wear and tear, frays, missing parts and mechanical

Interventions	Allied activities	Possible Risk	Management Measures
			or electrical problems (Refer Annexure 15 for Food Safety). <ul style="list-style-type: none"> • Ensure an emergency aid service is in place in the work zone

Supporting Agency in interventions under APART are:

1. Assam Rural Infrastructure And Agricultural Services (Arias) Society
2. Director Sericulture, ASSAM,
3. Assam Agricultural University
4. District Agriculture Technology Management Agency (ATMA) Societies

Annex 12

ANNEXURE 12: PEST MANAGEMENT PLAN (PMP)

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
1	Rice				
(1)	Normal Ahu/ Autumn rice (Direct seeded)	(A) Diseases: (In main field)			
		(i)Blast: (<i>Magnaporthe grisea</i>) (Leaf blast, Nodal blast, Neck blast)	Spraying carbendizim at disease appearance	<ul style="list-style-type: none"> Grow tolerant variety: Govinda, Cauvery, IR-36 Seed selection by putting in plain water and stirring well. Select the sunken seeds and reject the floating ones. Pre-sowing seed treatment by dry method: Put the selected seeds in a container and mix with mancozeb or captan @ 2.5 g/kg thoroughly for five minutes. At tillering stages (40-55 days after sowing) spray carbendazim or thiophanate-methyl @ 1 g/l. Subsequent spraying with same fungicide (1 g/l) at panicle initiation stage and panicle open stage may be required. Use bacterial bio-control agents viz., <i>Pseudomonas fluorescence</i> and <i>Bacillus</i> as seed treatment (1%) and post transplanting spray (0.5%). 	√Prevalent in LBVZ, BVZ, CBVZ √ If 5% leaf area of top five leaves damaged then restore fungicide spraying
		ii. Sheath blight (<i>Rhizoctonia solani</i>)	Spraying carbendizim at disease appearance	<ul style="list-style-type: none"> Destruction of crop residue of disease infected field by burning Spray talc based formulation of <i>Trichoderma harzianum</i> along with CMC (Carboxyl Methyl Cellulose) @ 8 g/l . Spraying of Botanicals viz., Cymbopogon 20 EC (Wanis) (5 ml/l) and Neemazal (neemoil) (3 ml/l) at 10 days interval, starting the first spray at symptom appearance.. Soil amendment with saw dust and FYM at the rate of 1% and application of carbendazim (0.1%) followed by spraying of <i>Trichoderma viride</i> (0.5%). In case of severe incidence spray with carbendazim 50WP (0.1%) or hexaconazole 5 EC (0.1%) 	
		iii. Brown spot	Spraying mancozeb	<ul style="list-style-type: none"> Pre-sowing seed treatment-dry seed treatment by mancozeb or 	Nutrient poor soil favour

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
		(<i>Helminthosporium oryzae</i>)	at disease appearance	captan @2.5 g/kg of seed <ul style="list-style-type: none"> Spray mancozeb (2.5 g/l) or carbendazim (1g/l) starting at initiation of the disease symptom. 	diseases developmeny
		iv. Bacterial leaf blight (<i>Xanthomonas campestris</i> pv. <i>oryzae</i>)	Spraying mancozeb at disease appearance	<ul style="list-style-type: none"> Grow tolerant variety: Govinda, IR-36 Avoid top dressing with nitrogenous fertilizers at panicle initiation stage, instead, top dressing with K₂O (@ 10 kg/ha or application of K₂O @ 5 kg/ha in the form of foliar spray of 3 % solution. Combine application of <i>Pseudomonas fluorescence</i> and <i>Trichoderma harzianum</i> (0.5%). 	
		v. Bakane Disease (<i>Fusarium moniliforme</i>)	Nothing	<ul style="list-style-type: none"> Seed soaking for 24 hrs in thiophanate-methyl or carbendazim solution (@ 2 g/kg seeds/lit of water) . Rouging and destruction of elongated seedlings from the nursery bed as well as main field. Spray thiophanate -methyl or carbendazim (0.1%) to check the spread of the infection to the adjacent plants 	
(B) Insect pests:(In main field)					
		(i) Stem borer: (<i>Scirpophaga incertulas</i>)	Spraying of malathion 50 EC (@2 ml/l) and many other non-recommended insecticides	<ul style="list-style-type: none"> Deep ploughing to expose the soil harbouring insect pests Clean cultivation with line sowing Use Birds perch @ 6 no/bigha For bio-control of stem borer- 6-8 release of egg parasitoides, <i>Trichogramma japonicum</i> and <i>T. chilonis</i>@ 50,000/ha/week starting from 30 days after transplanting. "Trichocard" should be put over the entire infested area throughout the egg laying period of pests. Cut each Trichocard by scissor into 6-12 pieces and distribute over the entire field by fixing them to the plant by using a stapler or adhesive. Spray of Chlorpyrifos 20 EC @ 2.5-3 ml/lit or Dimethoate 30 EC @ 2 ml/lit of water) repeat after 10 days if necessary. Start spraying when > 5% dead heart is noticed. 	✓Prevalant in all 16 districts ✓ Restore spraying if 1 egg mass /m ² or 5% dead heart
		ii. Leaf folder (<i>Cnaphalocrosis medinalis</i>)	Spraying of malathion 50 EC (@2 ml/l) and many other non-recommended insecticides	<ul style="list-style-type: none"> Deep ploughing to expose the soil harbouring insect pests Clean cultivation with line sowing Use Birds perch @ 6 no/bigha For bio-control of leaf folder- Require 6-8 release of egg parasitoides, <i>Trichogramma japonicum</i> and <i>T. chilonis</i>@ 50,000/ha/week starting from 30 days after transplanting. "Trichocard" should be put over the 	✓Prevalant in all 16 districts ✓ Restore spraying if >1 damaged leaf per hill is noticed.

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
				entire infested area throughout the egg laying period of pests. Cut each Trichocard by scissor into 6-12 pieces and distribute over the entire field by fixing them to the plant by using a stapler or adhesive. <ul style="list-style-type: none"> Spray of chlorpyriphos 20 EC @ 2.5-3 ml/lit and repeat after 10 days if necessary. 	
		iii.Rice/Gandhi bug (<i>Leptocorisa orientalis</i>)	Spraying of malathion 50 EC (@2 ml/l) and many other non-recommended insecticides	<ul style="list-style-type: none"> Arrange fire in the surrounding bundhs to attract adult rice bugs Put half rotten fish/frog/snail etc. which attract masses of insect , and subsequently kill manually Use Birds perch @ 6 no/bigha Dusting of malathion 5% Dust @ 20-25 kg /ha. 	√ Restoredusting if 1-2 bugs/m ² is noticed.
(2)	Normal Ahu/ Summar rice (Transplante)	(A) Diseases: (In Nursery)			
		(i)LeafBlast: (<i>Magnaporthe grisea</i>)	No general control measures adopted against pest and diseases.	<ul style="list-style-type: none"> Grow tolerant variety: Govinda, Cauvery,IR-36, Seed selection by putting in plain water and stirring well. Select the sunken seeds and reject the floatingones. Pre-sowing seed treatment by wet method: Soak the selected seeds in a container containing fungicidal solution of mancozeb or captan or carbendazim @ 2.5 g/kg of seeds/litre of water for 24 hrs. Need based spray of carbendazim (1 g/l)) is to be done. 	√Prevelant in all 16 districts √ As soon as 1 or 2 spindle shaped brownish blast spots are seen, start spray.
		(B) Insect pests and nematode (In Nursery)			
		Root knot nematode, Thrip, Stem borer, Leaf folder, (<i>Cnephalocrocis medinalis</i>)	Application FYM only	<ul style="list-style-type: none"> Apply neem cake or mustard oil cake (500 g/m²) in soil 15 days prior to sowing in root –knot nematode and stem borer endemic areas. For the control of thrips or stem borer or leaf folder infestation in nursery beds, spray choropyriphos @ 2 ml/l. Generally, one week after seedling germination one insecticidal spray is most effective against most pests. 	
		(C) Diseases: (In main field)			
		(i) Blast (Leaf blast, Nodal blast, Neck blast) (<i>Magnaporthe grisea</i>)	Spraying carbendizm at disease appearance	Same as in case of direct seeded ahu	√ If 5% leaf area of top five leaves damaged then restore fungicide spraying

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
		ii. Sheath blight (<i>Rhizoctonia solani</i>)	Spraying carbendazim at disease appearance	Same as in case of sheath blight of direct seeded Ahu rice (Autumn rice)	
		iii. Brown spot (<i>Helminthosporium oryzae</i>)	Spraying mancozeb at disease appearance	Same as in case of brown spot of direct seeded Ahu rice (Autumn rice)	
		iv. Bacterial leaf blight(<i>Xanthomonas campestris</i> pv. <i>Oryzae</i>)	Spraying mancozeb at disease appearance	Same as in case of BLB of direct seeded Ahu rice (Autumn rice)	
		v. Bakane Disease (<i>Fusarium moniliforme</i>)	Nothing	Same as in case of bakane disease of direct seeded Ahu rice (Autumn rice)	
(D) Insect pests: (In Main field)					
		(i) Stem borer: (<i>Scirpophaga incertulas</i>)	Spraying of malathion 50 EC (@2 ml/l) and many other non-recommended insecticides	<ul style="list-style-type: none"> • Deep ploughing to expose the soil harbouring insect pests • Field sanitation to prevent pest multiplication .Clean cultivation with line sowing • Placement of branches of <i>Chromoleana odoratum</i>, <i>Schima wallihii</i>, <i>Artimisia vulgaris</i> in the field for repellent of insect and it also act as perch for predatory birds. Or use wooden bar or bamboo made Birds perch @ 6 no/bigha • Clipping of leaf tip of rice seedlings in nursery after uprooting to prevent the spread of insect infestation from nursery to the main field. • Installation of pheromone traps @ 16-20/ha in a triangular patten at 60 m distance for trapping the adult male. • 6-8 release of egg parasitoides, <i>Trichogramma japonicum</i> and <i>T. chilonis</i> @ 50,000/ha/week starting from 30 days after transplanting. "Trichocard" should be put over the entire infested area throughout the egg laying period of pests. Cut each Trichocard by scissor into 6-12 pieces and distribute over the entire field by fixing them to the plant by using a stapler or adhesive. • Spraying of Neem oil 0.03% @ 3 ml/l at 10 DAT followed by second spray after 20 day interval. • Spray of Chlorpyrifos 20 EC @ 2.5-3 ml/lit and repeat after 10 days if necessary. 	Prevalant in all 16 districts √ Restore spraying if 1 egg mass /m ² or 5% dead heart is observed
		(ii).Leaf folder (<i>Cnephalocrocis medinalis</i>)	Spraying of malathion 50 EC (@2 ml/l) and many other non-	<ul style="list-style-type: none"> • Deep ploughing to expose the soil harbouring insect pests • Clean cultivation with line sowing 	√Prevalant in all 16 districts √ Restore spraying if >1

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
			recommended insecticides	<ul style="list-style-type: none"> For bio-control of leaf folder: 6-8 release of egg parasitoids, <i>Trichogramma japonicum</i> and <i>T. chilonis</i> @ 50,000/ha/week starting from 30 days after transplanting. "Trichocard" should be put over the entire infested area throughout the egg laying period of pests. Cut each Trichocard by scissor into 6-12 pieces and distribute over the entire field by fixing them to the plant by using a stapler or adhesive. Spraying of Neem oil 0.03% @ 3 ml/l at 10 DAT followed by second spray after 20 day interval. Spray of Chlorpyrifos 20 EC @ 2.5-3 ml/lit at 10 days interval, if necessary. 	damaged leaf per hill is noticed.
		(iii) Rice/Gandhi bug (<i>Leptocorisa oratoria</i> , <i>L. orientalis</i>)	Spraying of malathion 50 EC (@2 ml/l) and mq=any other non-recommended insecticides	<ul style="list-style-type: none"> Arrange fire in the surrounding bundhs to attract adult rice bugs An aqueous extract prepared out of few captured gandhi bug at the beginning of their infestation may repel subsequent infestation by the gandhi bug population Put half rotten fish/frog/snail etc which attract masses of insect, and subsequently kill manually Use Birds perch @ 6 no/bigha Dusting of malathion 5% Dust at 20-25 kg /ha. 	√ Restore dusting if 1-2 bugs/m ² is noticed.
		(iv) Mealy bug (<i>Brevinnia rehi</i>)	Spraying of Dimethoate (@2 ml/l)	<ul style="list-style-type: none"> Cleaning of field bunhs to remove weeds Remove and destroy the affected plants Continuous flooding of the field at 5 cm depth Encourage the growth of natural predators like coccinellids by avoiding unnecessary insecticide sprays. Bio-control agents like Ceraphronidae (<i>Ceraphron</i> sp), Encyrtidae (<i>Adelencyrtus</i> sp), Mymaridae (<i>Lymaemon</i> sp) etc could be use effectively. Spraying of Neem oil 0.03% @ 3 ml/l at 10 DAT followed by second spray after 20 day interval. Patch application of malathion dust 5% in the infested hills Spot application of chloropyrifos (2.5-3 ml/l) 	
(3)	Sali rice/ Winter rice	Diseases: (In Nursery)			
		(i) Leaf Blast: (<i>Magnaporthe grisea</i>)	No general control measures adopted	<ul style="list-style-type: none"> Grow Resistant/tolerant variety: Monohar Sali, Prasad, Pankaj, Prafulla, Gadhari, Mohan, Srimanta, Bharati 	

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
			against pest and diseases.	<ul style="list-style-type: none"> Seed selection by putting in plain water and stirring well. Select the sunken seeds and reject the floating ones. Pre-sowing seed treatment by wet method: Soak the selected seeds in a container containing fungicidal solution of mancozeb or captan or carbendazim @ 2.5 g/kg of seeds/litre of water for 24 hrs. Seed treatment for eliminating seed borne pathogens can be carried out by dry seed treatment method (As mentioned in case of direct seeded normal Ahu rice) also. As soon as 1 or 2 spindle shaped blast spots are seen on leaf, carbendazim (1 g/l) is to be sprayed 	
(B) Insect pests and nematode: (In Nursery)					
		Root knot nematode, Thrip, Stem borer, Leaf folder	Spraying of malathion 50 EC (@2 ml/l)	Same as in case of nursery insect of transplanted ahu rice (Summer rice)	
(C) Diseases: (In main field)					
		(i) Blast (<i>Magnaporthe grisea</i>) (Leafblast, Nodal blast, Neck blast)	Spraying of carbendazim at disease appearance	<ul style="list-style-type: none"> At tillering stage (30-35 days after sowing) spray carbendazim or thiophanate-methyl @ 1 g/l. Subsequently, need based sprays with carbendazim (1 g/l) at panicle initiation stage and panicle open stage. Use bacterial bio-control agents viz., <i>Pseudomonas fluorescence</i> and <i>Bacillus</i> as seed treatment (1%) and post transplanting spray (0.25%) is also effective 	If 5% leaf area of top 5 leaves is damaged then start spraying
		(ii) Sheath blight (<i>Rhizoctonia solani</i>)	Spraying carbendazim at disease appearance	Same as in case of sheath blight of direct seeded Ahu rice (Autumn rice)	
		(iii) Brown spot (<i>Helminthosporium oryzae</i>)	Spraying mancozeb at disease appearance	<ul style="list-style-type: none"> Pre-sowing dry or wet seed treatment with carbendazim or mancozeb or captan @ 2.5 g/kg of seed or 2.5 g//kg of seed Spray mancozeb (2.5 g/l) or carbendazim (1g/l) starting at initiation of the disease symptoms. 	
		(iv) Bacterial leaf blight (<i>Xanthomonas campestris</i> pv. <i>oryzae</i>)	Spraying mancozeb at disease appearance	<ul style="list-style-type: none"> Grow tolerant variety viz., Govinda, Monahar sali Lakhimi, Mashuri etc Destruction of alternate/collateral hosts, weeds as well as crop residues Collection of seeds from disease free areas and followed by pre-sowing seed treatment (As mentioned in case of transplanted Ahu) Avoid top dressing with nitrogenous fertilizers at panicle initiation 	

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
				<p>stage, instead, top dressing with K₂O (@ 10 kg/ha or application of K₂O @ 5 kg/ha in the form of foliar spray of 3 % solution.</p> <ul style="list-style-type: none"> Mix fresh cow dung 1 kg in 10-15 litre of water , strain and apply in BLB infected areas Combine application of <i>Pseudomonas fluorescence</i> and <i>Trichoderma harzianum</i> (0.25%) is effective. 	
		(v)Bakane Disease (<i>Fusarium moniliforme</i>)	No control measures adopted	Same as in case of bakane disease of direct seeded Ahu rice (Autumn rice)	
		(vi).Sheath rot (<i>Sarocladium oryzae</i>)	Spraying of mancozeb	<p>Manuring and fertilizer:</p> <ul style="list-style-type: none"> Application of neem cake @ 1 ton/ha Avoid application of excess amount of nitrogenous fertilizers instead potassic fertilizers reduce sheath rot Foliar application of calcium sulphate and zinc sulphate Application of Gypsum (calcium sulphate) at 500 kg/ha (50% as basal and 50% at 35 DAT) <p>Spacing and planting time:</p> <ul style="list-style-type: none"> Wider spacing reduce the disease and avoid late planting as the disease intensity is more in late planted crops. <p>Reduction in primary inoculums:</p> <ul style="list-style-type: none"> Collection of healthy seeds from disease free fields Seed selection by putting in plain water and stirring well. Select the sunken seeds and reject the floating ones. Pre-sowing seed treatment by wet method: Soak the selected seeds in a container containing fungicidal solution of mancozeb or captan or carbendazim @ 2.5 g/kg of seeds/litre of water for 24 hrs. Seed treatment for eliminating this pathogens can be carried out by dry seed treatment method (As mentioned in case of direct seeded normal Ahu rice) also. Destruction of crop residues, weeds, collateral host Biological: Seed treatment and foliar application of <i>Pseudomonas fluorescence</i> (0.5%) found effective <p>Botanicalst:</p> <ul style="list-style-type: none"> Application of 5% Neem Seed Kernel Extrac (NSKE) twice viz., during booting stage and repeat after 10 days. 	

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
				<ul style="list-style-type: none"> Application of Neem oil and pongamia oil based formulation (3 ml/l) as soon as symptoms are observed. Foliar application of 10% leaf extract of Ipomea <p>Chemical control:</p> <ul style="list-style-type: none"> Need bases foliar spray with carbendazim (0.1%) may be started in the case of severe infection. 	
(D) Insect pests: (In Main field)					
		(i) Stem borer: (<i>Scirpophaga incertulas</i>)	Spraying of malathion 50 EC (@2 ml/l) and many other non-recommended insecticides	Same as in case of stem borer of transplanted Normal ahu	
		(ii) Leaf folder (<i>Cnaphalocrosis medinalis</i>)	Spraying of malathion 50 EC (@2 ml/l) including other non-recommended insecticides	<ul style="list-style-type: none"> Deep ploughing to expose the soil harbouring insect pests Clean cultivation with line sowing Use Birds perch @ 6 no/bigha For bio-control of leaf folder: 6-8 release of egg parasitoides, <i>Trichogramma japonicum</i> and <i>T. chilonis</i> @ 50,000/ha/week starting from 30 days after transplanting. "Trichocard" should be put over the entire infested area throughout the egg laying period of pests. Cut each Trichocard by scissor into 6-12 pieces and distribute over the entire field by fixing them to the plant by using a stapler or adhesive. Need based application of choropyriphos @ 2 ml/l may be done at 10 days interval. 	Start spraying when > 1 damaged leaf per hill is noticed
		(iii) Rice/Gandhi bug (<i>Laptocorisa oratoria</i>)	Spraying of malathion 50 EC (@2 ml/l) including other non-recommended insecticides	<ul style="list-style-type: none"> Arrange fire in the surrounding bundhs to attract adult rice bugs Put half rotten fish/frog/snail etc which attract masses of insect, and subsequently kill manually Use Birds perch @ 6 no/bigha Dusting of malathion 5% Dust at 20-25 kg /ha. 	Start dusting when 1-2 bugs/m ² are seen.
		(iv). Mealy bug (<i>Brevennia rehi</i>)	Spraying of Dimethoate (@2 ml/l)	Same as in case of mealy bug of Normal Ahu transplanted	
		(v) Gall midge (<i>Orseolia oryzae</i>)	Spraying of Dimethoate (@2 ml/l)	<ul style="list-style-type: none"> Removal and destruction of grassy weeds from the surrounding areas 	1 silver shoot per m ² in endemic area or 5%

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
			and many other non-recommended insecticides	<ul style="list-style-type: none"> In maggot prone areas, early planting could escape the infestation. Avoid staggered planting of rice Biological: Natural predators like Wolf spider pardosa, Pseudoannulata and Lynx spider Oxyopes javanas usually feed on rice maggots Prophylactic spray of chlorpyrifos 20 EC @ 2.5-3 ml/lit at nursery stage is beneficial. Need based spray of chlorpyrifos 20 EC @ 2.5 ml/lit may be continued. 	silver shoots in non-endemic area
4.	Bao rice (Deep water rice)	(A) Diseases:(In Nursery)			
		(i) Leaf Blast: (<i>Magnaporthe grisea</i>)	No general control measures adopted against pest and diseases.	<ul style="list-style-type: none"> Grow Resistant/tolerant variety: Panindra, Keteki joha, Luit etc Seed selection by putting in plain water and stirring well. Select the sunken seeds and reject the floating ones. Pre-sowing seed treatment by wet method: Soak the selected seeds in a container containing fungicidal solution of mancozeb or captan or carbendazim @ 2.5 g/kg of seeds/litre of water for 24 hrs. Seed treatment for eliminating seed borne pathogens can be carried out by dry seed treatment method also (As mentioned in case of direct seeded normal Ahu rice). As soon as 1 or 2 spindle shaped brown blast spots are seen on leaf, carbendazim (1 g/l) is to be sprayed 	
		(B) Insect pests, rodents and nematode:(In Nursery)			
		Root knot nematode Thrip Stem borer Leaf folder	Spraying of malathion 50 EC (@2 ml/l)	Same as in case of nursery insect of transplanted Ahu rice (Summar rice)	
		(C) Insect pests, rodents and nematode: (In Main Filed)			
		(i) Field rats	No control measures adopted	Apply dry poison baits in bait stations (broken earthen pots, coconut shell, bamboo cylinder etc). Prebait prepared out of 1 kg cereal + 20 g vegetable oil + 10 g dried fish may be apply @ 10 g/live burrow for 3 days then place mechanical rat trap near the furrows.	
		(ii) Nematodes: Root knot	No control measures	In plant parasitic nematode endemic areas application of neem cake or	

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
		(<i>Melodogyne graminicola</i>), white tip (<i>Aphelonchoides besseyi</i>), cyst nematode (<i>Heterodera</i> spp)	adopted	mustard oil cake @ 500 g/m ² should be done 15-20 days prior to transplanting.	
		(iii) Ufra disease /Stem nematode (<i>Ditylenchus angustus</i>)	No control measures adopted	<ul style="list-style-type: none"> • Use early maturing Bao variety like "padmapani" • Burning of the stubbles and straw followed by several ploughings just after the harvest • Delay sowing upto mid April 	
5.	Boro rice/Hybrid Boro rice (Summer rice)	(A) Diseases: (In Nursery)			
		(i) Leaf Blast: (<i>Magnaporthe grisea</i>)	No general control measures adopted against pest and diseases.	<ul style="list-style-type: none"> • Grow moderately resistant variety like Dinanath, Swarnabh etc • Seed selection (As mentioned in case of Sali rice) • Pre-sowing seed treatment by wet method (As mentioned in case of Sali rice) • As soon as 1 or 2 spindle shaped blast spots are seen on leaf, carbendazim (1 g/l) is to be sprayed 	
		Insect pests and nematode: (In Nursery) Root knot nematode, Thrip, Stem borer, Leaf folder	Spraying of malathion 50 EC (@2 ml/l)	As in case of nursery insect of transplanted Normal Ahu rice (Summer rice)	
		(B) Diseases:(In main field)			
		(i)Blast (<i>Magnaporthe grisea</i>) (Leaf blast, Nodal blast, Neck blast)	Spraying of carbendazim at disease appearance	<ul style="list-style-type: none"> • At tillering stage (30-35 days after sowing) spray carbendazim or thiophanate- methyl @ 1 g/l. Subsequently, two sprays either with carbendazim or thiophanate- methyl (1 g/l) at panicle initiation stage and panicle open stage should be done, if required.. • Use bacterial bio-control agents viz., <i>Pseudomonas fluorescence</i> and <i>Bacillus</i> as seed treatment (1%) and post transplanting spray (0.5%). 	If 5% leaf area of top 5 leaves is damaged then start spraying

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
		(ii) Sheath bligh (<i>Rhizoctonia solani</i>)	Spraying carbendimz at disease appearance	As in case of sheath bligh of sali rice (winter rice)	
		(C) Insect pests: (In Main field)			
		(i) Stem borer: (<i>Scirpophaga incertulas</i>)	Spraying of malathion 50 EC (@2 ml/l)	As in case of stem borer of sali rice (winter rice)	
		(ii)Leaf folder (<i>Cnaphalocrosis medinalis</i>)	Spraying of malathion 50 EC (@2 ml/l)	As in case of leaf folder of sali rice (winter rice)	
		(iii)Rice/Gandhi bug (<i>Laptocorisa oratoria</i>)	Spraying of malathion 50 EC (@2 ml/l)	As in case of gandhi bug of sali rice (winter rice)	
		iv.Whorl maggot (<i>Hydrallia philippina</i>)	Spraying of Dimethoate (@2 ml/l)	Same as in case of control measures of whorl maggot in Sali rice	
		v. Gall midge (<i>Orseolia oryzae</i>)	Spraying of Dimethoate (@2 ml/l)	Same as in case of control measures of gall midge in Sali rice	
6.	Early Ahu (Direct seeded)	(A) Diseases:(In main field)			
		(i)Blast disease (Leaf blast, Nodal blast, Neck blast) (<i>Magnaporthe grisea</i>)	Spraying of carbendimz at disease appearance	Same as in case of blast disease control in Boro rice	
		(ii). Sheath bligh (<i>Rhizoctonia solani</i>)	Spraying carbendimz at disease appearance	Same in case of Sheath bligh of sali rice (winter rice)	
		(B) Insect pests: (In Main field)			
		(i) Stem borer: (<i>Scirpophaga incertulas</i>)	Spraying of malathion 50 EC (@2 ml/l)	Same as in case of stem borer in sali rice (winter rice)	
		(ii)Leaf folder (<i>Cnaphalocrosis medinalis</i>)	Spraying of malathion 50 EC (@2 ml/l)	Same in case of leaf folder in sali rice (winter rice)	
		(iii)Rice/Gandhi bug	Spraying of malathion	Same in case of gandhi bug in sali rice (winter rice)	

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
		(<i>Lapcorisa oratoria</i>)	50 EC (@2 ml/l)		
		iv. Whorl maggot (<i>Hydrallia philippina</i>)	Spraying of Dimethoate (@2 ml/l)	Same as in case of control measures of whorl maggot in Sali rice	
		v. Gall midge (<i>Orseolia oryzae</i>)	Spraying of Dimethoate (@2 ml/l)	Same as in case of control measures of gall midge in Sali rice	
7.	Early Ahu (Transplanted)	(A) Diseases: (In Nursery)			
		(i) Leaf Blast: (<i>Magnaporthe grisea</i>)	No general control measures adopted against pest and diseases.	Same as in case of leaf blast of sali rice	
		Insect pests and nematode: (In Nursery) Root knot nematode Thrip Stem borer Leaf folder	Spraying of malathion 35 EC (@2 ml/l)	Same as in case of insect pest and nematode of Transplanted Ahu rice (Summar rice)	
		(B) Diseases:(In main field)			
		(i) (Leaf blast, Nodal blast, Neck blast) (<i>Magnaporthe grisea</i>)	Spraying of carbendizim at disease appearance	Same as in case of blast disease of Sali rice	
		(ii) Sheath blight (<i>Rhizoctonia solani</i>)	Spraying carbendizim at disease appearance	Same as in case of sheath blight of Direct seeded Ahu rice (Autumn rice)	
		(iii) Brown spot (<i>Helminthosporium oryzae</i>)	Spraying mancozeb at disease appearance	Same as in case of brown spot of Sali rice	
		(iv) Bacterial leaf blight (<i>Xanthomonas campestris</i> pv. <i>oryzae</i>)	Spraying mancozeb at disease appearance	Same as in case of BLB of Sali rice	
		(v) Bakane Disease	No control measures adopted	Same as in case of bakane disease of Direct seeded Ahu rice (Autumn rice)	

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
		(<i>Fusarium moniliforme</i>)			
		(vi) Sheath rot (<i>Sarocladium oryzae</i>)	Spraying of mancozeb	Same as in case of sheath rot of Sali rice	
		Root knot nematode: (<i>Melodogyne graminicola</i>) (In main field)	Application of fertilizers	Same as in case of Sali rice	
		(C)Insect pests: (In Main field)			
		(i) Stem borer: (<i>Scirpophaga incertulas</i>)	Spraying of malathion 50 EC (@2 ml/l)	Same as in case of stem borer control measures in Sali rice	
		(ii)Leaf folder (<i>Cnaphalocrosis medinalis</i>)	Spraying of malathion 50 EC (@2 ml/l)	Same as in case of control measures of leaf folder in Sali rice	
		(iii)Rice/Gandhi bug (<i>Laptocorisa oratoria</i>)	Spraying of malathion 50 EC (@2 ml/l)	Same as in case of control measures of rice bug in Sali rice	
		(iv) Mealy bug (<i>Brevennia rehi</i>)	Spraying of Dimethoate (@2 ml/l)	Same as in case of control measures of mraly bug in Sali rice	
		iv.Whorl maggot (<i>Hydrallia phillipinna</i>)	Spraying of Dimethoate (@2 ml/l)	Same as in case of control measures of whorl maggot in Sali rice	
		v. Gall midge (<i>Orseolia oryzae</i>)	Spraying of Dimethoate (@2 ml/l)	Same as in case of control measures of gall midge in Sali rice	
8.	Rapseed Mustard (<i>Brassica campestris</i>) (<i>B.juncea</i>)	(A) Diseases: (In main field)			
		(i) Alternarial Blight (<i>Alternaria brassicae</i>)		<ul style="list-style-type: none"> • Proper cleaning to remove discolored shunken seeds • Storage of seeds at 35⁰C eliminate the fungus • Early planting (October) of toria escape the disease. • Seed treatment with Iprpodione (Rovral) @ 2.5 g/kg of seed for the control of seedling infection. • Balanced fertilizer application N40 P35 K15 coupled with first spray of mancozeb @0.25% at full flowering stage followed by second spray 	

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
				<p>with same fungicide @ 0.25% at pod development stage.</p> <ul style="list-style-type: none"> • Combination of boron @ 0.5% spray boric acid or zinc @ 0.2% through zine oxideshowed synergistic effect in efficacy of mancozeb. • Bio-control: The fungus <i>Nectria inventa</i> acts as a parasite of <i>A. brassicae</i> • Botanicals: Bulb extract of <i>Allium sativum</i> (1%w/v), Leaf extract of <i>Acacia nilotica</i>, <i>Eucalyptus</i> spp., <i>Azadirachta indica</i> @ 1.5-2% and NSKE (10%) 	
		(ii) Downy mildew (<i>Hyaloperonospora parasitica</i>)		<ul style="list-style-type: none"> • Crop rotation for 3 yrs with non cruciferous crops • Collection and destruction of crop residues • Control volunteer plants and wild mustard. • Seed treatment with mancozeb @ 2.5 g/kg of seeds • On the incidence of disease symptoms, spray the crop with Bordeaux mixture (1%) • In disease prone areas, spray with mancozeb @ 2.5 g/l at floewring and pod formation stage 	
		(iii)white rust (<i>Albugo candida</i>)		<ul style="list-style-type: none"> • Crop rotation for 3 yrs with non cruciferous crops • Collection and destruction of crop residues • Good quality disease free seeds should be treated with mancozeb @2.5 g/kg of seeds • If needed, spray with mancozeb @ 2.5 g/l at flowering and pod formation stage. 	
		(B) Insect pests: (Main field)			
		1. Leaf webber (<i>Crocidolomia binotalis</i>)	Spraying of malathion 50 EC @ 2 ml/l at 10-15 days interval	<ul style="list-style-type: none"> • Remove and destroy the badly infested webbed leaves initially to reduce insect population • Application of 5% Neem Seed Kernal Extract (NSKE) or <i>Azadirachtin</i> 0.03% (3000 ppm) neem oil based WSP @ 5 ml/l at 10-15 days interval if needed 	
		ii. Aphid (<i>Lipaphis erysimi</i>)	Spraying of malathion 50 EC @ 2 ml/l	<ul style="list-style-type: none"> • The crop sown before 15th November escape the damage. • Set up yellow stick traps to monitor aphid population. • Destroy the affected parts along with aphid population in the initial stage. 	

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
				<ul style="list-style-type: none"> • Bio-control: <ul style="list-style-type: none"> ○ Conserve the following natural enemies: Ladybird beetles viz., <i>Coccinella septempunctata</i>, <i>Menochilus sexmaculata</i>, <i>Hippodamia variegata</i> and <i>Cheilomones vicina</i> are most efficient predators of the mustard aphid. Adult beetles may feed on an average of 10 to 15 adults/day. ○ Several species of syrphid fly i.e., <i>Sphaerophoria spp.</i>, <i>Eristalis spp.</i>, <i>Metasyrphis spp.</i>, <i>Xanthogramma spp</i> and <i>Syrphus spp.</i> are predated on aphids. ○ The braconid parasitoid, <i>Diaretiella rapae</i> a very active bio control agent cause the mummification of aphids. ○ The lacewing, <i>Chrysoperla carnea</i> predated on the mustard aphid colony. ○ Predatory bird <i>Motacilla cospica</i> is actively feeding over aphids in February-March. ○ A number of entomogenous fungilike <i>Cephalosporium spp.</i>, <i>Entomophthora</i> and <i>Verticillium lecanii</i> control aphid population by infection. • Chemical: If necessary, spray the crop with chlorpyrifos @ 2 ml/l. 	
		iii. Saw fly (<i>Athalia lugens proxima</i>)	Spraying of malathion 50 EC @ 2 ml/l at 10-15 days interval	<ul style="list-style-type: none"> • Summer ploughing to destroy the pupa. • Early sowing should be done. • Maintain clean cultivation. • Application of irrigation in seedling stage is very crucial for sawfly management because most of the larvae die due to drowning effect. Severe cold also helps in reducing pest load. • Collection and destruction of grubs of saw fly in morning and evening • Biological: Conserve <i>Perilissus cingulator</i> (parasitoids of the grubs), and the bacterium <i>Serratia marcescens</i> which infect the larvae of sawfly. • Botanical: Use of bitter gourd seed oil emulsion as an anti-feedant. • Chemical: In severe infestation, spray the crop with malathion 50 EC @ 2 ml/l 	
9.	Lentil (<i>Lend culinaris</i>)	(A) Diseases: (Main field)			

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
		(i) Wilt: (<i>Fusarium oxysporum</i> f.sp. <i>ciceri</i>)		<ul style="list-style-type: none"> • Soil with fine tillage having adequate drainage facility should be selected. Avoid wet and poorly drained soil • Maintain soil health by applying recommended dose of manures and fertilizers and including lime • Pre-sowing seed treatment with carbendazim (0.1%) • Soil amendment with neem cake or groundnut cake @ 0.5T/ha • Bio-control: Basal application of <i>Trichoderma viride</i> @ 25 kg/ha • Soil drenching with carbendazim (0.1%) in localized patches, in case of severe incidence 	
		(ii) Wet rot/ White blight (<i>Rhizoctonia solani</i>)		<ul style="list-style-type: none"> • Soil with fine tillage having adequate drainage facility should be selected. Avoid wet and poorly drained soil • Selection of sclerotia free healthy seeds • Seed treatment with talc based <i>Trichoderma</i> powder @10 g/ kg of seeds or chemically(dry method) by adding carbendazim 2 g for one kg of seeds • Infected plants along with sclerotia are to be collected and destroy by burning • Bio-control: Basal application of <i>Trichoderma viride</i> @ 25 kg/ha • In disease prone areas, at the appearance of disease symptoms, start foliar spray with carbendazim (0.1%) or mancozeb (0.2%) 	
		(iii) Rust (<i>Uromyces fabae</i>)	Use of various non-recommended pesticides like Dimethoate, malathion etc.	<ul style="list-style-type: none"> • Encourage late sowing of lentil in disease prone areas i.e in the second week of November • Clean the seeds free of rust pustules should be treated with iprodione (2 g/kg of seed). • Control of volunteer plants over the summer and removal of infected lentil debris. • Botanicals: Foliar spray of Neemoil (3000 ppm), jatropha oil (3000 ppm) at the rate 5 ml/l at 7-10 days interval • Bio-control: Foliar spray of talc based formulation of <i>T. viride</i> or <i>Gliocladium virens</i> at 10 g/l • Preventive sprays with mancozeb (2.5 g/l) at early disease development stage as well as same fungicide may be sprayed as curative, later on. 	

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks	
		(B) Insect pests: (Main field)				
		(i) Aphid (<i>Aphis craccivora</i> , <i>Acyrtosiphon pisum</i>)	Spraying of malathion 50 EC (@ 2 ml/l) at the time of flowering	<ul style="list-style-type: none"> Biocontrol with predatory Coccinellids or other natural enemies should be encouraged by avoiding application of unnecessary chemical pesticides. Hand picking of egg mass and aphid population followed by destruction. Spraying of NSKE @ 5% or neem oil (3000 ppm) @ 5 ml/l 		
		(ii) Pod borer (<i>Helicoverpa armigera</i>)	.Spraying of dimethoate (@ 2 ml/l) at the time of flowering and early pod setting.	<ul style="list-style-type: none"> Application of biopesticide like <i>Helicoverpa armiger</i> Nucleopolyhedrosis virus (HaNPV) also proved to be very effective. Spraying of NSKE @ 5% or neem oil (3000 ppm) @ 5 ml/l 		
		Storage pests: Bruchid (<i>Calosobruchussinencis</i>)	Storage in Earthen pot, gunny bag, duli etc	Properly dried seeds of lentil should be mixed thoroughly with black pepper seed powder @ 3 g/kg of seed. Treated seeds should be kept in poly bag with outer covering of gunny bags.		
10.	Maize (<i>Zea mays</i>)	(A)Diseases: (Main field)				
		(i)Banded leaf blight (<i>Rhizoctoniasolani</i>)		<ul style="list-style-type: none"> Cut the infected leaves and destroy by burning Mechanical: √Stripping of 2 lowe leaves along with the leaf sheath <ul style="list-style-type: none"> ○ Rough and destroy the infected plants along with alternate hosts ○ Use bird scare to protect seeds Biological:Seed treatment with talc based <i>Trichoderma harzianum</i> @ 20 g/kg of seeds Chemical:√Pre-sowing seed treatment with captan (@ 4 g /kg of seeds) <ul style="list-style-type: none"> ○ After removing infected leaves,spray the crop with carbendazim(0.5 g/lit water) @ about 700 lit/ha of spray solution at an interval of 12-15 days 		
		(ii)Maydis leaf blight		<ul style="list-style-type: none"> Protective spray of mancozeb or zineb (0.25-0.3%) at the appearance of disease symptoms or at knee height should be done. Severely infected plant parts are to be cut and destroy. 		
		(iii)Turcicum leaf blight or southern corn		<ul style="list-style-type: none"> Grow PEMH-5, Vivek 21, Vivek 23, Vivek 25, Pratap Kanchan 2, Nityashree in the recommended areas. 		

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
		(<i>Exserohilum turcicum</i>)		<ul style="list-style-type: none"> Implement integrated nutrient management(INM) to maintain soil health since in poor soil the disease may become serious In nutrient poor soil , top dressing of urea (5-8 Kg/bigha) followed by light irrigation helps to minimize the disease 2-3 foliar spray of mancozeb or zineb (@ 2.5 g/l) (with adjuant @ 0.05%) at 8-10 day interval starting from the appearance of disease symptoms should be done.Need based sprays of mancozeb or zineb @ 2.5g/litre of water 	
		(iv) Pythium stalk rot (<i>Pythium aphanidermatum</i>)		<ul style="list-style-type: none"> Good field drainage. Drain out the excess rain water from the field, if possible Destruction of previous crop's debris Seed treatment with mancozeb@ 2.5 g/kg of seeds Biological control:√Seed treatment with <i>Trichoderma harzianum</i> @ 20 g/kg of seeds √Soil application: Add <i>T. harzianum</i> (Talc based formulation) at 1: 20 in the furrow in the time of sowing. Chemical: Apply fungicidal solution of captan or thiram (@ 2.5 g/l) at lower internode of plants, 30-35 days after planting. Chemical: Apply fungicidal solution of captan (2.5 g/l) at lower internodes of plants , 30-35 DAP 	Thoroughly mix <i>T. harzianum</i> (1 kg) with 20 kg Vermicompost or well decompost FYM and incubate for 15 days in moist condition
		v. Charcoal rot (<i>Macrophomina phaseolina</i>)		<ul style="list-style-type: none"> Sow resistant variety e.g. diara, hinius etc Destruction of previous crop's debris Deep ploughing Avoidaning water stress at flowering time reduce disease incidence Balanced fertilization, avoid high level of N and low level of K Bio-control: Add <i>Trichoderma harzianum</i> (Talc based formulation) at 1: 20 in the furrow in the time of sowing. 	Thoroughly mix <i>T. harzianum</i> (1 kg) with 20 kg Vermicompost or well decompost FYM and incubate for 15 days in moist condition
(B) Insect pests: (Main field)					
		i.Stem or stalk borer (<i>Chilo partellus</i>)		<ul style="list-style-type: none"> Intercropping of maize with suitable varieties of cowpea is an eco-friendly option for reducing the incidence of Chilo. Release of egg parasitoid (<i>Trichogramma chilonis</i>) i.e.Trichocards 8 nos. per hectare at 10 days after germination Chemical:(a)Application of malathion D 5% @ 5g /plant in the whorls 	

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
				of infested plant <ul style="list-style-type: none"> Foliar spray of chlorpyrifos 20 EC @ 2.5 ml/l at 10-15 days after germination is very effective. 	
		ii. Pink borer (<i>Sesamia inferans</i>)		Same as in case of stem or stalk borer (<i>Chilo partellus</i>)	
		iii. Cutworms (<i>Agrotis</i> spp.)		<ul style="list-style-type: none"> Keep fallows clean and eliminate weeds from paddock perimeters at least one month before planting. Inspect emerging seedlings twice per week, particularly in higher risk situations. Manual collection of caterpillar and destruction Spot treatments e.g. along field edges with neem oil (300 ppm) @ 5 ml/l or malathion 50 EC at 1.5 ml/l. Spray late in the afternoon to increase the likelihood of contact with feeding caterpillars. 	Treat seedlings when there is a rapidly increasing area of infestation or if the crop damage is >10%
		iv. Aphid (<i>Rhopalosiphum maidis</i>)		<ul style="list-style-type: none"> Inspect the field for the incidence of aphid infestation at weekly intervals. Encourage the growth of natural Predators of aphids like ladybird larvae, damsel bugs, big eyed bugs (<i>Geocoris</i> sp), larvae of green lacewings (<i>Mallada basalis</i>) and larvae of hoverflies. Wasp parasitoids mummify and kill aphids. 	
		v. Cob borer (<i>Helicoverpa armigera</i>), Jassid and mite (<i>Tetranychus urticae</i>)		<ul style="list-style-type: none"> The use of broad spectrum insecticides is associated with outbreaks of mites. Broad spectrum insecticides disrupt the activity of beneficial insects, particularly predatory thrips (<i>Aelothrips</i> spp) mite (<i>Amblyseius swirskii</i>) which suppress mite populations For the control of cob borer, jassid etc need based application of malathion 50 EC at 1.5 ml/l or NSKE 5% may be done. 	
11.	Black gram (<i>Vigna mungo</i>)	(A) Diseases: (Main field)			
		i. Cercospora leaf spot (<i>Cercospora canescens</i>)		<ul style="list-style-type: none"> Grow tolerant black gram varieties like UG 135, TPU 4, TPU 5, TPU 11, TPU 12, AKU 4 and SP 21 Remove and burn infected plant debris Spray carbendazim (1 g/l) or mancozeb (2.5 g/l) at initiation of the disease and subsequent sprays may be done at 7-10 days interval. 	Spraying of fungicides may be started at 5% leaf area damaged
		ii. Anthracnose		<ul style="list-style-type: none"> Grow resistant variety 	

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks	
		(<i>Colletotrichum lindemuthianum</i>)		<ul style="list-style-type: none"> Use certified disease free seeds Crop rotation with wheat or corn Seed treatment-Hot water (52° C for 11 minutes) or carbendazim @ 2 g/kg of seed 24 hours Remove and destruct plant debris Need based spraying with mancozeb (2g/l) or carbendazim (1 g/l) at 7-10 days interval may be continued. 		
		iii. Yellow Vein Mosaic (<i>Mungbean Yellow Mosaic Virus</i>)		<ul style="list-style-type: none"> Removal of weed hosts from the field periodically In disease endemic areas increase the seed rate upto 25 kg/ha Growing resistant varieties such as Pant- U-19, Pant U-30, VBN 4, VBN 6 and VBN 7 Rogue out the infected plants up to 45 days of planting Installation of yellow sticky traps, 15 nos/ha Foliar spray of neem oil (3000 ppm) @ 3 ml/lit or NSKE @5% at 15 and 30 DAS 		
		iv. Leaf Crinkle (<i>Leaf Crinkle Virus</i>)		Same as in case of YMV of black gram		
		v. Powdery Mildew (<i>Erysiphe polygoni</i>)		<ul style="list-style-type: none"> Remove and destroy infected plant debris. Botanicals: Spraying with NSKE 5% or Neem oil (3000 ppm) @ 3 ml/l or Eucalyptus leaf extract 10% twice at initiation of the disease and 10 days later. If require, two sprays with carbendazim or thiophanate-methyl @ 0.1%, one immediately after disease appearance and the second after 15 days. 		
		(B) Insect pests: (Main field)				
		i. Aphid (<i>Aphis craccivora</i>)		<ul style="list-style-type: none"> Inspect the field for the incidence of aphid infestation at weekly intervals. Encourage the growth of natural Predators of aphids like ladybird larvae, damsel bugs, big eyed bugs (<i>Geocoris</i> sp), larvae of green lacewings (<i>Mallada basalis</i>) and larvae of hoverflies. Wasp parasitoids mummify and kill aphids. Botanicals: Spray NSKE 5% twice followed by Neem oil (3000 ppm) @ 3 ml/l 		

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
		ii. Pod borer (<i>Riptortus pedestris</i> and <i>R. linearis</i>)		<ul style="list-style-type: none"> Removal and destruction of early stage larvae found in cluster Mechanical collection and destruction of insects Two sprays , first on the incidence of aphids with neem oil (3 ml/l) and second spray with spinosad 4S @ 0.3% 20 days later 	
		iii. Pod borer (<i>Helicoverpa armigera</i>)		<ul style="list-style-type: none"> Deep summer ploughing in 2-3 years to eliminate quiescent pupa. Early sowing, short duration varieties. Avoid closer plant spacing. Grow tall sorghum or maize as comparison crop to serve as biological bird perches or install Bird perches @ 50/ha. Collect and destroy larvae and adults to the extent possible Install pheromone traps at a distance of 50 m @ 5 traps/ha for each insect pest. Setting of light traps (1 light trap/5 acre) to kill moth population. Control is achieved by releasing of <i>Trichogramma chilonis</i> at weekly intervals @ 1.5 lakh/ha/ week for four times. Conserve green lacewing, predatory stink bugs, spider, ants Application of NPV 250 LE /ha with teepol 0.1% and Jaggery 0.5% thrice at 10 – 15 days interval commencing from flowering stage. (Note: Insecticide / Ha NPV spray should be applied when the larvae are in early stage). Application of <i>Bt</i> powder @ 600 g/ha, neem oil or pungum oil 80 EC @ 2ml/lit Alternatively, two spray of NSKE 5% could be done. 	
		iv. Pod bug (<i>Nezera viridula</i>)		<p>1. Common mechanical practices:</p> <ul style="list-style-type: none"> Collect and destroy eggs and early stage larvae Handpick the older larvae during early stages and also handpicking of gregarious caterpillars and the cocoons which are found on stem and destroy. Use yellow or blue pan water or sticky traps @ 4-5 trap/acre Use light trap @ 1/acre and operate between 6 pm and 10 pm Install pheromone traps @ 4-5/acre for monitoring adult moths activity (replace the lures with fresh lures after every 2-3 weeks) Erect of bird perches @ 20/acre for encouraging predatory birds such 	

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
				<p>as king crow, common mynah etc.</p> <p>2. Biological practices:</p> <ul style="list-style-type: none"> Conserve natural enemies through ecological engineering by devoid of unnecessary chemical spray Augmentative release of natural enemies <p>3. Plant product:</p> <ul style="list-style-type: none"> Alternatively, two spray of NSKE 5% could be done. 	
		v.Green stink bug/Lab lab bug (<i>Coptomosa cribraria</i>)		<ul style="list-style-type: none"> Destruction of larvae manually Erect of bird perches @ 20/acre for encouraging predatory birds such as kingcrow, common mynah etc Spray neem oil (3000 ppm) @ 3 ml/l in case of severe infestation. 	
		vi.Bihari hairy caterpillar (<i>Spilosoma obliqua</i>)		<p>1. Cultural control:</p> <ul style="list-style-type: none"> Deep summer ploughing Inter cropping with pigeon pea at a row ratio of 2:1 Irrigate once to avoid prolonged mid-season drought to prevent pre-harvestinfestation. <p>2. Mechanical control:</p> <ul style="list-style-type: none"> Collection and destruction of mass of larvae 	
12.	Pea (<i>Vigna mungo</i>)	(A)Diseases: (Main field)			
		i. Rust (<i>Uromyces fabae</i>)		<ul style="list-style-type: none"> Destroy the crop residue after harvest by burying Follow suitable crop rotation for 2-3 years with suitable non-leguminous crop Need based application of carbendazim (1 g/l) at 7-10 days interval. 	
		ii. Fusarium wilt (<i>Fusarium solani</i>)		<ul style="list-style-type: none"> Avoid early sowing to escape high humidity and temperature Crop rotation of 2-3 years with suitable non-leguminous crop Rouging of infected plants and destroy by burning. Spot/patch wise soil drenching with Bordeaux mixture (1%) in severely infected areas. 	
		iii.Ascochyta blight (<i>Ascochyta pisi</i>)		<ul style="list-style-type: none"> Select well drained fertile soil Select certified disease free seeds Seed treatment with carbendazim (0.1%) 	

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
				<ul style="list-style-type: none"> Need based spraying of carbendazim (0.1%) 	
		iv. Yellow Mosaic virus disease (YVMV)		<ul style="list-style-type: none"> In disease endemic areas ,early planting is beneficial Rogue out the infected plants up to 45 days Installation of yellow sticky traps @ 12 nos/ha In disease endemic areas, foliar spray with neem oil (3000 ppm) @ 3 ml/lit or NSKE @5% at 15 and 30 DAS to suppress the insect vectors. 	
(B) Insect pests: (Main field)					
		i. PeaAphid (<i>Acyrtosiphon pisum</i>)		<ul style="list-style-type: none"> Growth of natural predators or enemies like Ladybird beetles, Lacewings, Syrphidflies are to be encouraged by avoiding unnecessary pesticides spraying. Collection and destruction of aphid population which are found to be in cluster Spray neem oil (3 ml/l) first time and later on if necessary, spray Malathion 50 EC @ 2 ml/l. 	Spraying should be done covering lower surface of the cleaves
		ii. Leaf miner (<i>Liriomiza huidobrensis</i>)		<ul style="list-style-type: none"> Collection and destruction of infected leaves Spraying Neem oil @ 3ml/l at 15-20 days interval In case heavy infestation spraying with chloropyriphos @ 2 ml/l may be followed 	
		iii. Pod borer (<i>Helicoverpa armigera</i>)		<ul style="list-style-type: none"> Deep summer ploughing in 2-3 years to eliminate quiescent pupa. Avoid closer plant spacing. Grow tall sorghum or maize as comparison crop to serve as biological bird perches or install Bird perches @ 50/ha. Collect and destroy larvae and adults to the extent possible Install pheromone traps at a distance of 50 m @ 5 traps/ha for each insect pest. Setting of light traps (1 light trap/5 acre) to kill moth population. Control is achieved by releasing of <i>Trichogramma chilonis</i> at weekly intervals @1.5 lakh/ha/ week for four times. Conserve green lacewing, predatory stink bugs, spider, ants Application of NPV 250 LE /ha with teepol 0.1% and Jaggery 0.5% thrice at 10 – 15 days interval commencing from flowering stage. (Note: Insecticide / Ha NPV spray should be applied when the larvae 	

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
				<p>are in early stage).</p> <ul style="list-style-type: none"> Alternatively, application of Bt powder @ 600 g, or neem oil (3000 ppm) / pungum oil 80 EC @ 3ml/lit could be done. Two spray with NSKE 5% is also effective. 	
13.	Cauliflower (<i>Brassica oleracea</i> L. var. <i>botrytis</i>)	(A)Diseases: (In Nursery)			
		i. Damping-off (<i>Pythium debaryanum</i> , <i>Rhizoctonia solani</i>)	Application of Malathion 35 EC @ 2 ml/l	<p>1. Nursery raising:</p> <ul style="list-style-type: none"> Select well drained friable light soil rich in organic matter Excessive irrigation should be avoided to reduce humidity around the plants. Raise the bed 10-15 cm above the ground level Mix 20 kg sand or silt and 20 kg well decomposed organic matter in addition of 10 kg enriched microbial compost for an area of 10 m² Otherwise drench the nursery bed with fungicidal solution of captan(2g) + carbendazim (1g) in 1 litre of water Cover the bed area with polythene sheet or gunny bag or big leaves for 2 days <p>2. Seed treatment:</p> <ul style="list-style-type: none"> Organic:Talc or liquid based bio-formulation containing <i>Trichoderma</i> sp and <i>Pseudomonas florescence</i>(e.g.Biovir, Biozin, Arka Krishi Briddhi etc) @ 20 g/l Chemical: Captan (2g) + carbendazim(1g) per kg of seeds <p>3. Root treatment:</p> <ul style="list-style-type: none"> Dipping of root portion of uprooted seedlings in the solution of bio-formulation containing <i>Trichoderma</i> sp and <i>Pseudomonas florescence</i> (e.g.Bioveer, Biotime, Arka Krishi Briddhi etc) @ 20 g/l <p>4. Soil application:</p> <ul style="list-style-type: none"> Application of pre-multipled bio-agents(<i>Trichoderma</i> sp and <i>Pseudomonas florescence</i>(e.g.Biovir, Biozin, Arka Krishi Briddhi etc) in well decomposed cow dung or vermicompost in ratio of 1:30. <p>5. Spraying of liquid bio-agent:</p> <ul style="list-style-type: none"> Dissolve 300 ml of Trichojoal (<i>Trichoderma</i>) in 5 litre of water and stir well. Mix this solution with 200 litre of water and spray 	<p>* avoid excess watering in nursery beds</p> <p>* Maintain proper seed reate</p>

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks	
				6. Chemical: <ul style="list-style-type: none"> If necessary, spray carbendazim (@1 g/l) 		
		(B) Diseases: (In Main field)				
		i.Black leg (<i>Phoma lingam</i> / <i>Leptosphaeria macutans</i>)	Adoption of no viable control measure	<ul style="list-style-type: none"> Well-drained, rich in organic matter fields should be selected. Deep ploughing followed by destruction of crop residues Use of disease free certified clean seeds Resistant variety like Pusa Drum Head Seeds treatment with benlate @ 2 g/ kg of seeds In high disease pressure areas, crop rotation with non-cruciferous crops and complete control of susceptible cruciferous weed hosts for four years are recommended. 		
		ii.Black rot/Brown rot (<i>Xanthomonas campestris</i> pv. <i>Campestris</i>)	Adoption of no viable control measure	<ul style="list-style-type: none"> Well-drained, rich in organic matter fields should be selected. Deep ploughing followed by destruction of crop residues Use of disease free certified clean seeds Use of disease resistant/tolerant variety like Pusa Subra, Pusa Snowball K-1, Pusa Snowball KT-25 Seed treatment with streptomycin or tetracycline @ 500 ppm for 1-2 hrs at 24 °C. Destroy the infected leaves and branches In disease endemic areas, crop rotation with non-cruciferous crops for 3-5 yrs and complete control of susceptible cruciferous weed hosts 		
		iii.Leaf Spot and Blight(<i>Alternaria brassicae</i> and <i>A. brassiciola</i>)	Spraying of carbendazim (1 g/l) at 5 days interval	<ul style="list-style-type: none"> Use of disease free seeds. Adoption of proper crop rotation with non-cruciferous crops destruction of crop residues are effective. Seed treatment with hot water at 50°C for 30 minutes. Collection and destruction of severely infected leaves to control the spread of the pathogen Prophylactic spray with Bordeaux mixture (1%) followed by spray with roval @ 2.5 g/l at 7-10 days interval. Crops grown for seed purpose should be sprayed at full bloom, pod set and pre- harvest stage with Captan (0.2%) 		

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
		iv. Downy mildew (<i>Peronospora parasitica</i>)	Adoption of no viable control measure	<ul style="list-style-type: none"> Use of disease resistant/tolerant variety like Pusa Hybrid-2, Pusa Kartik Sankar Maintain proper plant spacing for Free air circulation, facilitate plants to dry between irrigations, and keeping leaves as dry as possible. The crop should be irrigated judiciously to avoid periods of high humidity. Alternate host (Weeds) of the pathogens should be destroyed before the start of cultivation. Spraying the seedlings in the nursery beds with Bordeaux mixture (1%) should be given as soon as the disease appear. Subsequent sprays may be needed at weekly intervals until the plants are transplanted in the field. In growing conditions, if require, the crop should be sprayed with Bordeaux mixture (1%). 	
		v. Browning or Hollow stem (<i>Boron deficiency</i>)	Spraying of carbendazi (1 g/l) at 5 days interval	<ul style="list-style-type: none"> Basal application of recommended dose of manures and chemical fertilizers and in addition application of borax @ 1 kg/bigha at the time of final land preparation In case of severe incidence, foliar spraying of borax @ 3 g/l 	
		(C) Insect pests:(In Main field)			
		i. Cutworm (<i>Agrotis ipsilon</i>)	i. Application of kerosin in the field ii. Hand picking and killing	<ul style="list-style-type: none"> Destroy crop residues; keep garden weed-free in winter. Use of recommended doses of manures and fertilizers along with adequate water, protect roots and trunks from damage. Mechanical control: <ul style="list-style-type: none"> (a) Hand-picking of larvae at night with a flashlight is very effective. (b) Trenching the field: Pests like cut worm, army worm march from one field to other which can be prevented by trenching in field. Clip and dispose of infested foliage and blossoms. Seedlings protection by cardboard collars, screen, or protective cloth. Sticky collars or barriers may be useful in preventing climbing cutworms. Biological: Spraying with <i>Bacillus thuringiensis</i> or spinosad is most effective. Chemical: Spraying of chlorpyrifos @ 2 ml/l at appearance of the 	

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
				pest.	
		ii. Diamond back moth (<i>Plutella xylostella</i>)	i. Application of kerosin in the field ii. Hand picking and killing	<p>1. Cultural:</p> <ul style="list-style-type: none"> Planting Indian mustard as trap crop. Sowing of two rows of bold seeded mustard for every 25 rows of cauliflower in twice per season i.e 12 days preceding planting and 40 days later of first planting ✓ Destroy mustard-type weeds several weeks before planting. Installation of pheromone traps @ 4-5/acre for monitoring of insect. <p>2. Mechanical control:</p> <ul style="list-style-type: none"> Hand-picking of larvae at night with a flashlight is very effective. <p>3. Botanicals:</p> <ul style="list-style-type: none"> Application of 5 % Neem Seed Kernel Extractor Azadirachtin 0.03% (3000 ppm) neem oil based WSP @ 5 ml/l at head initiation stage i.e 17 to 28 days after planting Repeat of spray of NSKE 5% at 10 to 15 days interval, when the population buildup is high and avoid the spray after curd formation because it could affect curd quality. <p>4. Biological control:</p> <ul style="list-style-type: none"> Release egg parasitoid, <i>T. chilonis/preliosum</i> @ 20,000/acre 4-6 times at weekly interval. Release larval parasitoids, <i>Diadegma semiclausm</i> @ 1,00,000/acre (Hills – below 25 –27°C) or <i>Cotesia plutellae</i> (plains) @ 20,000/acre from 20 days after planting Applications of <i>Bacillusthuringiensis</i>(Delfin) or spinosad 2.5% SC @ 240-280 g in 200 l of water per acre are also very effective. <p>5. Chemical:</p> <ul style="list-style-type: none"> Spraying of chlorpyriphos @ 0.05% 	
		iii. Tobacco caterpillar, (<i>Spodoptera litura</i>)	Application of malathion 35 ec or rogor @ 1-2 ml/l at 7-10 day interval	<ul style="list-style-type: none"> Treat the nursery soil with neem cake at 1.0 kg/m² Setting up light traps for adults @ 1/acre Funnel trap baited with pheromone (Spodolure) for <i>S. litura</i> @ 12 nos./ha Erecting of bird perches for encouraging predatory birds such as mynah, drongo etc. Use of ovipositional trap crops such as castor @ 250 plants/acre and collection of larvae from flowers 	

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks	
				<ul style="list-style-type: none"> Collection and destruction of egg masses and gregariously feeding early instar larvae Need based application of SI NPV Spray of NSKE 4 % in early stage of larvae Collection and destruction of large larvae and use of sharp iron needle to kill the hidden larvae in the curd. 		
		iv. Aphids, (<i>Brevicornea brassicae</i> , and <i>Lipaphis erisimi</i>)	i. Manual destruction ii. Application of malathion 35 ec or rogor @ 1-2 ml/l at 7-10 day interval	<ul style="list-style-type: none"> Cultural: Install yellow sticky traps, yellow water pan traps @ 12/acre to monitor alates (winged adult). Biological control: <ul style="list-style-type: none"> (a) Conservation of parasitoids such as <i>Aphidius colemani</i> (adult and nymph), <i>Diaeretiella</i> spp. (adult and nymph), <i>Aphelinus</i> spp. (adult and nymph) etc. (b) Conservation of predators such wasps, green lacewings, earwigs, ground beetles, rove beetles, spiders etc. Planting mustard as trap crop Use of NSKE 4% when control is necessary Spraying with liquid formulation of <i>Metarhizium anisopliae</i> (Org-Metajal) @ 5 ml/l at 15 days interval 		
14.	Cabbage (<i>Brassica oleracea</i> var. <i>italica</i>)	(A)Diseases: (In Main field)				
		i. Black rot/Brown rot (<i>Xanthomonas campestris</i> pv. <i>Campestris</i>)	Application of carbendazim @ 1 g /l at 7-10 day interval	Same as in case of cauliflower black rot/brown rot		
		ii. Leaf Spot and Blight (<i>Alternaria brassicae</i> and <i>A. brassiciola</i>)	i. Removal of infected leaves ii. Application of carbendazim @ 1 g /l at 7-10 day interval	Same as in case of cauliflower leaf spot and blight		
		iii. Black leg (<i>Phoma lingam</i> / <i>Leptosphaeria</i>)	Adoption of no control measures	Same as in case of cauliflower blackleg		

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks	
		<i>macutans</i>)				
		iv.Sclerotinia rot/ White Mould(<i>Sclerotinia sclerotiorum</i>)	i. Removal of infected plants ii.Application of carbendazim @ 1 g /l at 7-10 day interval	<ul style="list-style-type: none"> Planting with proper spacing for free flow of air within the plants. Crop rotation with non- host crops such as maize/corn, rye, wheat, etc. Should be done. Mechanical injuries to cabbage heads during intercultural operations/ harvesting operations should be avoided. Soil application: Application of pre-multipiled bio-agents (<i>Trichoderma</i> sp and <i>Pseudomonas floescence</i> (e.g.Biovir, Biozin, Arka Krishi Briddi etc) in well decomposed cow dung or vermicompost in ratio of 1:30. Spraying of liquid bio-agent: Dissolve 300 ml of Trichjal (<i>Trichoderma</i>) in 5 litre of water and stir well. Mix this solution with 200 litre of water and spray Chemical: spray carbendazim (1 g/l) 		
		v.Clubroot of Cabbage(<i>Plasmodiophora brassicae</i>)		<ul style="list-style-type: none"> In acidic soil, application of finely ground limestone in the soil 6 week before planting to raise the soil P^H above 7 is effective. Long duration crop rotations (6 years or longer) help prevent a pathogen buildup and reduce disease incidence. 		
		(B) Insect pests: (In Main field)				
		1. Cutworm (<i>Agrotis ipsilon</i>)	i.Application of kerosin in the field ii. Hand picking and killing	Same as in case of cauliflower cutworm		
		ii. Diamond back moth (<i>Plutella xylostella</i>)	i.Application of kerosin in the field ii. Hand picking and killing	Same as in case of cauliflower diamond back moth		
		iii.Tobacco caterpillar, (<i>Spodoptera litura</i>)		Same as in case of cauliflower tobacco caterpillar		
		iv.Aphids, (<i>Brevicornea brassicae</i> , and <i>Lipaphis erisimi</i>)	i. Manual destruction ii.Application of malathion 35 ec or rogor @ 1-2 ml/l at 7-	Same as in case of cauliflower aphid		

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks	
			10 day interval			
15.	Tomato (<i>Lycopersicon esculentum</i> Mill)	(A) Diseases: (In Nursery)				
		i. Damping-off (<i>Pythium debaryanum</i> , <i>Rhizoctonia solani</i> , <i>Phytophthora</i> spp.)	Application of Malathion 35 EC @ 2 ml/l	Same as in case of cauliflower damping-off		
		(B) Diseases: (Main field)				
		i. Fusarium wilt (<i>Fusarium oxysporum</i> f.sp. <i>lycopersici</i>)	Uprooting and drenching of mancozeb (2.5 g/l)	<ul style="list-style-type: none"> In disease prone areas , application of reduced amount of nitrogenous fertilizers with increase amount of potassic fertilizer is helpful Soil amendment with enriched compost or neem cake or mustard oil cake (1 t/ha) Use solarised, raised bed to improve drainage Seed treatment: <ul style="list-style-type: none"> (a) Organic: Talc or liquid based bio-formulation containing <i>Trichoderma</i> sp and <i>Pseudomonas florescence</i> (e.g. Biofor-pf or Biozin) @ 100 g/kg of seeds or Arka Krishi Briddi @ 20 g/l (b) Chemical: Captan (2g) + carbendazim(1g) per kg of seeds for 5 minutes .Seedling root treatment: Dipping of root portion of uprooted seedlings in the solution of bio-formulation containing <i>Trichoderma</i> sp and <i>Pseudomonas florescence</i> (e.g. Biofor-pf, Biotime, Arka Krishi Briddhi etc) @ 20 g/l Soil application: Application of pre-multiplied bio-agents (<i>Trichoderma</i> sp and <i>Pseudomonas florescence</i> (e.g. Biofor-pf, Biozin, Arka Krishi Briddi etc) @ 100 g/plant, 30-40 days after transplanting.(After mixing 1 kg bioformulation in 10 kg vermicompost or well decomposed cowdung) Chemical: Drench the root zone of diseased plants after uprooting and destruction along with the apparently nearby healthy plants with carbendazim (2 g/l) 		
		ii. Late blight	Application of	<ul style="list-style-type: none"> Removal and destruction of infected plant debris after harvest. 	*Cool night with heavy dew favou blight	

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
		(<i>Phytophthora infestans</i>)	mancozeb @ 2.5 g/l	<ul style="list-style-type: none"> Maintenance of optimum plant spacing to allow free air circulation Depending upon the weather condition ,particularly cool,cloudy, wet condition prophylactic spray with mancozeb (0.2%) along with sticker (indotruf or tricon etc) @ 1 ml/l should be initiated Alternate spray with mancozeb (2.5 g/l) and Bordeaux mixture (1%) or Dimethomorph (0.2%) at 7-10 days interval, with sticker @ 1 ml/l) 	disease, hence spray should be started covering the lower surface of leaf.
		iii. Early blight (<i>Alternaria solani</i>)	Application of mancozeb @ 2.5 g/l	<ul style="list-style-type: none"> Use disease free tubers for raising the crop. Removal and destruction of crop residues by burning after harvest of tomato. Irrigate in early hours to promote rapid drying of foliages Cultivation of other solanaceous crops nearby tomato field must be avoided. Prophylactic foliar spray in nursery bed with Bordeaux mixture (1%) or propineb (2 g/l) prior to transplanting in main field. In main field on the incidence of disease symptoms spray the crop with mancozeb (0.2%) or Bordeaux mixture (1%) at 7-10 days interval. 	
		iv.Bacterial wilt (<i>Ralstonia solanacearum</i>)	Application of a combo fungicide, mancozeb + carbendazim @ 2.5 g/l in base of the plant	<ul style="list-style-type: none"> Seed treatment: Same as in case of Fusarium wilt of tomato Growing Dhaincha (<i>Crotalaria</i> spp) in the field and incorporation in soil by ploughing at vegetative stage Application of sufficient amount of organic matters like FYM, neem cake or mustard oil cake, bone meal, dry fish powder to encourage the growth of natural antagonists. Seed treatment, Seedling root dip treatment and soil application of bio- control agents like <i>Pseudomonas</i> , <i>Trichoderma</i> : Same as in case of Fusarium wilt of tomato Application of organic formulation consisting of turmeric powder (5 g) + Asafoetida (1 g) in 10 litres of water. Drench the root zone of crop at 15, 30 and 45 days after transplanting. 	
		v.Tomato leaf curl virus	i.Uprooting and destruction of infected plants ii.Application of carbendazim @ 1 g/l	ToLCV is transmitted by white fly (<i>Bemisia tabaci</i>). Therefore, control of insect vector spreading virus is important. Management in nursery: <ul style="list-style-type: none"> Cultivation of TLCV resistant/tolerant variety like Avinash, Mruthinjay-1, Mruthinjay-2 arka ananya, Sankranti etc. Grow seedlings under nylon net cover(40-50 mesh size) 	

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks	
				Management in main field: <ul style="list-style-type: none"> Maize or jowar or bajra as boarder crop 25 days before te seedlings trasplanting. Use silver or black coloured mulches for repelling insect vectors. Soil application of Neem cake or mustard oil cake (@ 500 g/m²) in addition of basal doses of manures and fertilizers at the time of final land preparation. Rouge out the TLCV infected plant and weeds as soon as observed. Spraying of 5 % Neem Seed Kernel Extractor Azadirachtin 0.03% (3000 ppm) neem oil based WSP @ 5 ml/l at 15 days after transplanting and repeat the same at 15 days interval 		
		vi. Tomato spotted wilt virus		Same as in case of Tomato Leaf Curl Virus		
		vii. Blossom end rot of tomat (Physiological disorder, Ca deficiency)	Lack of knowledge on the problem. Spray mancozeb (2.5 g/l)	<ul style="list-style-type: none"> In disease prone areas, application of lime or dolomite @ 200 g/m² at the of final land preparation. Maintain proper moisture regime in soil In standing crops, weekly spraying of calcium chloride (@ 2.5 g/l) should be done. 		
		(C) Insect pests: (In Main field)				
		i. White fly (<i>Bemisia tabaci</i>)	Spraying of malathion 50 Ec @ 2 ml/l	Same as in case of cauliflower white fly control measures		
		ii. Fruit borer (<i>Spodoptera litura</i> , <i>Helicoverpa armigera</i>)	Spraying of malathion 50 Ec @ 2 ml/l	<ul style="list-style-type: none"> Physical control: <ul style="list-style-type: none"> (a) Burning: Damaged or infested fruits should be burn to avoid carry over of pest (b) Maintain proper moisture level in the field to reduce chance of borer infestation Cultural: Summer ploughing of field to expose different stages of insect like egg, larvae etc Certified seeds: Use certified seeds free from insect infestation, disease Select proper time of sowing so that vulnerable stage of crop and pest incidence can not synchronized. 		

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
				<ul style="list-style-type: none"> Judicious and proper application of chemical fertilizers. Nitrogenous fertilizers invite more pests whereas phosphorus fertilizers help reducing pest incidence. Weed free clean cultivation Crop rotation: Monocropping of tomato, brinjal may aggravate the situation Trap cropping: Planting of yellow tall marigold (<i>Tagetes Spp.</i>) or tobacco around tomato (1:5) has been found promising. All the eggs of <i>H.armigera</i> deposited on yellow <i>Tagetes</i> flower buds could be destroyed by the inundation of <i>Helicoverpa</i> adapted strain of egg parasitoid (<i>Trichogramma Chilonis</i>). The main crop of tomato is also sprayed either with hHaNPV or Bt, both of which are compatible with <i>Trichogramma</i> Installation of pheromone traps (Helilure) @ 2 /acre for monitoring and 10/acre for mass trapping Biological control: <ul style="list-style-type: none"> (a) Egg parasite: 6 times release of <i>Trichogramma chilonis</i> or <i>T.brasiliense</i> or <i>T. pretiosums</i> @ 50,000/ha starting the first release 30 days after transplanting. (b) Larval parasite: <i>Bracon hibitor</i> parasites larvae of <i>H.armigera</i>. (c) Entomopathogeni microorganisms: Application of <i>Bacillus thuringiensis</i> (Delfin etc) @ 1 g/l and (NPV) Nuclear Polyhedrosis Virus @ 250 LE /ha including fungal bio-agent like <i>Beauveria bassiana</i> (@5 ml/l) can be used for control of lepidopterous pests. 	
		iii. Aphids (<i>Aphis grossipii</i>)	Spraying of carbendazim @ 1 g/l	<ul style="list-style-type: none"> Regular monitoring and collection and destruction of infested leaves, shoots etc Installation of yellow sticky trap for mass trapping of aphids Botanicals: Spraying of Neem seed kernel extract (2 to 5%), garlic extract (5%) has been found effective against aphids. 	
		iv. Leaf miner (<i>Tula absoluta</i>)	Spraying of malathion 50 EC @ 2 ml/l	<ul style="list-style-type: none"> Destroy the infested leaves with first sign of tunneling Maintaining the plant health with organic manures and fertilizers to enhance plant's vigour Use yellow or blue sticky trap for catching adults. Spraying with neem oil (Azadirachtin 0.03%) (@3 ml/l) at 7 days 	

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
				interval <ul style="list-style-type: none"> Apply spinosad as a drench to the soil beneath the tomato plant for monitoring and killing of pupa of the insect Use abamectin @ 0.5 ml/l followed by spray chlorpyrifos 20 EC @ 2.5 ml/l at 20 days interval 	
16.	Brinjal (<i>Solanum melongena</i> L.)	(A) Diseases: (In Nursery)			
		1. Damping-off (<i>Pythium debaryanum</i> , <i>Phytophthora</i> spp.)	Application of Malathion 35 EC @ 2 ml/l	Same as in case of cauliflower damping-off	
		(B) Diseases: (Main field)			
		i. Fusarium wilt (<i>Fusarium oxysporum</i> f.sp. <i>lycopersici</i>)	Uprooting of infed plant and application of carbendazim @ 2 g/l	Same as in case of tomato Fusarium wilt	
		ii. Bacterial wilt (<i>Ralstonia solanacearum</i>)	Uprooting of infed plant and application of carbendazim @ 2 g/l	Same as in case of bacterial wilt in tomato	
		iii. White mould/White blight (<i>Sclerotinia sclerotiorum</i>)	Application of mancozeb (2 g/l)	<ul style="list-style-type: none"> Crop residues should be collected and burnt after harvest Deep Summer ploughing Crop rotation with onion,beet,maize or spinach Chemical fungicides: Spraying with carbendazim (0.1%) 	
		iv. Collar rot (<i>Pythium</i> spp.)	Application of carbendazim (1 g/l)	<ul style="list-style-type: none"> Seedling raising method, seed treatment, seed bed treatment , basal application of bio-agent method etc are same as in case of tomato fusarium wilt Uprooting and destruction of disease infected plants. Disinfect the soil of uprooted plant by the solution of captan (0.3%) In disease endemic areas, soil drenching with captan (0.3%) or mancozem (0.25%) 	
		v. Phomopsis blight (<i>Phomopsis vexans</i>)	Collection and destruction of infected	<ul style="list-style-type: none"> Cultural:√ Use of disease free healthy seeds 	

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks	
			fruits	(a) Crop rotation: Excluding brinjal for at least 3 years (b) Collection and destruction of crop debris (c) Deep summer ploughing (d) Seed treatment : Hot water seed treatment at 50 °C for 30 minutes • Chemical: Spraying of captan or mancozeb @ 2.5 g/l should be done at nursery bed as a prophylactic measure as well as in main field at the incidence of leaf symptoms.		
		(C) Insect pests: (In Main field)				
		i. Aphid (<i>Aphis grossipii</i>)		Same as in case of Tomato aphid		
		ii. Shoot and Fruit borer (<i>Leucinodes orbonalis</i>)	✓Cutting and throwing of wilted terminal shoot ✓Application of kerosene solution	<ul style="list-style-type: none"> Application of neem cake @ 250 kg/ ha (in two splits) in soil along the plant rows at 25 and 60 days after transplanting Growing garlic as inter crop or boarder crop reduce borer infestation Clipping of borer damaged shoots and collection & destruction of damaged fruits. Crop rotation with non-solanaceous crops should be followed. Bird perches @ 10/ acre should be erected for facilitating field visits of predatory birds. Sprays of NSKE (5%) or neem oil (3000 ppm) (4 ml/l) are beneficial Pheromone traps @ 5/ acre should be installed for monitoring and mass trapping of shoot & fruit borer <i>Leucinodes orbonalis</i>. Replace the lures with fresh lures after every 15-20 day interval. Release egg parasitoid <i>Trichogramma brasiliensis</i> @ 1 – 1.5 lakh/ ha, 4-5 times at weekly interval. Chemicals: If the borer incidence crosses ETL (5% infestation), then apply spinosad. 		
17.	Potato (<i>Solanum tuberosum</i>)	(A) Diseases: (Main field)				
		i. Late blight (<i>Phytophthora infestans</i>)	Repeated spray of mancozeb @ 2 g/l	<ul style="list-style-type: none"> Resistant Variety: Kufri Megha (for plain), Kufri Himalini (for Hill region) ,Early bulking variety Kufri pukhraj Sanitation: Infected seed tubers, diseased haulms left from previous 		

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks	
				<p>harvest and cull pieces should be collected and destroyed either by burning or burying them deep in the soil.</p> <ul style="list-style-type: none"> • Use of disease free healthy tuber seeds • Seed tuber treatment: Treat the seed tubers in the solution of mancozeb or metalxyl+ mancozeb @ 2.5 g/l for 15 minutes • Rest of control measures are same as in case of tomato late blight 		
		ii. Early blight (<i>Alternaria solani</i>)	Spraying of mancozeb @ 2 g/l	<ul style="list-style-type: none"> • Use disease free tubers for raising the crop. • Removal and burning of haulms of the affected potato crop help in reducing the inoculum in the field. • Cultivation of solanaceous crops, being collateral hosts, nearby potato field must be avoided. • In case of severe incidence, spray the crop with mancozeb (0.2%) or Bordeaux mixture (1.0%) at 7-10 days interval. 		
		iii. Bacterial wilt (<i>Ralstonia solanacearum</i>)	Spraying of carbendazim @ 2 g/l	Same as in case of bacterial wilt in tomato		
		iv. PLRV (Potato Leaf Roll Virus)	Non-adoption of any control measures	<ul style="list-style-type: none"> • Use of certified tuber seeds • For the control of white fly (<i>Bemisia tabaci</i>) spray with neem oil (3000 ppm) @ 3 ml/l followed by periodical spray with Chloropyriphos (1.5 ml/l) is effective. 		
		(B) Insect pests: (Main field)				
		i. Red ant (<i>Dorylus orientalis</i>)	Application of malathion powder (5%)	<ul style="list-style-type: none"> • Application of mustard oil cake @ 150 kg/ha at the time of earthening up • In insect prone areas, application of malathion 5% dust @ 30 kg /ha in the soil at the time of earthening up followed by application of organic mulch. 		
		ii. Potato tuber moth (<i>Phthorimaea operculella</i>)	Soil application malathion Dust 5% @ 50 g/m ²	<ul style="list-style-type: none"> • 3% Boric acid for 30 minutes before storage and prior planting • Earthing up the crop to close the crevices helps in minimizing infestation • Release of egg, larval parasite (<i>Copidosoma kohleri</i>) in potato field which parasites egg of potato tuber moth and comes out at larval 		

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
				<p>stage by killing the pest. Release of same parasitoid @ 1.5 lakhs/ton of stored potato in godown may be done.</p> <ul style="list-style-type: none"> Application of mustard oil cake @ 150 kg/ha at the time of earthening up In insect prone areas, application of malathion 5% dust @ 40 kg /ha in the soil at the time of earthening up. 	
		iii. Cutworm (<i>Agrotis ipsilon</i> (Hufn.))	1. Soil application malathion dust 5%	<ul style="list-style-type: none"> Hand picking during night under flush light and destruction of larvae. Find out the hiding larvae by turning up of soil around the new infested plant and kill manually. Make some trenches or holes (around 10 cm depth) in heavily infested spot to trap the larvae Application of mustard oil cake @ 20-25 kg/bigha Soil application of malathion Dust 5% @ 5 kg/bigha Soil drenching with chlorpyrifos (@ 2 ml/l) before planting. 	
18.	Onion (<i>Allium cepa</i> L)	(A) Diseases: (Main field)			
		i. Purple blotch (<i>Alternaria porri</i>)	No knowledge about the diseases. Therefore, spraying of mancozeb (0.2%) at 10 days interval	<ul style="list-style-type: none"> Maintain proper spacing of transplanted onion seedlings with the promotion of good drainage to reduce hours of leaf wetness. Grow tolerant variety like Arka Niketan, arka Pragati, Sel-13-1-1 Application of reduced dose of nitrogenous fertilizers in insect prone areas Prophylactic spray with propineb (0.2%) followed by spraying of mancozeb (0.2%) at fortnightly interval from the onset of the disease symptoms. 	
		ii. Stemphylium leaf blight (<i>Stemphylium vesicarium</i>)	No knowledge about the diseases	<ul style="list-style-type: none"> Maintain proper spacing of transplanted onion seedlings with the promotion of good drainage to reduce hours of leaf wetness. Collection and destruction of infected leaves. Prophylactic spray with propineb (0.2%) followed by spraying of chlorothalonil (0.2%) or mancozeb (0.2%) at fortnightly interval from the onset of the disease symptoms. 	
		iii. Basal rot (<i>Fusarium oxysporum</i> f.sp. <i>ceapae</i>)	Spraying of mancozeb (0.2%) and uprooting of infected plants.	<ul style="list-style-type: none"> Application of FYM or enriched compost (@ 1 t/ha) in the soil Seed treatment: <ul style="list-style-type: none"> (a) Organic: Talc or liquid based bio-formulation containing 	

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
				<p><i>Trichoderma</i> sp and <i>Pseudomonas floescence</i> (e.g. Biofor-pf or Biozin) @ 100 g/kg of seeds or Arka Krishi Briddi @ 20 g/l for 10 minutes</p> <p>(b) Chemical: carbendazim (3 g/kg of seeds) for 5 minutes</p> <ul style="list-style-type: none"> Seedling root dip treatment: Dipping of root portion of uprooted seedlings in the solution of bio-formulation containing <i>Trichoderma</i> sp and <i>Pseudomonas floescence</i> (e.g. Biofor-pf, Biotime, Arka Krishi Briddhi etc) @ 20 g/l Soil application of pre-multipled bio-agents (<i>Trichoderma</i> sp and <i>Pseudomonas floescence</i> (e.g. Biofor-pf, Biozin, Arka Krishi Briddhi etc) @ 100 g/ m² at planting (After mixing 1 kg bio-formulation in 10 kg vermicompost or well decomposed cowdung) In disease prone areas, application of carbendazim (0.1%) or thiophinate methyl (0.1%) may be done. 	
		(B) Insect pests: (Main field)			
		i. Thrips (<i>Thrips tabaci</i>)	Assuming it as disease infection , spary carbendazim 1 g/ l	<ul style="list-style-type: none"> Mulching with rice straw or other organic mulch on the plant bed helps in reducing thrips populations and improving onion growth Release of adult beetle of ladybird beetles (<i>Coccinella septempunctata</i> and <i>C. coccinoides</i>) @ 25 beetles/ m² and early instars of green lace wings (<i>Chrysoperla carnea</i>) @ 50,000 eggs /ha are very effective against onion thrips. Chemical: Spray chlorpyriphos (@ 2 ml/ l 	
19.	Pumpkin (<i>cucurbita moschata</i>)	(A) Diseases: (In Main field)			
		i. Anthracnos (<i>Colletotrichum lagenarium</i>)	Sparyinf of carbendazim 1 g/ l or mancozeb (0.2%)	<ul style="list-style-type: none"> Seed treatment with carbendazim (0.1%) Maintain proper plant populations Removal and destruction by burning of severely infected leaves Need based folira application of thiophanate-methyl (0.15) or carbendazim (0.1%) or mancozem (0.2%) at 7-10 days interval. 	
		ii. Powdery mildew	Sparyinf of mancozeb (0.2%)	<ul style="list-style-type: none"> If possible, removal and destruction by burning of first infected leaves or entire plant is helpful. 	

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks	
		(<i>Erysiphe cichoracearum</i>)		<ul style="list-style-type: none"> • Strict hygiene is necessary as powery mildew fungus can survive in plant debris. • Spraying of plant based oil such as neem oil or jojoba oil @ 3 ml/l is effective. • Application of bio-agents like <i>Bacillus subtilis</i> (0.5%) prevent infection of powdery mildew • Prophylactic spray of wettable sulphur 85 WP (@ 3 g/l). • Need based application of carbendazim (1 g/l) may be done. 		
		iii. Downy mildew (<i>Pseudoperospora cubensis</i>)	Sparyinf of mancozeb (0.2%)	<ul style="list-style-type: none"> • In disease prone areas, care should be taken to minimize the chances of leaf wetness. • Crop rotation with non- cruciferous crops for three years reduces the downy mildew incidence. • Controlling alternate hosts (weeds) in and around the field is important to eliminate the overwintering inoculum. • Over watering in the field as well as on leaves is strictly prohibited. • Ensure sufficient plant spacing (some time canopy pruning may be required) for free air circulation. • Infected leaves or plant parts should be carefully removed and destroyed by burning. • Pre-infection (prophylactic) spray of mancozeb 74 WP @ 2.5 g/l at 7-14 days interval. • Post-infection (eradicator) spray of fostyl @ 2 g/l or Bordeaux mixture (1%) at 7-14 days interval. 		
		(B) Insect pests: (Main field)				
		i. Fruit fly (<i>Bactrocera cucurbitae</i>)	Spraying of rogor @2 ml/l	<ul style="list-style-type: none"> • Deep ploughing of soil to expose the insect cocoon or larvae • All the fallen and infested fruits should be collected and destroyed to prevent the carryover of the pest. • Frequent raking of the soil under the vines or ploughing the infested fields after the crop is harvested can help in killing the pupae. • If possible cover the young fruits with cloth or polythene for 2 weeks • Grow trap crop like maize around the main field 20-25 day before and spray the maize with endosulphan (@ 2 ml/L) • Baits prepared with ripen banana or pumpkin 50 g, jiggery 50 g , 		

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
				<p>malathion 50 EC 2 ml in one litre of water , to be applied as 200 spot splashes per hectare on the undersurface of cucurbit leaves.</p> <ul style="list-style-type: none"> The flies when they congregate and rest on the under surface of large leaves of ribbed gourd may be controlled by spray application of malathion 50 EC (2 ml/l) 	
		ii. Cut worm (<i>Agrostis</i> sp.)	Application of ash in the field	<ul style="list-style-type: none"> Hardened plant seedlings (4-5 weeks) should be planted Deep ploughing of fields 3 – 6 weeks prior to planting. Maintaining of weed-free fields following crop emergence. Natural predators like wasps, grasshoppers etc should be encouraged by avoiding unnecessary spraying; Hand picking of larvae during night under flush light followed by destruction. Trace out the hiding larvae by turning up of soil around the new infested plant and kill manually. Make some trenches or holes (around 10 cm depth) in heavily infested spot to trap the larvae Application of mustard oil cake @ 20-25 kg/bigha Soil application of malathion Dust 5% @ 5 kg/bigha Soil drenching with chlorpyrifos (@1.5 ml/l) before planting.Under severe infestation(3 –10% crop damage), chloropyrifos (@ 2.5 ml/l) should be sprayed. 	
		iii.Red Pumpkin beetles (<i>Aulacophora foenicollis</i>)	1 Soil application malathion dust 5%	<ul style="list-style-type: none"> Collect infested fruits and dried leaves and dump in deep pits. Change the sowing dates as the fly population is low in hot dry conditions and at its peak during rainy season. Early planting of pumpkin during October – November to avoid damage by pumpkin beetle Frequent rake the soil under the vine or plough the infested field after the crop to kill eggs, grubs and pupae. Manual killing of adult insects early in the morning. Application of mustard oil cake @ 20-25 kg/bigha Soil application of malathion Dust 5% @ 5 kg/bigha Spray neem oil (3000 ppm) @ 5 ml/l in the afternoon. 	
20.	Okra	(A)Diseases:			

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks	
	<i>(Abelmoschus esculentus L.Moench)</i>	(In Main field)				
		i. YMV (Yellow Vein Mosai Virus)	Spraying of dimethoate @ 1.5 ml/n at 10 days interval	<ul style="list-style-type: none"> Culltural management: ✓ Eradication of early infected plants and weeds from the field (a) Boarder cropping (barrier crop) with maize (b) Cultivation of Prabhani Kranti, arka anamika, Varsha Upha or Punjab Kesari Soil application of Neem cake or mustard oil cake (500 g/m²) at the time of land preparation. To check insect vector spraying with neem oil (3000 ppm) @ 4 ml/l or neem seed kernel extract (5%) is effective 		
		ii. Okra enation leaf curl virus disease	2. Uprooting of infected plants	Same as YMV disease of Okra		
		(B)Insect pests: (Main field)				
		i. Fruit and shoot borer (<i>Earias vittella</i>)	Destruction of infected fruits.	<ul style="list-style-type: none"> Growing of maize or sorghum as barrier/trap crop to prevent the entry of fruit and shoot borer adults. Erection of birds perches @ 20-25 nos/ha. Installation of pheromone traps @ 4-5 nos/ha for monitoring or killing of <i>Earias vitella</i>. Replace the lure at 15-20 days interval Release of egg parasitoid <i>Trichogramma chilonis</i> @ 1-1.5 lakh/ha starting from 30-35 days after sowing. 4-5 times at weekly interval. Removal and destruction of infested shoots, fruits and shed material helps in reducing the intensity of infestation and Alternate spraying with Neem oil (3000 ppm) @ 4 ml/l or malathion 50 EC @ 2 ml/l at 10-15 days interval 		
		ii.Aphids (<i>Aphis grossipii</i>)		<ul style="list-style-type: none"> Regular monitoring and collection and destruction of infested leaves, shoots etc Installation of yellow sticky trap for mass trapping of aphids Botanicals: Spraying of Neem seed kernel extract (2 to 5%), garlic extract (5%) has been found effective against aphids. Spray malathion 50 EC @ 2 ml/l at 10-15 days interval. 		
21.	Ginger	(A)Diseases: (In Main field)				

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
	(<i>Zingiber officinale</i> L.)				
		i. Rhizome (soft) rot (<i>Pythium aphanidrematum</i> ., <i>P. myriotylum</i> , <i>P. vexans</i>)	Spraying with mancozeb @ 2 g/l at 10 days interval	<ul style="list-style-type: none"> • Raised beds with abundant organic matter devoid of chance of being water logged. • Seed rhizome should be collected from disease free areas. • Crop rotation with maize, cotton, soybean etc. • Intercrop ginger with maize and pineapple is also beneficial. • Treat the rhizomes with hot water at 47° C for 30 minutes to get rid – off from nematode followed by treating the same seeds lot with talc based <i>Trichoderma</i> + <i>Pseudomonas</i> formulation @ 50 g /l for 10 minutes • Chemical rhizome treatment: Rhizomes could be treated with mancozeb 75 wp (2.5 g/l) for 30 minutes before storage and planting • Application of oil cakes made from <i>Azadirachta indica</i> or, <i>Pongamia glabra</i>, or <i>Brassica campestris</i> @ 1 t/ha • Bio-control: Soil application of vermicompost or cowdung based multiplied bio-formulation (<i>Trichoderma</i> + <i>Pseudomonas</i>) in the ratio of 1: 20 • Remove the badly affected plants and drench the soil around the infected plants, after slightly removing of soil, with Bordeaux mixture (1%) or mancozeb @ 2.5g/1 liters of water. 	
		ii. Phyllosticta leaf spot (<i>Phyllosticta zingiberi</i>)		<p>Cultural control:</p> <ul style="list-style-type: none"> • Pluck and destroy by burning the severely infected leaves. • Use proper green mulching to reduce soil splashes. • If possible, provide shade 30-40% to minimize the disease or grow crops under partial shade <p>Chemical control:</p> <ul style="list-style-type: none"> • Application of Bordeaux mixture 1% or mancozeb 0.2% during monsoon at 7-10 days interval. 	
		iii. Bacterial wilt (<i>Ralstonia solanacearum</i>)		<ul style="list-style-type: none"> • Seed rhizomes must be selected from bacterial wilt-free source • Good drainage with hygiene are important, moving around the wilt infected field is restricted. Soil solarisation for 60 days during summer • Use crop rotation with non-host crops like paddy, maize, sorghum or green manuring crop like daincha etc. Avoid crop rotation with 	

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks	
				tomato, potato, chillies, brinjal and peanut etc. <ul style="list-style-type: none"> • Rhizome treatment with hot water 47⁰C for 3 minutes. • Bio-fumigation by growing cabbage or mustard or daincha and incorporating them in soil at flowering or vegetative stage. • Application of sufficient amount of organic matter like FYM, bone meal, dry fish in the soil to encourage the growth of beneficial micro-organisms. • Application of bleaching powder @ 25 kg/ha at the time of final land preparation • Bio-control: Soil application of vermicompost or cowdung based multiplied bio-formulation (<i>Trichoderma</i> + <i>Pseudomonas</i>) in the ratio of 1: 20 • Application of organic formulation (Asafodita 1g+Termeric powder 5g + 10 lit of water) in the root zone • Chemical control: Soil drenching with Bordeaux mixture (1%) 		
		(B)Insect pests: (Main field)				
		i. Shoot borer (<i>Dichocoris punctiferalis</i>)		1. Cultural control: <ul style="list-style-type: none"> • Use the attractant plant for natural biocontrol conservation. • Cut open the shoot and pick out the caterpillar and destroy. Spray neem oil (3000 ppm) (0.5%) at fortnightly intervals if found necessary. • Mulching with green leaves of <i>Vitex negundo</i> @ 2 t/acre at 40 and 90 days after planting. 2. Biological control: <ul style="list-style-type: none"> • Encourage the growth of natural bio-agents (predators) such as lady bird beetle, spiders, <i>chrysopids</i>, <i>Trichogrammatids</i> etc. by stopping or minimizing unnecessary chemical spray • Release of <i>Trichogramma chilonis</i> @ 40000/ acre for lepidopterans insect-pests. • Two sprays of neem oil 0.15% EC (1500 ppm) @ 3 ml/l at two weeks interval 		
		ii. Leaf roller (<i>Udaspes folus</i>)		1. Cultural control: <ul style="list-style-type: none"> • Collect and destroy the larvae, egg masses from the infested leaves 		

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
				<ul style="list-style-type: none"> Do not allow the weed host to grow inside and near the field <p>2. Biological control:</p> <ul style="list-style-type: none"> Encourage the growth of natural bio-agents (predators) such as lady bird beetle, spiders, <i>chrysopids</i>, <i>Trichogrammatids</i> etc. by stopping or minimizing unnecessary chemical spray Release of <i>Trichogramma chilonis</i> @ 20,000 per acre. for Lepidopteran insect-pests <p>3. Botanical:</p> <ul style="list-style-type: none"> Two sprays of neem oil 0.15% EC (1500 ppm) @ 3 ml/l at two weeks interval <p>4. Chemical:</p> <ul style="list-style-type: none"> Chlorpyriphos (@ 2 ml/ l at appearance of pest 	
		iii. Nematode (<i>Melodogyn</i> spp./ <i>Radopholus similis</i>)		<p>1. Cultural control:</p> <ul style="list-style-type: none"> Uproot and destroy the infested stunted, deformed plants Intercropping of marigold with turmeric Deep ploughing or solarized beds of infested fields during summer. Grow Repellant plants like Marigold , <i>Gliricidia</i>, Asparagus, Dahelia etc well ahead of cultivation of main crop Crop rotation: Crop rotation with cereal crops, Marigold, <i>Chrysanthemum</i>, <i>Sesbania</i>, <i>Crotalaria</i> spp., <i>Gaillardia</i>, castor bean and <i>Desmodium</i> spp. is helpful in reducing parasitic nematodes. <p>2. Biological control:</p> <ul style="list-style-type: none"> An extract of asafetida (1g)+ turmeric powder (5 g) + water 10 lit is effective against this nematode. Application of neem (<i>Azadirachta indica</i>) cake 1 t/ ha at the time of final land preparation. 	
22..	Turmeric (<i>Curcuma longa</i> L.)	(A) Diseases: (In Main field)			
		i. <i>Taphrina</i> leaf blotch (<i>Taphrina maculans</i>)	.Foliar spray of mancozeb (2,5 g/l)	<p>1. Use resistant/tolerant cultivars like Roma, Swarna, Sudarshana, Suguna, Sugandham, Ranga, Rashmi, Rajendra</p> <p>2. Cultural control:</p> <ul style="list-style-type: none"> Use proper green mulching to reduce soil splashes. 	

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
				<ul style="list-style-type: none"> Field sanitation should be practiced. Follow crop rotation with cereal and legume crops to reduce the inoculum build up <p>3. Botanicals:</p> <ul style="list-style-type: none"> Use of plant extracts such as garlic extracts (5%) is effective against this foliar pathogens. <p>4. Chemical control:</p> <ul style="list-style-type: none"> Foliar spray of Bordeaux mixture (1%) or mancozeb 75 WP (0.2%). Spraying should be done at 15 days interval starting at the first appearance of the disease symptoms. 	
		ii. Colletotrichum leaf spot (<i>Colletotrichum zingiberi</i>)	Foliar spray of mancozeb (2,5 g/l)	<p>1. Use of resistant/tolerant cultivars like Sonia, Krishna, Prabha, Pratibha, Alleppey Supreme, Kedaram</p> <p>2. Cultural control:</p> <ul style="list-style-type: none"> Pluck and remove the infested leaf and uproot the infested plants and destroy them. Use proper green mulching to reduce soil splashes. Field sanitation should be practiced. Follow crop rotation with cereal and legume crops to reduce the inoculum build up <p>3. Botanicals:</p> <ul style="list-style-type: none"> Use of plant extracts such as garlic extracts (5%) is effective against this foliar pathogens. <p>4. Chemical control:</p> <ul style="list-style-type: none"> Foliar spray of Bordeaux mixture (1%) or mancozeb 75 WP (0.2%). Spraying should be done at 15 days interval starting at the first appearance of the disease symptoms 	
		iii. Rhizome rot/ soft rot (<i>Pythium</i> spp.)	Removal and destruction of infected plants.	<p>1. Cultural control:</p> <ul style="list-style-type: none"> Adopt phytosanitary measures like infected plants should be uprooted and destroyed Adopt crop rotation with non-host like maize, paddy, sorghum, soybean etc. Planting of disease-free seed rhizomes. Maintain proper drainage by using 30 cm raised bed and 1 m width with at least 50 cm spacing between the beds. 	

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
				<p>2. Seed rhizome treatment:</p> <ul style="list-style-type: none"> Treat the rhizomes with hot water at 47° C for 30 minutes to get rid – off from nematode followed by treating the seeds with talc based <i>Trichoderma</i>+ <i>Pseudomonas</i> formulation @ 50 g/l for 10 minutes Rhizomes treatment can be done by keeping them under clear polythene sheet under direct sunlight for raising the temperature 48o C and this temperature is retained for 30 minutes. Chemical rhizome treatment: Rhizomes could be treated with mancozeb 75 wp (2.5 g/l) for 30 minutes before storage and planting <p>3. Use bio-fumigation by growing dhaincha and incorporating them in the soil at their vegetative stage, also can be done by using cabbage and mustard plant refuses.</p> <p>4. Botanicals:</p> <ul style="list-style-type: none"> Application of neem cake or mustard oil cake or <i>Pongamia cake</i> @ 1 tonnes/ ha at the time of final land preparation. <p>5. Bio-control:</p> <ul style="list-style-type: none"> Soil application of vermicompost or cowdung based multiplied bio-formulation (<i>Trichoderma</i> + <i>Pseudomonas</i>) in the ratio of 1: 20 <p>6. Chemical treatment:</p> <ul style="list-style-type: none"> Remove the badly affected plants and drench the soil around the infected plants, after slightly removing of soil, with Bordeaux mixture (1%) or mancozeb @ 2g/1 liters of water. 	
		(B) Insect pests: (Main field)			
		i. Leaf Roller (<i>Udaspes folus</i>)	Spraying with dimethoate (@ 1 ml/l) at 15 days interval	<ul style="list-style-type: none"> Manual collection and destruction of egg masses and larvae Eradication of alternate weed hosts in and around the field. Biological control: ✓ Ensure eco-friendly measures to conserve the natural enemies (predators) such as ladybird beetle, spiders, chrysopids, <i>Bracon</i> sp, fire ants, dragon fly , praying mantis, ground beetle and Trichogrammatids etc. by suspending unnecessary spraying of chemical insecticides. (a) Release of egg parasitoid e.g. <i>Trichogramma chilonis</i> @ 20,000/acre, 2-4 times. Botanical:Foliar spray of neem oil (@ 3 ml/l) at 7-10 days interval 	
		ii. Shoot borer	Spraying with	1. Cultural control:	

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
		(<i>Conogethes punctiferalis</i>)	dimethoate (@ 1 ml/l) at 15 days interval	<ul style="list-style-type: none"> Destroy the infested shoots including harbouring caterpillars Place light traps @ 1 /acre and operate between 6 and 10 pm to attract and trap the adult moths. Collect and kill the trapped moths . Mulching with green <i>Lantana camara</i> and <i>Vitex negundo</i> leaves @ 2 t/acre at 40 and 90 days after planting. <p>2. Biological control:</p> <ul style="list-style-type: none"> Release of <i>Trichogramma chilonis</i> @ 40,000/acre.. Conserve natural enemies such as <i>Angitia (Dioctes) tronchanterata</i>; <i>Xanthopimpla australis</i>, <i>Theromia inareolata</i>, <i>Bracon hebetor</i>, <i>B. brevicornis</i>, <i>B. nosatoi</i>, <i>B. lasus</i>, <i>Phanerotoma hendecasisella</i>, <i>Myosoma</i> sp, <i>Apanteles</i> sp, <i>Brachymeria euloeae</i>, earwigs, robber flies andspiders, ladybird beetle, spiders, chrysopids, Trichogrammatids etc. <p>3. Botanicals:</p> <ul style="list-style-type: none"> Spray neem oil (1500 ppm) (0.5%) at fortnightly intervals. <p>4. Chemical:</p> <ul style="list-style-type: none"> Spraying with malathion 50% EC (2 ml/l) starting from june to august at 15 day interval. 	
		iii.Nematode (<i>Melodogyne</i> spp/ <i>Radophalus similis</i>)	<p>1.Soil incorporation of Malathion dust 5%2 3 kg/bgaha</p> <p>2.Uprootinf of infested plants.</p>	<p>1. Cultural control:</p> <ul style="list-style-type: none"> Uproot and destroy the badly infested (stunted, deformed) plants. Treat seed rhizomes with hot water (50 °C) for 10 minutes. Nematode prone area (turmeric beds) could be placed under solarization for 40 days during summer after deep ploughing. Intercropping of marigold @ 5:1 Follow crop rotation with cereal crops, marigold, <i>Chrysanthemum</i>, <i>Sesbania</i>, <i>Crotalaria</i> spp., Gaillardia, cluster bean and <i>Desmodium</i> spp., <p>2. Botanicals:</p> <ul style="list-style-type: none"> An extract of asafetida (1 g) + turmeric powder (5 g) and water (10 l) is effective. Application of neem (<i>Azadirachta indica</i>) seed cake 100 Kg/acre before planting <p>3. Biological:</p>	

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks	
				<ul style="list-style-type: none"> <i>Pochonia chlamydosporia</i>, a nematode biocontrol agent can be incorporated in turmeric beds (20 g/bed at 10⁶ cfu/g) at the time of sowing. 		
23..	Papaya (<i>Carica papaya</i> L.)	(A) Diseases: (In Main field)				
		i. Damping-off (<i>Phytophthora, Pythium, Rhizoctonia and Fusarium</i> sp)	Spraying of urea (3%)	Same as in case of cauliflower damping-off disease		
		ii. Stem rot or foot rot (<i>Phytophthora</i> sp. <i>Pythium aphanidermatum</i> <i>Rhizoctonia solani</i>)	i. Uprooting of infected pknat followed by soil application om mancozeb (@ 2 g/l)	<ul style="list-style-type: none"> Well drained fertile soil shoul be selected. Nursery bed treatment and seed treatment with bio-agent like <i>Trichoderma</i> sp or <i>Trichoderma</i> sp + <i>Pseudomonas</i> in the ration 1:20 (1kg talc based bio-formulation: 20 kg vermicompost or FYM) and 20 g/kg of seeds should be done. Chemical Seed dressing with captan or chlorothalonil @ 2 g/kg of seed could be done Pit application of pre-multiplied <i>Trichoderma</i> sp or <i>Trichoderma</i> sp + <i>Pseudomonas</i> (with neem cake or vermicompost or FYM in the ratio of 1:20) @ 2 kg/pit should be done before planting Uprooting followed by destruction of dead plant should be carried out to restrict the spread of pathogen. Drench the soil of rouged out plant including collar region of surrounding nearby healthy looking plants with Bordeaux mixture (1%) Prophylactically soil drenching with mancozeb (0.2%) or Bordeaux mixture (1%) at bimonthly interval provide effective control of the standing crops. 		
		iii. Anthracnose (<i>Colletotrichum gloeosporiodes</i>)	Spraying with mancozeb (0.2%)	<ul style="list-style-type: none"> Infected leaves and fruits should be removed and destroyed. Spraying of macozeb (0.2%) or carbendazim (0.1%) at 15 days interval provides effective control. To minimize the post harvest damage , dipping of harvested fruit at hot water (46-49 °C) for 20 minutes shortly after harvest provide control of the disease under storage 		
		iv. Papaya leaf curl	Destruction of	1. Cultural:		

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
		disease (<i>Papaya leaf curl virus</i>)	infected plants	<ul style="list-style-type: none"> Nursery management: Growing papaya seedlings under nylon net cover (60-80 mesh size) to prevent entry of insect vector <i>Bemisia tabaco</i> Eradicate early infected plants and weeds from the main field Growing maize as boarder crop reduce the disease spread <p>2. Chemical:</p> <ul style="list-style-type: none"> Soil application of Neem oil cake or mustard oil cake @ 500 g/m² the time of pit preparation. Seedlings in the nursery bed , 5 days prior to transplanting should be sprayed with neem oil (1500 ppm) @ 3 ml/l In main field after establishing the seedlings, foliar spray of malathion 50 Ec (@2 ml/l) 15 day interval or need base are effective. Chemical spray followed by neem seed kernel extract @ 2% is also effective in rotation with insecticide. 	
		v.Ring spot virus disease (<i>Papaya Ring spot virus</i>)	Destruction of infected plants	Same as in case of Papaya leaf curl virus disease contro measures.	
		(B) Insect pests: (Main field)			
		i. Papaya mealy bug (<i>Paracoccus marginatus Williams and Granara de Willink (Hemiptera: Pseudococcidae)</i>)	i. Hand picking ii.Spraying of rogor (2 ml/l)	<p>1. Cultural and Mechanical</p> <ul style="list-style-type: none"> Monitoring and scouting to detect early presence of the mealybug Pruning of infested branches and burning them including crop residues Removal of weeds/alternate host plants like Hibiscus, Parthenium etc. in and nearby papaya crop Avoiding the movement of planting material from infested areas to other areas Avoiding flood irrigation Prevention of the movement of ants and destruction of already existing ant colonies Sanitization of farm equipment before moving it to the uninfested crop Application of sticky bands or alkathene sheet or a band of insecticide on arms or on main stem to prevent movement of crawlers <p>2. Biological control:</p> <ul style="list-style-type: none"> Conservation of natural enemies like <i>Cryptolaemus montrouzieri</i>, 	Insecticide resistance and non-target effects on natural enemies make chemical control a less desirable control option.

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
				<p>ladybird beetles, lacewings, hover flies, <i>Scymnus</i> sp. and certain hymenopteran and dipteran parasitoids in nature plays important role in reducing the mealybug population.</p> <ul style="list-style-type: none"> • In the nature, lepidopteran predator, <i>Spalgis epius</i> (Lycaenidae) is a well known representative of carnivorous butterfly feeding on various species of pseudococcids and coccids. <i>S. epius</i>, being the dominant predator, feeds efficiently on the ovisacs, nymphs and adult of papaya mealybug. Newly hatched larvae of <i>S. epius</i> are pale pink in colour and remain inside the mealybug ovisac devouring the eggs of the mealybug. • There is a need to conserve the native predators of the pest. Australian ladybird beetle (<i>C.montrouzieri</i>) predate on mealybugs, eating 3,000-5,000 mealybugs in various life stages and is released @ 10 beetles per tree or @ 5000 beetles/ ha. • When high activity of <i>S. epius</i> and other natural enemies is observed, care should be taken to delay spraying operations and measures should be taken to conserve them. • Exotic parasitoids/predators such as <i>Anagyrus loeckii</i> Noyes and Menazes, <i>Acerophagous papayae</i> Noyes and Schauff and <i>Pseudeptomastrix Mexicana</i> Noyes and Schauff (Hymenoptera: Encyrtidae) were released in Sri Lanka in May 2009 (imported from Puerto Rico) and resulted in 95 to 100% control of the papaya mealybug in some parts of that country by August 2009. There is a need to introduce such exotic parasitoids in India to contain the pest without harming the environment. • Regular monitoring of the crop for mealybug infestation and its natural enemies. <p>3. Chemical control</p> <ul style="list-style-type: none"> • Locate ant colonies and destroy them with drenching of chlorpyrifos 20 EC @ 2.0 ml/litre of water. • Spot application of insecticide immediately after noticing mealybug on some plants in the crop field. If the activities of natural enemies are not observed, use of botanical insecticides such as neem oil (1 to 2%), NSKE (5%), or Fish Oil Rosin Soap (25g/litre of water) should be the first choice. • Apply chlorpyrifos 20 EC (2ml/litre) with stickers (@ 0.1%) • Some times drenching the soil with chlorpyrifos around the collar 	

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
				region of the plant to prevent movement of crawlers of mealybug and ant activity is useful.	
24.	Banana (<i>Musa spp.</i>)	(A) Diseases: (In Main field)			
		1. Panama wilt (<i>Fusarium oxysporum</i> f.sp <i>cubense</i>)	Soil drenching with carbendazim (0.1%)	<p>Care to be taken before the disease infection:</p> <ul style="list-style-type: none"> Suckers should be selected from the yellow disease free garden. Cleaning of suckers by removing dried black coloured roots, outer skin (about 1-1.5 cm thick peeling) with help of sharp knife, and also give a slanting cut to the pseudo stem 30 cm above the base of the sucker. Soak the pared suckers in the solution of carbendazim (2 g/ litre of water) for 30 minutes. Pit application of pre-multiplied <i>Trichoderma</i> sp or <i>Trichoderma</i> sp + <i>Pseudomonas</i> (with neem cake or vermicompost or FYM in the ratio of 1:20 @ 5 kg/pit should be at the time of planting. <p>Care to be taken after the disease infection (in standing crop):</p> <ul style="list-style-type: none"> Uprooting of diseased plant along with root system followed by chopping and drying for few days and destroy by burning. Soil drenching of carbendazim @ 2 g/l at 2 months interval from 6 month of planting onwards Corm injection of carbendazim (2%) at 5,7 and 9 month after planting at the base of the suckers. Make holes of 5 cm depth at 45° angle with pencil thick stick in three directions and push solution @ 3 ml /hole with the help of syringe. Application of carbendazim as capsule (embedded carbendazim 50 mg/capsule) in the rhizome has been reported to be effective Basal application of talc based boi-formulation (pre-multiplied with FYM or vermicompost) containing <i>Trichoderma</i>, <i>Pseudomonas</i> and <i>Bacillus</i> like Biozin-PTB @ 3 kg/plnat at 3rd 5th and 7th month after planting. 	
		ii. Leaf spot or Sigatoka disease (<i>Mycosphaella fusicola</i> / <i>Cercospora musace</i>)	Spraying with mancozeb (0.2%)	<ul style="list-style-type: none"> Good agronomic practices including improved drainage, weed control, removal of suckers and adoption of correct spacing helps in reducing the disease incidence. Removal and destruction by burning of infected leaves. Spraying of thiophanate methyl (0.1%) or carbendazim (0.1%) along 	

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
				with some stickers (e.g Teepol, Indtro-AE etc) @ 2 ml/l at 2 weeks interval during severe disease incidence period.	
		iii. Banana bunchy top virus disease (Banana bunchy top virus)	Uprooting of diseased plants	<ul style="list-style-type: none"> Selection of only disease free vhealthy suckers or mico propagated plants should be done. BBTV infected plants should be destroyed immediately by digging followed by pouring burn diesel or kerosene. In disease prone areas, to control the aphid vectors, spraying of neem oil (1500 ppm) @ 5 ml/l should be done periodically. 	
(B) Insect pests: (Main field)					
		i.Pseudostem Borer (<i>Odoiporus longicollis</i>)	i.Application of malathion dust 5% at base of banana ii. Spraying of chloropyriophos (@ 2 ml/l on the pseudostem	<ul style="list-style-type: none"> Clean cultivation by removing weeds, unwanted plants and also maintaind recommended number of suckers in each clump Remove old dry leaves along with old detached outer leaf sheath After harvest of banana, cut the pseudostem into pieces about 1.5' length and split into half. Spead the half pieces keeping cut portion down on soil surface to trap the aduld weevils for monitoring as well as killing manually. Severely infested broken or bended plants with boring signs on pseudostes should be cut open to expose the larvae, pupa and adult beetles followed by destroy them manually. Biological control: Soil application of Beauverjal (<i>Beauveria bassiana</i>) dissolve 300ml in 5 litre of water, again dilute it in 200 litre of water and stir thoroughly and spray on the soil of infedted area during evening hours. In frequently weevil occurring areas, soil application of neem cake (@ 1.5-2 kg /stool) is effective. On the notice of jelly exudation through the holes on Pseudostem, injection of 2 ml solution of malathion 50 EC or chlorpyriphos (@ 2.33 ml/l), two injection per plant at 2 and 4 feet above the ground. 	
		ii.Rhizome Weevil (<i>Cosmopolites sordidus</i>)	i. Removal of infested plant ii.Spraying of chloropyriophos (@ 2 ml/l) in the pit and on the pseudostem	<ul style="list-style-type: none"> Plantations should be clear of debris after harvest in which borers can survive. It is most important to use clean, healthy planting material from fields, known to be free of weevils infestation. Pre-planting pared suckers should be treated in the solution of malathion 50 EC (@ 15 ml/l) for 20 minutes. 	

Sl. No	Name of Crops	Name of pests and diseases	Farmer's practice	Recommended measures	Remarks
				<ul style="list-style-type: none"> Rhizomes and pseudostems of harvested banana are cut into pices (1-2 feet long), split longitudinally and placed on the plantation floor haphazardly between plants. Adult beetles get attracted to these stem pieces and upon periodical checking can be destroyed manually. Soil application of Beauverjal (<i>Beauveria bassiana</i>) and org-metajal (<i>Metarhizium anisopliae</i>) 2.5 ml/l on the soil. 	
		iii. Fruit and Leaf Scarring Beetle (<i>Nodostoma viridipinne</i> , <i>Colaspis hypochlora</i>)	i. Foliar spray of malathion 35 EC (@ 2 ml/l) in the evening.	<ul style="list-style-type: none"> Reduce over crowding by removing unnecessary daughter suckers, dry leaves etc. Keep plantation grass weeds free. Bagging: Insert bags made of either breathable plastic or muslin cloth or blue polythene sheet (with pin holes for air circulation) before fruit setting or at the emergence of bunch and remove after 60 days of fruit setting. Application of neem oil @ 3 ml/l in the crown covering young leaves Biological control: Foliar spray of "Beauverjal" (<i>Beauveria bassiana</i>) dissolve 300ml in 5 litre of water, again dilute it in 200 litre of water and stir thoroughly and spray during evening hours. Chemical: In case of severe infestation spraying with Malathion 50 EC @ 2 ml/l controls the pest. 	
		v. Nematode problem (<i>Radopholus similis</i> , <i>Pratylenchus coffeae</i> , <i>Melodogyne incognita</i> , <i>Heterodera oryzicola</i> , <i>Hilicotylenchus</i> spp.)		<ul style="list-style-type: none"> Collections of planting materials from nematode free gardens. Crop rotation with rice, sugarcane, cotton Growing of marigold as repellent crop in between banana rows Application of neem cake @ 500 g/plant along with any one of the bioagents like <i>Trichoderma viride</i> or <i>Pacilomyces lilacinus</i> or <i>Pseudomonas fluorescens</i> @ 20 g/plant. Biological: Application of talc based bio-pesticide (pre-multiplied with FYM or vermicompost) containing <i>Trichoderma</i>, <i>Pseudomonas</i> and <i>Bacillus</i> like Biozin-PTB @ 3 kg/plant at time of planting and again 3 month after planting. 	

ANNEXURE 12a: CLASS II (MODERATE HAZARD) TECHNICAL GRADE ACTIVE INGREDIENTS IN THE PESTICIDE

Common name	CAS no	UN no	Chem type	Phys state	Main use	GHS	LD ₅₀ mg/kg	Remarks
Acephate [ISO]	30560-19-1		OP	S	I	4	945	JMPR 1991, 2003b, 2006b; ICSC 748
Acifluorfen [ISO]	50594-66-6			S	H	4	1370	Strong irritant to eyes
Alachlor [ISO]	15972-60-8	2588		S	H	4	930	See note 1; DS 86; IARC 19, 36, 63; ICSC 371
Alanycarb [ISO]	83130-01-2		C	S	I	4	330	
Allethrin [ISO]	584-79-2		PY	Oil	I	4	c685	See note 9, page 8; EHC 87; HSG 24; ICSC 212; JMPR 1965a
Ametryn [ISO]	834-12-8		T	S	H	4	110	
Amitraz [ISO]	33089-61-1			S	AC	4	800	ICSC 98; JMPR 1999
Anilofos [ISO]	64249-01-0		OP	S	H	4	472	
Azaconazole	60207-31-0			S	F	4	308	
Azamethiphos [ISO]	35575-96-3		OP	S	I	4	1010	
Azocyclotin [ISO]	41083-11-8	2786	OT	S	AC	3	80	JMPR 1990, 1995b, 2006b
Bendiocarb [ISO]	22781-23-3	2757	C	S	I	3	55	DS 52
Benfuracarb [ISO]	82560-54-1	2992	C	L	I	3	205	
Bensulide [ISO]	741-58-2	2902		L	H	3	270	ICSC 383
Bensultap [ISO]	17606-31-4			S	I	4	1100	
Bentazone [ISO]	25057-89-0			S	H	4	1100	HSG 48; ICSC 828; JMPR 1999, 2005
Bifenthrin	82657-04-3	3349	PY	S	I	3	c55	JMPR 1993
Bilanafos [ISO]	71048-99-2			S	H	3	268	
Bioallethrin [C]	584-79-2		PY	L	I	4	c700	See note 2; note 9, p. 8; ICSC 227
Bromoxynil [ISO]	1689-84-5	2588		S	H	3	190	
Bromuconazole	116255-48-2			S	F	4	365	ICSC 1264
Bronopol	52-51-7			S	B	3	254	ICSC 415
Butamifos [ISO]	36335-67-8		OP	L	H	4	630	
Butralin [ISO]	33629-47-9			S	H	4	1049	

Common name	CAS no	UN no	Chem type	Phys state	Main use	GHS	LD ₅₀ mg/kg	Remarks
Butoxydim [ISO]	138164-12-2			S	H	4	1635	
Butylamine [ISO]	13952-84-6	1992		L	F	4	380	Irritant to skin; ICSC 401; JMPR 1982, 1985b
Carbaryl [ISO]	63-25-2	2757	C	S	I	3	c300	DS 3; EHC 153; HSG 78; IARC 12, Suppl.7; ICSC 121; JMPR 1997b, 2002
Carbosulfan [ISO]	55285-14-8	2992	C	L	I	3	250	JMPR 1987a, 2004
Cartap [ISO]	15263-53-3			S	I	4	325	EHC 76; JMPR 1996a
Chloralose [C]	15879-93-3			S	R	4	400	
Chlordane [ISO]	57-74-9	2996	OC	L	I	4	460	See notes 3 and 4; DS 36; EHC 34; HSG 13; IARC 79; ICSC 740; JMPR 1995a
Chlorfenapyr [ISO]	122453-73-0			S	LMT	4	441	
Chlormequat (chloride) [ISO]	999-81-5			S	PGR	4	670	ICSC 781; JMPR 2000
Chloroacetic acid [C]	79-11-8	1751		S	H	4	650	Irritant to skin and eyes; data refer to sodium salt; ICSC 235
Chlorphonium chloride [ISO]	115-78-6	2588		S	PGR	3	178	Irritant to skin and eyes
Chlorpyrifos [ISO]	2921-88-2	2783	OP	S	I	3	135	DS 18; ICSC 851; JMPR 2000
Clomazone [ISO]	81777-89-1			L	H	4	1369	
Copper hydroxide [C]	20427-59-2		CU	S	F	4	1000	
Copper oxychloride [C]	1332-40-7		CU	S	F	4	1440	
Copper sulfate [C]	7758-98-7		CU	S	F	3	300	ICSC 751
4-CPA [ISO]	122-88-3		PAA	S	PGR	4	850	
Cuprous oxide [C]	1317-39-1		CU	S	F	4	470	ICSC 421, EHC 200
Cyanazine [ISO]	21725-46-2		T	S	H	3	288	ICSC 391
Cyanophos [ISO]	2636-26-2		OP	L	I	4	610	
Cyhalothrin [ISO]	68085-85-8	3352	PY	Oil	Ix	3	c144	See note 9, p. 8; EHC 99; HSG 38; ICSC 858; JMPR 1985c; JECFA 2000b
Cyhexatin [ISO]	13121-70-5		OT	S	AC	3	265	EHC 15; JMPR 1995b, 2006b
Cymoxanil [ISO]	57966-95-7			S	F	4	1196	

Common name	CAS no	UN no	Chem type	Phys state	Main use	GHS	LD ₅₀ mg/kg	Remarks
Cypermethrin [ISO]	52315-07-8	3352	PY	L	I	3	c250	See note 9, p. 8; DS 58; EHC 82; HSG 22; ICSC 246; JECFA 1996
Alpha-cypermethrin [ISO]	67375-30-8	3349	PY	S	I	3	c79	See note 9, p 8; EHC 142; JECFA 1996; JMPR 2008
Cyphenothrin [(1R)-isomers] [ISO]	39515-40-7	3352	PY	L	I	4	318	
Cyproconazole	94361-06-5			S	F	4	1020	
2,4-D [ISO]	94-75-7	3345	PAA	S	H	4	375	DS 37; EHC 29, 84; HSG 5; IARC 41, Suppl. 7; ICSC 33; JMPR 1998b
Dazomet [ISO]	533-74-4			S	F-S	4	640	Irritant to skin and eyes; ICSC 786
2,4-DB	94-82-6			S	H	4	700	
DDT [ISO]	50-29-3	2761	OC	S	I	3	113	See notes 3 and 4; DS 21; EHC 9, 83; IARC 53; ICSC 34; JMPR 1985c, 2001
Deltamethrin [ISO]	52918-63-5	3349	PY	S	I	3	c135	See note 9, p. 8; DS 50; EHC 97; HSG 30; IARC 53; ICSC 247; JMPR 2001
Diazinon [ISO]	333-41-5	3018	OP	L	I	4	300	DS 45, EHC 198; ICSC 137; JMPR 1994, 2002, 2008
Dicamba [ISO]	1918-00-9			S	H	4	1707	ICSC 139
Dichlorobenzene [C]	106-46-7			S	FM	4	500-5000	Mixture of isomers: ortho (3) 95-50-1, meta (3) 541-73-1, para (2B) 106-46-7; ICSC 37
Dichlorophen [ISO]	97-23-4		OC	S	F	4	1250	
Dichlorprop [ISO]	7547-66-2			S	H	4	800	ICSC 38
Diclofop [ISO]	40483-25-2			S	H	4	565	
Dicofol [ISO]	115-32-2		OC	S	AC	4	c690	DS 81; IARC 30; ICSC 752; JMPR 1993
Difenoconazole [ISO]	119446-68-3			S	F	4	1453	JMPR 2009b
Difenzoquat [ISO]	43222-48-6	2588		S	H	4	470	
Dimepiperate [ISO]	61432-55-1		TC	S	H	4	946	
Dimethachlor [ISO]	50563-36-5			S	H	4	1600	
Dimethipin [ISO]	55290-64-7			S	H	4	1180	JMPR 2000, 2005

Common name	CAS no	UN no	Chem type	Phys state	Main use	GHS	LD ₅₀ mg/kg	Remarks
Dimethenamid [ISO]	87674-68-8			L	H	4	371	LD ₅₀ of P isomer is 429 mg/kg bw; JMPR 2006b
Dimethylarsinic acid [C]	75-60-5	1572	AS	S	H	4	1350	
Dimethoate [ISO]	60-51-5	2783	OP	S	I	3	c150	DS 42; EHC 90; HSG 20; ICSC 741; JMPR 1997b, 2004
Diniconazole [ISO]	83657-24-3			S	F	4	639	
Dinobuton [ISO]	973-21-7	2779	NP	S	AC,F	3	140	
Dinocap [ISO]	39300-45-3		NP	S	AC,F	4	980	ICSC 881; JMPR 1999
Diphenamid [ISO]	957-51-7			S	H	4	970	ICSC 763
Diquat [ISO]	2764-72-9	2781	BP	S	H	3	231	Irritant to skin and eyes and damages nails; DS 40; EHC 39; HSG 52; JMPR 1994; ICSC 1363
Dithianon [ISO]	3347-22-6			S	F	4	640	JMPR 1993
Dodine [ISO]	2439-10-3			S	F	4	1000	JMPR 2001
Endosulfan [ISO]	115-29-7	2761	OC	S	I	3	80	DS 15; EHC 40; HSG 17; ICSC 742; JMPR 1999
Endothal-sodium [(ISO)]	125-67-9	2588		S	H	3	51	
EPTC [ISO]	759-94-4		TC	L	H	4	1652	ICSC 469
Esfenvalerate [ISO]	66230-04-4	3349	PY	S	I	3	87	JMPR 2003b; ICSC 1516
Ethion [ISO]	563-12-2	3018	OP	L	I	3	208	ICSC 888; JMPR 1991
Fenazaquin [ISO]	120928-09-8	2588		S	AC	3	134	
Fenitrothion [ISO]	122-14-5		OP	L	I	4	503	DS 30; EHC 133; HSG 65; ICSC 622; JMPR 2001
Fenobucarb	3766-81-2		C	S	I	4	620	
Fenothiocarb [ISO]	62850-32-2		C	S	L	4	1150	
Fenpropidin [ISO]	67306-00-7			L	F	4	1440	
Fenpropathrin [ISO]	64257-84-7	3349	PY	S	I	3	c66	See note 9, p. 8; JMPR 1994
Fenpyroximate [ISO]	134098-61-6			S	AC	3	245	Highly toxic by inhalation (LC ₅₀ = 0.21-0.36 mg/l); JMPR 2007
Fenthion [ISO]	55-38-9	3018	OP	L	I,L	3	D586	DS 23; ICSC 655; JMPR 1998b
Fentin acetate[(ISO)]	900-95-8	2786	OT	S	F	3	125	DS 22; EHC 15; JMPR 1992; CICAD 13

Common name	CAS no	UN no	Chem type	Phys state	Main use	GHS	LD ₅₀ mg/kg	Remarks
Fentin hydroxide[ISO]]	76-87-9	2786	OT	S	F	3	108	DS 22; EHC 15; ICSC 1283; JMPR 1992; CICAD 13
Fenvalerate [ISO]	51630-58-1	3352	PY	L	I	4	c450	See note 9, p. 8; DS 90; EHC 95, HSG 34; IARC 53; ICSC 273; JMPR 1986c
Ferimzone [ISO]	89269-64-7			S	F	4	725	
Fipronil	120068-37-3	2588		S	I	3	92	JMPR 1998b, 2001; ICSC 1503
Fluchloralin [ISO]	33245-39-5			S	H	4	1550	
Flufenacet [ISO]	142459-58-3			S	H	4	600	May cause skin sensitization
Fluoroglycofen	77501-60-1			S	H	4	1550	
Flurprimidol [ISO]	56425-91-3			S	PGR	4	709	
Flusilazole	85509-19-9			S	F	4	672	JMPR 1996b, 2009b
Flutriafol [ISO]	76674-21-0			S	F,FST	4	1140	
Fluxofenim [ISO]	88485-37-4			oil	H	4	670	
Fomesafen [ISO]	72178-02-0		OC	S	H	4	1250	
Fuberidazole [ISO]	3878-19-1			S	F	4	336	
Furalaxyl [ISO]	57646-30-7			S	F	4	940	
Gamma-HCH [ISO], Lindane	58-89-9	2761	OC	S	I	3	88	ICSC 53; JMPR 2003b; See note 3
Glufosinate [ISO]	53369-07-6			S	H	4	1625	JMPR 2000
Guazatine	108173-90-6			S	FST	3	230	LD ₅₀ value refers to triacetate; JMPR 1998b
Haloxypop	69806-34-4			S	H	4	300	JMPR 1996b, 2008 (includes Haloxypop-R and esters)
HCH [ISO]	608-73-1	2761	OC	S	I	3	100	See notes 3, 4 and 5; EHC 123; IARC 5, 20, 42; ICSC 487; JMPR 1974
Hexazinone [ISO]	51235-04-2			S	H	4	1690	
Hydramethylnon	67485-29-4			S	I	4	1200	
Imazalil [ISO]	35554-44-0	2588		S	F	3	227	ICSC 1303; JMPR 2001, 2002, 2006b
Imidacloprid [ISO]	138261-41-3			S	I	4	450	JMPR 2002; ICSC 1501

Common name	CAS no	UN no	Chem type	Phys state	Main use	GHS	LD ₅₀ mg/kg	Remarks
Iminoctadine [ISO]	13516-27-3			S	F	3	300	Eye irritant
Indoxacarb [ISO]	173584-44-6			S	I	3	268	JMPR 2006b; LD ₅₀ applies to 3:1 mixture of isomers in commercial use
Ioxynil [ISO]	1689-83-4	2588		S	H	3	110	ICSC 900
Ioxynil octanoate [(ISO)]	3861-47-0			S	H	4	390	
Iprobenfos	26087-47-8			S	F	4	600	
Isoprocarb [ISO]	2631-40-5	2757	C	S	I	4	403	
Isoprothiolane [ISO]	50512-35-1			S	F	4	1190	
Isoproturon [ISO]	34123-59-6			S	H	4	1800	
Isouron [ISO]	55861-78-4			S	H	4	630	
Lambda-cyhalothrin	2164-08-1	3349	PY	S	I	3	c56	See note 9, p. 8; EHC 142; HSG 38; JMPR 2009b; ICSC 859
MCPA [ISO]	94-74-6		PAA	S	H	4	700	IARC 30, 41; ICSC 54
MCPA-thioethyl [ISO]	25319-90-8		PAA	S	H	4	790	
MCPB [ISO]	94-81-5			S	H	4	680	
Mecoprop [ISO]	7085-19-0			S	H	4	930	ICSC 55
Mecoprop-P [ISO]	16484-77-8			S	H	4	1050	
Mefluidide [ISO]	53780-34-0			S	H	4	1920	
Mepiquat [ISO]	15302-91-7			S	PGR	4	1490	
Mercurous chloride [C]	10112-91-1	2025	HG	S	F	3	210	See note 3; ICSC 984; CICAD 50
Metalaxyl [ISO]	57837-19-1			S	F	4	670	JMPR 1983, 2003b
Metaldehyde [ISO]	108-62-3			S	M	3	227	DS 93
Metamitron [ISO]	41394-05-2			S	H	4	1183	ICSC 1361
Metam-sodium [(ISO)]	137-42-8	2771		S	F-S	3	285	
Metconazole [ISO]	125116-23-6			S	F	4	660	
Methacrifos [ISO]	62610-77-9		OP	L	I	4	678	JMPR 1991

Common name	CAS no	UN no	Chem type	Phys state	Main use	GHS	LD ₅₀ mg/kg	Remarks
Methasulfocarb [ISO]	66952-49-6	2757		S	F	3	112	
Methylarsonic acid [ISO]	124-58-3		AS	S	H	4	1800	ICSC 755; EHC 224
Methyl isothiocyanate [ISO]	556-61-6	2588		S	F-S	3	72	Skin and eye irritant; see note 6
Metolcarb [ISO]	1129-41-5		C	S	I	3	268	
Metribuzin [ISO]	21087-64-9			S	H	4	322	ICSC 516
Molinate [ISO]	2212-67-1		TC	L	H	4	720	
Myclobutanil	88671-89-0			S	F	4	1600	JMPR 1993
Nabam [ISO]	142-59-6	2771		S	F	4	395	Goitrogenic in rats
Naled [ISO]	300-76-5	3018	OP	L	I	4	430	DS 39; ICSC 925
2-Naphthyloxyacetic acid [ISO]	120-23-0			S	PGR	4	600	
Nitrapyrin [ISO]	1929-82-4			S	B-S	4	1072	ICSC 1658
Nuarimol [ISO]	63284-71-9			S	F	4	1250	
Octhilinone [ISO]	26530-20-1			S	F	4	1470	
Oxadixyl	77732-09-3			S	F	4	1860	
Paclobutrazol [ISO]	76738-62-0			S	PGR	4	1300	JMPR 1989
Paraquat [ISO]	1910-42-5	2781	BP	S	H	3	150	See note 7; DS 4; EHC 39; HSG 51; ICSC 5; JMPR 1987a, 2004
Pebulate [ISO]	1114-71-2		TC	L	H	4	1120	
Pendimethalin [ISO]	40487-42-1			S	H	4	1050	
Permethrin [ISO]	52645-53-1	3352	PY	L	I	4	c500	See note 9, p. 8; DS 51; EHC 94; HSG 33; IARC 53; ICSC 312; JMPR 2000
Phenthoate [ISO]	2597-03-7	3018	OP	L	I	4	c400	DS 48; JMPR 1985c
Phosalone [ISO]	2310-17-0	2783	OP	S	I	3	120	ICSC 797; JMPR 1998b, 2002
Phosmet [ISO]	732-11-6	2783	OP	S	I,AC	3	113	ICSC 543; JMPR 1999, 2004
Phoxim [ISO]	14816-18-3		OP	L	I	4	D1975	DS 31; JECFA 2000a
Piperophos [ISO]	24151-93-7	3018	OP	oil	H	4	324	

Common name	CAS no	UN no	Chem type	Phys state	Main use	GHS	LD ₅₀ mg/kg	Remarks
Pirimicarb [ISO]	23103-98-2	2757	C	S	AP	3	147	JMPR 1983, 2005
Pirimiphos-methyl [ISO]	29232-93-7		OP	L	I	4	1667	DS 49; JMPR 1993, 2008
Prallethrin [ISO]	23031-36-9	3352	PY	oil	I	4	460	
Prochloraz [ISO]	67747-09-5			S	F	4	1600	JMPR 1985a
Profenofos [ISO]	41198-08-7	3018	OP	L	I	4	358	JMPR 1991, 2008
Propachlor [ISO]	1918-16-7			S	H	4	1500	DS 78; EHC 147; HSG 77; JMPR 2002
Propanil [ISO]	709-98-8			S	H	4	c1400	ICSC 552
Propiconazole [ISO]	60207-90-1			L	F	4	1520	JMPR 1988, 2005
Propoxur [ISO]	114-26-1	2757	C	S	I	3	95	DS 25; ICSC 191; JMPR 1990
Prosulfocarb [ISO]	52888-80-9		TC	L	H	4	1820	
Prothiofos [ISO]	34643-46-4		OP	L	I	4	925	
Pyraclufos [ISO]	77458-01-6	3018	OP	L	I	3	237	
Pyrazophos [ISO]	13457-18-6	2784		S	F	4	435	JMPR 1993
Pyrazoxyfen [ISO]	71561-11-0			S	H	4	1644	
Pyrethrins [C]	8003-34-7			L	I	4	500-1000	See note 8; DS 11; JMPR 2000, 2004; ICSC 1475
Pyridaben [ISO]	96489-71-3			S	AC	4	820	
Pyridaphenthion	119-12-0		OP	S	I	4	769	
Pyroquilon [ISO]	57369-32-1			S	F	4	320	
Quinalphos [ISO]	13593-03-8	2783	OP	S	I	3	62	
Quinoclamine [ISO]	2797-51-5			S	H	4	1360	
Quizalofop	76578-12-6			S	H	4	1670	
Quizalofop-p-tefuryl [ISO]	119738-06-6			L	H	4	1012	
Rotenone [C]	83-79-4	2588		S	I	3	132-1500	See note 9; HSG 73; ICSC 944
Simetryn [ISO]	1014-70-6		T	S	H	4	1830	
Sodium chlorate [ISO]	7775-09-9	1495		S	H	4	1200	ICSC 1117

Common name	CAS no	UN no	Chem type	Phys state	Main use	GHS	LD ₅₀ mg/kg	Remarks
Spiroxamine [ISO]	118134-30-8			L	F	4	500	Dermal LD ₅₀ 1068 mg/kg; may cause skin sensitisation
Sulfluramid [ISO]	4151-50-2			S	I	4	543	
2,3,6-TBA [ISO]	50-31-7			S	H	4	1500	
TCA [ISO] (acid)	76-03-9	1839		S		4	400	See note 5 to Table 4, p. 38; ICSC 586
Tebuconazole [ISO]	107534-96-3			S	F	4	1700	JMPR 1995b
Tebufenpyrad [ISO]	119168-77-3			S	MT	4	595	
Tebuthiuron [ISO]	34014-18-1			S	H	4	644	
Terbumeton [ISO]	33693-04-8		T	S	H	4	483	
Tetraconazole [ISO]	112281-77-3			Oil	F	4	1031	
Thiacloprid	111988-49-9		S	I		4	396	JMPR 2008
Thiobencarb [ISO]	28249-77-6		TC	L	H	4	1300	
Thiocyclam [ISO]	31895-22-4			S	I	4	310	
Thiodicarb [ISO]	59669-26-0	2757	C	S	I	3	66	JMPR 2001
Thiram [ISO]	137-26-8			S	F	4	560	DS 71; EHC 78; IARC 12, 53; ICSC 757; JMPR 1993; See note 3
Tralkoxydim [ISO]	87820-88-0			S	H	4	934	
Tralomethrin	66841-25-6	3349	PY	S	I	3	c85	
Triadimefon [ISO]	43121-43-3			S	F	4	602	JMPR 1986b, 2005
Triadimenol [ISO]	55219-65-3			S	FST	4	900	JMPR 1990, 2005
Triazamate [ISO]	112143-82-5	2588		S	AP	3	50-100	
Trichlorfon [ISO]	52-68-6		OP	S	I	3	250	DS 27; EHC 132; HSG 66; IARC 30, Suppl 7; ICSC 585; JMPR 1979; JECFA 2000b, 2003
Triclopyr [ISO]	55335-06-3			S	H	4	710	
Tricyclazole [ISO]	41814-78-2			S	F	4	305	
Tridemorph [ISO]	81412-43-3			Oil	F	4	650	
Triflumizole	99387-89-0			S	F	4	695	ICSC 1252

Common name	CAS no	UN no	Chem type	Phys state	Main use	GHS	LD ₅₀ mg/kg	Remarks
Uniconazole [ISO]	83657-22-1			S	PGR	4	1790	
XMC	2655-14-3		C	S	I	4	542	
Xylylcarb	2425-10-7		C	S	I	4	380	
Ziram [ISO]	137-30-4			S	F	4	1400	Irritant to skin; DS 73; EHC 78; IARC 12, 53; ICSC 348; JMPR 1997b

EHC = Environmental Health Criteria Monograph; DS= Pesticide Data Sheet; HSG = Health and Safety Guide; IARC = IARC Monographs on the Evaluation of Carcinogenic Risks to Humans; ICSC = International Chemical Safety Card; JECFA = Evaluation by the Joint FAO/WHO Expert Committee on Food Additives; JMPR = Evaluation by the Joint FAO/WHO Meeting on Pesticide Residues.

Notes to Class II

1. Alachlor was previously classified as a Class Ia pesticide due to its carcinogenicity in rats. However mechanistic studies have indicated that tumors are induced by a mechanism not relevant to humans.
2. Bioallethrin, esbiothrin, esbiol, and esdepalléthrine are members of a series; their toxicity varies considerably within this series, according to concentrations of isomers.
3. The international trade of chlordane, DDT, Gamma-HCH (lindane), HCH, mercury compounds and thiram is regulated by the Rotterdam convention on Prior Informed Consent (see <http://www.pic.int/>), which entered into force on 24 February 2004. See Table 7, p. 51.
4. The production and use of chlordane, DDT, Gamma-HCH (lindane) and HCH (specifically alpha-HCH and beta-HCH) are strictly limited by the Stockholm convention on persistent organic pollutants, which entered into force on 17 May, 2004 and has subsequently been amended. See <http://www.pops.int/>.
5. HCH: The LD₅₀ varies according to the mixture of isomers. The value shown has been chosen, and the technical product placed in Class II, as a result of the cumulative properties of the beta isomer.
6. The melting point of methyl isothiocyanate (S) is 35°C.
7. Paraquat has serious delayed effects if absorbed. It is of relatively low hazard in normal use but may be fatal if the concentrated product is taken by mouth or spread on the skin.
8. Mixture of compounds present in *Pyrethrum cineraefolium* and other flowers.
9. Compounds from roots of *Derris* and *Lonchocarpus* spp.

ANNEXURE 12b: LIST OF RECOMMENDED PESTICIDES AND BANNED PESTICIDES**Table 1: List of recommended pesticides**

Sl. No	Name of pesticides	Main use	Effective against	Class as per WHO
1.	Iprodione	F	Fungal pathogens	Class III ⁷⁹
2.	Penconazole	F	Fungal pathogens	Class III
3.	Malathion, Dust/EC	I	Insect pests	Class III
4.	Hexaconazole	F	Fungal pathogens	Class III
5.	Chloropyrifos	I	Insect pests	Class III
6.	Spinosad	I	Insect pests	Class III
7.	Propergite	I	Insect pests	Class III
8.	Captan	F	Fungal pathogens	Class IV ⁸⁰
9.	Mancozeb	F	Fungal pathogens	Class IV
10.	Propineb	F	Fungal pathogens	Class IV
11.	Thiophanate-methyl	F	Fungal pathogens	Class IV
12.	Carbendazim	F	Fungal pathogens	Class IV
13.	Benomyl	F	Fungal pathogens	Class IV
14.	Cholorthalonil	F	Fungal pathogens	Class IV
15.	Dimethomorph	F	Fungal pathogens	Class IV

Source: WHO Recommended Classification of Pesticides by Hazard and Guidelines to Classification 2009

Note: F - Fungicide, I – Insecticide

⁷⁹Class III Pesticides are slightly hazardous technical grade active ingredients in Pesticides

⁸⁰Class IV Pesticides are unlikely to present acute hazard in normal use

Table 2: List of banned pesticides

SI. No	Name of pesticides	Main use	Effective against
1	Phorate	I	Insect pests
2	Phosphamidon	I	Insect pests
3	Carbofuran	I	Insect pests
4	Dichlorvos	I	Insect pests
5.	Edifenphos	I	Insect pests
6.	Monocrotophos	I	Insect pests
7	Triazophos	I	Insect pests
8	Zinc phosphide	I	Insect pests
9	Carbaryl	I	Insect pests
10	Carbosulfan	I	Insect pests
11	Copper oxychloride	F	Fungal pathogens
12	Cymoxanil	F	Fungal pathogens
13	Cypermethrin	I	Insect pests
14	Deltamethrin	I	Insect pests
15	Fipronil	I	Insect pests
16	Imidacloprid	I	Insect pests
17	Metalaxyl	F	Fungal pathogens
18	Profenophos	I	Insect pests
19	Propiconazole	F	Fungal pathogens
20	Quinalphos	I	Insect pests
21	Tebuconazole	F	Fungal pathogens
22	Tridemorph	F	Fungal pathogens

Source: WHO Recommended Classification of Pesticides by Hazard and Guidelines to Classification 2009

Note: F - Fungicide, I – Insecticide

ANNEXURE 12c: DISPOSAL OF PESTICIDE CONTAINERS AND SAFETY MEASURES FOR PESTICIDE APPLICATIONS

1. DISPOSAL OR MANAGEMENT OF EMPTY CONTAINERS

Empty pesticide containers should be treated/ handled as hazardous waste. The guideline given in the Hazardous Waste Management & Handling Rules, 2008 should be adopted. The following are some of the measures for safe disposal of the pesticide containers.

- Disposal of containers contaminated with pesticides should be done in a manner consistent with FAO guidelines and with manufacturer's directions
- When a pesticide container is empty, it should be washed thoroughly. The washed water should be used as dilutant for diluting the pesticides of same grade.
- Washed and emptied containers should be punctured or otherwise rendered unusable for any other purpose. Even apparently empty containers contain pesticide residues that cannot be completely removed and they must, therefore, never be used for any purpose other than storage of the pesticides that they originally contained.
- Empty pesticide containers should not be used as storage containers for other materials such as fuel, chemicals and even food or water.
- Safe, hazard-free burning of empty pesticide containers could be done based on good understanding of pesticide chemistry, while for safe pesticide container burial requires knowledge of local hydrology as well as of the environmental behavior of pesticides.
- Many end users of pesticides do not have such knowledge or cannot apply it to their particular circumstances. It is, therefore, strongly recommended that the burying or burning of pesticide-related waste and empty containers be discouraged rather than, as happens at present, encouraged.
- Whenever possible, empty pesticide containers should be returned to the distributor or taken to an approved collection scheme. If no facilities exist for the return or safe disposal of empty pesticide containers and unwanted or unusable pesticides, end users should lobby pesticide distributors, local authorities and agricultural advisers to establish schemes. The aim should be to remove potentially hazardous waste pesticides and empty containers from users and pass them on to competent authorities who have the resources to deal with them safely.

2. SAFETY MEASURES FOR PESTICIDE APPLICATIONS

- Always read label before using any insecticide or pesticide
- Use only target specific insecticides or pesticides which have minimum effects on non-targeting organisms (i.e. other animals, insects, birds etc.,).
- Use insecticides or pesticides only when they are necessary. Use chemical control as your last option. First try to use other types of control methods like cultural control, mechanical control, physical control, biological control and genetic control. Always use chemical control in the last.
- Always use gloves, full covering cloths, closed shoes and mask before applying any type of chemical.
- Use only the recommended dose which is present on the label of the product. Never use dose higher or lower than the recommended dose.
- Always apply insecticides or pesticides in the direction of the wind and never spray opposite to the direction of wind because all chemical will shower or fall on you if you apply chemical

- Use only those insecticides which are degradable in normal temperature.
- Avoid chemicals which are highly persistence because these will store in the food items and when someone eats these food items they will cause toxicity.
- Never smell any insecticide or pesticide because it is very dangerous for health.
- Use vegetables or food items at least after 15 days of spray or chemical application.
- Keep chemicals (insecticides or pesticides) away from the reach of children.
- If unfortunately any toxicity caused by chemical then immediately contacts your doctor and remember to take the bottle of pesticide or insecticide with yourself because it is very essential. Doctor will suggest you proper treatment only after reading the label of the bottle.
- Try to use new chemistry insecticides because these are comparatively safe as compared to conventional insecticides.
- Always remember using insecticides without proper safety measures is extremely dangerous and it may even cause death. Always keep in mind the precautionary measures before using any chemical.

1.2. EMERGENCY MEASURES IN CASE OF PESTICIDES POISONING

1.2.1 Signs and Symptoms of Poisoning

Poisonings due to pesticides are usually acute and result from extensive skin contact or ingestion. Signs and symptoms vary with the type of pesticide and can sometimes be confused with those of other illnesses.

1.2.2 Indications of Pesticide Poisoning

- **General:** extreme weakness and fatigue. Skin: irritation, burning sensation, excessive sweating, staining.
- **Eyes:** itching, burning sensation, watering, difficult or blurred vision, narrowed or widened pupils.
- **Digestivesystem:** burning sensation in mouth and throat, excessive salivation, nausea, vomiting, abdominal pain, diarrhea.
- **Nervoussystem:** headaches, dizziness, confusion, restlessness, muscle twitching, staggering gait, slurred speech, fits, unconsciousness.
- **Respiratorysystem:** Cough chest pain and tightness, difficulty with breathing, wheezing.

Annex 13

ANNEXURE 13: Monitoring Checklists - Project Activities**Basic Information**

79.

Name of Project:

Village :

Block :

Type of the Project :

Total Area :

Name of Monitor's :

Name of Supervisor :

Cluster:

District:

1. New

2. Enhancement of Existing activities

3. Other

Level of Monitoring:

- Village Level : 100% Sample area should be monitored
- Cluster level : 50% Sample area should be monitored
- District level : 25% Sample area should be monitored

Parameter	Monitoring Indicator	Frequency	Responsibility	Supervision
Soil Quality (nutrient)	Area treated with organic manure used	2 times in a year (specially on time of sowing crop)	Contractor (during project construction) Dedicated Extension Officer (project operation)	Supervise by Environmental Expert of DLCC and randomly checked by Environmental Safeguard Specialist from OPIU
	Number of improved compost units (pit, vermicomposting etc.,)			
	Ratio of N:P:K use			
	Percentage of farmer using Organic Mulching			
Water Quality	Water Quality Monitoring as per the IS:2296 (Class C).	Two times a year	Contractor (during project construction) Dedicated Extension Officer (project operation)	Supervise by Environmental Expert of DLCC and randomly checked by Environmental Safeguard Specialist from OPIU
	Key parameters that has to be monitored includes pH, BOD, COD, DO coliform count, total suspended solids, total dissolved solids, Iron, etc			
Air Quality	Key parameters that are to be monitored includes Sulphur Dioxide (SO ₂), Oxides of Nitrogen (NO _X), Carbon Monoxide (CO), Particulate matter (PM ₁₀ & PM _{2.5}) (refer National Ambient Air Quality Standards)	Once in a year	Contractor (during project construction) Dedicated Extension Officer (project operation)	Supervise by Environmental Expert of DLCC and randomly checked by Environmental Safeguard Specialist from OPIU
Noise Quality	Parameters as specified in the Ambient Noise Quality standards	Occasionally to hotspot areas	Contractor (during project construction) Dedicated Extension Officer (project operation)	Supervise by Environmental Expert of DLCC and randomly checked by Environmental Safeguard Specialist from OPIU
Construction related	% of tree actually planted with respect to Compensatory afforestation	After completion of construction work	Contractor and Dedicated Extension Officer	Supervise by Environmental Expert of DLCC and randomly checked by Environmental Safeguard Specialist from OPIU
	% of area restored after the completion of construction			
Pesticides/insectici	Amount of pesticides used (to ensure if it's used as indicated in	4 times (season wise describe	Dedicated	Supervise by Environmental

Parameter	Monitoring Indicator	Frequency	Responsibility	Supervision
des	the Integrated Pest Management Plan)	the usage)	Extension Officer	Expert of DLCC and randomly checked by Environmental Safeguard Specialist from OPIU
	Expenditure on chemical pesticides			
	% of farmer procured pesticide from licensed vendor			
	% of farmer use bio fertilizer technique			
Soil and Water conservation	% Area treated with soil moisture conservation practices	2 times (rabi and kharif season)	Dedicated Extension Officer	Supervise by Environmental Expert of DLCC and randomly checked by Environmental Safeguard Specialist from OPIU
	Area under drip or sprinkler irrigation			
	Area under crop rotation			
	Area under intercrops			
Groundwater level	Number of percolation/recharge pits	Two times (season wise describe the usage)	Dedicated Extension Officer	Supervise by Environmental Expert of DLCC and randomly checked by Environmental Safeguard Specialist from OPIU
	Number of water harvesting structures			
	% fluctuation in water table			
Shifting Cultivation	Area coverage under shifting cultivation	Once in a year	Dedicated Extension Officer	Supervise by Environmental Expert of DLCC and randomly checked by Environmental Safeguard Specialist from OPIU
	Productivity			
	Soil nutrient status			
	Soil moisture content			
	Area coverage under sustainable shifting cultivation			
Agriculture	% of area where crop has been chosen as per climate and soil suitability	Once in a year	Dedicated Extension Officer	Supervise by Environmental Expert of DLCC and randomly checked by Environmental Safeguard Specialist from OPIU
	% of area using varieties of recommended crop			
	% of farmer attended training for IPM			
Livestock	Percentage of livestock that is stall-fed	Once in a year	Dedicated Extension Officer	Supervise by Environmental Expert of DLCC and randomly checked by Environmental Safeguard Specialist from OPIU
	Percentage increase in livestock health care through vaccination			
	percentage breed improvement through artificial insemination (AI)			
	Livestock farm Production/area			
	% of area managing livestock waste in suitable manner (as prescribed in the guideline)			
Availability of green and dry fodder	Area under fodder cultivation	Once in a year	Dedicated Extension Officer	Supervise by Environmental Expert of DLCC and randomly checked by Environmental Safeguard Specialist from OPIU
	Area under pasture development/protection			
	Number of chaff-cutters			

Parameter	Monitoring Indicator	Frequency	Responsibility	Supervision
Fish	% of farmer culturing indigenous species	Twice a year	Dedicated Extension Officer	Supervise by Environmental Expert of DLCC and randomly checked by Environmental Safeguard Specialist from OPIU
	Production / area			
	% farmer culturing high yield variety (to inspect the introduction of exotic species)			
	No of Beel managing their system as per State Beel development Committe			
	% of farmer using good quality feed for fish			
Sericulture	% sufficiency of Fodder plant for Worm	Twice a year	Dedicated Extension Officer	Supervise by Environmental Expert of DLCC and randomly checked by Environmental Safeguard Specialist from OPIU
	% of farmer using suitable waste management method			
	% of farmer having better health after good worm rearing practice as per given in EMF			
Wild Life movement	% of farmer trained in Natural habitat management Training plan	Once in a year	Dedicated Extension Officer	Supervise by Environmental Expert of DLCC and randomly checked by Environmental Safeguard Specialist from OPIU
	No of cases resolved by farmer after getting training			

Annex 14

Annexure 14: Selection of Climate Resilient Crop Varieties/ Suitable Crops Varieties (Cereals, Pulses, Fruits and Vegetables)

1. Agro climatic Zone

Sl. No	Name of Agro climatic Zone	Districts
1.	Barak Valley Zone (B)	Cachar
		Hailakandi
		Karimganj
2.	Central Brahmaputra Valley Zone (C)	Marigaon
		Nowgoan
3.	Hills Temperate Zone (H)	KarbiAnglong
		N.C. Hills
4.	Lower Brahmaputra Valley Zone (L)	Barpeta
		Bongaigaon
		Dhubri
		Goalpara
		Kamrup
		Kokrajhar
		Nalbari
5.	North Bank Plain Zone (N)	Darrang
		Dhemaji
		Lakhimpur
		Sonitpur
6.	Upper Brahmaputra Valley Zone (U)	Dibrugarh
		Golaghat
		Jorhat
		Sivasagar
		Tinsukia

2. Recommendation for paddy in flood affected areas

Climatic Condition	Recommended Varieties
In occasionally flood affected areas if flood recedes early and rice can be transplanted by mid-August	<ul style="list-style-type: none"> Kushal, IET-6666, Pankaj, Biraj, AnderwSali, Solpona, Gitesh and Prasadbhog.
In chronically flood affected areas where flood is expected to recede by the last part of August	<ul style="list-style-type: none"> Andrew Sali, Biraj, Monohar Sali, Kmj-1-19-1, Luit, Kapilee, Dum Sali, Gitesh and Prafulla should be selected. In absence of these any traditional sensitive coarse grain sali variety can be used.
In areas where transplanting is not possible before mid-September	<ul style="list-style-type: none"> Extra early varieties such as Luit, Kapilee, Culture-1, Heera and Disang should be selected.

Source: Based on study of Agricultural Department Assam

3. Rice (*Oryza sativa*) Normal Ahu (Autumn rice) (Direct seeded)

Agro climatic zone wise Varieties of Rice and their maturation period

Varieties	*Agro-climatic zone	Duration (days)	Av. Plant height (cm)
A. **Semi dwarf			

Varieties	*Agro-climatic zone	Duration (days)	Av. Plant height (cm)
Govind	U,C,L,B,H	105-100	95
***IR-50	U,C,L,B,H	105-110	85
Rasi	N,U,L,H	110-115	90
IR-36	N,C,L,H	110-120	85
B. Tall			
Banglami	N,L	115-120	100-140
Rangadoria	N,C,L	115-120	-do-
Ahu joha	N,U,L	110-120	-do-
Maibee	H	90-100	-do-
Dimroo	H	90-100	-do-

*** Not recommended for blast endemic areas.

a. Varieties recommended (for direct seeded, rainfed upland/Jhum land situations of Hills Zone only):

Variety	Sowing time	Duration (days)	Fertilizer (N:P:K) dose (kg/ha)	Grain Yield (t/ha)	Reaction to insect pests & diseases
Maizu Biron	April-May	115	20:10:10	2.7	Moderately resistant to blast and BLB and durable field resistance to stem borer, leaf folder, case worm and rice bug
Inglongkiri	-do-	110	-do-	3.4	Resistant to blast and moderately resistant to stem borer, case worm and leaf folder
Dehangi	-do-	115	-do-	3.3	-do-

Land selection: Areas having surface soil with medium to sandy texture overlying a silty clayey sub-soil should preferably be selected

4. Rice (*Oryza sativa*) Sali rice (Winter rice)

Varieties	*Agro-climatic zone	Duration (days)	Sowing time	Avg. plant height(cm)
A. Transplanted normal Sali :				
i) Semi dwarf				
IR-36	U,C	110-125	July	85
Jaya	N,U,C,L	125-130	do	105
Pankaj	N,U,C,L,B,H	145-150	do	110
Lakhimi	N,U,C,L,B	140-150	do	135
Bahadur	N,U,C,L,B,H	150-155	June	114
Piolee	N,U,C,L,B,H	150-155	do	102
Kushal	N,U,C,L,B,H	150-155	do	116
Moniram	N,U,C,L,B,H	150-155	do	105
Ranjit	N,U,C,L,B,H	150-155	do	102
Kmj 10-2-2	B	150-155	do	102
TTB 101-15	B	150-155	do	102
ii) Glutinous :				
Rangalee	N,U,C,B	160-165	June	135
Bhogalee	N,U,C,B	155-160	June	99
Kmj 3-144	B	155-160	June	105
Aghoni	N,U,C,B	160-165	June	105
iii) Multiple cropping :				
Satya	N,U,L,B	130-135	do	113

Varieties	*Agro-climatic zone	Duration (days)	Sowing time	Avg. plant height(cm)
Basundhara	N,U,C,L	130-133	do	107
iv) Tall :				
Monoharsali	N,U,C,L,B,H	155-160	do	130-140
Mahsuri	N,U,C,L,B,H	140-145	Mid June	130
Swarnaprova	U,B	115-120	July	135
v) Scented Rice				
Ketekijaha	N,U,C,B	155-165	June	100-140
B. Post flood transplanted (late Sali) :				
Manohar Sali	N,U,C,L,B	-	Mid Jul to 1 st week of Aug.	130
Biraj	U	-	do	120
Andrewasali	U,B	-	do	130
Solpona	N	-	do	130-140
Prasad bhog	N	-	do	do
Govindabahog	N	-	do	do
Kmj-1-19-1	L	-	July	do
C. Direct Seeded late Sali :				
Sonamukhi	H	85-95	Mid July to 1 st week of August	do
Luit	N,U,C,L,B	90-95	do	do
Kapilee	N,U,C,L,B	90-95	do	do
Dishang	N,U,C,L,B	90-95	do	do

Source: Based on study of Agricultural Department Assam

A. RICE VARIETIES SUITABLE FOR STAGGERED PLANTING IN SALI SEASON WITH AGEDSEEDLINGS

Variety	Plant height (cm)	Duration (days)	Sowing time	Transplanting time	Age of seedlings	Yield (t/ha)	Agro-Climatic zone	Disease reaction
Prafulla	134	150-160	June	July-Sep	30-75	4.5-5.0	All except Hills zone	R to Sheath rot, MR to blast & BLB, S to sheath blight
Gitesh	130	150-160	June	July-Aug	30-60	5-5.5	All except Hills zone	R to Sheath rot, MR to blast, T to BLB, S to sheath blight

Varieties with plant height more than 130cm are considered as tall varieties

Source: Based on study of Agricultural Department Assam

B. SUBMERGENCE TOLERANT RICE VARIETIES FOR RAINFED, LOWLAND FLASH FLOOD SITUATION

Variety	Plant height (cm)	Duration (days)	Sowing Time	Transplanting time	Age of seedlings	Yield (t/ha)	Agro-climatic zone	Disease reaction
Jalashree	133	150-155	June	July	30-35	4.0	All except L & H	T to BLB & sheath blight MR to blast
Jalkunwari	138	150-155	June	July	30-35	4.0	All except L & H	-do-

Source: Based on study of Agricultural Department Assam

C. RICE VARIETIES FOR LOW INPUT SITUATION:

Variety	Sowing Time	Duration (days)	Fertilizer (N:P:K) dose (kg/ha)	Grain Yield (t/ha)	*Agro-climatic diseases zone	Reaction to insect pests
Gandhari (JR 1)	June 15-30	125	20:10:10	4.2	C	R to blast, BLB, stem borer & rice bug;; MR to sheath blight; MS to leaf folder
Mohan (JR 5)	-do-	126	-do-	4.1	C	R to blast, stem borer & rice bug; MR to sheath blight; MS to leaf folder
Srimanta (JR 2)	-do-	138	20:10:10 40:20:20	4.4 5.1	U,C,H	R to blast, stem borer; MR to BLB & sheath blight; MS to leaf folder
Bharati (JR 7)	-do-	138	20:10:10 40:20:20	4.1 4.8	U,C,H	R to blast, BLB & rice bug; MR to sheath blight & stem borer; MS to leaf folder

Source: Based on study of Agricultural Department Assam

D. NEW RICE VARIETIES RECOMMENDED FOR DIFFERENT SITUATIONS

Variety	Duration (days)	Yield (t/ha)	Adaptation	Disease & pest reaction	Zone for which recommended
Shraboni (TTB 404)	135	5.00	Sali	Moderately resistant to sheath rot, neck blast & RTD and moderately resistant to GLH, PH & stem borer.	All Zones
Mulagabhoru (TTB103-21-1)	135	4.60	Sali in multiple cropping situation	Tolerant to blast, brown spot & sheath blight	All Zones
TTB 303-18-3 (Chakra lahi)	138	4.76	Sali with waterlogged situation up to 50 cm	Resistant to brown spot; MR to blast & BLB; tolerant to sheath blight & stem borer	UBVZ, NBPZ, LBVZ & BVZ
TTB 303-2-23 (Diphalu)	137	5.11	Sali with waterlogged situation up to 50 cm	MR to blast, brown spot, BLB & Sheath blight; tolerant to stem borer	UBVZ, NBPZ, LBVZ & BVZ
TTB 303-1-42 (Dhansiri)	139	4.84	Sali with waterlogged situation (up to 50 cm)	MR to brown spot & sheath blight; tolerant to blast, BLB & stem borer.	UBVZ, NBPZ, LBVZ & BVZ
TTB 303-1-26 (Manah)	138	4.66	Sali with waterlogged situation (up to 50 cm)	-	UBVZ, NBPZ, LBVZ & BVZ
Swarna Sub1 (IR 82809-237)		4.5-5.0	Survives up to 12 days of complete submergence	-	
BR 11 Sub1	150	4.5-5.0	Submergence tolerance for 10-12 days (Flash flood situation)	-	

Source: Based on study of Agricultural Department Assam

E. RICE HYBRIDS RECOMMENDED

Rice Variety	Adaptation	Zone for which recommended	Grain yield (t/ha)	Disease & pest reaction
NK 5251	Kharif	UBVZ, NBPZ & LBVZ	5.19	Resistant to blast, GM; moderately resistant to SB

Rice Variety	Adaptation	Zone for which recommended	Grain yield (t/ha)	Disease & pest reaction
DRRH 2	Kharif	UBVZ, NBPZ & LBVZ	5.00	Resistant to BL; moderately resistant to BS & SB
CRHR 5	Kharif	UBVZ, NBPZ & LBVZ	6.10	Moderately resistant to BL, BLB & SB
PAC 835	Kharif	UBVZ, NBPZ & LBVZ	5.83	Moderately resistant to BL, BLB & SB
US 312	Kharif	UBVZ, NBPZ & LBVZ	5.90	Resistance to blast, GM; moderately resistant to SB
PA 6444 Gold	Kharif	UBVZ, NBPZ & LBVZ	5.80	Resistance to GM and BLB; moderately resistance to

Source: Based on study of Agricultural Department Assam

5. Rice (*Oryza sativa*) Bao Rice (Deep Water Rice)

Varieties	*Agro-climatic zones
<u>Maguri</u>	<u>N,U,C</u>
<u>Panikekua</u>	<u>N,U</u>
<u>**Padmapani</u>	<u>N</u>
<u>(PJNB) Panindra</u>	<u>N</u>
<u>(PJNB) Padmanath</u>	<u>N</u>
<u>Rayada 16-06</u>	<u>N</u>
<u>Amona</u>	<u>U</u>
<u>Negheri</u>	<u>U,C,L</u>
<u>Kakua</u>	<u>C,L</u>
<u>Salibadal</u>	<u>B</u>
<u>Dholabadal</u>	<u>B</u>

A. DEEPWATER RICE VARIETIES RECOMMENDED

Variety	Duration	Yield (t/ha)	Adaptation
LPR 106 (Panchanan)	186 (T), 240 (DS)	3.0	Deepwater (50-100 cm water depth)
KDML 105 [Padumani]	180 (T), 230 (DS)	2.6	Deepwater (50-100 cm water depth)

6. Rice (*Oryza sativa*) Boro Rice

Variety	Sowing time	Planting time	Harvesting time	*Duration (Days)	#Agro-climatic Zone	Average yield (t/ha)
Boro 1	Nov.	Dec./Jan.	Apr./May	150	N,U,C,L,B	3.0
Boro 2	Nov.	Dec./Jan.	May	165	N,U,C,L,B	3.0
Culture 1	Nov.	Dec./Jan.	Mid April	140-145	N,L,B	2.0
Kalinga 3	Nov.	Dec./Jan.	Mid May	175	U,L	3.0
Krishna	Nov.	Dec./Jan.	April	145-155	B	3.5
**Mahsuri	Oct.	Nov./Dec.	May	180-190	N,U,C,L	4.0
**IR-50	Nov./Dec.	Dec./Jan.	Apr./May	155-160	C,B	3.0
Cauvery	Nov./Dec.	Dec./Jan.	Apr./May	150-155	B	3.0
Banglami	Nov./Dec.	Dec./Jan.	Apr./May	155-160	B	3.5
Joymati	Nov./Dec.	Dec./Jan.	May/Jun.	175	C,L	5.1
Bishnuprasad	Nov./Dec.	Dec./Jan.	Apr.	165	All zones	4.5

Variety	Sowing time	Planting time	Harvesting time	*Duration (Days)	#Agro-climatic Zone	Average yield (t/ha)
Jyotiprasad	Nov./Dec.	Dec./Jan.	Apr.	165	All zones	4.5
Dinanath	Nov	Dec./Jan.	Apr./May	160-165	N,U,C, L,B	6.28
Swarnabh	Nov	Dec./Jan.	Apr./May	160-165	N,U,C, L,B	6.16
Kanaklata	Dec	Jan-Feb	May/June	165-175	U,C,L, B	5.0-5.5

Source: Based on study of Agricultural Department Assam

A. VARIETIES: HYBRID BORO RICE

Variety	Duration (days)	Yield (t/ha)
Pro Agro 6444	170-175	7.5
DRRH 1	165-170	7.1
KRH 2	175-180	6.0

Source: Based on study of Agricultural Department Assam

B. NEWLY RECOMMENDED HYBRIDS

PAC 837	Boro	UBVZ, LBVZ, HZ & CBVZ	6-7	Resistance to Blast; MR to RTV & BS; tolerant to GLH
Arize 6129	Boro	UBVZ, LBVZ, HZ & CBVZ	6-7	MR to BS, BLB & Sheath Blight; tolerant to blast & SB

7. Rice (*Oryza sativa*) Early Ahu (Direct Seeded)

Varieties	#Agroclimatic zone	Duration (days)	#Reaction to blast
A. Semi Dwarf			
IR50*	U,C	110-120	S
Bala	N	110-120	T
DR92(Subhadra)	N	115-125	S
Pusa 2-21*	N,U,C,L	120-125	S
Cauvery	L	115-120	T
Rasi	N,U,L	125-130	T
IR36		120-130	-
Culture 1 (Kalinga 3)	N,U,C,L	90-100	T
Luit	N,U,C,L	95-100	T
Kapilee	N,U,C,L	95-100	T
B. Tall			
Ch63	N,C	120-130	T
Banglami	N,L	115-120	S
Rangadoria	N,U	115-120	S
Dubaichenga	N,U	115-120	S
Ahujaha	N	110-120	S

Varieties	#Agroclimatic zone	Duration (days)	#Reaction to blast
Dagaranga	N	85-95	S
Kalasopila	C	-	-
Ihajit	C	-	-
Panjasali	C,L	110-115	S
Fapori ahu	C	-	-
Koijapori	L	95-105	S
Hasakumra	L	80-85	-
Guni	L	80-85	S
Kolamanik	L	115-120	S
Koimurahi	B	95-100	-
Nilajee	U,L	-	S
HarinKajali	L	115-120	-

Source: Based on study of Agricultural Department Assam

A. NEWLY RECOMMENDED VARIETY:

Variety	Plant height (cm)	Duration (days)	Sowing time	Transplanting time	Age of seedlings (days)	Yield (q/ha)	*Agro-climatic Zone	Disease reaction
Kanaklata	125	130-135	February	March	25-30	40-45	U,C, L,B	MS to blast & sheath rot, and T to BLB & sheath Blight

Source: Based on study of Agricultural Department Assam

8. Rice (*Oryza sativa*) Transplanted Early Ahu

Varieties	#Agro climatic zone	Duration** (days)	Grain character	Reaction to blast
A. Semi dwarf				
Pusa2-21*	N,U,C,L,H	125-130	Short bold	S
Rasi	N,U,C,L,H	130-135	Medium slender	T
Saket-4	N,U,C,L,B	125-130	Long slender	S
IR-50*	N,U,C,B	115-125	Long slender	S
Govind	N,U,B	115-125	Long slender	T
DR- 92 (Subhadra)	L,B	120-130	Long bold	S
IR-36	C,L,B	125-135	Long slender	T
Cauvery	L,B	120-125	Short bold	T
Ratna	N,L,B	125-130	Long slender	T
Krishna	C,B	130-135	Medium slender	-
Jaya	N,U,C,B,H	140-145	Long bold	-
IR-8	U,C,B,H	140-145	Long bold	-
Culture 1	U,C,L,B	100-105	Long slender	T
Luit	U,C,L,B	100-105	Long slender	T
Kapilee	U,C,L,B	100-105	Long slender	T
B. Tall				
Panjasail	C,L	115-125		S
Koijapori	L	95-105		S

Varieties	#Agro climatic zone	Duration** (days)	Grain character	Reaction to blast
Laujuli	L	115-120		S
Hasakumra	L	80-85		

Source: Based on study of Agricultural Department Assam

9. Maize (*Zea mays*)

Recommended Varieties:

Varieties	Duration (days)	Special features	Potential yield (q/ha)
<u>Hybrid:</u>			
Ganga 5	110-120	=	48
Hi-starch	130-140	High starch content	45-50
Vivek Maize Hybrid 47	=	=	=
Vivek Maize Hybrid 53	=	=	=
Bio 9544	=	=	=
<u>Composite:</u>			
NLD	110-120	=	45-50
Dhawal	110-120	=	48
Naviot	90-100	=	48
Diara	85-90	Suitable for flood prone areas	25-30

Note:

- i) Seed from hybrid maize should not be kept as the crop deteriorates due to segregation. The seeds from composite can be used for three to four years without much deterioration in yield.
- ii) All the above varieties are drought tolerant and resistant to most of the diseases to a fair degree.
- iii) Excepting Diara, all other varieties/hybrids are suitable for all the zones except Barak Valley Zone.

10. Rapeseed – Mustard (*Brassica campestris*), (*Brassica juncea*)

Recommended Varieties:

Varieties	#Agro-climatic zone	Duration (days)	Yield (q/ha)	Oil content (%)
Rapeseed:				
<i>(Toria)</i>				
TS-38	All zones	90-95	10-12	41-44
M-27	All zones	90-95	10-12	44.6
TS-29	All zones	85-90	10-12	44.0
TS-36	All zones	90-95	10-12	41-43
Mustard:				
TM-2	U,C,L,H	105-115	12-16	36-40
TM-4	U,C,L	105-115	12-16	36-40
Varuna	L,H	110-120	12-16	37-40

Source: Assam Agricultural University

Newly Recommended Rapeseed or Toria Varieties

Verities	Duration (days)	Seed yield (q/ha)	Adaptation	Recommended for	Disease & pest reaction	Oil content (%)	Remarks
JT 90-1 (Jeuti)	89	6.97	Rabi; delayed sowing in rice fallow	All zones except Hills Zone & BVZ	Moderately Susceptible to <i>Alternaria</i> blight (leaves and pods show symptoms);	43	Suitable for late sowing

					moderately susceptible in case of incidence of aphids and sawfly		
TS 46	94	9.06	Rabi	All zones except Hills Zone & BVZ	-		Suitable for late sowing
TS 67	90	7.01	Rabi	All zones except Hills Zone & BVZ	-	42	Suitable for late sowing

Source: Assam Agricultural University

Indian mustard varieties newly recommended

Verities	Duration (days)	Seed yield (q/ha)	Adaptation	Recommended for	Oil content (%)
PM 26	107	12-14	Rabi	All zones except BVZ and Hills Zone	40.32
PM 27	107	13.44	Rabi	All zones except BVZ & Hills Zone	43.03

Source: Assam Agricultural University

11. Agriculture /Horticulture Variety and suitable site for cropping

a. Banana (*Musa spp*)

Site suitability: Well drained friable loamy soil with adequate organic matter is ideal.

Planting: Planting is generally done in pits. Double planting (2 plants/pit) with a spacing of 1.8 m x 1.8 m for Jahaji gives higher yield.

Time of planting: March – May

Weeding: Grow one crop of cowpea and incorporation in soil followed by hand weeding at 30 days interval upto shoot stage.

Varieties:

Dwarf	Jahaji (Dwarf Cavendish)
Medium tall	Chenichampa, Malbhog and Bar Jahaji
Tall	Pura Kal, Manohar, Jati and Bhimkal

b. Ginger (*Zingiber officinale*)

Recommended Variety	Rio-de-Geneiro, Nadia, Karkai, Bardwan, Moran and Jorhat
Soil:	Well drained medium loam.
Planting Time:	March-April
Spacing:	25 cm x 15x 10 cm (Row to Row x Plant to Plant) to be planted in shallow pit.

c. Vegetable (Onion, Potato, Tomato, Cabbage, Cauliflower, Brinjal, Pumpkin)

i. Onion

Variety :	Pusa Red, PusaRatnar, Pusa White (Round), Pusa white (Flat), N-53, Agrifound Light Red, Punjab Red Round, PusaMadhuri, ArkaNiketan.
Soil	Well drained sandy loam to silty loam rich in organic matter with pH5.5-6.5.
Sowing time	Last week of September – mid October. For Hills Zone: Transplanting of seedlings should be done in the last week of October (25 th October).

ii. Tomato

Variety:	Characteristics to Environment and Sensitivity
Punjab Chhuhara:	Suitable for distant transport and processing.
S-12	Suitable for growing in the plains for fresh marketing (table purpose).
Punjab Kesri	no fruit cracking, moderate incidence of late blight and fruit borer, susceptible to root-knot nematode, less suitable for processing
Pusa Early Dwarf	---
Sioux	good for short distance market and suitable for hilly region
Pusa Ruby	Withstands hot and humid climate, good for fresh market and for marking ketchup; tolerant to excess rain.
ArkaAbha (BWR-1)	Resistant to bacterial wilt.
ArkaAlok (BWR-5)	Resistant to bacterial wilt.
BT-1	High yielder, tolerant to bacterial wilt

Time of Sowing: October – November.

Suitable Soil Type: Well drained sandy loam rich in organic matter with pH 5.0-7 would be a good soil condition for tomato cropping.

iii. Cabbage

Variety	Maturity Days	
Golden Acre	early maturity (60-70 days)	
Pride of India	early maturity (60-70 days)	
PusaMukta	maturity 65 days	Resistant to Black Rot
Drum Head	late maturity (80-100 days),	
Soil Condition: Well drained sandy loam with pH 5.5-6.5 would be suitable.		
Time of Sowing: First week of September to last week of November		

iv. Cauliflower

Variety	Maturity Days	Sowing time
Early Kunwari	Tends to grow loose faster,	From mid-July to first week of August (Matures by October).
PusaKatki	Early maturity (60-70 days)	
PusaDeepali	Maturity 100-120 days	
Improved Japanese	Maturity 90-95 days	Mid: From first week of September to last week of October (Matures by Dec - January).
Pusa Synthetic	Maturity 130 days	
Pusa Snowball		
Snowball-16	Maturity 90 days	Up to first week of November (Matures by Feb - March).
Pusa Snowball K1: resistant to black rot.	Maturity 90-95 days,	
Soil Condition: Well drained sandy loam for early and well drained loam to clay loam for mid and late varieties. Optimum pH- 6.0-7.0 would be suitable.		

v. Brinjal

Variety	Characteristics	
Pusa Purple Long	Maturity 100-110 days.	
Pusa Purple Cluster	Maturity 75 days	Relatively resistant to bacterial wilt and little leaf disease.
Pusa Purple Round:		Resistant to shoot borer and little leaf disease
Kuchia		Tolerant to fruit and shoot borer.
BB-7		Tolerant to bacterial wilt.

BWR-34		Tolerant to bacterial wilt.
Pant Samrat		Resistant to fruit and shoot borer and bacterial wilt
JC-1:	Maturity 130 days	No incidence of little leaf and wilt, phomopsis and fruit borer infestation moderate. (Good for Hilly Zone)
JC-2:	Maturity 120 days	
Soil: Well drained rich sandy loam for early and silt loam to clay loam for late crop. pH 5.5 – 7.0 is ideal		
First week of September to October for winter crop and January to February for spring crop.		

vi. **Pumpkin**

Variety	Characteristics	
Arka Suryamukhi	Maturity 100 days,	Highly resistant to fruit fly and rich in vitamin C, keeping and transport qualities are good.
Arka Chandan	Maturity 120 days	Rich in vitamin A, cooking and keeping qualities are good
Soil: Well drained sandy to moderately heavy soil rich in organic matter with pH 6.0-6.5.		
Sowing time: January – April (For summer harvest), Sept. – October (For spring harvest).		

vii. **Potato (*Solanum Tuberosum*)**

*Varieties	Duration (days)	Reaction to diseases
KufriChandramukhi	80-100	Leaf roll &
KufriJyot	110-120	Late blight
KufriSindhuri	110-12	Moderately Tolerant
*KufriMegha	100-120	Late blight
Soil Type: Well drained sandy loam and loam soils, rich in organic matter are suitable. A pulse crop should preferably be included in the rotation to improve the soil condition.		
Planting time: The optimum time for planting is mid-October to mid-November. In case of KufriSindhuri planting may be extended up to middle of December.		

*Potato variety KufriMegha can be grown late (up to Mid-December) in Upper Brahmaputra Valley Zone.

12. Lentil (*Lens culinaris*)

Recommended Varieties	Plant type	Maturity (days)	Yield (q/ha)
B-77	Erect,	110-120	8 –12
L-9-12	Erect,	120-130	8 –12
PL 406	Branched	120-125	10-12
PL 81-4	Branched	120-125	11-13

Newly recommended Lentil varieties

Verities	Duration (days)	Yield (q/ha)	Disease reaction	Protein content (%)	Zone for which recommended	Adaptation
HUL 57 (Small Seeded Lentil Variety)	112-115	12.26	Resistant to rust & tolerant to wilt		CBVZ, LBVZ & UBVZ	1. Rabi season of Assam
AxomMasur 1 (SL 2-24)	115-120	10.65	Moderately resistant to wilt	27.60		Rabi season of Assam
AxomMasur 2 (SL 2-28)	115-120		Moderately resistant to wilt	26.90		Rabi season of Assam

Soil type : Loam or silty loam is preferable.

Time of Sowing : Mid October to mid-November.

13. Black gram (*Vigna mungo*)

<u>Recommended Varieties</u>	<u>Duration(days)</u>	<u>Grain yield (q/ha)</u>	<u>Reaction to diseases</u>
T 9	80-90	10-12	Tolerant to MYMV and <i>Cercospora</i> leaf spot
T 27	80-90	10-12	-do-
Pant U 19	80-95	10-12	-do-
T 122	80-90	10-12	Susceptible to MYMV and <i>Cercospora</i> leaf spot
#Saoniamah (SB 121)	70-80	10-12	-do-
KU 301	80-90	13-15	Resistant to <i>Cercospora</i> leaf spot and YMV
USJD113	80-90	13-15	-do-
New Recommended Varieties for delayed sowing upto 30th September			
Beki (SB 27-3)	80-85	12-13	Resistant to CLS, YMV and WB
Kolong (SB 25-19)	80-85	12-13	Resistant to CLS, YMV and WB.
New black gram varieties recommended for normal sowing			
**Sonkush (SB 23-5)	80-90	9.17	Resistant to CLS, YMV and WB
Manas (SB 32-13)	80-90	10.00	Resistant to CLS, YMV and WB
SBC 40	75-85	11.89	Resistant to CLS & YMV, moderately resistant to WB
*SBC 47	75-80	14-16	Resistant to CLS and YMV
Sowing Time: Mid-August to mid-September; Summer Black Gram: The optimum time for sowing summer black gram is from mid-February to March			
Soil Type: Black gram can be grown on a wide range of soils, but sandy loam soil is preferable			

***Suitable for all zones, except Saoniamah, which is recommended for Central Brahmaputra Valley Zone only.**

**** Suitable for Kharif Season under delayed sowing**

#Saoniamah: Mid July to mid-August

14. Pea (*Pisum sativum*)

Varieties	Maturity (days)	Yield (q/ha)	Other characters
T-163	110-120	10-11	Susceptible to powdery mildew and fusarium root rot.
Boneville	100-120	10-12	Susceptible to powdery mildew and fusarium root rot.
HUP-2	115-125	13-15	Resistant to powdery mildew and downy mildew.
KFPD 1	100-105	18-20	Susceptible to powdery mildew but escapes the disease because of earliness
Rachna	120-125	10-12	Almost similar to T-163, tolerant to powdery mildew
*FP-255	108	11.49	Moderately resistant to rust
Soil Type: Peas can be grown on variety of soils; well drained light soils are suitable.			
Time of Sowing: The optimum time of sowing is mid-October.			

***Suitable for Hill zone**

Annex 15

E 15: FOOD SAFETY QUALITY STANDARDS

Sl.no.	Products	International standard and its scope	Key features of the standard	Reference
1.	Paddy	<u>Codex standard for rice</u> <u>Codex stan 198-1995</u> This standard applies to husked rice, milled rice, and parboiled rice, all for direct human consumption; i.e., ready for its intended use as human food, presented in packaged form or sold loose from the package directly to the consumer. It does not apply to other products derived from rice or to glutinous rice.	<ul style="list-style-type: none"> • General and specific (Extraneous matter, Filt, Other organic extraneous matter, Inorganic extraneous matter) quality factors of rice • Contaminants like heavy metal, pesticide residues. • Hygienic production and handling • Packaging with maintenance of the hygienic, nutritional, technological, and organoleptic qualities of the food • Labeling comprising of name of the product and labeling of non-retail containers. 	http://www.fao.org/fao-who-codexalimentarius/sh-proxy/ru/?Ink=1&url=https%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252Fstandards%252FCODEX%2BStan%2B198-1995%252FCXS_198e.pdf
2.	Maize	<u>CODEX STANDARD FOR MAIZE (CORN)</u> <u>CODEX STAN 153-1985 (Rev. 1-1995)</u> This standard applies to maize (corn) for human consumption, i.e., ready for its intended use as human food, presented in packaged form or sold loose from the package directly to the consumer. This standard specifies requirements for whole grain shelled dent maize, <i>Zea mays indentata</i> L., and/or shelled flint maize, <i>Zea mays indurata</i> L., or their hybrids. It does not apply to processed maize.	<ul style="list-style-type: none"> • General and specific (Moisture content, Extraneous matter, Filt, Toxic or noxious seeds, Other organic extraneous matter, Inorganic extraneous matter) quality factors of maize • Contaminants like heavy metal, pesticide residues, Mycotoxins • Hygienic production and handling • Packaging with maintenance of the hygienic, nutritional, technological, and organoleptic qualities of the product • Labeling comprising of name of the product and labeling of non-retail containers. 	www.fao.org/infocentre/download/standards/51/CXS_153e.pdf
3.	Black Gram and Green Gram	<u>CODEX STANDARD FOR CERTAIN PULSES</u> <u>CODEX STAN 171-1989 (Rev. 1-1995)</u> This Standard applies to the whole, shelled or split pulses defined below which are intended for direct human consumption. The Standard does not apply to pulses intended for factory grading and packaging, industrial processing, or to those pulses intended for use in the feeding of animals.	<ul style="list-style-type: none"> • General and specific (Moisture content, Extraneous matter, Toxic or noxious seeds) quality factors of pulses • Contaminants like heavy metal, pesticide residues, Mycotoxins • Hygienic production and handling • Packaging with maintenance of the hygienic, nutritional, technological, and organoleptic qualities of the product • Labeling comprising of name of the product and labeling of non-retail containers. • Methods of analysis and sampling 	www.fao.org/infocentre/download/standards/56/CXS_171e.pdf
4.	Banana	<u>CODEX STANDARD FOR BANANAS</u> <u>CODEX STAN 205-1997, Amd. 1-2005</u> This Standard applies to commercial varieties of bananas grown from <i>Musa</i> spp. (AAA), of the <i>Musaceae</i> family, in the green state, to be supplied fresh to the consumer, after preparation and packaging. Bananas intended for cooking only (plantains) or for industrial processing are	<ul style="list-style-type: none"> • Provisions concerning quality and classification of bananas • Provisions concerning sizing • Provisions concerning tolerances (quality and size) • Provisions concerning presentation (uniformity, packaging and presentation) • Marking or labelling <ul style="list-style-type: none"> ✓ Consumer packages <ul style="list-style-type: none"> ❖ Nature of produce 	ftp://ftp.fao.org/codex/Publications/Booklets/FreshFruitsVeg/FFV_2007_EN.pdf

Sl.no.	Products	International standard and its scope	Key features of the standard	Reference
		excluded.	<ul style="list-style-type: none"> ❖ Identification ❖ Nature of produce ❖ Origin of produce ❖ Commercial identification ❖ Official inspection mark • Contaminants like heavy metal, pesticide residues. • Hygiene production and handling 	
5.	Ginger	<p><u>CODEX STANDARD FOR GINGER CODEX STAN 218-1999, Amd. 1-2005</u></p> <p>This Standard applies to the rhizome of commercial varieties of ginger grown from <i>Zingiber officinale</i> Roscoe, of the <i>Zingiberaceae</i> family, to be supplied fresh to the consumer, after preparation and packaging. Ginger for industrial processing is excluded.</p>	<ul style="list-style-type: none"> • Provisions concerning quality and classification of ginger • Provisions concerning sizing • Provisions concerning tolerances (quality and size) • Provisions concerning presentation (uniformity, packaging) • Marking or labelling <ul style="list-style-type: none"> ✓ Consumer packages <ul style="list-style-type: none"> ❖ Nature of produce 86. <ul style="list-style-type: none"> ✓ Non-retail containers <ul style="list-style-type: none"> ❖ Identification ❖ Nature of produce ❖ Origin of produce ❖ Commercial identification ❖ Official inspection mark • Contaminants like heavy metal, pesticide residues • Hygiene production and handling 	www.fao.org/inp/ut/download/standards/344/CXS_218e.pdf
6.	Turmeric	<p><u>Spices Grading and Marking Rules, 2005</u></p> <ul style="list-style-type: none"> • They shall apply to following spices (whole and powder), namely: <ol style="list-style-type: none"> 1. Turmeric (<i>Curcuma longa</i> L.) 2. Ginger (<i>Zingiber officinale</i>) 	<ul style="list-style-type: none"> • Quality (Whole and Powder) • Grade designation mark • Method of packing • Method of Marking • Special conditions of certificate of authorization 	http://agmarknet.nic.in/spices.pdf
7.	Mustard	<p><u>Codex Standard for Named Vegetable Oils (CODEX-STAN 210-1999)</u></p> <ul style="list-style-type: none"> • This Standard applies to the vegetable oils (described in Section 2.1 of the standard), presented in a state for human consumption. 	<ul style="list-style-type: none"> • Essential composition and quality factors <ul style="list-style-type: none"> ✓ GLC ranges of fatty acid composition (expressed as percentages) <ul style="list-style-type: none"> ❖ <u>Low-erucic acid rapeseed oil</u> ❖ <u>High oleic acid safflower oil</u> ❖ <u>High oleic acid sunflower oil</u> ✓ Slip point (palm olein & palm stearin) • Food additives <ul style="list-style-type: none"> ✓ Flavours ✓ Antioxidants ✓ Antioxidant synergists ✓ Anti-foaming agents (oils for deepfrying) • Contaminants <ul style="list-style-type: none"> ✓ Heavy metals ✓ Pesticide residues • Hygiene • Labelling <ul style="list-style-type: none"> ✓ Name of the food 	http://www.fao.org/docrep/004/y2774e/y2774e04.htm

Sl.no.	Products	International standard and its scope	Key features of the standard	Reference
			<ul style="list-style-type: none"> ✓ Labelling of non-retail containers • Methods of analysis and sampling <ul style="list-style-type: none"> ✓ Determination of GLC ranges of fatty acid composition ✓ Determination of slip point ✓ Determination of arsenic ✓ Determination of lead 	
8.	Milk	<p><u>CODE OF HYGIENIC PRACTICE FOR MILK AND MILK PRODUCTS CAC/RCP 57-2004</u></p> <ul style="list-style-type: none"> • This Code applies to the production, processing and handling of milk and milk products as defined in the <i>General standard for the Use of Dairy Terms</i> (CODEX STAN 206-1999). Where milk products are referred to in the code it is understood that this term also includes composite milk products. The scope of this Code does not extend to the production of raw drinking milk. This Code applies to products in international trade. It may also serve as a basis for national legislation. 	<ul style="list-style-type: none"> • Primary production <ul style="list-style-type: none"> ✓ Environmental hygiene ✓ Hygienic production of milk <ul style="list-style-type: none"> ❖ Areas and premises for milk production ❖ Animal health ❖ General hygienic practice (Feeding, Pest control, Veterinary drugs) ❖ Hygienic milking 87. <ul style="list-style-type: none"> ✓ Handling, storage and transport of milk <ul style="list-style-type: none"> ❖ Milking equipment ❖ Storage equipment ❖ Premises for, and storage of, milk and milking-related equipment ❖ Collection, transport and delivery procedures and equipment ❖ Documentation and record keeping • Establishment: design and facilities • Control of operation <ul style="list-style-type: none"> ✓ Control of food hazards <ul style="list-style-type: none"> ❖ Hazard identification and evaluation ❖ Control measure selection ❖ Establishment of process criteria 88. <ul style="list-style-type: none"> ✓ Key aspects of hygiene control systems <ul style="list-style-type: none"> ❖ Temperature and time controls (Management of products within the plant, Distribution of finished products, Establishment of shelf life) ❖ Specific process steps ❖ Microbiological and other specifications ❖ Microbiological cross contamination ❖ Physical and chemical contamination ✓ Incoming material (other than milk) requirements ✓ Water • Establishment: maintenance and sanitation <ul style="list-style-type: none"> ✓ Maintenance and cleaning ✓ Cleaning programmes 	www.fao.org/inp/ut/download/standards/10087/CXP_057e.pdf

Sl.no.	Products	International standard and its scope	Key features of the standard	Reference
			<ul style="list-style-type: none"> • Establishment: personal hygiene • Transportation <ul style="list-style-type: none"> ✓ Requirements ✓ Use and maintenance • Product information and consumer awareness- labelling • Training (training programmes) 	
9.	Pork	<p><u>CODE OF HYGIENIC PRACTICE FOR MEAT CAC/RCP 58-2005</u></p> <ul style="list-style-type: none"> • The scope of this code covers hygiene provisions for raw meat, meat preparations and manufactured meat from the time of live animal production up to the point of retail sale. It further develops General Principles of Food Hygiene in respect of these products. Where appropriate, the Annex to that code (Hazard Analysis and Critical Control Point System and Guidelines for its Application) and the Principles and Guidelines for the Establishment and Application of Microbiological Criteria Related to Foods⁵ are further developed and applied in the specific context of meat hygiene. 	<ul style="list-style-type: none"> • General principles of meat hygiene • Primary production <ul style="list-style-type: none"> ✓ Principles of meat hygiene applying to primary production ✓ Hygiene of slaughter animals ✓ Hygiene of feed and feed ingredients ✓ Hygiene of the primary production environment ✓ Transport • Presentation of animals for slaughter <ul style="list-style-type: none"> ✓ Principles of meat hygiene applying to animals presented for slaughter ✓ Conditions of lairage ✓ Ante-mortem inspection ✓ Information on animals presented for slaughter • Establishments: design, facilities and equipment <ul style="list-style-type: none"> ✓ Principles of meat hygiene applying to establishments, facilities and equipment ✓ Design and construction of lairages ✓ Design and construction of slaughter areas ✓ Design and construction of areas where bodies of animals are dressed or meat may otherwise be present ✓ Water supply ✓ Temperature control ✓ Facilities and equipment for personal hygiene ✓ Means of transport • Process control <ul style="list-style-type: none"> ✓ Principles of meat hygiene applying to process control ✓ Process control systems <ul style="list-style-type: none"> ❖ Sanitation standard operating procedures (SSOPs) ❖ Outcome-based parameters for process control ❖ Regulatory systems ❖ Quality assurance (qa) systems ✓ General hygiene requirements for process control ✓ Hygiene requirements for parts of animals deemed 	<p>http://www.fao.org/fao-who-codexalimentarius/standards/list-of-standards/en/</p>

Sl.no.	Products	International standard and its scope	Key features of the standard	Reference
			<ul style="list-style-type: none"> unsafe or unsuitable for human consumption ✓ Systems for removing products that are in circulation • Establishments: maintenance and sanitation • Personal hygiene • Transportation • Product information and consumer awareness • Training 	
10	Fish	<p><u>CODE OF PRACTICE FOR FISH AND FISHERY PRODUCTS CAC/RCP 52-2003</u></p> <ul style="list-style-type: none"> • AQUACULTURE PRODUCTION <p>Aquaculture establishments should operate in a responsible way such that they comply with the recommendations of the Code of Conduct for Responsible Fisheries (FAO, Rome, 1995) in order to minimize any adverse impact on human health and the environment, including any potential ecological changes.</p>	<ul style="list-style-type: none"> • General <ul style="list-style-type: none"> ✓ Site selection ✓ Growing water quality ✓ Source of fry and fingerlings • Identification of hazards and defects <ul style="list-style-type: none"> ✓ Hazards ✓ Defects • Production operations <ul style="list-style-type: none"> ✓ Feed supply ✓ Veterinary drugs ✓ Growing ✓ Harvesting ✓ Holding and transportation ✓ Storage and transportation of live fish <ul style="list-style-type: none"> ❖ Live fish stored and transported at ambient temperature ❖ Live fish stored and transported at low temperatures 	ftp://ftp.fao.org/codex/Publications/Booklets/Practice_code_fish/CFFP_2012_EN.pdf