

## 7.6 Monitoring Plans

Specific monitoring plans within the GIP area are required for future engineering purposes. The requirement for other types of monitoring are dealt with in Volume 4 for the regional plan. The baseline ecology surveys and water quality sampling has provided a base from which future monitoring can take place. These sites should be viewed as the local monitoring stations. The basic responsibilities for longer term monitoring are given in Table 7.3.



**Table 7.3 Summary of Longer Term Monitoring for GIP**

Monitoring Target	Objectives	Methods	Responsible Agency
Flooding in target or external impact area	Identify change in flooding depth and related issues	Monitoring of flood depth and consequences	BWDB
Regulator efficiency	Ensure ongoing efficiency of regulators in maintaining desired wet and dry season water levels for integrated water management	- Monitoring of wetland cover and habitat quality - Periodic inspection of regulators - Community participation	DOF, Thanas and NGOs
Drainage canals	Ensure efficiency of drainage system in alleviating drainage congestion.	Community feedback and periodic survey of drainage system and sedimentation levels	BWDB, NGOs
Water quality	Ensure adequate quality standards for domestic uses and wetland functions in surface and groundwater	Immediate research and monitoring to establish seasonality and ecological linkages.	BWDB, DOE, DAE
Groundwater status	Maintain seasonal groundwater levels and responses for desired uses	Systematic and regular monitoring of groundwater and water body levels with community feedback systems	BWDB, DOE, NGOs
Soil status	Improve and sustain soil environment for food and others products and its functional role in floodplain processes	Inter-disciplinary on-going survey and analysis of physical and ecological systems	DAE, IRRI, BRRI
Terrestrial production	Attain sustainable systems and production levels in agriculture, livestock, forestry and horticulture	Ongoing analysis of farmer, womens and institutional responses	DAE, BARC, Universities
Aquatic production	Floodplain and wetland bio-diversity and production	Ongoing analysis of wetland stocks, harvests and management systems	DOF, IRRI, AWB, IUCN, ICLARM
Biodiversity	Increase in diverse vegetation cover for enhancing flora and faunal habitats and species to reduce pests and diseases, provide fuelwood, improve nutrition and enhance soil and water quality.	Monitoring the performance of the existing indigenous species and other introduced species	DAE, BARC, FD
Threatened habitats, species and gene pools	Establish protected area networks and community based conservation management to sustain habitats and species utility	Baseline and monitoring ecological survey of wetland quantity, quality, species diversity and ecological integrity	MOEF, IUCN, Universities, NGOs
Communities at risk	Ensure status of displaced and impacted communities	Annual survey of relocated and flood proofed households	LGEB
Protected communities	Ensure status of target communities	Annual survey of key social, economic and health indicators	Thanas
Disease vectors	Disease vector occurrence and abundance	Periodic survey of habitat status and vector abundance	NIPSOM, DPHE
Flood events exceeding design criteria	Disaster preparedness to reduce losses by anticipating potentially damaging floods	Continuous climatic monitoring in upper catchment and timely flood forecasting and warning systems	BWDB, JRC
Structural integrity	Disaster preparedness for system failures due to erosion breaches, public cuts and seismic events or liquefaction.	Proper survey and supervision prior to during construction. Periodic and thorough inspection of embankments. Coordinated response plan	BWDB and independent reviews



## **7.7 Residual Risks**

### **a. Increased Damage and Disruption**

The most significant residual impacts will include the higher risks of damage and disruption of an failure to maintain the integrity of the sealing of the BRE and TRE. As each year goes by maintaining this integrity the attitude to risk inside the GIP will change affecting land and other values in the society and as the natural resource base is concerned. Growth of small villages into towns and small towns into cities would accompany the growth in population and greater levels of infrastructure and commercial investment in other sectors in this were commercially attractive. Expansion of Gaibandha town across the Ghagot would not be inconceivable. Any failure after many years of no breach would lead to increasingly levels of damage and disruption. This appraisal stresses the need for a properly integrated flood proofing and disaster preparedness programme to be totally integrated into the detailed design phase.

### **b. Impeded Drainage**

The cutting across of even small local drainage lines will create varying degrees of recurring impeded drainage across the compartments. These areas will require special attention and management to ensure that problems of poor water quality and development of sites for insect vector breeding do not develop. These aspects can probably be mitigated to some extent during the detailed design phase and by monitoring of the system after construction to identify appropriate levels of response in the agricultural, fisheries and public health sectors.

### **c. Reduced Floodplain Processes**

The upstream potential sources of pollutants from outside the project into the GIP area come mainly from Rangpur. The diversion of flows into the Ghagot and off the GIP floodplain will be of marginal benefit to GIP and will tend to raise the pollutant load of the Ghagot. The most significant feature here will be the lack of flushing and dilution from having sealed the TRE. The capacity of floodplain wetlands to take up nutrients and pollutants would be reduced by disconnecting them from the Ghagot and heavier reliance would be put on the capacity of the river Ghagot bio-system to undertake this role. This residual impact would require monitoring and, if necessary, lead to controls and processing of potential pollutants and sewage from sources which currently primarily emanate from Rangpur.

The loss of connections to many floodplain depressions and beels will affect the characteristics of the habitat and species composition of wetland dependant species. However, the results of compartmentalisation indicate that some wetland areas may be advantaged, while other may be disadvantaged. The basic change in the system being that recharge will come more from local rainfall catchments and not from spillage out of connections to the Teesta waters and its aquatic life forms that are transmitted in the current system. Given that the current degradation of the ecology from its natural state is so extensive this issue can no longer be of primary concern.

Substantial losses to floodplain fisheries is forecast with the project in its current format. This will significantly change the current system of exploitation and survival strategies that utilise this natural resource base. These impacts are most likely to affect those who already the most dis-advantaged including the poor, landless, women and children. The effects would need to be monitored and responded to in other forms of relief efforts. The key areas for monitoring will be terms of access to income, deteriorating health status, often associated with nutrition related disorders.



**c. Social Conflicts**

Even the current level FCD in the area supported by many other background features and events have created the seeds of conflict that are a feature of properly conducted socio-economic surveys and public participation in the areas. The primary conflict of direct concern for FCD planning are those which related to competing claims for water and wetland land resources as the project works start to exert their influence on these resources. The primary issues will involve fishing communities, commercial and influential interests moving into exploit the residual fishery potential, farmers and country boats operators. While these trade offs will always be present the means of reconciling their interests and looking effective means of conflict resolution must be addressed in detail in the detailed design phase and proper resources invested during and after construction. The role of the project proponent and government must be to act as mediators and arbitrators and to promote the maximum level of participation and leadership in dealing with these issues as they arise.

**Health Issues Which Cannot be Mitigated**

Due to the geographic and geological conditions of the area and the economic constraints of the inhabitants the following issues cannot be mitigated immediately.

**a. Lack of Awareness and Purchasing Capacity**

The purchase of latrine and iodised salt by all people will be limited by financial poverty, together with lack of awareness among the communities of proper sanitation. Bad communication within the region will also hinder effective distribution systems.

**b. Summer Vegetables in the Lowland and Char Area**

Regular flooding of low lying areas makes cultivation of traditional summer vegetables almost impossible. Scarcity of resources also makes it difficult for the production of early varieties of summer vegetables.





**APPENDIX A**

**LIST OF TERRESTRIAL MACRO FLORA AND FAUNA  
RECORDED IN THE GIP AREA**



Table A.1 Species List and Resource Utilization of Terrestrial Macrophytes in the GIP, 1992

TYPE	SCIENTIFIC NAME		ENGLISH NAME	BENGALI NAME	UTILITY			
	Genus	Species			Construction	Cartwheels	Fish traps	Commercial craft
Trees	Aescia	nilotica	Bulbul Tree	Bablu/Badul	Construction	Cartwheels	Anvils	
	Albizia	lucida		Sil Koroi	General timber	Fuel	Boat building	
	Albizia	procera	White Siris	Sada Koroi	General timber	Fuel	Boat building	
	Annona	reticulata	Bullock's Heart	Nona	Fruit crop	Fuel	General timber	
	Anthocephalus	chinensis	Kadam	Kadam	General timber	Fuel	Decorations	
	Apsanaxis	polystachya		Pitng/Raina	General timber	Fuel	Construction	
	Areca	catechu	Betel Nut Palm	Supari/Gua	General timber	Fish traps	Fruit crop	
	Artocarpus	heterophyllus	Jack Fruit Tree	Kahal	Fruit crop	General timber	Commercial craft	Ornamental wood
	Averrhoa	canabola		Kamranga	Fruit	Jaundice	Fuel	
	Azadirachta	indica	Margosa	Necm	General timber	Skin disease	Fuel	
	Bombax	ceiba	Red Silk Cotton	Simul	Construction	Fibre	Fuel	
	Butea	superba	Flame of the Forest	Lal Palash	Fuel	Decorative	NA	
	Cassia	fistula	Indian Laburnum	Bandurathi/Sonalu	General timber	Fuel	NA	
	Cerbera	odotum		Dakur	timber	Fuel	NA	
	Citrus	grandis		Jambura	Fruit crop	Fuel	NA	
	Cocos	nucifera	Coconut	Narikel/Dab	Fruit/drink crop	Fibre	Construction	Ornamental
Dalbergia	sisoo	Sissoo	Sisoo/Sisua	General timber	Fuel	NA		
Diospyros	pergrina	Nigerian Ebony	Gab	Construction	Boatbuilding	Commercial crafts	Cultural	
Ficus	benghalensis	Banyan Tree	Bot	General timber	Wet season fodder	Fuel		
Ficus	comosa		Pakur	General timber	Fuel	Medicinal		



TYPE	SCIENTIFIC NAME		ENGLISH NAME	BENGALI NAME	UTILITY			
	Genus	Species			Fruit	Fuel	NA	General timber
Trees	Ficus	heterophylla		Bhuidumur	Fruit	Fuel	NA	
	Mangifera	indica	Mango Tree	Aam	Fruit crop	Fodder	General timber	Wood crafts
	Moringa	oleifera		Sajra	Vegetable crop	Fruit crop	Fuel	Fodder
	Spodias	pinnata	Hog-Palm	Anra	Fruit	Fuel	NA	
	Syzygium	sp	Indian Black Berry	Jam	Fruit crop	General timber	Fuel	
	Tamarindus	indica	Tamarind	Teal	Fruit crop	Fuel	Fodder	
	Zizyphus	mauriana	Jujube Tree/Indian Palm	Borui/Kul Gach	Fruit crop	Fodder	Fuel	
	Acalypha	welkesiana		Panabahr	cultural	NA	NA	
	Calotropis	gigantica		Akanda Pata	Rheumatism	Religious (H)	Fuel	
	Carica	papaya	Papaya	Pepe	Fruit crop	Gastic medicine	Meat tenderiser	
	Datura	fastuosa		Dhutra	Medicinal	Fuel	NA	
	Ficus	hispida		Dumur/Kak-Dumur	Fruit	Fuel	NA	
	Heliotropium	indicum		Hidishur	Veterinary	Eye diseases	Compost	
	Hibiscus	rosarinensis	China Rose	Jaba	Ornamental	Religious	Fuel	
	Ipomoea	fiatulosa		Dhol Kalmi	Fuel	Narcotic	NA	
Ricinus	communis		Reri	Rheumatism	Bank stabliser	Fuel		
Herbs	Ammania	baccifera			NA	NA	NA	
	Leucas	aspera		Dulfi/Danda Kalas	NA	NA	NA	
	Clerodendrum	viscosum		Bhant	Rheumatism	Veterinary	Fuel	
	Alocasia	indica		Maan Kachus	Emergency food	Vegetable	Rheumatism	



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TYPE	SCIENTIFIC NAME		ENGLISH NAME	BENGALI NAME	UTILITY			
	Genus	Species			Vegetable	NA	Vegetable	NA
Herbs	Aloe	barbadensis		Gheo Kachu	Vegetable	NA	NA	NA
	Amaranthus	spinosus		Kanta Note	Veterinary	Vegetable	Fodder	Fuel
	Amaranthus	viridis		Note Shak	Vegetable	Fodder	Fuel	
	Ananas	sativus	Pine Apple	Ananas	Fruit crop	Fuel	NA	NA
	Aponogelon	natans		Ghetu	Fuel	NA	NA	NA
	Argemone	mexicana		Shial Kanta	Veterinary antise	Fodder	NA	NA
	Bambusa	sp	Bamboo	Bans	Construction crop	Fuel	Crafts	
	Brassica	sp	Mustard	Sarisha	Vegetable oil crop	Fuel	NA	NA
	Burmeria	pilosa		Harjorah	Bone fractures	NA	NA	NA
	Caculia	axillaris			NA	NA	NA	NA
	Caesia	occidentalis		Jharjhani	Eczema	Fodder	Fuel	
	Centella	asiatica		Thankuni	Dysentery	Emetic	Vegetable	
	Centipeda	orbicularis		Hachuti	Fodder	NA	NA	
	Chrysopogon	acicularis		Chorekanta	Headaches	Bank stabiliser	Anthraemorrhage	Fodder
	Cleome	viscosa		Yellow Hurluria	Emergency fuel	NA	NA	
	Colocasia	esculenta		Kachu	Skin diseases	Vegetable crop	NA	
	Cotula	hemispherica			NA	NA	NA	
	Cynodon	dactylon		Durbaghas	Antiseptic	Religious (M/H)	Grazing	
	Digitaria	violascens			NA	NA	NA	
	Echinochloa	colinum	Grass	Syamaghas	Fooder	Bank stabiliser	NA	





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TYPE	SCIENTIFIC NAME		ENGLISH NAME	BENGALI NAME	UTILITY		
	Genus	Species					
Herbs	Eclipta	alba		Keshra/Keshuti	NA	NA	NA
	Eleusine	indica		Milakuri	Fodder	NA	NA
	Eragrostis	sp			Fodder	NA	NA
	Fimbristylis	sp			Grazing	NA	NA
	Gnaphalium	affinse			Charland pioneer	Compost	NA
	Gnaphalium	indicum			NA	NA	NA
	Grangea	mederapatana		Nemuti	NA	NA	NA
	Gynandropsis	gynandra		White Hurburia	Fuel	NA	NA
	Herpesita	charnietroidea			NA	NA	NA
	Hygrophila	auriculata		Keshardam	Veterinary use	Fodder	NA
	Lindocenia	sp			NA	NA	NA
	Ludwigia	hyssopifolia			NA	NA	NA
	Malva	verticillata		Napashak	medicinal	NA	NA
	Musa	sepientum	Banana	Kala	Fruit crop	Vegetable	Religious (H)
	Musa	paradisica	Plantain	Kach Kala	Fruit crop	Vegetable	Religious (H)
	Oryza	sp	Rice	Dhan	Grain crop	Thatching	Fodder
Polycarpon	prostratum		Gimshak	Vegetable	NA	NA	
Polycarpon	sp			NA	NA	NA	
Polygonum	hydropiper		Bishkali	Antihemorrhagic	Fuel	NA	
Polygonum	orientalis		Bishkali	NA	NA	NA	



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TYPE	SCIENTIFIC NAME		ENGLISH NAME	BENGALI NAME	UTILITY			
	Genus	Species						
Herbs	Polygonum	plebeium		Abjaban	Antihemorrhagic	NA	NA	
	Ranunculus	scleratus		Palik	Charland pioneer	NA	NA	
	Rumex	maritimus			NA	NA	NA	
	Saccharum	sponaneum		Kish	Fodder	Crafts	Thatching	
	Scoparia	dulcis		Bondhane/Furfuni	NA	NA	NA	
	Setaria	barbata		Bansapa Ghash	Fodder	NA	NA	
	Spilanthes	acnella		Marhatiga	NA	NA	NA	
	Triticum	esativum		Gom	Grain crop	Thatching	Fodder	
	Aquatics	Ipomoea	aquatica		Kalmi Shak	Vegetable	Fodder	



Table A.2 Vertebrate Species (Macro-fauna, Excluding Fish) Recorded During the Ecological Survey of the GIP, 1992

TYPE	SCIENTIFIC NAME		ENGLISH NAME	BENGALI NAMES	FOODS	
	Genus	Species				
Mammals	Bandicota	bengalensis	Rat	Indur	Omnivore	
	Bandicota	indica	Bandicoot Rat	Boro Metho Indur	Omnivore	
	Callosciurus	pygerythrus	Irrawaddy Squirrel	Kathiraly	Fruit, seeds	
	Herpestes	auropunctatus	Small Mongoosic	Beje	Snakes, small animals	
	Lutra	lutra	Oter	Udbiral	Fish	
	Mus	booduga	Little Field Mouse	Choto Metho Indur	Grain etc.	
	Mus	musculus	House Mouse	Nengti Indur	Grain etc.	
	Platanista	gangetica	Gangetic Dolphin	Schau	Fish	
	Vulpes	bengalensis	Fox	Shial	Scavenger	
	Birds	Acridotheres	ginginianus	Bank Myna	Gang Salik	Insects
		Acridotheres	tristis	Common Myna	Bhat Salik	Insects
		Acridotheres	fuscus	Jungle Myna	Jhut Salik	Insects
		Alcedo	athus	Common King Fisher	Choto Mirchrunga	Fish
		Anasomus	phoenicurus	White Breasted Water Hen	Dahuk	Small animals, insects
		Anasomus	oscitans	Openbill Stork	Shamuk Khor	Small animals
		Ardeola	alba	Great Egret	Boro Bok	Fish, frogs
Ardeola		grayii	Pond Heron	Xani Bok	Fish, frogs	
Bubulcus		ibis	Cattle Egret	Go Bok	Fish, frogs	
Centropus		sinensis	Crow Pheasant	Kana Kukta	Fruit	
Columba	livia	Blue Rock Pigeon	Jalali Kabutor	Grain		



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TYPE	SCIENTIFIC NAME		ENGLISH NAME	BENGALI NAMES	FOODS
	Genus	Species			
Birds	Copsychus	malabaricus	Shama	Shama	Insects
	Copsychus	sularis	Magpie-robin	Doyel	Insects
	Corvus	splendens	House Crow	Pati Kak	Scavenger
	Dicurus	adimilis	Black Drongo	Finga	Insects
	Dinopium	benghalense	Wood Pecker	Kat-Thokra	Insect larvae, worms
	Egretta	intermedia	Intermediate-Egret	Sada Bok	Fish, frogs
	Gallinago	henna	Pintail Snipe	Kodakhocha	Insects, fish, frogs
	Haleyon	anymensis	White Breasted King Fisher	Sedabok Machhanga	Fish
	Haliaeetus	indus	Brahminy Kite	Shoakho Chel	Fish, frogs
	Ichthyophaga	ichthyetus	Grey Headed Fishing Eagle	Kura	Fish
	Leptoptilos	dubius	Greater Adjutant	Hargila	Invertebrates, fish
	Lonchura	malabarica	White Throated Munia	Sada Gola Munia	Grain
	Megascops	haemacephala	Coppersmith Barbet	Boshonto Baure	Insects
	Motacilla	alba	White Wagtail	Sada Khanjan	Insects, worms
	Motacilla	sp.	Wagtail	Khanjan	Insects, worms
	Actinopus	coromandelianus	Cotton Teal	Bilhana	Small invertebrates
	Nectarinia	zeylonica	Purple-rumped Sun Bird	Madhuchura	Nectar
	Oriolus	xanthornus	Black-headed Oriole	Kutum Pakhi/Holde Pakhi	Insect larvae, etc.
	Orthotomus	autorius	Tailor Bird	Tuntani	Insects, insect grubs, worms
	Passer	domesticus	House Sparrow	Choro	Grain etc.





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TYPE	SCIENTIFIC NAME		ENGLISH NAME	BENGALI NAMES	FOODS
	Genus	Species			
Birds	Phalacrocorax	niger	Little Cormorant	Pancowri	Fish
	Ploceus	philippinus	Baya	Babui	Grain
	Pittacula	krameri	Parakeet	Toya	Fruit, grain
	Pycnonotus	cafer	Red Vented Bulbul	Bulbul	Fruit, insects
	Sterna	aurantia	Indian River Tern	Gang Cheel	Fish
	Streptopelia	decaocta	Ring Dove	Dhobai Ghughu	Grain eater
	Streptopelia	chinensis	Spotted Dove	Tila Ghughu	Grain
	Sturnus	copra	Pied Myna	Go Salik	Insects
	Upupa	epopa	Hoopoe	Hudhud	Insects on ground
	Colotes	vericolor	Common Garden Lizard	Roktochous	Insects
	Enhydria	enhydria	Common Water Snake	Huria	Fish, small animals
	Hemidactylus	brookii	House Wall Lizard	Tiktike	Insects
	Mabuia	carinata	Skink	Angila	Insects
	Naja	naja	Cobra	Gokhm Sap	Small animals
Ptyas	mucosus	Rat Snake	Daraj Sap	Small animals	
Varanus	bengalensis	Monitor Lizard	Kalo Gui	Small animals	
Varanus	flavescens	Yellow Land Monitor	Sonagui	Small animals	
Varanus	sp	Monitor	Gui	Small animals	
Vipera	ruscilli	Russell's Viper	Chaudra Bora	Small animals	
Xenochrophis	piscator	Checkered Keelback Water	Dhorm Sap	Small animals, fish	
Reptiles					



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TYPE	SCIENTIFIC NAME		ENGLISH NAME	BENGALI NAMES	FOODS
	Genus	Species			
Amphibia	Bufo	melanostictus	Toad	Kuno Bang	Insects
	Rana	tigrina	Bull Frog	Sona Bang	Insects

