

Farabari, (5) Gangachara, (6) Kaunia, (7) Laskara, (8) Palasbari, (9) Pirgacha, (10) Uttargaon, (11) Ulipur and Sand & Silty Alluvium Complex. The outline of the soil associations are shown in the following table:

Physiography	Soil Associations	Area (ha)
Active & Young Brahmaputra floodplain	(1) Brahmaputra Alluvial Complex	400 (1%)
Active & Young Dharala Teesta meander floodplain	(2) Teesta alluvial Complex	1,500 (2%)
	(3) Teesta alluvial-Chilmari-Gangachara Complex	4,200 (6%)
Older Teesta meander floodplain	(4) Pirgacha-Palasbari-Bonarpara Association	5,500 (7%)
	(5) Pirgacha-Amgaon Association	3,200 (5%)
	(6) Farabari-Uttargaon Association	1,200 (2%)
Lower Teesta	(7) Palasbari-Babapara Association	1,900 (3%)
	(8) Gangachara-Kaunia Association	44,600 (63%)
	(9) Bonarpara-Farabari-Pirgacha Association	4,300 (6%)
	(10) Kaunia-Laskara Association	3,200 (5%)
Total		70,000 (100%)

The first three of the above associations i.e., the Brahmaputra Alluvial Complex, the Teesta Alluvial Complex and the Teesta alluvial-Chilmari-Gangachara Complex are generally sandy textured and are poor soils for agricultural purposes. These soils occupy 9% of the study area and most of which lie outside the embankment. The other seven soil associations, occupying 91% of the study area lies within the embankment and are generally suitable for agricultural purposes.

### 2.3. Surface and Groundwater Characteristics

**Surface Water Features:** The topography of the area is dominated by its rivers. The Brahmaputra, the Teesta and the Dharala with thier tributeries and distributerics like the Bamani, Buri Tista exercise enormous influence on the surface hydrology of the study area. The Brahmaputra, one of the three major rivers in Bangladesh, originates in the Himalayas far beyond the Indian border with Bangladesh. After being confluent with the Dharala and Teesta rivers at the eastern and south eastern portion of the study area respectively, the Brahmaputra flows due soutwards to about 270 km to be confluent with the Ganges river.

The Dharala river, originating near the southwestern region of Bhutan & India, flows down southeastwards through the Indian territory and enters Bangladesh near Talukshimulbari in Fulbari thana in Lalmonirhat district. After sharply meandering in the Bangladesh territory, the river outfalls with a entire catchment area of about 5,100 km<sup>2</sup> into the Brahmaputra river near the Kurigram town.

The Teesta river, originating near the Himalayan piedmont in the Darjeeling region, India flows down initially southward, and then, turns southeastwards to Jalpaiguri town, India and enters the Bangladesh territory near Dimla thana at Nilphamari district. After joininmg the Buri Teesta river, it reaches the Teesta Barrage which is located about 110 km upstream from the confluence with the Brahmaputra. Further flowing down in the northern periphery of Rangpur town, the river goes across the national railway at Kaunia and finally outfalls to the

Brahmaputra river. The total catchment area of the river is 12,500 km<sup>2</sup>. In olden days Teesta used to flow south along the western border of this region feeding Atrai in Dinajpur and the Karatoa river in Rangpur. At the same time a small creek known as Teesta creek meandered south-east towards Rangpur town lost itself for a while in Ghagat and then reappearing and entered the Brahmaputra near Ulipur.

The area's main surface water supply, however, will come from the Dharala river as this was found most suitable for the purpose. Based on monthly mean discharge at the Kurigram gauging station the flow has been found to be economically sustainable for development of irrigation planning. The dependable 10 year return period flow here was found to be 52m<sup>3</sup>/sec.

Ground water features: The study area is covered with a vast flat alluvial plain, slanting from northwest to southeast. Following the topographic slanting of the area, groundwater flows toward the Brahmaputra river nearly from north-west to southeast. The two regional rivers, the Teesta and Dharala, play a vital role in the ground water recharging. The average groundwater gradient is estimated at about 1/2,760 at the end of the monsoon season.

The ground water level in and around the study area has been measured and monitored by BWDB from an observation hole network, 3 holes in Lalmonirhat, 3 holes in Kurigram, 2 holes each in Ulipur and Chilmari. The lowest groundwater level ranges from 3.6 to 5.6 m from the ground surface in April. The ground water level rises by recharge from May and reaches its highest level in late July. After keeping the highest level during August to September, the groundwater level gradually draws down to its lowest level. Seasonal fluctuation of the groundwater level ranges from 3.4 to 5.1 m.

#### 2.4 Land Use Pattern

The analysis of the land use pattern has revealed that almost 85% of the land area within the embankment (about 50,400 ha) are given to agricultural production. Settlements occupy about 12% (7,400 ha) and 3% (or 1,500 ha) land is taken up by water bodies. The area is thus a predominantly agricultural area with a net cultivated area of 42,800 hectares.

#### 2.5 Flora & Fauna

Flora: There are no large forests now in the study area as most of the original forest cover has been taken over for human settlements. Despite this absence of the original vegetation cover the numerous homesteads contain a large number and varieties of plant life. Among the numerous trees are Jackfruit (*Artocarpus interfrifolia*), Mango (*Mangifera indica*), Karai (*Albizia procera*) and Jarul (*Lagerstroemia flosreginae*). The Babul (*Acacia arabica*), Rain-tree and different kinds of palm are also found. The principal varieties of bamboos include the Barbans, the Tallabans and the Berubans.

Fauna: The extensive human habitation have wiped out all but a very few of the original wild mammalian population of the study area. The District Gazetteer of Rangpur (1977) in describing the fauna of the district (of which the study area is a part) mention large number of Jackals, wild pigs, fox, several species of mongoose and hares. Squirrels, mice and rats represent the rodents. The area has a great variety of birds. The beels and marshes are inhabited by numerous rails, coots, water-hens, storks, herons, cranes, cormorants, divers, dabchicks, waders, gulls, terns and paddy-birds. In cold weather great flights of duck and teal visit the area. The most ordinary varieties are common teal, whistling teal, blue-winged teal, common wild duck, widgeon, gadwali, geese and the Brahmani duck.

Among larger birds are the white tailed Eagle, several varieties of vultures, owls, kites, hawks and buzzard. The common crow and the carrion crow are seen everywhere. Other birds include golden orioles, doves, finches, warblers, tits, weaver birds, parakeets, swallows and martins.

## **2.6 Urban & Rural Settlements**

With only two Paurashavas (Municipality) namely Kurigram & Lalmonirhat the study area is predominantly a rural. Besides the above two which can boast of modern municipal services like electricity, piped water supply, garbage removal facilities, paved streets, street lights there are a few other very small urban places like the thana headquarters of Rajarhat, Ulipur and Chilmari. Of the two Upazilas in the project area Kurigram is more urbanized with 12 percent urban population in 1981. only 9 percent of the population in Lalmonirhat was urbanized in 1981. The urbanization figures for 1991 is yet to be published. However, there is no evidence that the settlement pattern has changed much during the intervening decade. The population of the project area remains predominantly rural and will apparently remain so for a long time. The total population in 1991 of the study area is estimated to be approximately 550,000, with a population density of 926 persons per square kilometer. The total number of households is estimated to be 110,000 with an average family size of 5.0 persons per household.

## **2.7 Physical Infrastructure**

The study area is well connected with the rest of the country with good all weather road, railway line as well as waterways. Within the project area the thana headquarters are interconnected with good motorable roads. Other places within are connected by Herring bone and Kutcha roads. The embankment in many places has turned into the single mode of transportation between places. Waterways play a minor role in internal circulation pattern. The towns of Lalmonirhat, Rajarhat, Kurigram, Ulipur and Chilmari are also interconnected by railway.

## **2.8 Major Socio-economic Feature**

The study area represents one of the most poverty stricken areas in the country. The major occupation here is agriculture. The socio-economic baseline survey carried out during July-Oct, 1992 in the area revealed that 57% of the households are landless and another 35% belong to small and medium category land owners. There are also a few large and very large land owners. While agriculture is the main occupation, other activities represented are fishing, petty labour, transport, petty business and others. The educational level of the study area population indicate a better situation compared to the national norm. Forty percent of the study population appeared to have some kind of education.

Agriculture provides Tk. 34,775 per household per annum among large households and Tk. 62,841 per household per annum among very large households according to the socio-economic survey. However, landless households get only Tk 6662 and small landowning households get Tk. 7910 per annum. While agriculture provides the bulk of income received by the large, medium & small landowning households, only 35 percent of the income of the landless come from agriculture. Wage labouring, fishing and transport are important sources of income for the landless. In the expenditure side, agriculture receives the maximum proportion in the cases of small, medium, large and very large households. The landless spend maximum part of their income for living expenses. This proportion gradually declines with the rise in socio-economic position. Of the total expenditure composition, agriculture receives 23.4 percent whereas living expenses receives 70 percent.

As for other indicators to living standards, 11 out of 22 very large farmers had sanitary latrines and only 11 out of 546 landless households had sanitary latrines indicating to the extreme class differences. All the very large farmers have tube well as source of drinking water and the access tube well for other groups is also fairly good. Electricity is present in 2 large land ownig households out of the 22 and 2 out of 546 landless household.

Indebtedness is more pronounced among the landless and small farmers. Proportion of indebted households gradually decline as the socio-economic position rises. Among landless more than 30 percent are indebted. Different purposes necessitate the credit requirement. Cultivation is one of the major purpose for seeking creit. Land purchase, household construction and education are far less important than subsistance, social ceremonial, medical treatment and marriage expenses are grouped together in the category others. Average interest rate for most of the credit is greater than the institutional rate.

## 2.9 Natural Hazards

For a record of the natural hazards suffered by the study area, the District Gazetteer Report of Rangpur (1977) is a good source of information. The following compilation on the natural hazards in the study area has been prepared from the above source. However, the compilation refers to the whole of the Rangpur District, rather than the study area only. The district is not ordinarily liable to natural calamities of any magnitude. There is rarely a serious deficit or excess of rainfall and the crops are not extensively affected by blights. The area is not generally affected by the cyclones which originate in the Bay of Bengal. Three major types of hazards recorded in this area are floods, draughts and earthquakes. Of these, floods have been the more numerous and more devastating and earthquakes have been the least occurring.

**Floods:** Floods causing very serious injury to crops during the present century are very few. The year in which inundation resulted in actual famine was 1787-88. About sixty years later, some heavy floods took place but they do not appear to have seriously affected the general harvest. In 1856, the crops on the lowlying parts of Rangpur were destroyed by inundation, but the produce of other tracts was sufficient to avert any extreme distress. Many villages in the Gaibanda was inundated by the flood of 1954. The crops covering a large areas in the district were destroyed. Because of the rise of water level, the bank along the Brahmaputra was overflowed. The areas like Rowmari, Ulipur, Fulbari, Nageswari, Bhurungamari and Lalmonirhat were partially inundated. The flood of 1964 affected areas in Nilphamari, Gaibandha and Kurigram. River Teesta eroded away 650 acres of land in the Baragacha union and threatened change of courses. In 1968 flood in Rangpur was grave. The Brahmaputra attained four feet above danger level. The flood waters engulfed Gaibanda, Kurigram and Nilphamari. Almost the whole of the Kurigram subdivision had been engulfed affecting 3,50,000 people in 55 unions. Hearths and homes of 18,000 families and crops over 1,80,000 acres of land in 550 sq. miles were submerged. Erosion of Brahmaputra had rendered 2,500 families homeless, including 1,500 families in Chilmari alone. The erosion of the river had almost completely washed away the main Chilmari Bandar. In recent Years the floods of 1988 caused extensive damages.

**Drought:** Only five cases of draught recorded as having occurred in the past century. These were in 1857-58, 1862-63, 1866-67, 1874 and 1908-1909 but only on the last two occasions was the damage such as to affect seriously the general harvest of the district. In 1857-58 and 1862-63, the price of food rose greatly and considerable distress was experienced by the poorest classes. But this was caused more by the demand from other districts and the consequent exportation or rice, then by any real deficiency in the outturn of the local crops.

**Earthquakes:** The earliest earthquake of which there is any record, is that of June 1885. It was of moderate intensity and duration and caused little damage. The earthquake of 1897 which was felt throughout the country was the most devastating for the region so far. It caused

extensive damage to land and property in the area. It was heralded by a loud rambling noise followed instantly by yawning fissures, east to west in direction from which torrents of sand and water poured over the surrounding country. A great shrinkage of water and an accession of sand in khals, streams, tanks and wells was observed immediately after the earthquake. Large tracts of cultivated land were covered with a thick layer of sand causing much damage to standing crops and rendering many lands unculturable. The earthquake wrecked or damaged most of the public and private masonry buildings, the railways, all sources of water-supply and almost all the roads and bridges.

### **3. Description of Existing & Proposed FCD/I Features**

#### **3.1 Flood Control & Drainage Facilities**

The existing FCD interventions in the project area include flood embankment, drainage channels, drainage regulators and river bank protection activities. Flood embankments designed on the maximum flood level with 50 years return period has already been constructed along the three rivers in the project area. The total length of the embankment is 108 km.

the major drainage channels in the study area include the Ratnai river, the Malbhanga Channel, the Bamni River, the Buri Teesta river and the Mathaler Chara. The total length of these channels is estimated at 133km. Six set of drainage regulators with 16 vents have been constructed at the end of major drainage channels, and in addition five sets of regulators have been constructed with 2 -3 vents for the reinforcement of the drainage capacity of other regulators. In addition four pipe sluices also serve the area for additional drainage.

Severe erosion problem at four places are being tackled with bank protection works, inclusive of groyne, cross bar and bank revetment. These bank protection works include the Kurigram Town Protection Scheme, the Joykunar Protective, Mogolbasha Protection work and Biddananda Protective work.

#### **3.2. Existing Irrigation Facilities**

The irrigation facilities in the project area is currently served by Deep Tube Wells and Shallow Tube Wells. Among the existing irrigated area of 9,800 ha, about 4,600 ha (55%) are covered by deep tube wells and the rest of 5,200 ha (45%) are irrigated by shallow tube wells. The number of operational tubewells is estimated at about 1,300 which are about 46% of the existing installed shallow tubewells

#### **3.3. Problems & Constraints for FCD/I Development**

The current problems and constraints for FCD/I development in the study area are as follows:

**Flood Control Aspect:** Riverbank erosion along the Dharala, Teesta and Brahmaputra rivers represent the most serious environmental hazard for the study area for the present time. The existing embankment and other flood protection facilities have not been well maintained and the public cuts and breaches remain open for long time. Besides, no operational rule for the existing regulators have been developed. There is no system of flood forecasting so that adequate preparation for an impending flood hazard can be taken.

**Drainage Aspect:** The existing main drainage channels are heavily silted, owing to the poor maintenance works. This is especially problematic for the lowlying areas of the study region.

**Irrigation Aspect:** Heavy financial burden has been shouldered by the farmers for installation and O&M of STWs/DTWs. The whole area can not be irrigated by use of groundwater. Only conjunctive use of both groundwater and surface water resources can irrigate the whole land. A large scale irrigation system by use of surface water from Dharala river should be developed with minimum investment.

### **3.4. Proposed Components of the Project**

The structural FCD/I measures proposed are the following:

**Flood Control Work:** Rehabilitation of the 108 km existing embankment with repair of public cuts and breaches.

**Drainage Improvement Works:** The proposed drainage improvement activities include consolidation of main drainage networks through desilting works of the existing drainage channels, beels, and khals, coupled with new construction of linkage canals; the diversion of the Ratnai river and re-construction of the Ratnai regulator; improvement of the existing regulators with the increased number of vents as required; construction of minor drainage system to improve minor stagnation; dual use of LLPs for irrigation and desilting and development of beels and khals for both retention of excess water and pisculture as required.

**Irrigation Development Work:** For irrigation development in the area the proposed measure include construction of Irrigation Regulator at Bumka; construction of main irrigation canal system depending on surface water resources; command area development with LLPs and groundwater development for irrigation by DTWs in the areas where surface irrigation can not benefit due to limited availability of surface water resources.

## **4. Environmental Impact Assessment**

The FCD/I interventions already in place in the area have substantially impacted the physical environment of the study region. People living in the area are already aware of these effects. Their experiences with these environmental effects of the interventions make it easier for them to predict the potential new effects of further interventions. The impact assessment reported in this section thus is based heavily on the responses of the households to the questionnaire survey conducted in the area. Additional information and insights came from the key informant interviews. Information gathered from the socio-economic survey and the public consultation survey was also used. All the interviews were treated as case studies and no attempt was made to tabulate these answers. The results reported here thus came from content analysis of the interviews and the surveys.

### **4.1 Impact on Agriculture**

Reduced flood depths and duration have contributed positively to cropping intensity in the project area. The soil fertility has perceptively increased. Crops can now be produced all the year round. Three crops are now harvested from the fields. Pests and rodents have increased due to the improvement in the living environment for such creatures. Previously annual floods used to keep the rats and other such animals away from the fields. Currently the problem of pests and rats are on the increase. The increase in pests and rats in its turn has resulted in an

increase in the use of various types of pesticides. These in turn have started affecting the aquatic habitats in the project area.

#### **4.2 Impact on Fisheries**

The fishery production system of the area supports populations of a large variety of fish and some shrimp species. Most of this consists of capture fisheries. But the stock of these inland fisheries are being adversely affected by several reasons such as silting up of the rivers and the beels, reclamation and utilization of low lying flood land areas, over fishing or inefficient management of public water bodies. FCD/I activities result in the loss of habitat and reduction in seasonal and perennial fishing grounds. The increased use of agro chemicals have also started affecting the fish habitat.

The impact on the fisheries especially on capture fisheries has been substantial. The embankment has severed the natural link between the inland depressions, waterbodies with that of the openwater part of the rivers. Previously fishes used to travel inland through the creeks, canals and small rivers as well during the flood season. The lowland habitat provided good spawning grounds for numerous types of fish species. This has stopped completely. Again the water that used to flow from inland waterbodies used to carry food for aquatic life. This has also been curtailed by the flood control projects. Thus the effect on fisheries has been the most important negative environmental effect of the FCD/I projects.

Kurigram, Ulipur and Lalmonirhat clearly show adverse effects in the project area as compared to similar non-project areas in terms of fish catches and in the per capita income of the fishermen. The total annual catch have declined by as much as 82 percent in Ulipur with the minimum loss of 10 percent in Kurigram. The yearly average catch of a fisherman fell by 25 to 32 percent and per capita annual income fell by 10 to 33 percent.

#### **4.3 Impact on Natural Vegetation**

The area did not have any natural forest stand and all natural vegetation consisted of the homestead vegetation. However, extensive grasslands used to be there in the char lands and other lowlands unsuitable for cultivation at the time.

Due to the control of water flow many low lying areas as well as due to the increased yield of land due to availability of irrigation water and other inputs all lands are now put to cultivation at the expense of natural vegetation. Previously the area produced enough 'Kashia' (a kind of grass) which is used as roofing material in housing.

Most of the large and old trees in the region has been cut. An examination of the homestead vegetation reveal that these are comparatively young trees. Many of the respondents complained about sudden tree death syndrome after the creation of the embankments. However, no clear linkage could be established. Further investigations are in order.

#### **4.4 Impact on Wild Life**

The whole land area in the project area has long been taken over for human habitation. Almost all corners are already taken up even before the establishment of the FCD/I measures. Thus these measures did not have any unique negative affects per se other than the usual i.e., in helping to expand man they have been pushed to the limits. Wild animal are thus very few in number. Due to expansion of cultivation even the population of the domesticated animals have declined. Due to the absence of grazing lands large herds of domestic animals are a rare sight in the project area now even though many informed that it not so in the past.

#### **4.5 Impact on Settlement Pattern**

There has been important effects on the human settlement pattern. A large number of erosion uprooted families have resettled on the embankments and many started living within the easy reach of the embankments due to the vulnerability during the time of unusual floods. The embankments provide shelter during floods. Also in many places settlements can be easily erected without raising the ground. The supply of local building materials declined due to the decline in vegetation like grasses and bamboos.

#### **4.6 Impact on Human Health**

While the households reported some newer kinds of diseases for the region after the introduction of the FCD/I intervention and the resulting environmental changes the professionals related to health care delivery deny that this is so. People complained about sudden increase in the incidence of paralysis and skin diseases after the embankments were built. The increased incidence of the skin diseases as pointed out by the respondents were due to the increase of stagnant water and the increased use of chemical fertilisers. However, the reported increase in paralytic diseases could not be confirmed nor the reason could be linked to the changed environment. Mosquitos have increased and cases of Malaria has also been reported. But the number of cases did not raise any alarm among the health professionals in the area. The incidence pattern of Diarrhoea has also been found to be normal.

#### **4.7 Checklist on Negative Effects**

The list of probable negative impacts used in the environmental survey are outlined below - along with their ranks of magnitude. For the impacts with low moderate or high magnitude, mitigating measures are also suggested in parentheses.

(Impact Level None: N; Low: L; Moderate: M; High: H)

1. Environmental degradation from increased pressure on land: L  
(Monitoring resettlement to balance with the carrying capacity of land: increased productivity from agricultural land)
2. Loss of land from inundation: L  
(Increased cultivation of HYV crops in irrigated and protected areas to offset losses)
3. Waterlogging from irrigation water: L  
(Number size and location of sluice gates should be chosen as per the supply and the requirement of water inside the project area. Excess water should be removed quickly. Sluices should be properly maintained and manned)
4. Salinization of soils from waterlogging: N
5. Increased soil erosion: N
6. Reduction in floodplain agriculture: N



7. Clogging/choking of canals from sedimentation: M

(Monitoring sedimentation at critical or potential sites and overall management of canals to minimize sedimentation)

8. Changes in natural vegetation cover: M

(Planned afforestation on the embankments and encouragement to plant homestead trees; introduction of new species)

9. Loss of wildlife habitat: M

(Monitoring the increase of pests and rodents and devising biological control of these by introduction of different animals or birds)

10. Adverse effect on fish habitat: M

(Provision of fish ladder and other passageways; protection of spawning grounds; alternate development of reservoir fisheries)

11. Effect on human settlement pattern: L

(Due to the absence of flood homesteads may be built anywhere encroaching valuable agricultural land. Effective land use zoning laws should be devised so that new homesteads are built toward the existing towns leaving the agricultural land)

12. Displacement of people due to canal construction: L

(Relocation in suitable land; compensation in kind and cash; simultaneous provision for creating non-farm income generating opportunities)

13. Problem of resettlement of displaced population: L

(Special provision for khas land distribution; compensation and simultaneous provision for creating non-farm income generating opportunities)

14. Problems in circulation network (roads, waterways): L

(Roadways may be maintained through an afforestation programme. The present RDRS model utilising the labour from the villages in the project area for maintaining rural roads has proven to be effective)

15. Reduction of downstream navigation potentials: N

16. Loss of historic and cultural features: N

17. Deterioration of water quality: M

(Stagnant water should be removed by having more sluice gates and having them open at the time of need)

18. Increase in incidence of water related diseases like Malaria: N

19. Increase in water borne diseases like Diarrhoea: N

20. Sanitation/drainage & garbage disposal in urban areas: N

21. Potential for structural failure: M

(Aforestation on the embankments; restriction on settlement on embankments; monitoring the physical condition of the embankments and river training)

22. Problem of downstream flooding: L

(Taking up of similar flood control projects in the affected areas)

## 5. Conclusions

### 5.1 Major Environmental Issues

The major issues identified from the environmental survey are:

- (a) Waterlogging in the Lowlying Areas: This is potentially very damaging to the environment at the low lying portions of the project area. The number and the size of the sluice gates for discharge of water from inside the project area at present not enough compared to the supply of water especially during a normal rainy season. Thus it takes a long time for the water to drain out. This affects the agriculture of the area. At times due to the abnormally water levels in the river Tista and Dharala, water from inside the project area can not drain out.
- (b) Displacement of Population due to New Canal: The proposed canal to divert the Ratnai to Dharala at the extreme north of the project is to displace some homesteads in that area. Their resettlement and rehabilitation if not handled carefully will create potential political problems.
- (c) Potential for Breach in the Embankment: This is a real threat at several points in the project area and it stems from two sources. The first is the shifting behaviour of the rivers Tista and Dharala. Both the river originates in the hilly regions to the north and as such have high currents and are very active. The current and the future vulnerable points should be identified. The second source for potential breach of the embankment is the tendency of the erosion displaced families to resettle on the embankment. Thus large sections of the embankment has been occupied and the security and safety of the project area has been compromised.
- (d) Breach in the Wildlife Chain: The increased availability of irrigation water and the resulting expansion of cultivation has affected the wild life chain in the area. All available bush and scrub areas have been turned into croplands destroying the wildlife habitat. Absence of flood waters and the accompanying aquatic habitat has limited the extent and the diversity of the bird population while at the same time drier grounds have encouraged the increase in pest and rodent population. The rat population in the project area has increased tremendously and it has started to become a menace to some crops especially Wheat and Boro rice. Different types of pests have also increased in the absence of the bird population which used to prey on them.
- (e) Problem of Water Quality & Health Problems: Stagnant water at various points in the project area has apparently started causing diseases like scabies and other related problems. Diseases like Malaria or Diarrhoea, however, occurs less frequently. The overall quality of the stagnant water at places has so deteriorated that it can not be used for any domestic purpose.

- (f) Decline in Fish Spawning Habitat: The irregular and the controlled linkage between the water bodies inside the project area and the rivers out side has resulted in a decline in fish spawning habitat inside the project area. The supply fish in the area and fisheries as a living have become very difficult for a large number of project beneficiaries.

These items are the ones that should be carefully monitored while making the final recommendations for the project area.

## Attachment 1

### CHECKLIST OF NEGATIVE EFFECTS EXCLUDED FROM SURVEY

1. Negative environmental effects of barrage construction, viz., air and water pollution from construction; soil erosion; vegetation destruction; sanitary and health problems.
2. Proliferation of aquatic weeds in reservoir and consequent impairing of navigation and fisheries downstream.
3. Sedimentation of reservoir and loss of storage capacity.
4. Siltation and choking of reservoir entrance and consequent waterlogging upstream.
5. Social disruption and lowering of living standards of relocated people.
6. Increase in humidity (locally), creating favourable habitat for disease vectors.
7. Increase in flood magnitude and duration downstream due to dam releases.
8. Increase fertilizer use leading to water pollution and higher costs [due to imported supplies].
9. Scouring of irrigation canals.
10. Leaching of nutrients from soil due to over watering and intensification of cropping.
11. Algal blooms and weed proliferation in irrigated field and drainage channels.
12. Clogging of irrigation and drainage canals from weeds.
13. Deterioration of river water quality below irrigation project and contamination of local ground water (higher salinity, nutrients, agrochemicals) affecting fisheries and downstream users.
14. Reduction of downstream flows affecting floodplain use, floodplain ecology, riverine and floodplain fisheries, and dilution of pollutants.
15. Encroachment of swamps and other ecologically sensitive areas.
16. Disease and health problems from use of waste water in irrigation .
17. Conflicts over water supply and inequities in water distribution throughout service area.
18. Overpumping of ground water leading to lowering water table.

## Attachment 2

### QUESTIONNAIRE FOR ENVIRONMENTAL IMPACT SURVEY

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Respondents should be project area long time residents old enough to recollect the pre project period environmental situation. The questionnaire will be administered at selected project area locations to represent various environmental situations. Randomly selected respondents will be asked open ended questions on the following aspects. The respondents will be encouraged to clarify their comments and responses in detail. The field assistants will try to record as much information as possible on separate sheet of paper. The final processing of the responses will be done through content analysis.

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Interview Date:            Location:  
Respondent's Profession:            Education:  
Total length of stay in the Area:

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**1. Effect on Agriculture:**

- a) Soil Productivity
- b) Cropping Pattern
- c) Pest/ Rodent
- d) Grazing Land
- e) Overall Positive Effects
- f) Overall Negative Effects

**2. Effect on Natural Vegetation:**

- a) Forest
- b) Trees
- c) Other plants

**3. Effect on Wild Life:**

- a) Animals
- b) Birds
- c) Other life forms

**4. Effect on Human Settlement:**

- a) Land for homestead
- b) Supply of construction materials
- c) Drainage
- d) Water supply
- e) Homestead Vegetation
- f) Domestic Animals

**5. Effect on Infrastructure:**

- a) Roads
- b) Waterways
- c) Bridges/Culverts

**6. Effect on Health:**

Diseases

**7. Effect on Hydrology:**

- a) Ground Water
- b) Surface Water

**8. Perception of Natural hazards:**

- a) Bank erosion
- b) Flood
- c) Draught
- d) Cyclone
- e) Earthquake

**APPENDIX - XVI**  
**ORGANIZATION**  
**AND MANAGEMENT**



FEASIBILITY STUDY ON  
KURIGRAM IRRIGATION AND FLOOD CONTROL PROJECT (SOUTH UNIT)

APPENDIX - XVI ORGANIZATION AND MANAGEMENT

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## APPENDIX-XVI ORGANIZATION AND MANAGEMENT

### 1. Existing Organizations related to Project Implementation and O&M

Various government agencies are expected to participate in the implementation and O&M of the proposed Project. Among other agencies, six (6) agencies (BWDB, BRDB, LGED, DAE, DOF and DOL) are expected to be directly involved. The proposed project requires inter-ministerial coordination because these agencies belong to different ministries as indicated on an organizational chart of GOB (Fig.XVI.1.1) and also have different functions and jurisdiction in government services (Fig.XVI.1.2). The staff strength and development budget allocation of these agencies for 1992/93 are summarized in Table XVI.1.1. The prospective participating agencies are briefly described hereunder.

#### 1.1 Bangladesh Water Development Board (BWDB)

The Bangladesh Water Development Board (BWDB), a semi-autonomous body under the Ministry of Irrigation, Water Development and Flood Control, was established after liberation of Bangladesh in 1972. The BWDB is responsible for planning and execution of water resource development works, encompassing flood control, drainage improvement, irrigation, town protection and river training schemes. Only in the field of groundwater irrigation and minor surface irrigation with LLPs, a part of the responsibilities is shared with the Bangladesh Rural Development Board (BRDB) and the Local Government Engineering Department (LGED).

The BWDB has now a staff strength of more than 18,000 of which nearly 2,000 are engineers. The present organization of the BWDB is shown on Fig.XVI.1.3. In the project area, an Executive Engineer (EE) stationed at Kurigram and assisted by Sub-Divisional Engineers, is supervising the maintenance works of the existing FCD facilities (see Fig. XVI.1.4, Organizational Chart of Kurigram WD Division-1). The Chief Engineer (CE), Project-IV, Implementation Division of BWDB, and the Superintendent Engineer (SE), Teesta Project Canal Circle-2, both stationed at Rangpur, have overall control. There is no O&M office in the project area. All the O&M activities are carried out by the EE's office at Kurigram with 49 staff in total.

The BWDB's annual development budget (ADP) is Tk 6,499 million in total for the financial year of 1991/92. However, not all the allocated funds are actually released mainly due to the regular adjustment made by the Government. The ADP allocation for 1991/92 includes Tk 5,864 million (90%) as investment to complete carried-over schemes from the TFYP and only Tk 635 million (10%) for taking up new projects. Implementation capacity of the BWDB in terms of manpower far exceeds the budgetary allocations. It is widely recognized that the major constraints of BWDB are insufficient and irregular release of funds coupled with complicated and time-consuming land acquisition procedures consequently resulting in cost overruns. The implementation plan should therefore keep these realities in view.

#### 1.2 Bangladesh Rural Development Board (BRDB)

The Bangladesh Rural Development Board (BRDB), formerly called the Integrated Rural Development Programme (IRDP) was re-organized in December, 1982, to promote and strengthen the growth of UCCA/KSS/BSS/MSS system. It is managed by a Governing Council, of which the Minister of Local Government, Rural Development and Cooperatives is the Chairman. The members represent related ministries and government agencies and include elected five representatives from the National Federation of UCCAs. The Director

General of BRDB acts the Member Secretary of the Governing Council. An organizational chart of BRDB is shown on Fig. XVI.1.5.

BRDB has now more than 1,900 staff in total. The Thana Rural Development Officer and the Assistant Thana Rural Development Officer represent BRDB at the Thana level. In the project area, 28 such officers are engaged in the field operations. The staff is supervised by the Project Director stationed at Rangpur and supported by two Deputy Project Directors. BRDB is now mainly engaged in two rural development projects in the project area; i.e., (1) the IDA-funded Rural Development II Project as the executing agency, and (2) the IFAD-funded Marginal and Small Farm Systems Crop Intensification Project as one of the participating agencies.

### **1.3 Local Government Engineering Department (LGED)**

The Local Government Engineering Department (LGED) under the Ministry of Local Government, Rural Development and Cooperatives was established in 1984 to accelerate the rural and urban infrastructure development activities and to provide technical support to the local government. In addition, the LGED was recently empowered to carry out small scale irrigation development. The LGED has now 9,650 staff in total. The chief executive is the Chief Engineer who is supported by 524 engineers. The organizational chart of LGED is shown on Fig. XVI.1.6.

The Thana Engineer and his assistants represent the LGED at the Thana level and take responsibility for planning, design and implementation of rural infrastructures and the related civil works. In the project area, a total of 86 staff including 26 engineers are engaged in the rural infrastructure development. At present, the LGED are undertaking two (2) on-going projects in the project area. They are (1) the SIDA and NORAD assisted Rural Development Project -IV, (RD-IV) and (2) the EEC assisted Rural Development Project -VIII (RD-VIII). The RD-IV covers 5 districts of which Kurigram is one. The RD-VIII covers four districts where Lalmonirhat is included.

### **1.4 Prospective Supporting Agencies**

#### **(1) Directorate of Agricultural Extension (DAE)**

The Directorate of Agricultural Extension (DAE) is the largest government agency which is directly involved in the agricultural development of the country under the Ministry of Agriculture. The DAE was established in 1982 by merging six extension-oriented organizations into one unified organization. The prime objectives of the DAE is to enhance agricultural productivity through training and visits. The DAE has a total strength of 23,954 persons. Total strength of the Kurigram district of DAE is 412 persons.

The Deputy Director of DAE has been posted at Kurigram and supervises all activities pertaining the agricultural extension in the district. In the project area, the DAE is represented by the Thana Agricultural Officer at each Thana Parishad, and mainly engaged in the IFAD/German assisted "Marginal and Small Farm System Crop Intensification Project (MSSCIP)" since 1987. The DAE has developed a network of agricultural extension workers through the MSSCIP. The agricultural extension workers, in daily contact with farmers, can expect to play a significant role in encouraging the achievement of potential benefits from the proposed project.

#### **(2) Directorate of Fisheries (DOF)**

The Directorate of Fisheries (DOF) was established in 1972 under the Ministry of Fishery and Livestock. The primary objective of the DOF is to increase the production of

fish for meeting the internal demand for home consumption from both fresh and saline water. To fulfill its objectives, the DOF is responsible for the management of fisheries resources, extension services and the enforcement of fisheries ordinances. It also support aqua culture through demonstration ponds, hatchery construction and operation. Recently an inter-agency agreement have been developed to give the DOF's fisheries management responsibility in selected water bodies owned by BWDB. The total staff strength of the DOF is 3,783 persons at present, while that of the Kurigram district is 58 persons. The Thana Fishery Officer and his assistants represent the DOF at the Thana level.

### (3) Directorates of Livestock (DOL)

The Directorate of Livestock (DOL) is also under the Ministry of Fishery and Livestock. The prime objective of the Directorate is to increase the poultry and livestock population of the country so as to meet the domestic nutritional demand and to increase the draught power which is fast declining. The DOL has a total staff strength of 7,605 persons. Total officers and staff strength of the Kurigram district is 65 persons. The Thana Livestock Officer and his assistants represent the DOL at the Thana level.

## 1.5 Local Authorities

The District acts the focal point of all development activities in Bangladesh, and the Deputy Commissioner is cast in the role of Chief Coordinator. The Deputy Commissioner does not only represent the Ministry of Establishment, rather he is the full face of the Government. He chairs various committees in the district where decisions relevant to development activities pursued by various departments and agencies are taken. The Deputy Commissioner would continue to act a pivot for all development activities in the district and the project would only succeed with the active support of the district administration headed by the Deputy Commissioner.

The Thana Parishad, an elected local government body, is headed by the elected chairman (the chairman of the former Upazila Parishad was recently abolished) and comprises the elected chairmen of all the Union Parishads of the Thana and three (3) nominated female members. The officers of the development agencies working in the Thana are also members of the Parishad but they do not have any voting power. The Upazila Parishad has all-pervading influence in development activities. The Thana Nirbahi Officer (TNO), appointed by the Ministry of Establishment, acts as the principal coordinator of all administrative and development activities in the Thana administration. An organizational chart of the Thana Parishad is presented on Fig.XVI.1.6. The basic electoral unit of local government is the Union Parishad. The Union Parishad comprises three members representing each village and two female members nominated by the Government. In recent years, coordination in development planning, designs and implementation at the Union level have been more and more emphasized by the Government.

## 2 Project Implementation

### 2.1 Executing Agencies

The Bangladesh Water Development Board (BWDB) will be the lead executing agency for the proposed project, and will be responsible for the implementation of major civil works for the proposed FCD/I components, including:

- (1) Rehabilitation of flood embankment and regulators,

- (2) Re-excavation of the existing drains for drainage improvement as well as surface irrigation water supply,
- (3) Construction of irrigation intake structure and irrigation canal systems, and
- (4) Establishment of Demonstration Farms

The Bangladesh Rural Development Board (BRDB) and the Local Government Engineering Department (LGED) will also be the executing agencies, being mainly responsible for the following project components under overall coordination of BWDB :

- (4) Command Area Development with LLPs (BRDB/LGED),
- (5) Groundwater irrigation development (BRDB/LGED), and
- (6) Rural infrastructure improvement (LGED)

Command area development (CAD) with LLPs will be made by private initiatives in view of the recent government policy shift to privatization and successful performance of private sector on small scale irrigation development. The BRDB will assist such private initiatives in terms of organizing farmer groups and arrangement of credit for them. The LGED will provide necessary engineering supports for CAD and O&M. LLPs will be supplied to farmer groups through private sector channels. Daily operation and maintenance of the installed LLPs will be made by the farmer groups at their own costs.

Groundwater irrigation development will also be made by private initiatives on same reasons mentioned above. The BRDB will organize farmer groups in the groundwater irrigation development areas, and help them obtain credit for tubewell development through the existing cooperative-based rural credit system with the banks. The LGED will provide necessary engineering supports for construction and O&M. Pump facilities will be supplied by private sector. Daily O&M of the tubewells will be made by the cooperatives at their own costs.

In order to facilitate the private initiatives for CAD and minor tubewell irrigation, Demonstration Farms will be established as one of the project components. Possible development modes for CAD will be demonstrated and/or tested at the demonstration farms. The demonstration farms will be established by BWDB at three (3) locations with prime objectives of demonstrating and testing (a) institutional build-up and arrangement for CAD with LLPs and tubewells, (b) physical planning and designs of CAD and (c) irrigation water management for cultivation. BRDB will be responsible for institutional aspects of the demonstration farms. DAE will take charge of extension aspects on irrigation water management.

In addition to the above major activities, BRDB will be responsible for organizing the landless groups with the help of the NGOs as Landless Contracting Societies (LCSs).<sup>1/</sup> Such LCSs will be entitled to undertake 25% of the earth work during the implementation of the project. The LGED will be an executing agency for rural infrastructure improvement.

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<sup>1/</sup> : The idea of LCSs has been initiated and implemented under the Early Implementation Project in order to help the landless. LCSs are entitled to undertake 25% of the earth works during the implementation. NGOs guide the landless to organize LCSs and help enlist the LCSs as class "D" contractors for BWDB. To help the LCSs execute the earthworks, a mobilization amount of 30% of the estimated cost of the work is advanced by BWDB with a special arrangement of donors' guarantee through a local bank.

Though not executing agencies, three (3) other agencies are expected to play an important role under the overall coordination and responsibility of BWDB. The Department of Agricultural Extension (DAE) is expected to provide farmer groups with agricultural extension services, particularly for Boro cultivation. The Department of Fishery (DOF) is expected to provide necessary technical inputs and advises for the enhancement of inland fishery activities particularly during the Rabi season. The Department of Livestock (DOL) is expected to provide the same particularly for enhancement of duck raising.

The relationship between the proposed project components and executing agencies is summarized on Fig.XVI.2.1.

## **2.2 Project Implementation Arrangement**

Close coordination among the above government agencies is crucial to the successful implementation of the proposed project. It is recommended that coordination committees consisting the representatives from the related agencies (BWDB, BRDB, LGED, DAE, DOF and DOL), will be established at the Central, District and Thana levels for the successful implementation of the proposed project. To ensure close coordination among the agencies, there should be clear and definite "Government Order" demarcating responsibilities of each agency. Follow-up actions should be regularly monitored at the central level. The proposed coordination structure for project implementation is illustrated on Fig. XVI.2.2.

The BWDB will establish a Project Implementation Office (PIO) which will be headed by the Superintendent Engineer, the Teesta Project Canal Circle-2, as the Project Director, and one full-time Executive Engineer will be assigned to the field office at Kurigram. At the Central, District and Thana coordination committees, BWDB will be represented by the Member (Implementation), Project Director (SE), and Executive/Sub-divisional Engineers, respectively. During O&M stage, the BWDB will be represented by the Member (O&M).

Similarly, the BRDB will assign the Project Director in Dhaka, and appoint the Deputy Director in Kurigram for day-to-day administration of its components under the project. At the District and Thana level, BRDB will be represented by the Deputy Director and Thana Rural Development Officers, respectively. LGED will also assign a Superintendent Engineer in Dhaka as the Project Director, and assign the Executive Engineer and Thana Engineers to represent it for District and Thana level coordination. DAE will also assign the Project Director in Dhaka, and assign the Deputy Director and Thana Agricultural Officers for coordination at the field level. DOF and DOL will also assign the Project Director in Dhaka and assign District and Thana Officers for District and Thana level coordination.

## **2.3 Beneficiary Participation**

The Project Implementation Office (PIO) should establish a Project Beneficiary Committee (PBC) in each of five (5) Thanas in the Project area, in order to facilitate close and uninterrupted interaction between the beneficiaries and the project executing agencies. The PBCs will consist of representatives from the government offices, Thana Nirbahi Officer (TNO) and members of the Union Parishad and others directly representing farmers, fisherman and the landless, and will also include the representatives from NGOs.

Formal discussion at the PBCs will facilitate the effective dissemination of project information among the beneficiaries and also a direct feedback from the local public. The available design options will be reviewed and selected at PBCs meetings, which will also ensure the integration of the proposed project designs into the specific, local development programme such as "Thana Development Plan". During the construction phase, various construction arrangements will be addressed at the PBCs to ensure close coordination with

the local authorities and beneficiaries. The land acquisition process will also be monitored at PBCs to ensure the smooth implementation of the project.

In the post construction phase, PBCs could also function as an effective benefit monitoring organization, extending its functions to ensure the sustained operation and maintenance (O&M) of the proposed project facilities.

#### **2.4 Non-governmental Organizations (NGOs)**

In the Project area, approximately 170 NGOs are working in various sectors of development to improve the living standards of the rural poor. Among these, CARE (Cooperation for American Relief Everywhere) and RDRS (Rangpur Dinajpur Rehabilitation Services) are well established in the Project area. It is considered that the experiences and capabilities of such NGOs in organizing and mobilizing the landless and women at the grass-root level will provide an important role in implementing various components of the Project. However, these NGOs have their own area of operation. The possible scope of cooperation with such NGOs should be kept as flexible as possible, and be examined during the initial phase of the project implementation.

#### **2.5 Land Acquisition Process**

Although the proposed project is planned with a view to minimizing land acquisition for the construction of the project facilities, it will still need about 370 ha of private land for canal construction in order to connect the irrigation intake with the existing drainage channels. Delays and difficulties in land acquisition are, in most cases, the most serious reason for overall delay in project implementation. In order to minimize such possible delays in land acquisition process, the following will be taken into account:

- (1) Participation of the beneficiaries (joint monitoring of land acquisition process by PBCs and executing agencies);
- (2) Adequate compensation in cash to farmers who are to lose their land as a result of the project's land acquisition;
- (3) "Land for land" concept, whereby farmers are to become landless as a result of the project's land acquisition, will be provided with the alternative land which will be made available through re-adjustment of land among the project beneficiaries; and
- (4) Disposal of excavated soils; the excavated soil will be spread over the adjacent land.

BWDB will prepare a detailed land acquisition plan for each project component immediately after the finalization of the detailed designs of the project. The detailed land acquisition plan should be reviewed and agreed at respective PBCs at Union level. In this process, owner-farmers and/or cultivators who are qualified for compensation or land redistribution will be identified by PBCs. Thereafter, process and progress in land acquisition, payment of compensation and resettlement will be continuously monitored and reported at the PBCs.

### **3 Operation and Maintenance (O&M) of Project Facilities**

#### **3.1 Current O&M Problems**

The operation and maintenance of FCD/I projects is a problem throughout the country. It is widely recognized that many of completed FCD/I projects become inoperative within a few years after completion mainly because the BWDB can not afford to finance and implement the required O&M works. Lack of adequate O&M has led to reduced benefits and as a consequence to little interest of the beneficiaries in the functioning of the projects. At present the readiness of the farmers to participate in the O&M of the projects is not virtually observed. The projects may be rehabilitated again, allowing the same process of inadequate O&M, but the project benefits will never reach their intended level due to consequent deterioration.

Such poor O&M have been recognized by the BWDB and numerous initiatives have been launched to find effective means of improving the current O&M. These initiatives include the System Rehabilitation Project (SRP), the Second Small Scale Flood Control, Drainage and Irrigation Project (SSSFCDIP), the Land Reclamation Project (LRP), the Early Implementation Project (EIP), the Land Reclamation Project (LRP) and the Operation and Maintenance Study (FAP-13). Most of these are still at the exploratory or pilot testing stages, and none of the approaches have been proved most effective by this time.

#### **3.2 Key Issues on O&M Programme**

FAP-13 has assembled the following recommendations on the basis of the recent development which takes place in the major existing initiatives on O&M improvement:

##### Institutional Framework

- (1) There is a need for improved inter-agency coordination at the national level and the individual project level; and
- (2) New institutional arrangements should be tested in the priority projects. These include multi-agency decision making, establishment of project level bodies, devolution of responsibility to local government or NGOs or complete handing over of smaller projects to local administration or the beneficiaries.

##### Public Participation

- (1) It is unlikely that a single approach to public participation will be found to be ideal. A range of participatory methods should be tested in the pilot and priority projects; and
- (2) Public participation from the beginning is essential using a variety of approaches to consultation over project planning and design. In most cases, the project will need to promote the establishment of farmers and non-farmers organizations in a variety of forms.

##### Transition from Implementation to O&M

- (1) A number of changes could be made during the process of transition from the "implementation stage" to "O&M stage". These include training of O&M staff, involvement of user groups in O&M, resolution of initial operational problems and the establishment of specific operating rules for individual structures; and



- (2) The institutional separation of organizations responsible for the implementation and O&M could lead to a formal handover process which would concentrate the attention on the needs to deliver a project that could be easily operated and cheaply maintained.

#### Maintenance of FCD/I Facilities

- (1) The maintenance programme should include the following components:
  - a) Routine embankment maintenance,
  - b) Emergency repair to embankment damages
  - c) Monitoring and record keeping,
  - d) Periodic maintenance of project facilities,
  - e) Routine maintenance of structures, and
  - f) Rehabilitation of damaged structures.
- (2) At present routine embankment maintenance is non-existent. Organization of the embankment maintenance groups (EMGs) can assure better quality maintenance and can divert the project benefits to the disadvantaged groups.

#### O&M Costs and Resources Mobilization

- (1) The raising of revenue from FCD/I projects is always difficult. Farmers often contribute the cost of irrigation, but do not contribute to the costs of drainage and flood control. However, efforts should be made to charge for these. It may be possible to introduce value-related land taxes in flood-protected areas, but other efforts to raise revenue directly are unlikely to be successful;
- (2) Costs estimates for O&M in feasibility studies are significantly lower than the actual level of expenditure. Much more thorough approaches would be needed for estimates of O&M costs; and
- (3) There are a range of opportunities to use FCD/I infrastructures as an indirect means of resource generation. These include the public use of embankment, the planting of trees on embankments and fish culture in borrow pits. These opportunities should be exploited in association with NGOs, farmer groups and groups of the landless. Trials of such opportunities would reduce conflict over O&M, raise resources for O&M and save maintenance costs.

#### O&M Manuals and Training

- (1) Project-specific O&M manuals should be prepared for all BWDB projects in Bangla, though in practice they rarely are. The manuals should be made available to or usable by field staff;
- (2) O&M manuals should include the detailed information needed for reference by O&M engineers and the basic operating guidelines. The basic operating manuals should be simple, illustrated, written in Bangla and used as training aids; and
- (3) There is an increasing need for training of BWDB field staff and non-BWDB staff involved in routine O&M of FCD/I facilities.

### 3.3 Basic Framework of Proposed O&M

BWDB does not have sufficient financial resources to run the completed projects efficiently. After completion of the proposed project, annual O&M costs will be significantly increased. Our public consultation survey indicates that most of the beneficiaries think they can afford to pay additional taxes for the O&M works provided that the effectiveness of the project facilities can be visually confirmed in the field. To ease the increased financial requirement for O&M works, various alternative arrangements should be undertaken, taking two (2) related issues into account; namely, (a) involvement of beneficiaries (PBCs) and (b) mobilization of local financial resources.

Considering all the above, preliminary framework of the O&M plan is conceived hereunder. The plan is only indicative and will need full discussions at the field level with local administration and also a pilot testing during the project implementation stage.

#### (1) Components of O&M programme

The activities to be taken up under the O&M programme will include (i) routine operation and maintenance, (ii) periodic maintenance, (iii) emergency maintenance, and (iv) rehabilitation or re-construction.

##### (i) Routine O&M of Project Facilities

Routine O&M of irrigation regulator (intake structure) will be carried out by the BWDB. Routine O&M of other project facilities such as embankment, drainage channels and structures will be ultimately entrusted to the Thana administration. The proposed project should be implemented on the understanding that the Thana/Union would be responsible for such routine O&M under a legal framework being developed enabling the Thana/Union to ensure public participation and collect taxes for O&M. The Thana/BWDB will make arrangement for public participation. For routine maintenance of the facilities, groups of the landless, preferably destitute female heads of households will be deployed under supervision of BWDB engineers.

##### (ii) Periodic maintenance

Periodic maintenance of all the project structures will be carried out by BWDB at the intervals to be specifically determined for each structure. This will include resectioning of embankments, repair of irrigation/drainage sluices, re-excavation of drainage channels, and repair and overhauling of LLPs. Funds for the periodic maintenance will be released following the procedure similar to those for new projects. As for earth work, 25% of the periodic maintenance will be given to the Landless Contracting Societies (LCSs).

##### (iii) Emergency maintenance

Emergency maintenance will be carried out by BWDB where an expected intervention is required to prevent failure of embankments and/or structures. Emergency maintenance can not be specifically planned, but funds should be made available at short notice. Emergency maintenance should only be limited to small scale interventions such as the sand-bagging to prevent embankment from over-topping of flood, and should not include such major works as saving a section of an embankment from river erosion. Such major works will be implemented under the category of Rehabilitation and Re-construction.

(iv) Rehabilitation and/or re-construction

Rehabilitation and/or re-construction of the project facilities will be inevitable even though the routine and periodic maintenance works are to be carried out properly. Rehabilitation and re-construction works will be carried out exclusively by BWDB following the procedures similar to those for new projects. Also 25% of earthworks for the planned rehabilitation or re-construction will be given to the LCSs.

(2) Responsibility for O&M

Considering that the North Unit of the Kurigram FCD/I project may be implemented simultaneously, O&M responsibility should be given to a circle with name and style as Kurigram O&M Circle stationed at Kurigram. One Executive Engineer for the South Unit and another Executive Engineer for North Unit, may be posted for the execution of the required O&M works under the existing O&M Office of North Western Zone at Rangpur, O&M Division of BWDB.

After completion of the project works, the project facilities will be officially transferred from the Project Implementation Office (PIO) to the Kurigram O&M Circle. The O&M circle will be responsible for not only routine and periodic maintenance of the project facilities but also emergency maintenance and rehabilitation or reconstruction. Terminal irrigation facilities (LLPs and terminal canal systems) will be operated and maintained by water user's cooperatives at their own costs.

(3) Mobilization of local resources

For sustainable O&M, local resources should be mobilized. Water rate for irrigation will be collected from the beneficiaries through BWDB or appropriate agency as per decision of the Government. The collected water rate for irrigation will be exclusively utilized for O&M of the irrigation intake structures and irrigation / drainage canal systems. Land development tax (for improvement of flood embankment and regulators) is unlikely to be collected under present circumstances. There is a need to mobilize the local resources in this aspect not only to ease the burden of BWDB but also to ensure the long-term viability of the project. This requires a participatory management approach. Therefore, all possible means should be tested during the implementation of the project. At least, routine maintenance of flood protection facilities will be entrusted to Union administration with technical supports of BWDB.

(4) Institutional Framework for O&M

In order to improve inter-agency coordination, clear and definite "Government Order" with definite routine responsibilities is necessary, and participating agencies at the central government level must monitor their field activities as part of their routine duty. O&M responsibilities at the field level of the related government offices and local authorities needs to be elaborated with clear demarcation. These should be examined and decided at central level during the implementation stage. The BWDB's O&M Circle should ensure close cooperation with the related government offices and local authorities to provide adequate services and help to the beneficiaries in order to get them involved in the O&M. The PBCs is expected to serve as an effective benefit monitoring organization, extending its functions to ensure the sustained O&M of the project facilities.

Suggested demarcation of responsibilities of participating agencies for O&M is given on Fig. XVI.3.1, and relationship between the Kurigram O&M Circle and other related agencies / public bodies under O&M stage is illustrated on Fig. XVI.3.2.

(5) Irrigation Water Management

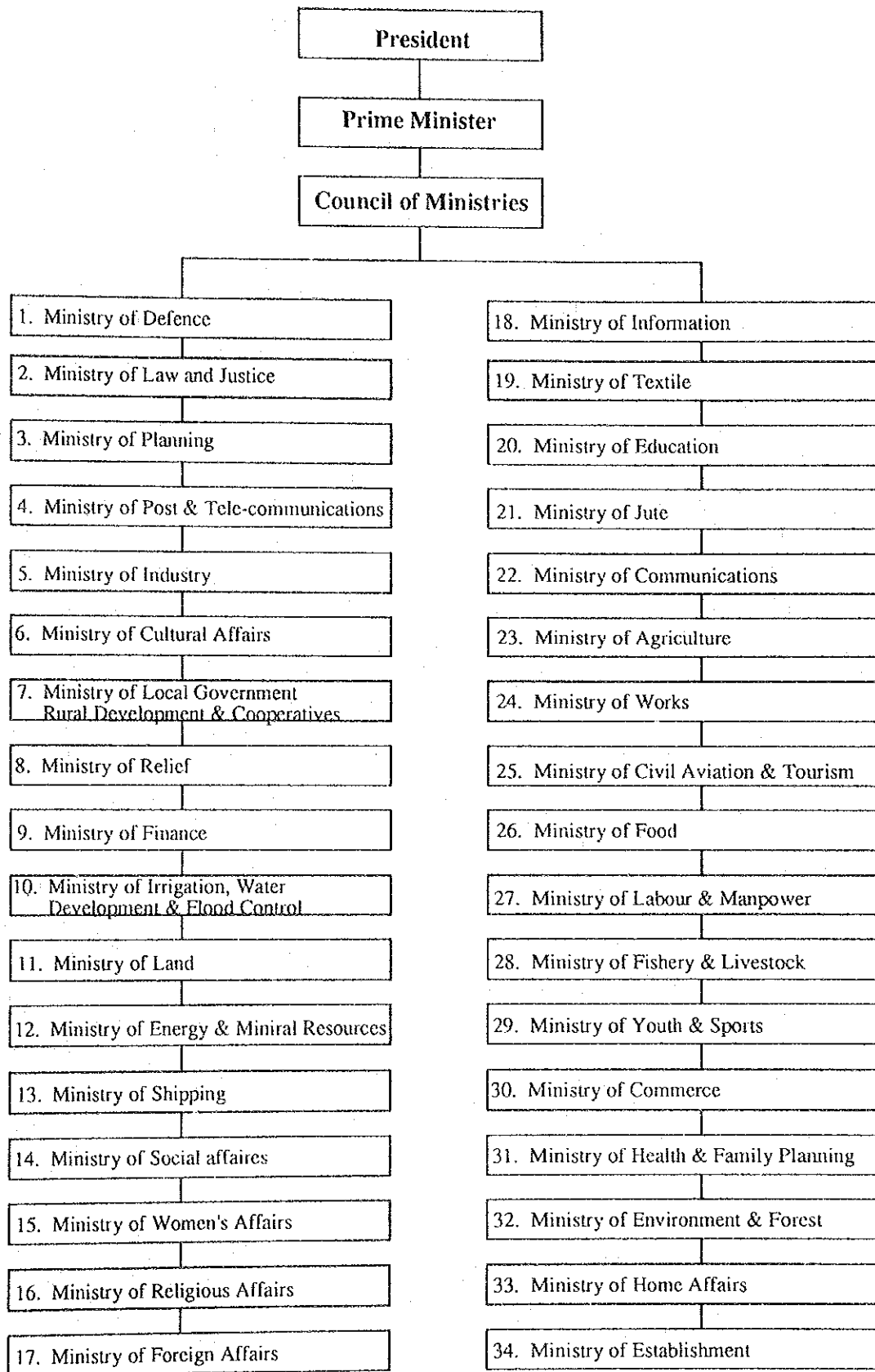
In the surface irrigation system, irrigation water will be diverted from the Dhalra river through an irrigation intake structure and will be distributed through the canal system which fully utilizes the existing drainage channels and creeks. Farmers will pump up the water by LLPs from the canals. The Intake structure and main canal networks will be operated and maintained by BWDB, while O&M of the terminal blocks irrigated by LLPs will be made by farmer groups. Coordination between BWDB and each farmer group will be indispensable for effective use of irrigation water for cultivation.

In the Study area, each Thana office has "Irrigation Management Committee (IMC)" to coordinate among the related agencies in development and O&M of irrigation schemes and also to make necessary guidance on irrigation practices to the farmers. Various agencies (DAE, LGED, BRDB, BADC) at Thana level are involved in the IMC. It is expected that after completion of the surface irrigation system, BWDB will also participate in the IMC together with the representatives of the Project Beneficiaries Committee (PBC) to discuss O&M issues and water management practices for cultivation.

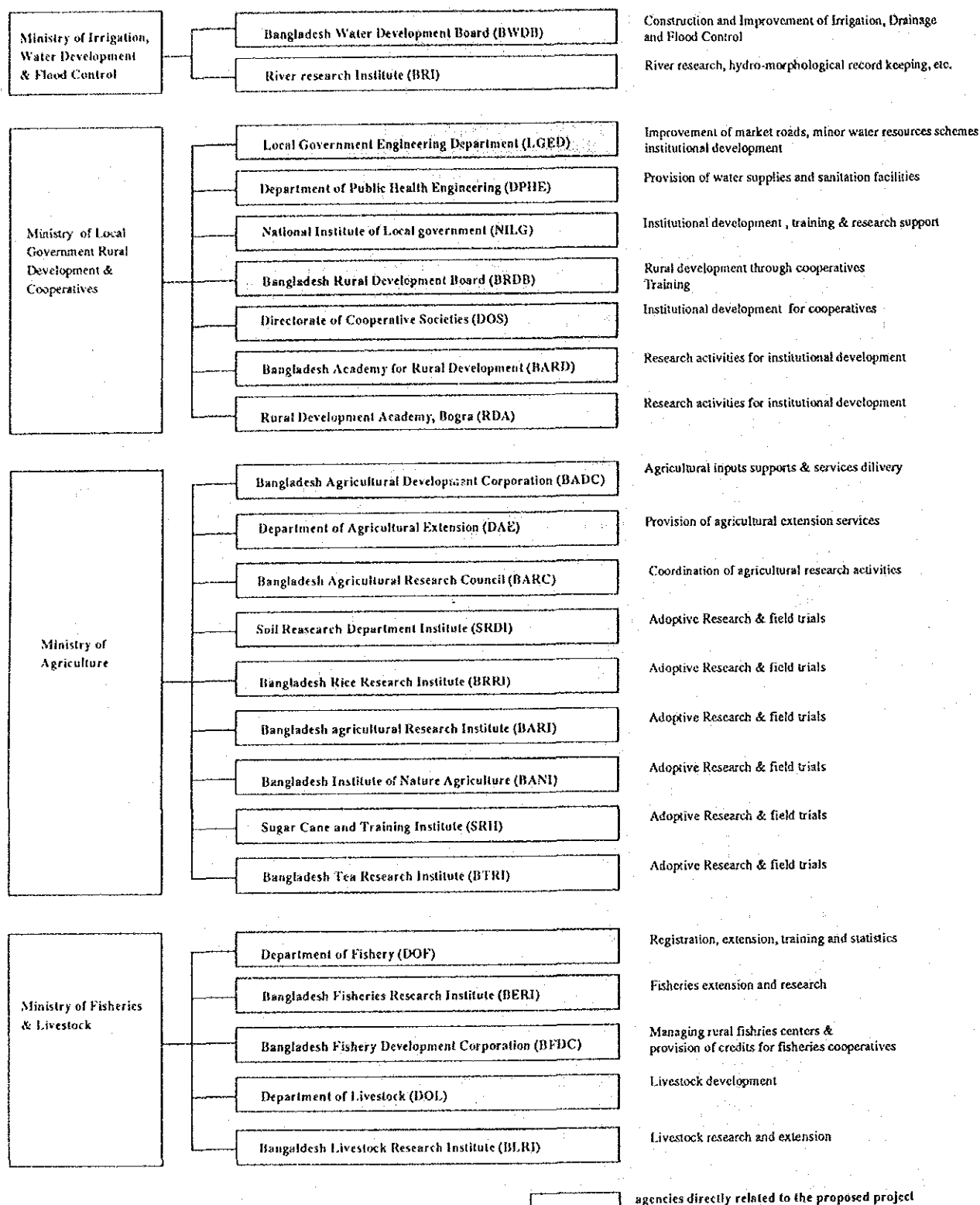
Table XVI. 1.1 Staff Strength and Budget Allocation of Prospective Participating Agencies (1992/93)

Item	Unit	BWDB	LGED	BRDB	DAE	DOF	DOL
1	<u>Nos. of Total Staff</u>						
	in whole organization	18,032	9,650	1,965	23,954	3,783	7,605
	in Kurigram district	49	86	28	412	58	65
2	<u>Total Budget Allocation for 1992/93 (whole Organization)</u>						
	<u>(Development Studies)</u>						
	Nos. of approved projects	29	7	2	1	6	3
	Estimated total costs	5,438	690	55	-	250	79
	Total allocation for 1992/93	943	113	9	3	35	20
	<u>(Implementation)</u>						
	Nos. of approved projects	28	17	10	8	15	8
	Estimated total costs	39,571	22,488	4,352	7,257	8,638	4,082
	Total allocation for 1992/93	4,500	3,254	587	127	895	731

Source: Annual Development Plan (ADP) / Respective Divisions and/or Departments



**Fig. XVI.1.1 Government Organization : Bangladesh**



**Fig. XVI.1.2 Main Government Agencies related to the Project**

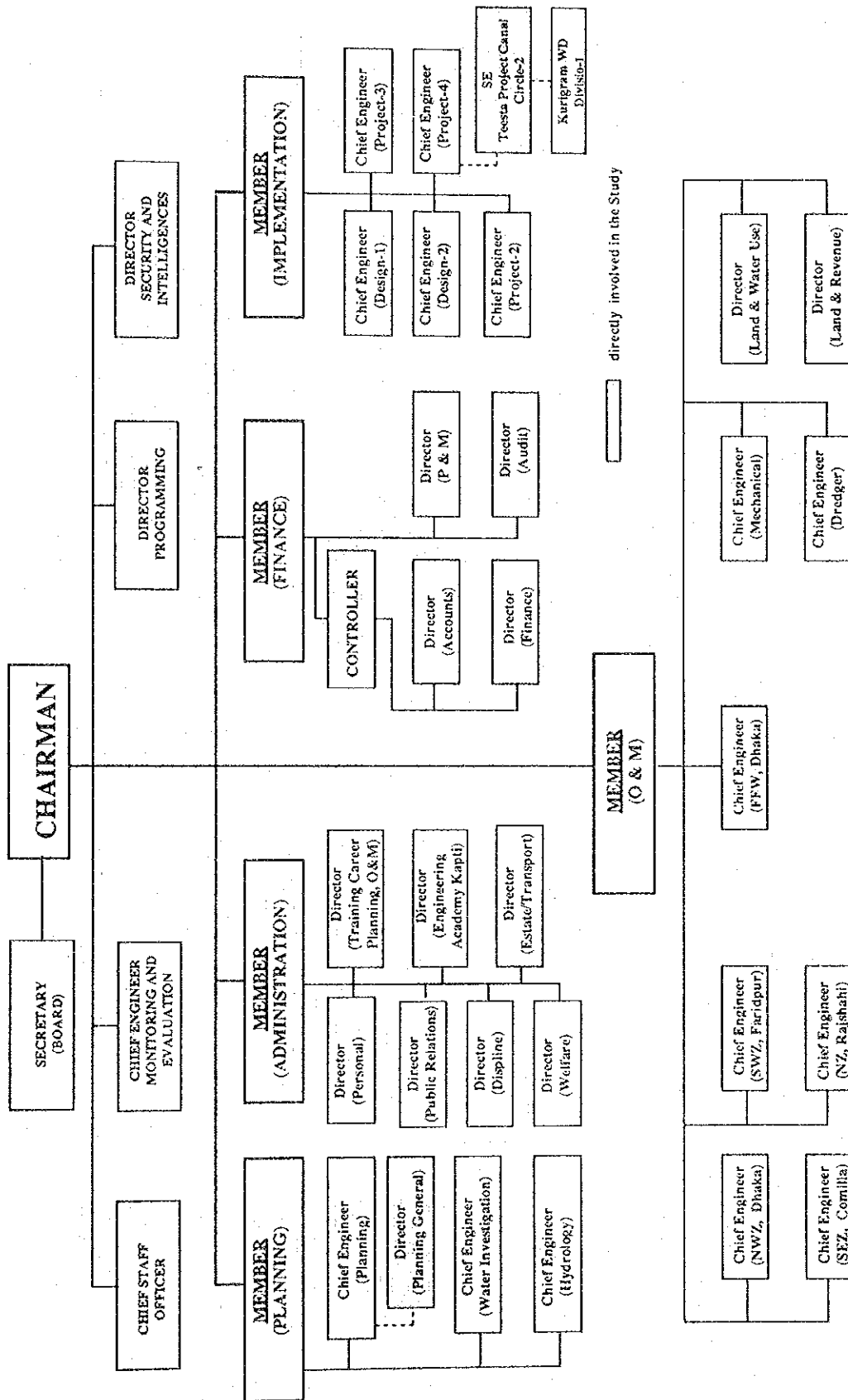


Fig. XVI.1.3 Organization Chart of BWDB



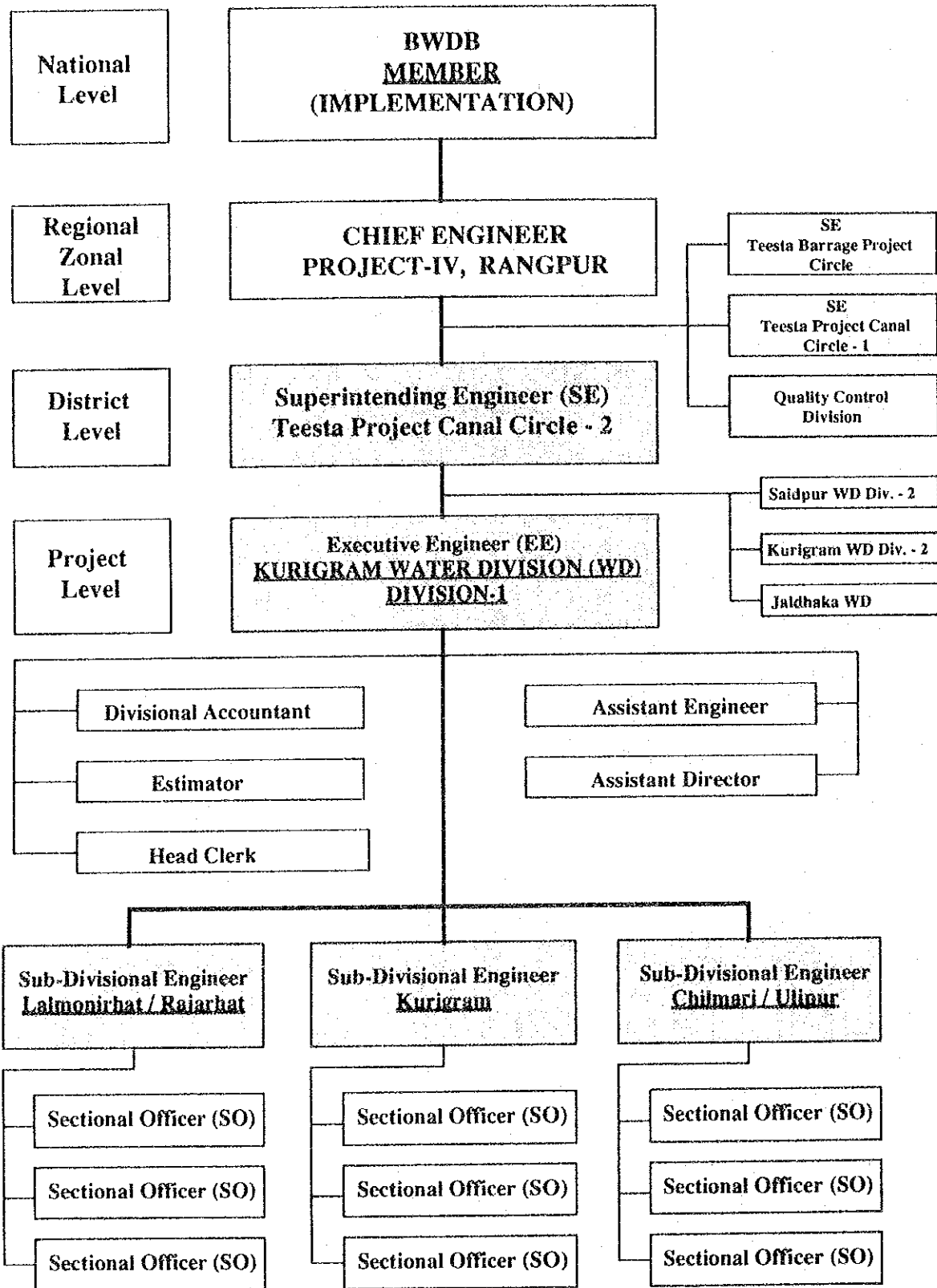


Fig. XVI.1.4 Organization Chart of Kurigram WD Division-I

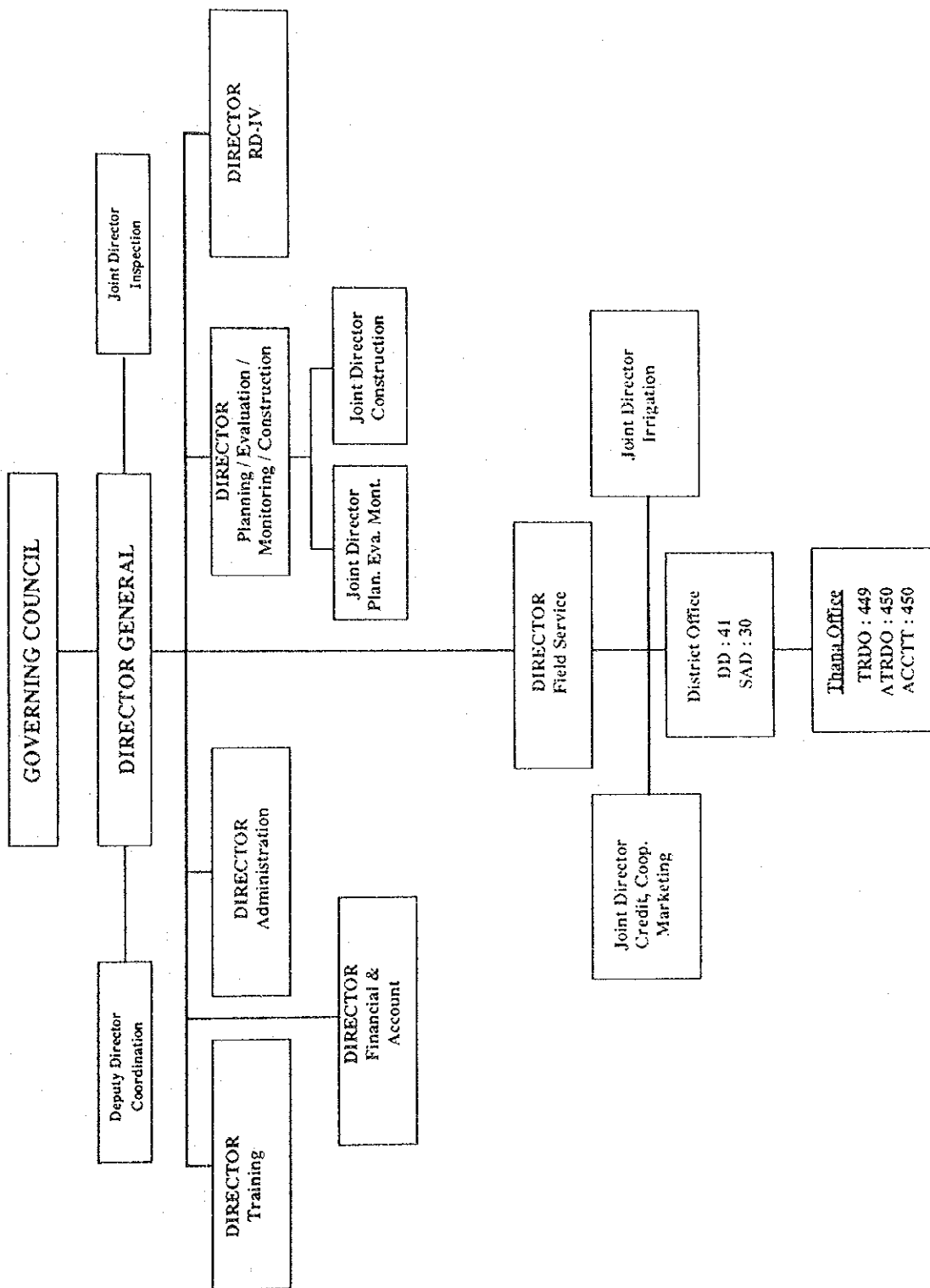


Fig. XVI.1.5 Organization Chart of BRDB

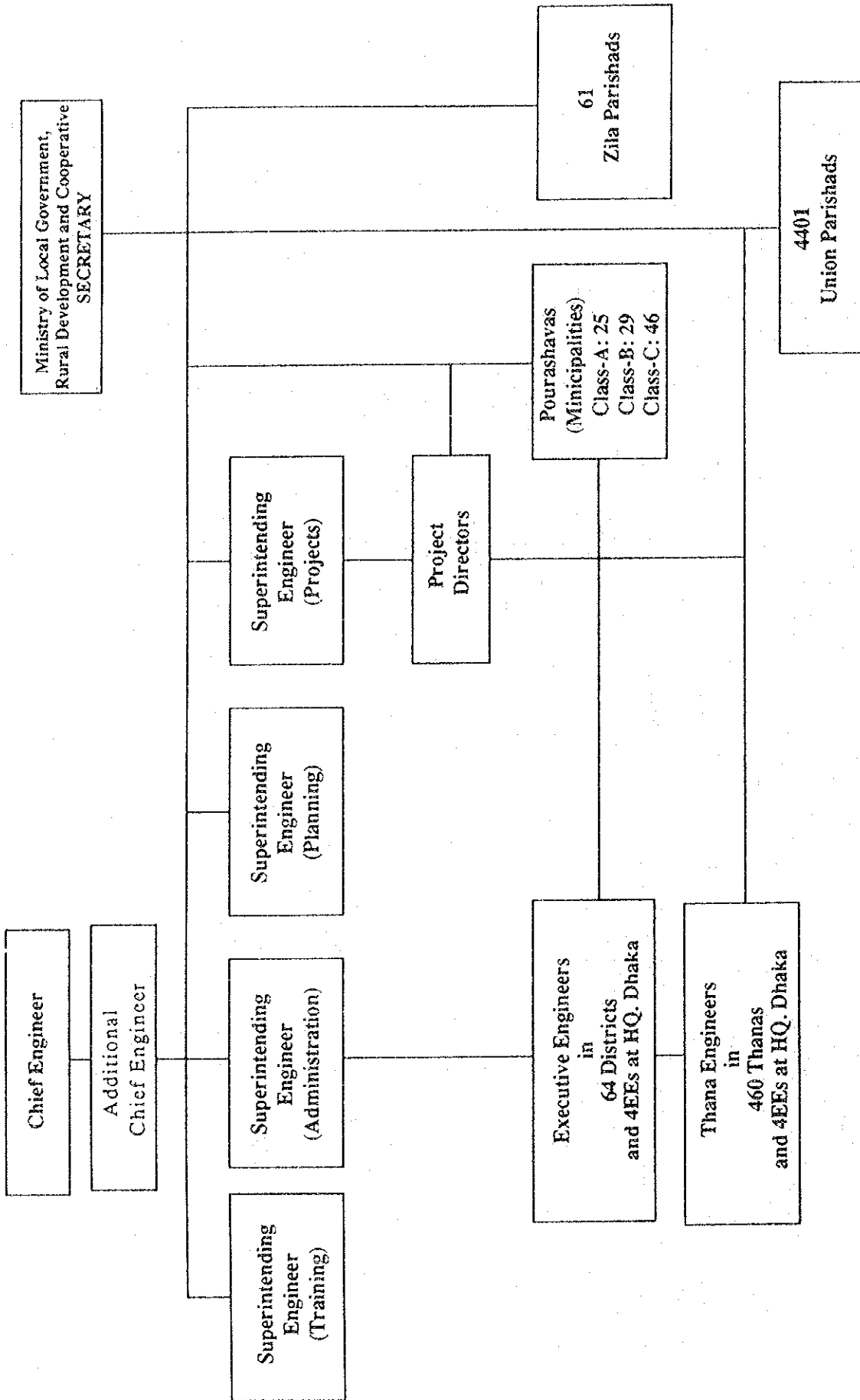


Fig. XVI.1.6 Organization Chart of LGED

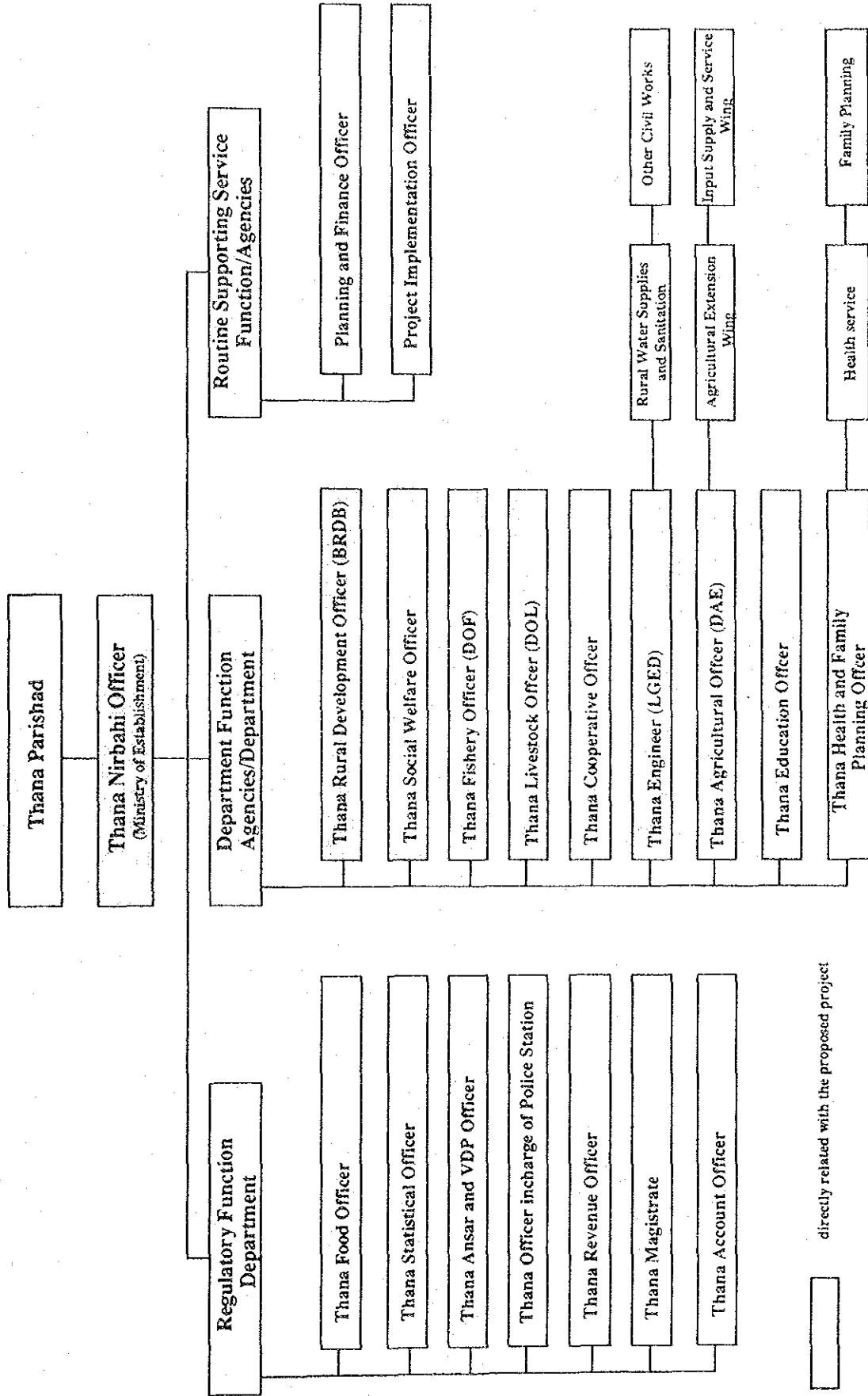


Fig. XVI.1.7 Organization Chart of Thana Administration

<u>Project Parts</u>	<u>Major Components</u>	<u>Executing Agencies</u>
<u>Flood Control and Drainage Improvement</u>	(1) Rehabilitation of Embankment and Regulators	BWDB
	(2) Desilting of Drainage Channels and Khal	BWDB
	(3) Organizing O&M Groups	BRDB
<u>Irrigation Development</u>	<u>Main Irrigation System</u>	
	(1) Irrigation Intake / Canal System	BWDB
	(2) Organizing O&M Groups	BRDB
	<u>Demonstration Farm</u>	
	(1) Construction Works	BWDB
	(2) Organizing Farmer Groups	BRDB
	(3) Demonstration and Extension Services	DAE
	<u>Command Area Development (CAD)</u>	
	(1) Organizing Farmer Groups for CAD	BRDB
	(2) Arrangement of Credit	BRDB
	(3) Supply of LLPs	Private Sector
	(4) Engineering Supports for Construction / O&M	LGED
	<u>Groundwater Development</u>	
	(1) Organizing Farmer Groups	BRDB
	(2) Arrangement of Credit	BRDB
	(3) Supply of STWs / DTWs	Private Sector
	(4) Engineering Supports for Construction / O&M	LGED
	<u>Extention Services</u>	
	(1) Irrigation Crop Management	DAE
	(2) Inland Fisheries	DOF
	(3) Duck Raising	DOL
<u>Rural Infrastructure Improvement</u>	(1) Construction of Bridges crossing Irrigation Drainage Channels	LGED
	(2) Organizing O&M Groups	BRDB

Fig. XVI.2.1 Project Components and Executing Agencies

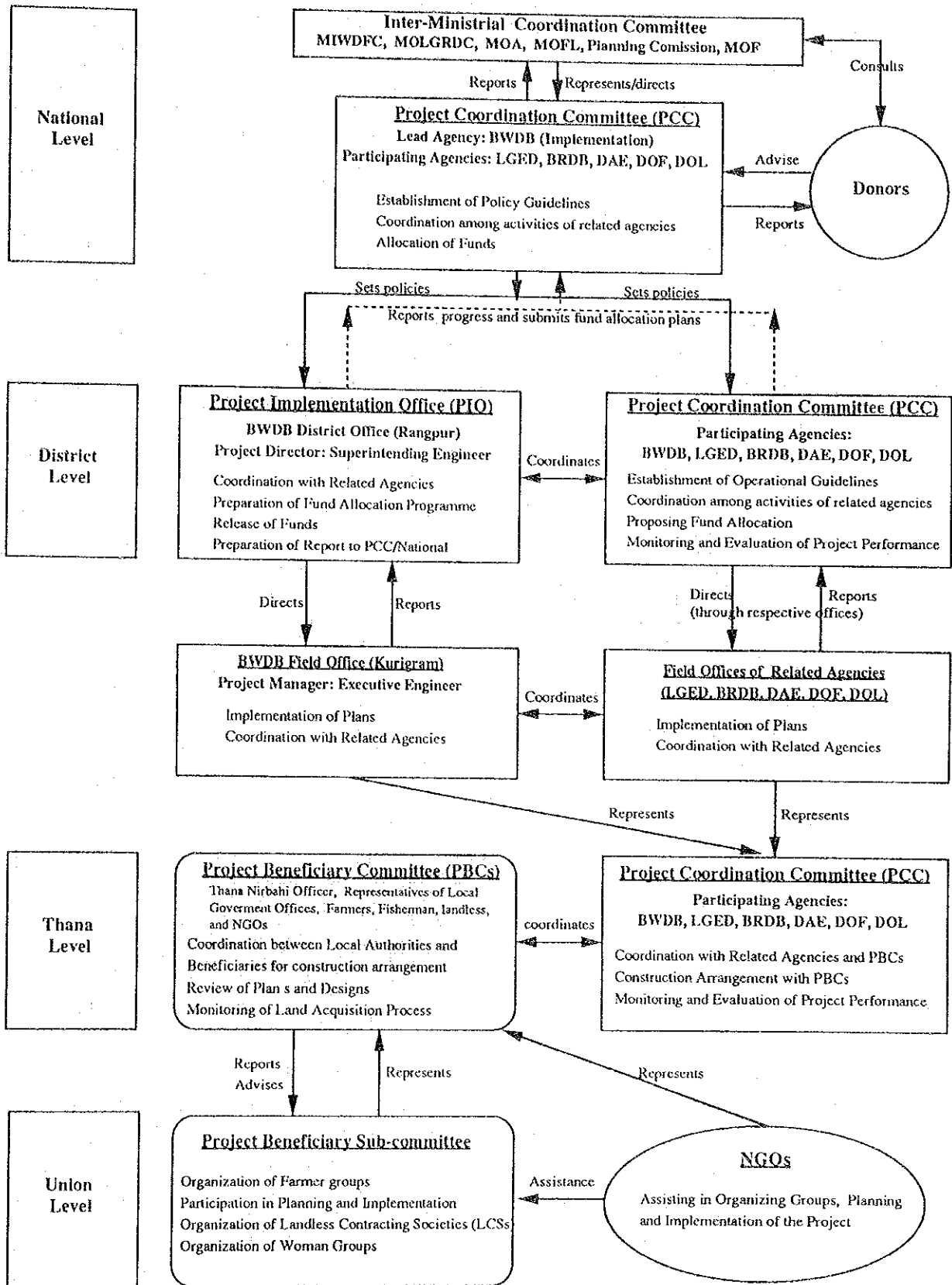


Fig. XVI.2.2 Project Organization and Management (Implementation Stage)

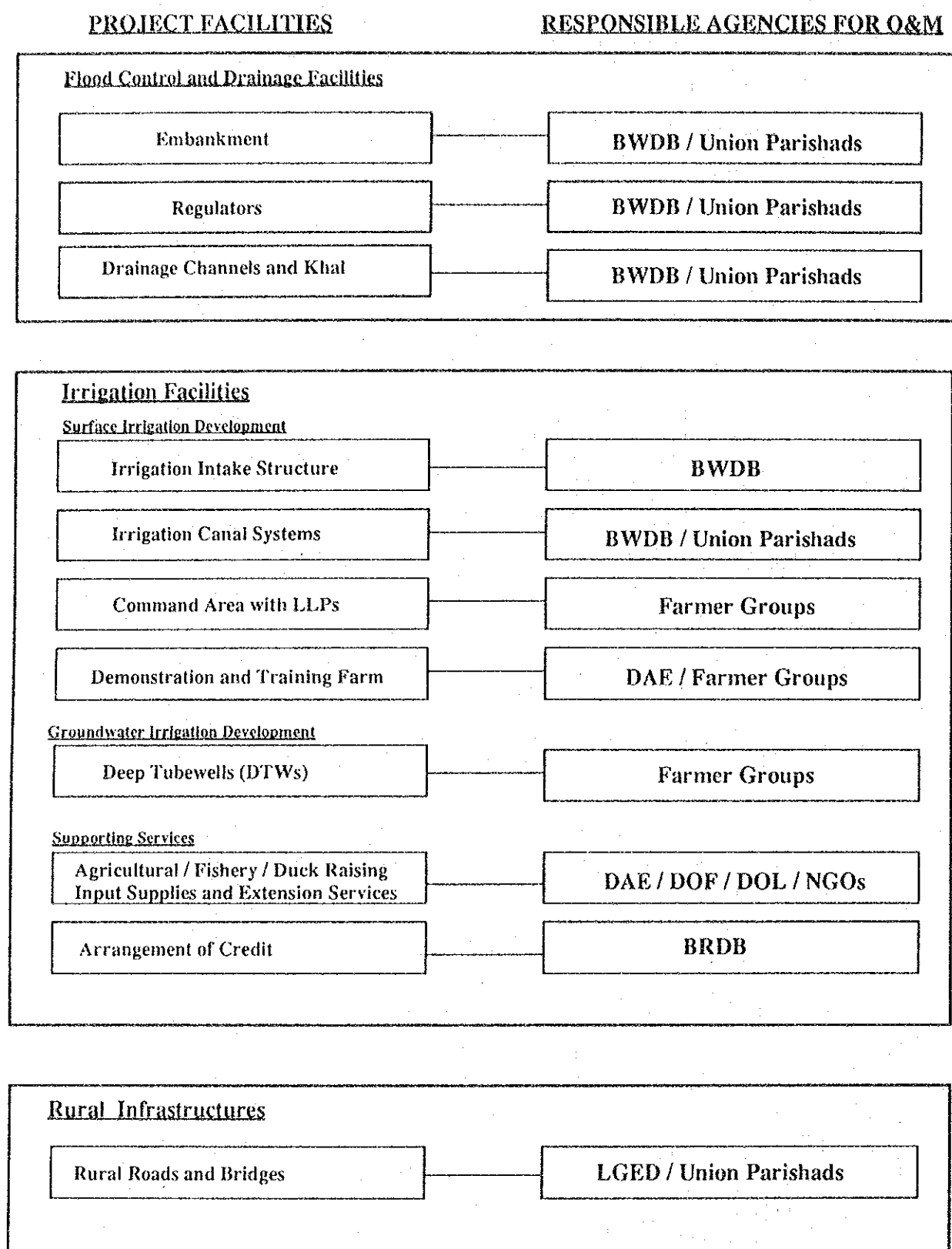


Fig. XVI.3.1 Project Components and Responsible Agencies for O&M

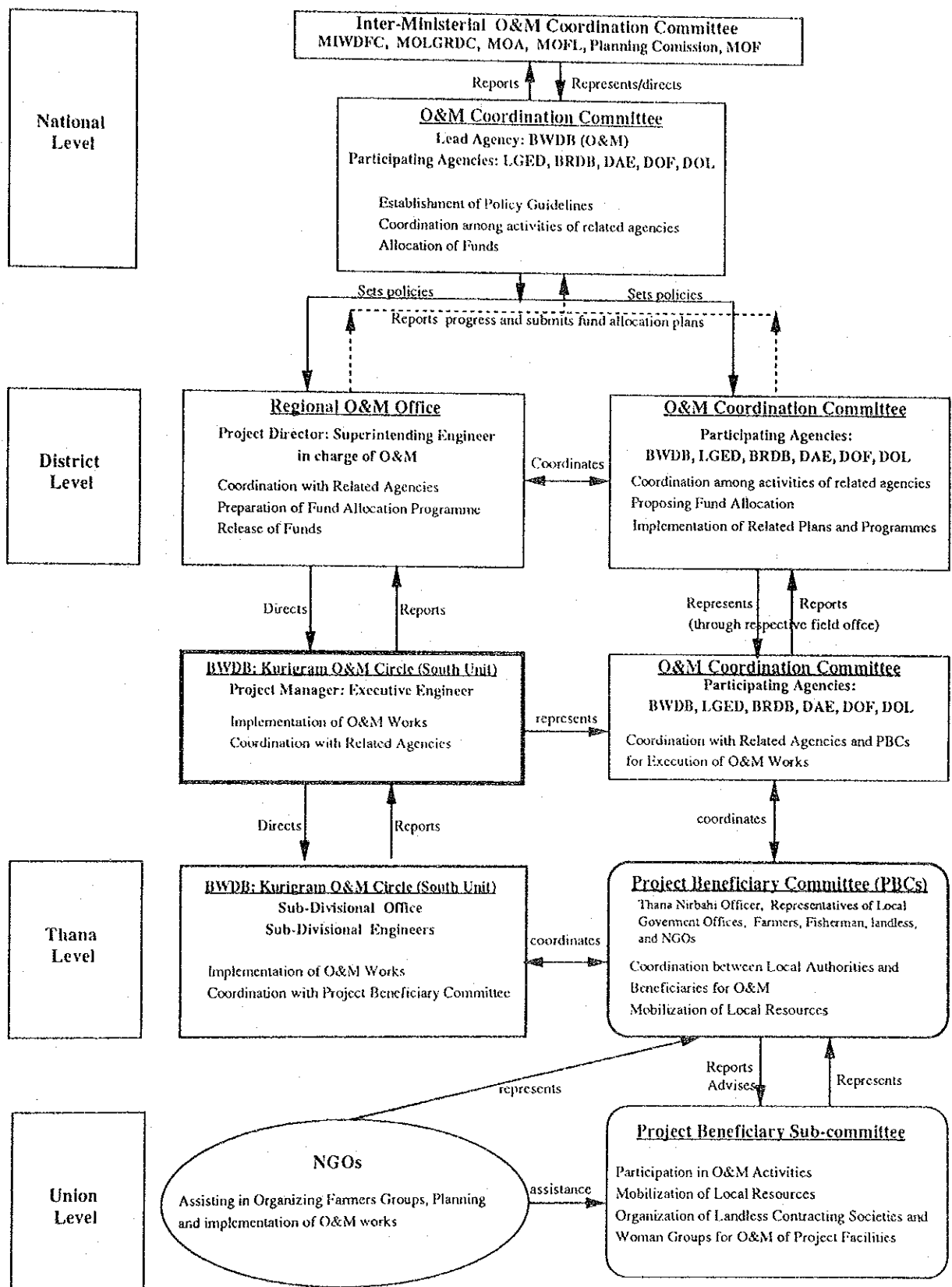


Fig. XVI.3.2 Project Organization and Management (O&M Stage)



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