BASIC DESIGN OF WATER SUPPLY FACILITIES

1. River Intake Facilities

The river banks on both sides of the intake point have a slope of 1/4 (16°). The topsoil layer of this sloped area is relatively thin with an approximate depth of 20cm, and in some places exposed lava outcrops may be seen. The bedrock of the area is composed of tuff. A very narrow strip of level land ranging in width from 3-10m extends along both banks. The same are underlain by bedrock at a depth of only 2-3m below ground surface. Boulders with diameters from 1.0-1.5m are scattered in the river.

The intake site was selected for the following reasons:

a) The intake site is situated at the minimum possible distance from the Project site. Construction costs of water distribution facilities will thus be minimized.

b) A suitable bedrock foundation extends across the entire breadth of the riverbed facilitating construction of an intake weir at minimal cost.

c) As the land from the intake point to the irrigation area is entirely owned by the government it will not be necessary to either buy or rent land. For the same reason, although maize is presently cultivated on the proposed water pipeline route which connects the intake tank to the settling pond, payment of crop compensation, etc. will be unnecessary.

d) The site selected has sufficient level area at the end of the water pipeline to allow for installation of a settling pond, pump station, distribution tank, and necessary other facilities.

e) The Kandara Road which runs along the Project area is asphalt paved and therefore will facilitate operation and management of the above mentioned facilities and other related structures.

f) The electric power line runs along the Kandara road, and thus service wire will be easily facilitated.

g) The existing access road which at present extends from the river terrace to the intake point will facilitate transport of construction materials to the river.

The intake weir will be located at elevation 1,508.5m and will be of concrete construction built on bedrock. The proposed structure and scale of the weir is:

- Height	4.00m
- Length	20.00m
- Crest width	1.00m
- Bottom width	4.00m
- Upstream slope	1:0.0
- Downstream slope	1:1.0
- Concrete volume	approx 500m^3
- Gate	2.00m x 3.00m
- Riverbed protection	Upstream 5.0
	Downstream 10.0
- Riverbed elevation	EL 1,508.50m
- Crest level	EL 1,511.50m
- Normal water level	EL 1,511.00m

2. Intake Pump and Introduction Pipe

As previously discussed, the intake pump will be installed in the intake tank. The intake tank will be constructed on a level area of the left bank located 20m upstream from the intake weir. The structure will be of concrete with dimensions 3.0m x 3.0m x 5.0m. An intake installed in the riverbed will convey water to the tank at the lower front face of the structure. The tank will be divided into 2 sections, the first of which contains the inflow control valve and the latter of which acts as a temporary reservoir and contains a submerged pump to pump water into the settling pond. To facilitate pump inspection and cleaning of the intake tank a manhole will be installed.

The dimensions of the proposed intake tank are:

- Dimension	3.0 x 3.0 x 6.0m deep
- River elevation	EL 1,509.00m
- Normal water level	EL 1,511.00m
- Height of intake	EL 1,508.80m
- Pond floor	EL 1,508.00m

Inside the intake tank a pump will be installed. A submerged vertical-type motor-driven pump is proposed as the intake pump in consideration of the following factors:

a) Water level fluctuation of the river is comparatively slight, at about 4.00m with a low water level of EL 1,509.00m and a high water level of EL 1,513.00m to an average level of EL 1511.00m.

b) The design intake discharge required to irrigate the Project area is as slight as 1.2m^3/min (0.02m^3/s) and the same volume is required for only 5-6 months in a year. At other times, the required intake is only 1/2 to 1/3 of the same.

c) There is only a limited area of level space along the narrow strip of the riverbank in the vicinity of the intake point.

d) The selected pump provides maximum efficiency and ease of operation under site conditions.

e) Costs of construction, pump equipment, electrical supply, etc., are minimized.

The main specifications of the proposed submerged motor pump are:

- Lowest suction surface	EL 1,509.00m
- Discharge water surface	EL 1,556.00m
- Net Head	47.00m
- Loss of head	8.0m
- Suction side	1.0m
- Discharge side	7.0m
- Total head	55.00m
- Theoretical horsepower	14.7kW
- Shaft horsepower	21kW (efficiency: 70%)
- Motor input	25kW (motor efficiency: 85%)

Water pumped up from the intake suction tank by the submerged motor pump will be conveyed to the settling pond via a 6" (15cm) diameter iron pipe. The level distance between these two points is 270m with a difference in height of 44m and an inclined distance of 274m. The average incline of the area is 10°.

The slope is composed of an extremely thin layer of topsoil (approximately 20cm) beneath which lies lava deposits. For this reason the pipeline will be laid along the ground surface. The pipe will be castiron and will be laid on a bed of concrete thrust blocks to avoid displacement. To prevent backflow of water inside the pipe in the event of pump failure, etc., a stop valve will be placed in the mouth of the pipe leading into the intake tank. At the opposite end, where water is discharged into the settling pond, the pipe will be divided into two branches, each leading to a separate settling pond.

3. Settling Pond

Two settling ponds, each with an effective capacity of 420m^3, will be installed and the sedimentation period for both will be 24hrs. Dimensions of each pond will be 20m x 15m x 2m (600m^3), although only 1.40m of water is useable. The bottom of the pond will be inclined and a drain installed at the lower end. The latter will be connected to a drainage pipe and automatically controlled by a valve to discharge sediment from the pond.

4. Distribution Pump

The suction tank structure is:

- Dimension:	4.00m x 5.00m x 3.00m
- Bottom elevation	EL 1,553.0m
- Suction water surface	EL 1,554.0m

The pump for the suction tank will be installed at the top of the same while the pump controls will be located seperately in the pump shed. Pump type and dimensions are:

- Type	Single suction volute pump
- Capacity	0.020m^3/s (1.2m^3/min)
- Actual head	19m
- Total head	20m
- Motor input	9kW

The specifications of the distribution tank are:

- Quality	Acrylic resin
- Dimension	3m x 5m x 10m (150m^3)
- Foundation	Steel framing, concrete foundation

5. Distribution Pipe

The pipe from the distribution tank will be laid along the ground surface for 60m up to the Kandara Road. The same will thereafter be embedded in the ground, crossing beneath the said road and into the area for the purpose of irrigation and domestic water. From there the said pipe will branch in two directions, one main pipe extending to the east up to the reservoir tank for domestic water and the other extending south along the existing road. Pipe used within the Project area will be polyvinyl chloride embedded type. The projected pipe lines for water supply are tabulated below:

PROJECT PIPE LINES FOR WATER SUPPLY

	Length (m)	Scale (ø) (mm)	Remarks
Main Pipe			
- North-south line	500	40-75	existing farm
- East-west line	860	75-150	scion garden, expt. farm, nursery building
Branch Pipe			
- Existing farm	600	40	diverted from north-south line
- Experimental farm	1,850	50	diverted from east-west line
- Scion garden	120	50	" "
- Nursery	430	40	" "
- Domestic water 1/	200	50	" "

1/: Domestic water for buildings

6. Domestic Water Supply Facilities

The domestic water source will be intaken from the terminal of the east-west main pipe line, and distributed to each building and facility through a water processing facility including a purifier, water tank, lift pump and elevated distribution tank.

The following buildings and facilities will be supplied with water for domestic use.

- Main building
- Nursery workshop
- Hostel

The specification of the facilities are tablated below.

DOMESTIC WATER SUPPLY FACILITIES

Facilities	Structure	Dimension	Remarks
1. Intake	Hard vinyl chloride	Q=1.6ℓ/s ø 50mm	from main pipe terminal to purifier
2. Purifier	Castiron	Capacity $50m^3$/day	projected water requirement $29m^3$/day
3. Water tank	Reinforced concrete	3m x 3m x 3m	
4. Lift pump	Centrifugal	Q=0.096m^3/min H=15m	
5. Distribution tank	Acrylic resin	5m x 5m x 2m ($50m^3$)	projected water requirement $29m^3$/day