Technical specification

The purpose of this water treatment plant is to treat river water in order to produce water turbidity less than 5 NTU. For this purpose following main units are considered:

- Flash mixer unit
- Flocculation unit
- Sedimentation unit
- Sand Filtration unit
- Water storage and pump station unit
- Alum solution preparation and dosing unit
- Pre chlorination and post chlorination unit

Chlorine will be used as disinfectant. It can be dosed both for pre-chlorination to flash mixing, located upstream from flocculation, and for final disinfection prior to filtered water storage and distribution.

Pre-chlorination shall take place when e.g. algal blooms and infestation with water hyacinths are identified in the raw water.

Flash mixing shall provide sufficient agitation to disperse the chemical thoroughly in water stream. Design detention time of flash Mixer is 30 second and the velocity gradient is more then 6001/s. The reagent shall fed in to the highest turbulence zone. Raw water is transferred in two flash mixers (one in operation and one in standby) by pipe with 1200 mm diameter. Water will exit from flash mixer over the weir and enter to flocculator by 1200mm pipe diameter. The flocculation unit will be based on the use of baffled flocculators. Energy is transmitted to the water in each compartment from the head loss across orifices in the entrance baffles and adequate flocculation will be achieved from turbulence caused by the 180° turn at each end of the baffle. Four flocculation tank will be considered. Water from flash mixer is transferred by gravity with pipe DN1200mm to Division box and then directed to each flocculation tank.

The Sedimentation unit will be based on the use of circular clarifier. Clarifiers will each have a sloping floor towards the basin center. The clarifiers will be equipped with suitable sludge pockets in the basin center to collect, thicken and withdraw sludge. Discharging will be by gravity and manually and visually controlled. Drawn off sludge will be transferred to a Mud pit tank.

The clarified water will be drawn off from the surface of the tanks through v-noteh weirs into evenly spaced collecting troughs.

These will be complete operational packages with local electric (MCC) and control panels for manual and automatic operating modes located on the clarifier bridge.

After clarification the clarified water will flow to rapid gravity sand filters for removal of residual suspended solids. The filtration system shall consist of eighteen individual filters, which can be operated independently via motorized valves fitted with electric actuators. Filter capacity nominal design is based on use of sixteen filters in operation plus one in backwash and one standby and assuming on average ten filters to be backwashed daily.

The combined surface area of the filters is 882 m^2 total (49 m^2 per filter). Particular attention shall be paid on ensuring that optimum effective grain size (approximately 0.8 mm) and uniformity coefficient ($d60/d10 < 1.4$) quartz filter sand is used.

Each filter will be equipped with one independent filter control system allowing even distribution of the unfiltered water between operating filters.
The influent- controlled declining rate filter systems are the simplest of all filter systems. No rate of flow controllers or flow splitting devices are required
The hydraulic gradient is allowed to vary throughout the filter run to adjust for the increase in head loss through the filter system when the hydraulic gradient become too high one filter unit is backwashed. An overflow weir will be placed in the filter effluent structure to maintain positive pressure in the filter bed at all times.

Filter sand will be supplied either as factory prewashed, meaning that sand filters need only mild backwash before take into use or as non-prewashed, meaning that sand shall be efficiently backwashed in the filters at least three times before take into use. After each of these pre-washes 3-5 cm of fine sand on the sand bed surface shall be scraped off and removed from the filter. In practice this means that the filters have to be filled initially with about 10 % excess amount of sand in order to assure the required sand bed thickness for filter normal operation.

The filter washing includes at least three main phases:

- First backwash with filtered water at a constant rate of 40 m^3/filter-m^2/hr.
- Second air scour at a constant rate of 60 m^3/filter-m^2/hr.
- third final rinsing with filtered water at a constant rate of 40 m^3/filter-m^2/hr

Dirty water collected from filter backwash shall be recovered in order to minimize net loss of water. For this purpose a backwash water recovery tank with net water volume of about 600 m3 to collect and store water of two full backwash.

Water from the recovery tank is pumped to the flash mixing tanks, located prior to Floculators.
After filtering and final disinfection water is divided by gravity flow between four concrete chlorine contact and storage reservoirs. These reservoirs act as storage buffers before transferring and distribution to water network. In addition some water is pumped by designated pumps for use as service water in the water treatment plant in chemical make down or as general purpose water. Filter backwash water and Chlorine boosting water will be taken from them as well.
For final disinfection chlorination shall be ensured after filtration and with a contact time of not less than 30 minutes. The free available chlorine concentration after the contact tank shall be not less than 0.5 mg Cl_2/l.