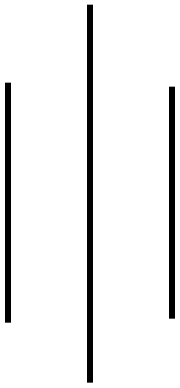
WATER SUPPLY ENGINEERING

(INTAKES)



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5.1 Definition of intakes

A structure placed in a water source to permit the withdrawal of water from the source and discharge it into an intake conduit through which it flows to the treatment plant is called intake. Intake consist of two sections First, intake conduit with the screen at the inlet end and valve to control the flow of water. Second, a structure permitting the withdrawal of water from source and housing and supporting intake conduit, valves, pumps etc. The structure may be of stone masonry or brick masonry, R.C.C, or concrete blocks. The structure is constructed watertight and is designed to resist all forces likely to come upon it including the pressures due to water, wave action, the wind, floating debris, annual rainfall, geological formations.

5.2 Site selection of intakes

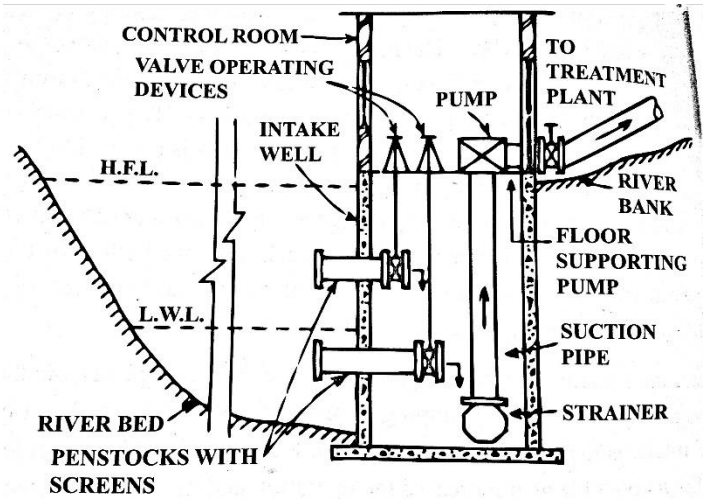
- Location:
- Should be constructed on the upstream side.
- Should never be located in the curves in the river or at least on sharp curves in meandering rivers.
- Should never be constructed near the navigation channel.
- Should be constructed such that it is accessible during the flood and other time.
- Quantity:
- Sufficient withdrawal of water is permitted.
- Capable to fulfil the expansion water works.
- Quality:
- Purer zone of the source must be selected for intake construction.
- Economy:
- For the reduction in system cost, the intake site is selected near the treatment plant.
- The site must be well connected by the good approach of roads.

5.3 Classification of Intakes

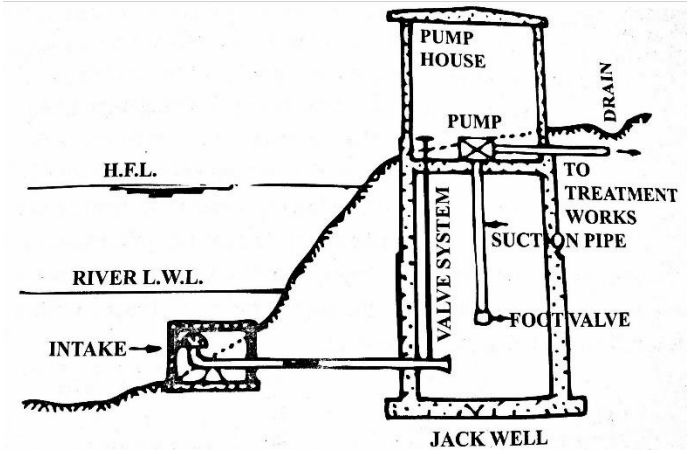
- **Submerged Intake:** Submerged intakes are those intakes that are constructed entirely under water and is commonly used to obtain water from lakes.
- **Exposed Intake:** Exposed intakes are in the form of oil or tower constructed near the bank of the river, or in some cases even away from the bank of the river. It is common due to ease of its operation.
- **Wet Intake:** In wet intake the water level of intake tower is practically the same as the water level of sources of supply. It is also known as jack well or sump well.
- **Dry Intake:** In dry intake there is no water in the water tower. Water enters through the port directly into the conveying pipes. The dry tower is simply used for the operation of valves.

5.4 Characteristics of Intakes

5.4.1 River Intakes:



River Intake



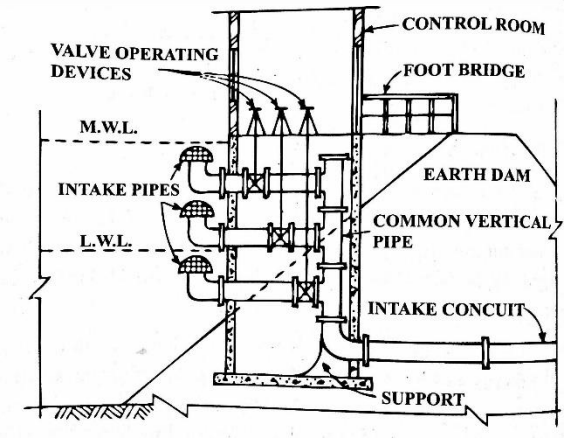
River Intake when river bed is unstable

It is the structure constructed with an objective of withdrawing water from the rivers. It is generally constructed when water is required in large amount for a large community. River intakes are so located that even during the low water level in the river water remains available at the intake in sufficient quantity. It consists of masonry or RCC inlet tower which is provided with several inlets called penstocks. Sometimes approach channel is constructed in the river to lead water from upstream of the river to the intake. The penstocks are provided with valves to control the entry of water through them. The penstocks are provided at different water levels to permit the withdrawal

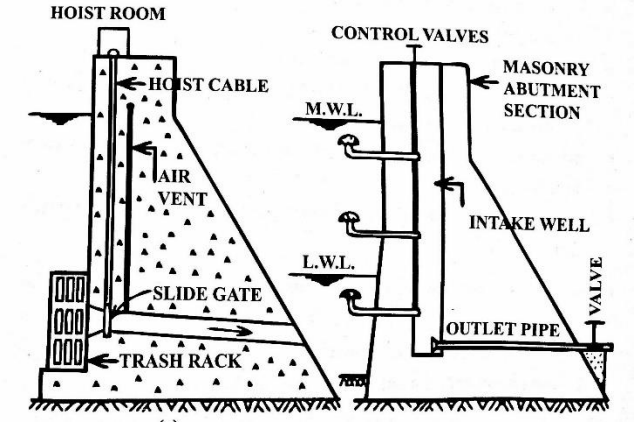
of water when the water level in the river drops. The penstocks discharge water into intake tower. Pumping is required when the level of intake is lower than community.

When river bed is unstable or soft, the foundation is kept slightly away from the river bed. Intake is kept submerged under lowest water level. Weir or channels are constructed to get water in all conditions.

5.4.2 Reservoir Intakes:



Reservoir Intake



Reservoir Intake (Gravity)

In the case of a reservoir created by constructing an earth dam, the intake consists of a masonry or R.C.C intake tower (or intake well) placed near the upstream toe of the dam. The intake tower is connected to the top of the dam by a foot bridge.

Earth dam:

- Made of the earth (or soil) and gravel built up by compacting successive layers of soil.
- Can be constructed to a moderate height to which it depends on foundation material.

- The shear strength of soil plays the vital role in resisting the forces.
- It is cheaper in construction.

Gravity dam:

- Made up of masonry or solid concrete.
- The weight of the water is actually enough to resist the horizontal thrust of water pushing against it.
- The weight of the gravity dam makes it more stable.
- It can be constructed to any height.
- Once built, it needs less maintenance.

Reservoir intake for earth dam

- The intake pipes are at different levels with the common vertical pipe.
- The intake pipe has the fine screen to permit entry of clear water.
- Pipes at different level maintain level of reservoir.
- Intake pipes are provided with valves to control the flow of water.
- The control room is at the top to operate valves.
- Common vertical pipe enters the conduit which carries water to the treatment plant.
- The dry intake tower has pipes fitted inside.

Reservoir intake for gravity dam

- In the case of the reservoir, the type of intake to be provided depends on the type of dam constructed to create the reservoir.
- The reservoir intake for gravity dam consists of an intake created by constructing gravity dam.

The reservoir intake involves two alternative forms of intake works as in figure below:

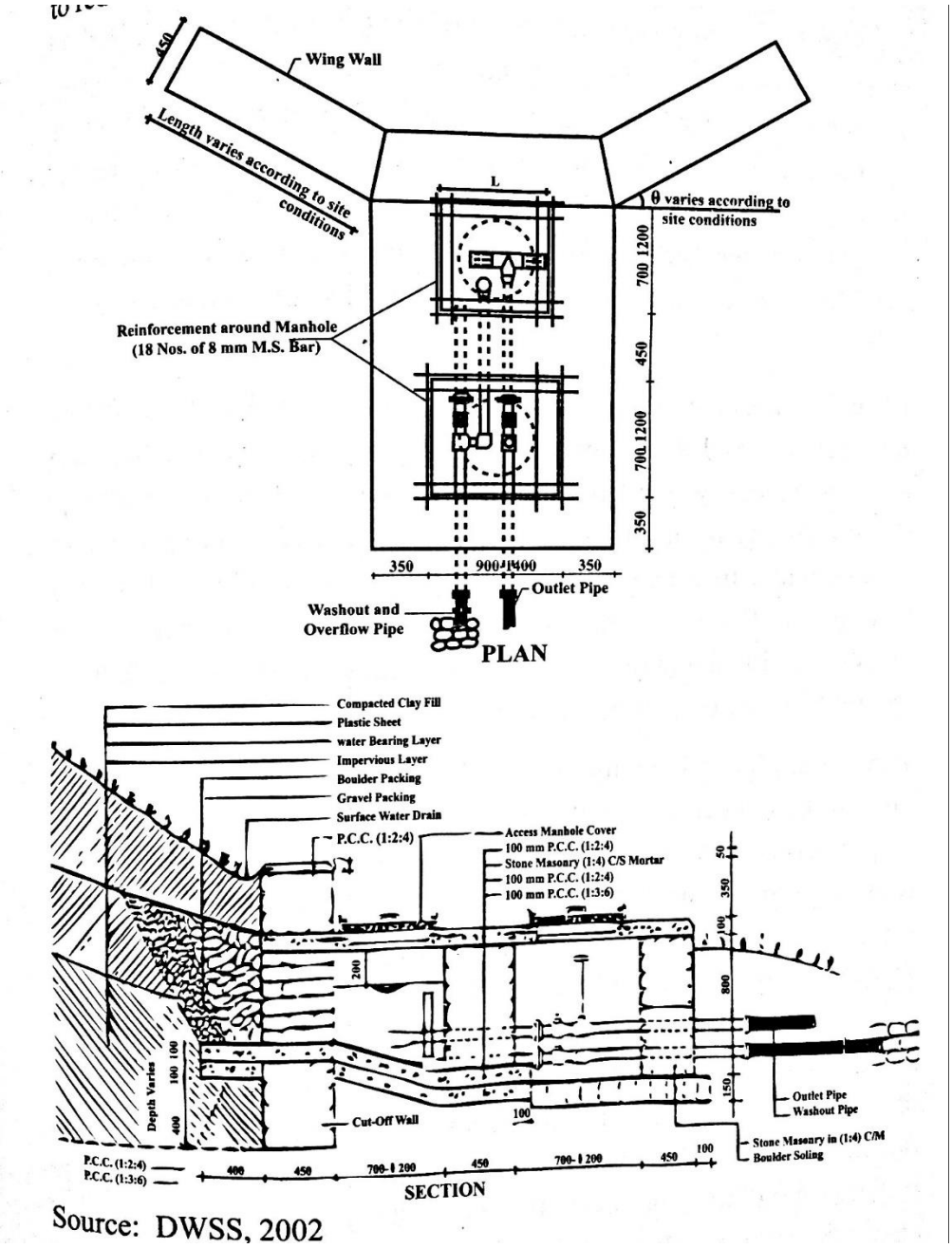
1. Single inlet port:

- The trash rack provided at the inlet check the entry of debris and other floating materials.
- Water enters from the single port which has trash rack.
- The slide gate allows water to flow through trash rack to another supply system.

2. Many inlet ports:

- In this, intake well is provided in the main body of the dam.
- Inlet at various levels enables withdrawal of water even if the level of reservoir water drops.
- Gates and valves are used to control the flow of water.
- Inlet ports have screened openings to prevent debris from entering.

5.4.3Spring Intakes:



Source: DWSS, 2002

Spring Intake

A spring intake is provided to abstract water from a spring source. It also prevents outside water and other sources of pollutants from entering into the water supply system. The intake thus protects the water from getting contaminated.

Selection basis for location of spring intakes:

- The place should be close to the source.
- The place should be above populated or farming areas.
- The place should be above foot path, cattle watering and washing places.
- Places where surface water run-off during the monsoon can be easily drained off.
- Where the immediate surrounding above the spring is not easily accessible to people and livestock.

It consists of two chambers as collection chamber and valve chamber. Collection chamber should be away from the source as far as possible. The base of the collection chamber is made of plain cement concrete to avoid leakage. All walls are made of stone masonry. The heavy structure is avoided to avoid its settlement. In order to reduce the backup pressure, the collection chamber needs to be constructed away from the source. The collection chamber is provided with the wing walls on both sides which divert the water from the source to the collection chamber. The collection chamber acts as sedimentation tank, which removes suspended particles and turbidity. In monsoon, the turbidity of the water is high, so special treatment with sedimentation and filters are needed. As far as possible the treatment work should be avoided to reduce the cost so a pure source needs to be selected. The gravel and packing are done in the water-bearing layer upstream to prevent the coarse material entering the collection chamber. Water-bearing layer is covered with the plastic sheet and clay filling. The outlet pipe fitted with screens is kept at about 10 to 15 cm above the floor to screen out the suspended particles to enter into the transmission main of water supply system. The water contains particle in it which may settle down in the collection chamber as sediments which should be washed out when it reaches 5 cm of the outlet pipe. The washout pipe is carried down the slope to allow the sediments to flow into the nearby drainage system. The overflow pipe is provided in the collection chamber to prevent the backup pressure. The washout valve is operated when washing of the sediments is done in the collection chamber. Mild steel, concrete or stone masonry covers are used to cover the collection and the valve chamber. In the valve chamber, the valves are connected to outlet pipe and washout pipe. During normal operation outlet valve is opened while washout valves are closed but during washing of the sediments from the collection is done it is opened. The vent pipe is provided to outlet pipe to release air pressure. The unions are provided to facilitate the removal of valves during maintenance works.

Protection of spring intakes

- For safe drinking water free of contamination.
- For increasing quality and quantity of water content.
- For prevention of scarcity of water in near future.

Proper drainage should be provided around source to divert the run-off water. Surface run-off must not be allowed to flow into the catchment of springs.

Elements for protection of spring intake:

- Afforestation
- Surface water drain

- Plantation (bush)
- Barbed wire fence
- Concrete covers.
- Retaining walls

Afforestation: Tress are planted above the spring sources allow the water to seep rather than as surface runoff and increase intake water.

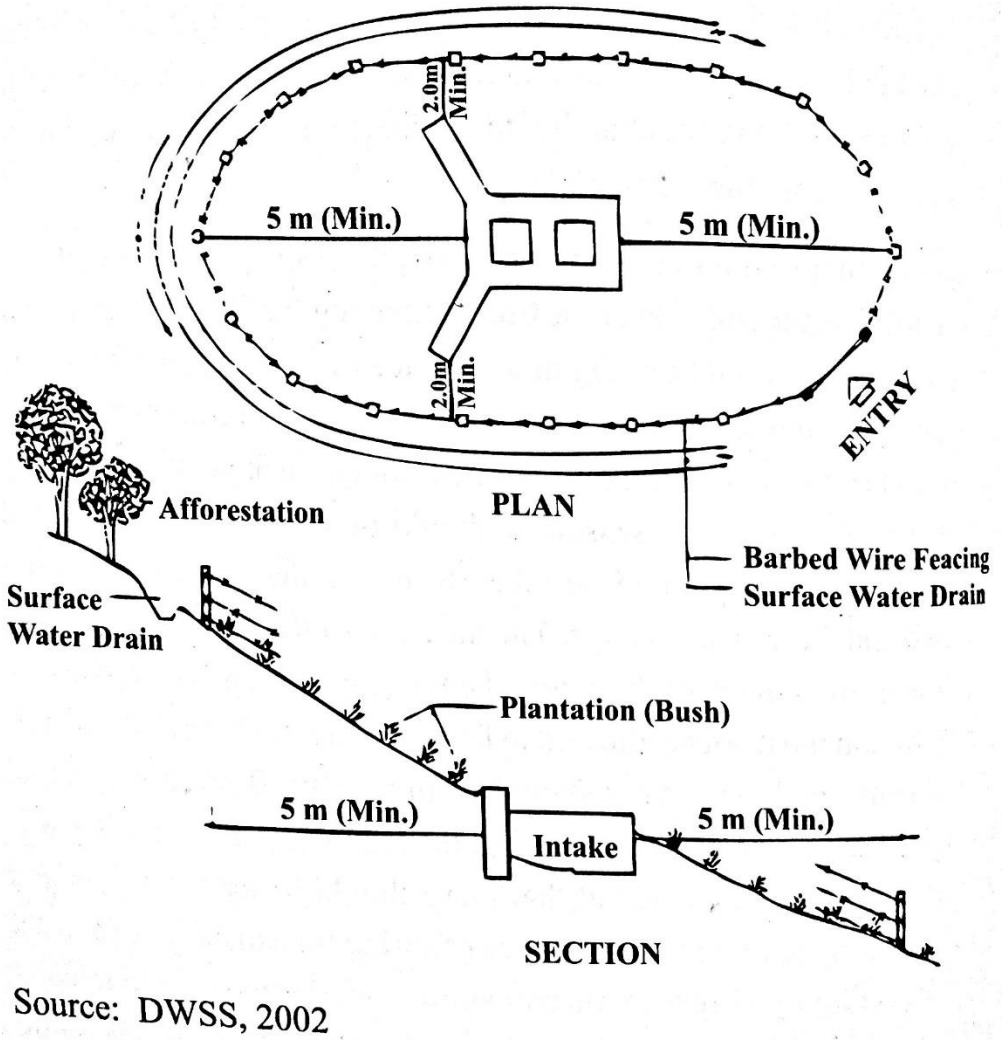
Surface water drain: Surface water drain should be 8m above and around the spring to drain the surface water run off during monsoon. The ditch should be deep, and can be lined with dry stone masonry.

Plantation (Bush): Plantation of grasses below the barbed wire fence which also allow the water to seep. Grasses and bushes prevent the surface soil erosion.

Barbed wire fence: There should be no habitant and easy access to animals around springs up to a distance of 30 m to 90 m to avoid contamination. To prevent trespassing of humans and grazing animals and contamination of spring water, barbed wire fencing at a distance of 5m from spring intake.

Concrete Covers: The catchment of a spring source can be roofed over with concrete slab and buried for further protection.

Retaining walls: If erosion is seen to be a major problem then retaining walls of gabion or dry stone masonry are built to stabilize land around the intake.



Source: DWSS, 2002

Protection of Spring Intake

Bibliography:

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Punmia B.C., Jain A., and JainA. (1998), Water Supply Engineering, Laxmi Publications (P) Ltd., New Delhi, India.