



# **WATER RECYCLING IN MANUFACTURING BEST PRACTICES IN WATER INTENSIVE OPERATIONS**

A. N. BHATTACHARJEE & MANAS BOSE

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BALLAVPUR PAPER MFG. LTD..

***A unit of EMTA***

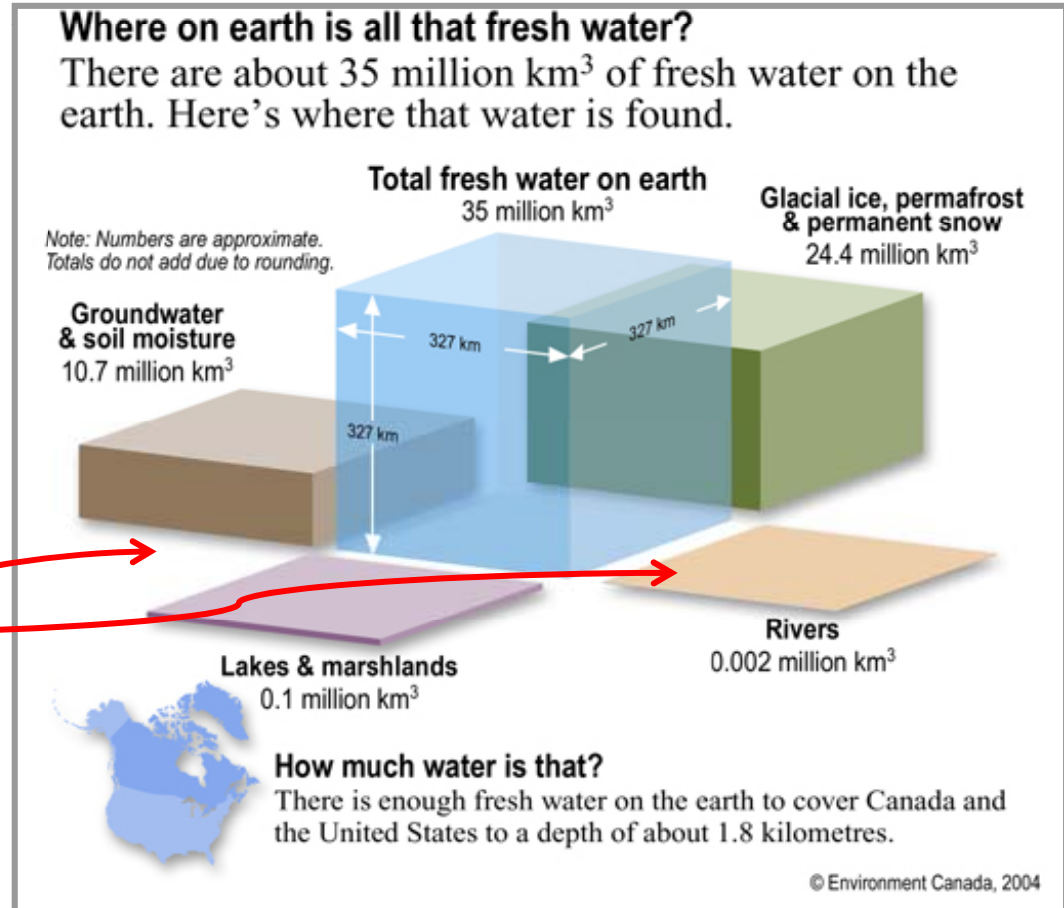
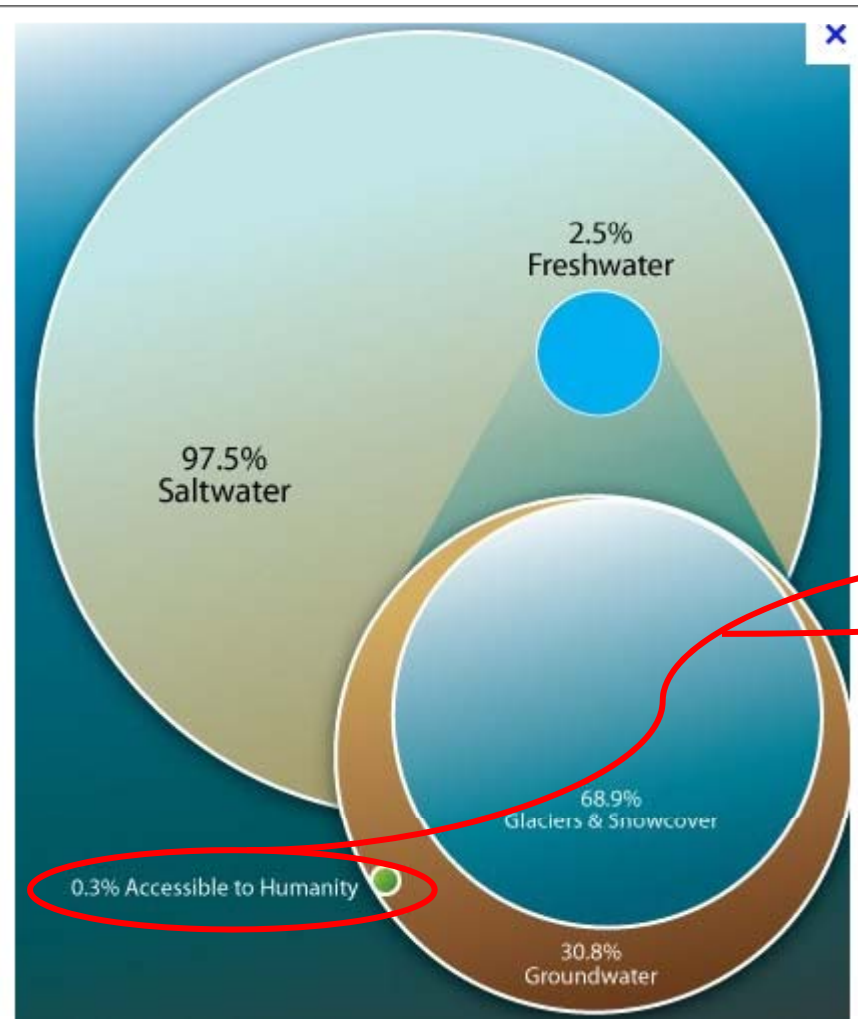
**WACKER** **SILICONES**

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- ECONOMISING PROCESS WATER IN PAPER INDUSTRY

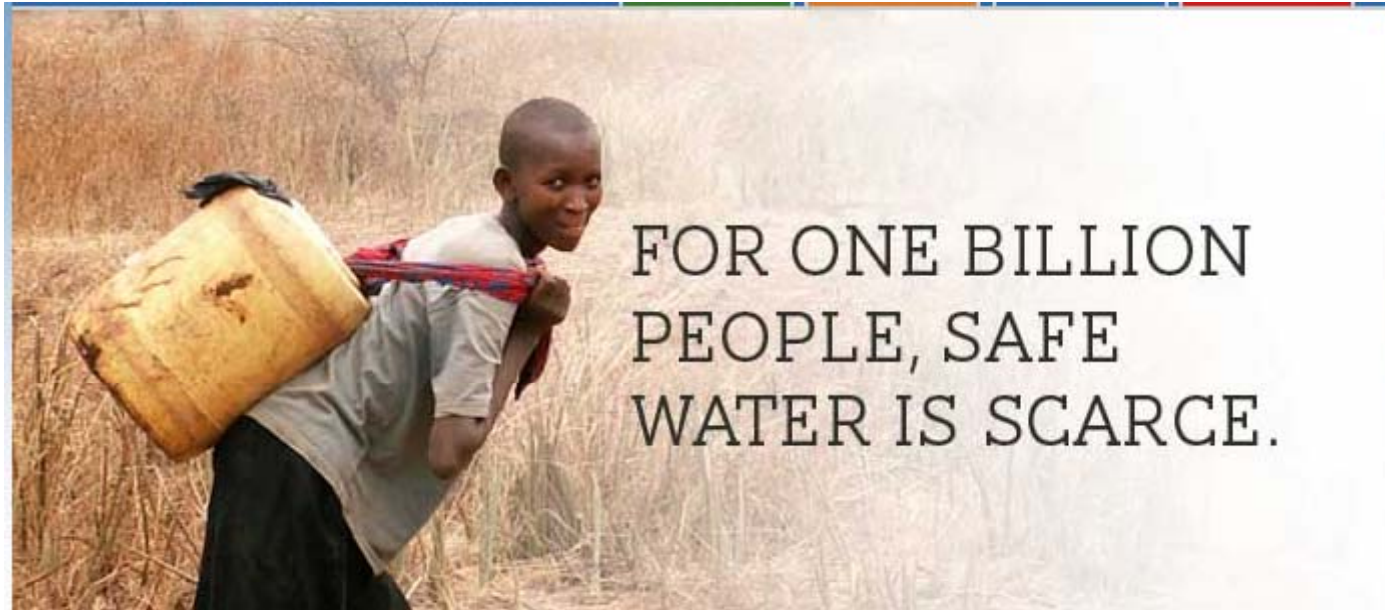


# GLOBAL WATER RESOURCE



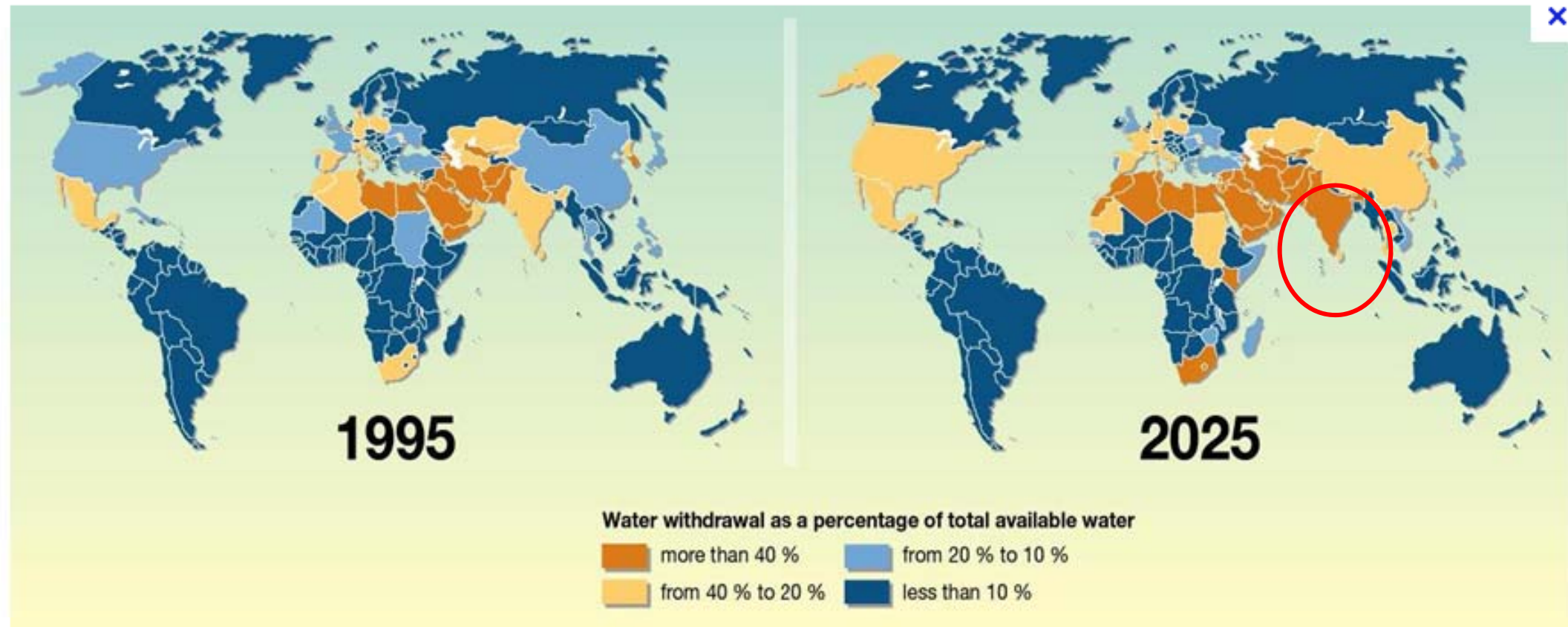
It is estimated that between 12500 to 14000 km<sup>3</sup> is available for human consumption each year

# STILL WE HAVE A SHORTAGE



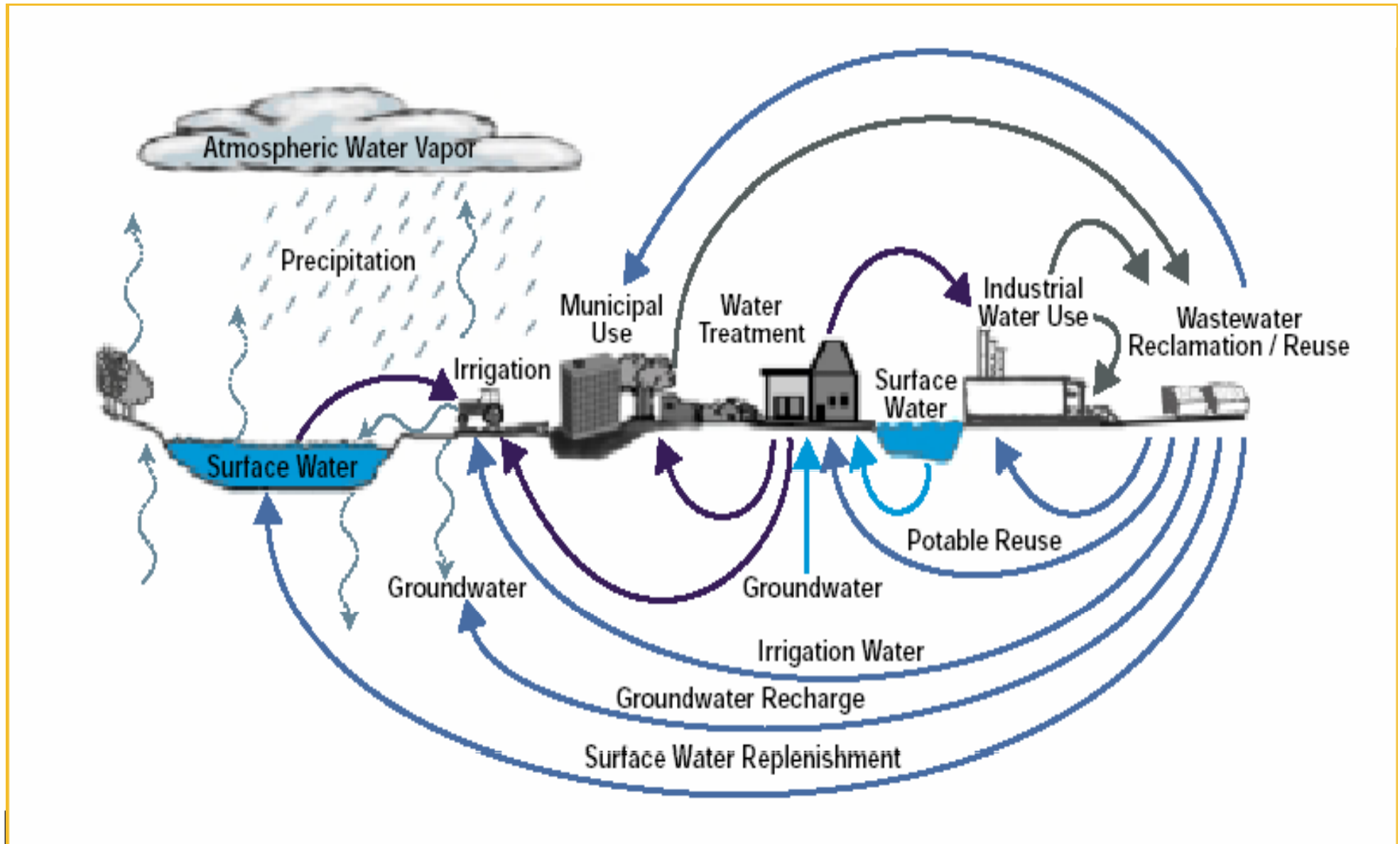
Many countries in Africa, the Middle East, Western Asia and some Eastern European countries have lower than average quantities of fresh water resources available to their populations

# POPULATION PRESSURE ON RESOURCES



Due to rapid population growth, water availability reduced from 12,900 m<sup>3</sup> per capita per year in 1970 to 9000 m<sup>3</sup> in 1990 and < 7000 m<sup>3</sup> in 2000. Expected to drop to 5100 m<sup>3</sup> by 2025.

# TYPICAL WATER CYCLE



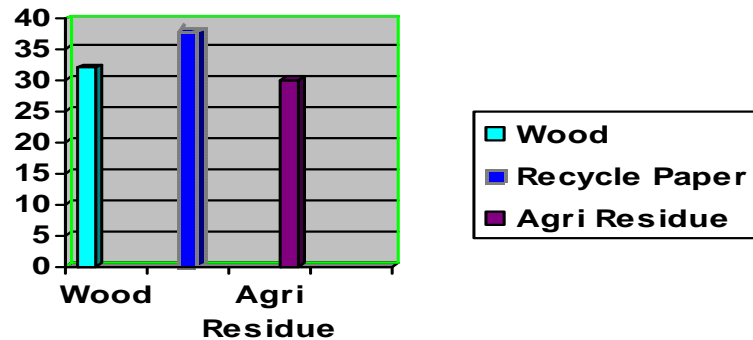
# PAPER INDUSTRY IN INDIA

- ❖ Paper manufacturing in India mainly comprises of integrated Pulp and Paper mills.
- ❖ Paper manufactured can be of different grades like
  - a) Writing Printing paper
  - b) Newsprint
  - c) Duplex Board
  - d) Industrial packaging paper (KRAFT)
  - e) Tissue
- ❖ Paper could be made from virgin pulp from bamboo, soft & hard wood, agricultural residue like bagasse or wheat/ rice straw or recycled fibre (waste paper).
- ❖ Water is the most vital component used in the paper making process.
- ❖ Check production capacity in India of various grades.

# SCENARIO OF PAPER INDUSTRY IN INDIA

## SOME USEFUL DATA

### RAW MATERIAL WISE PAPER PLANT IN INDIA



- **Wood :- 32 %**
- **Recycled Paper :- 38 %**
- **Agri Residue :- 30 %**

**India Produces 11.37 Million tonnes of Paper Per Year**  
**West Bengal Produces 0.4 Million Tonnes of Paper Per Year**

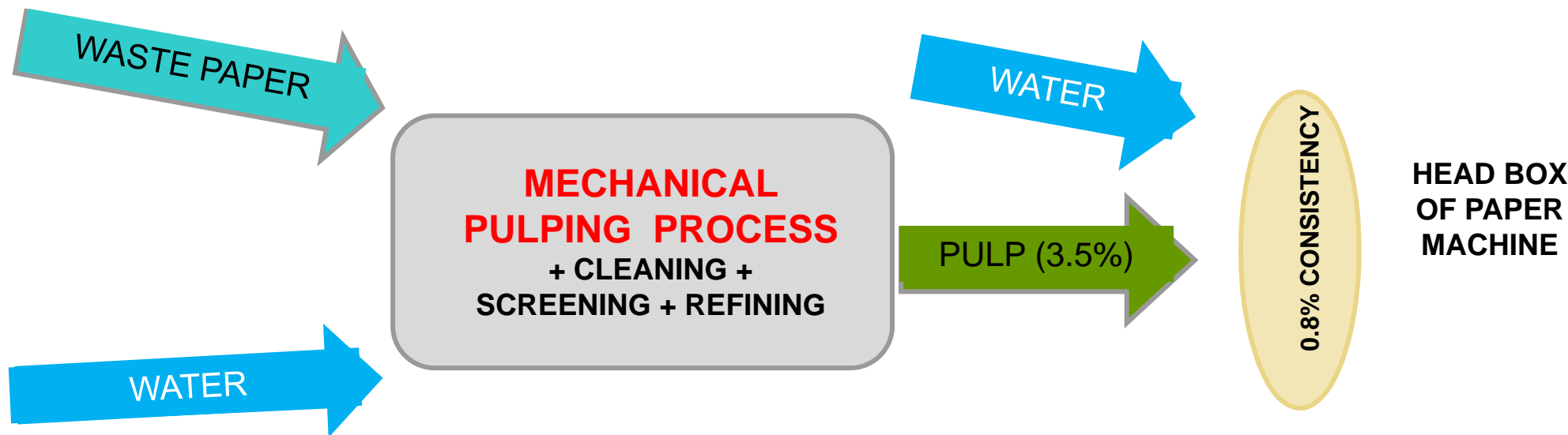
**In India Specific water consumption :- 150M3/tonne of product**

**In Global best Specific Water Consumption :- 29 M3/tonnes of product**



# PAPER MANUFACTURING PROCESS

## STEP 1 – PULP MAKING



Pulp is commercial cellulose fibers derived from wood, recycled paper etc by mechanical or chemical treatment to release fibers. For every time the Fibre are recycled it gets shorter which decreases strength, so it can be reused 5 to 7 times.

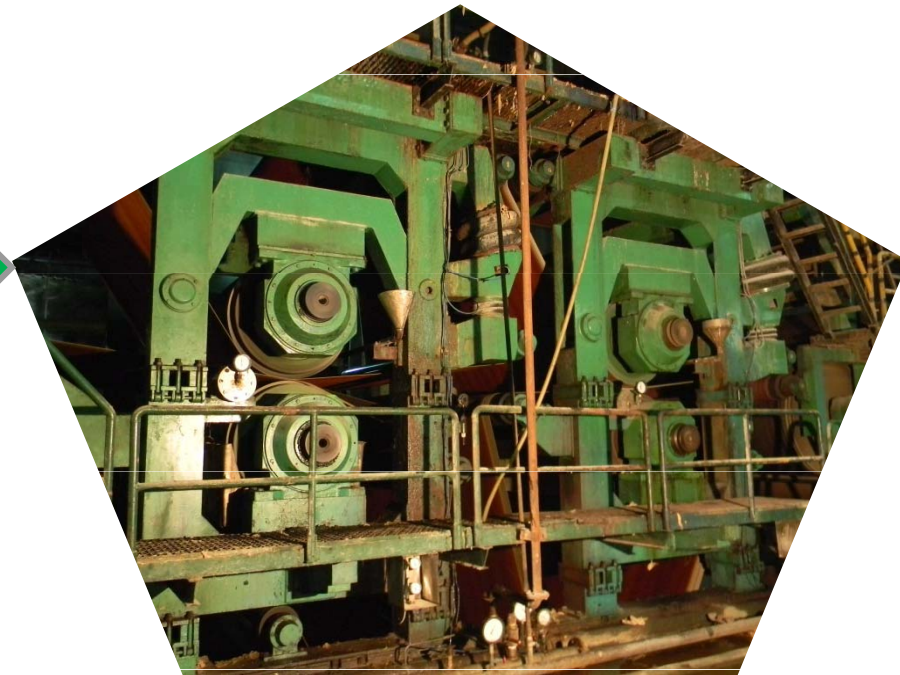
## STEP 2 – PAPER MACHINE



### WIRE PART

Water is removed in this section by gravity and vacuum suction. Resulting mixture has 25% solid. If production is at 6tons/hr then water removed will be 720 M3 / Hr

Water is removed in this section by pressing between rolls. Resulting mixture has 50% solid. If production is at 6tons/hr then water removed will be 6 M3 / Hr



### PRESS PART

## STEP 2 – PAPER MACHINE



Water is removed in this section steam drying.

Resulting mixture has 94% solid.

If production is at 6tons/hr then water removed at this stage is tons 6 M3 /Hr

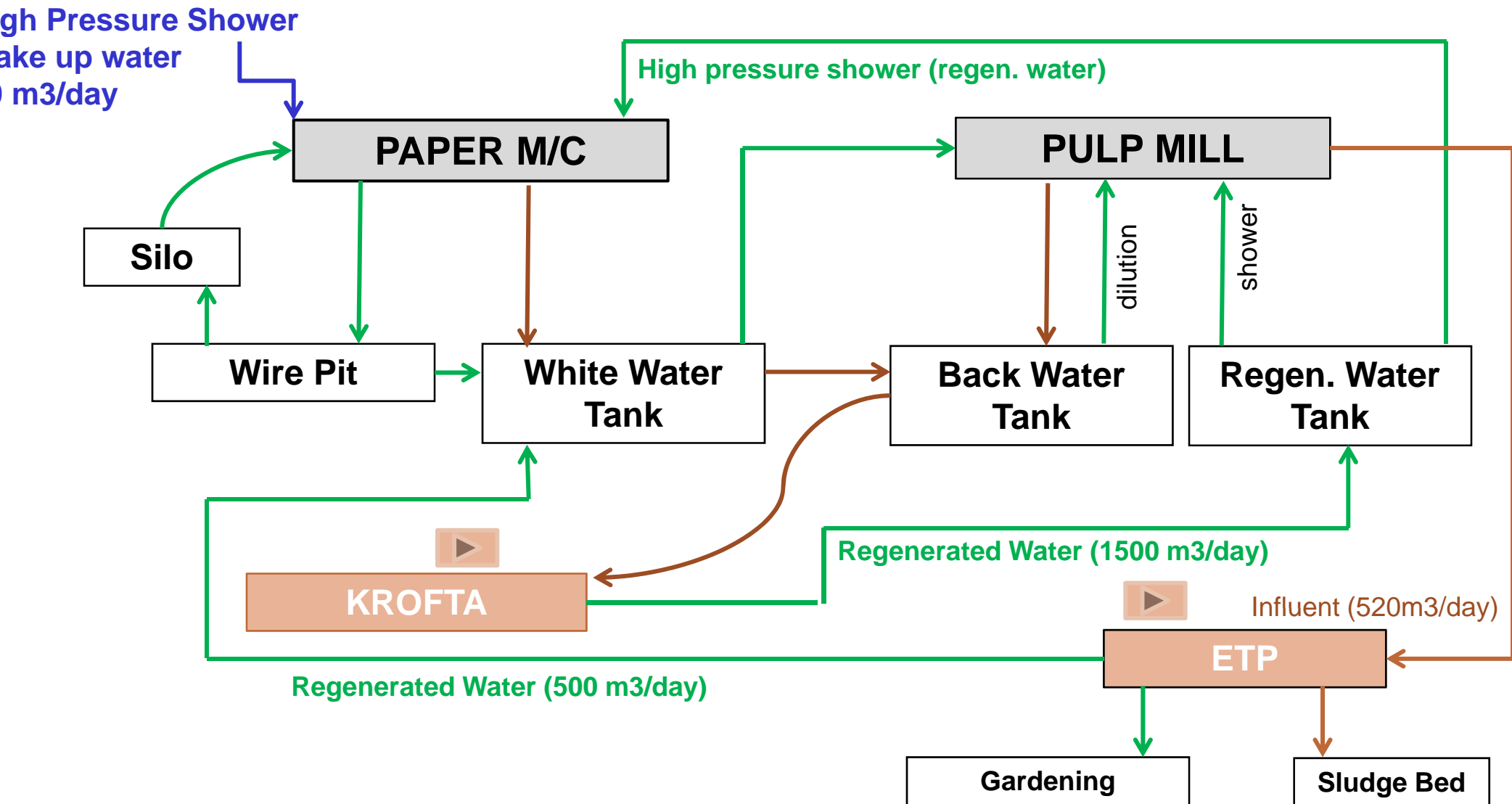
### STEAM DRYER SECTION

# PAPER MAKING – A WATER INTENSIVE PROCESS

- ❖ The paper making process generates a great quantity of waste water.
- ❖ Concerns for the environment has led to development of procedures to minimise water consumption. Less discharge!
- ❖ High cost of fresh water (eg. in states like Gujarat) has also spurred the development to re-use process water to the maximum possible.

**CURRENT TREND IN PULP & PAPER INDUSTRY IS TO  
CLOSE THE PROCESS WATER SYSTEM**

# WATER FLOW IN CLOSED WATER SYSTEM



# WHITE WATER SYSTEM – PITFALLS & SOLUTIONS

1. Organic compounds accumulate in white water system. This acts as a substrate for micro-organism to grow on water surface as a bio-film. This film enters the paper web. In subsequent drying process, the bio-film fragments damaging the **quality of product**.
2. Water is exposed to atmosphere and absorbs  $O_2$ . Micro-organisms in water consumes this  $O_2$  and an environment without  $O_2$  suitable for anaerobes is produced. Once the  $O_2$  is used up the micro-organisms start to ferment releasing some volatile fatty acids (VFA) giving of **unpleasant odour & increasing demand of retention aides**.

Use Biocides to control content of micro-organics. Often combined with dispersion agent, this dissolves the cluster of micro-organisms.

# WHITE WATER SYSTEM – PITFALLS & SOLUTIONS

- ❖ Inorganic ions accumulate increasing the temperature of white water. This high temperature coupled with anionic ions creates **corrosive** conditions.
- ❖ Different additives added in white water affects process in the form of stickies, pitch and anionic trash.
- ❖ Cations in the white water (if present in high concentration) **decrease the paper strength** by decreasing the number of inter-fibre bonds.

Use fixing agents to remove substances from the whitewater.

Adopt membrane filtration to reduce COD discharge

# CUMULATIVE EFFECT OF CLOSED WATER SYSTEM

- **TOTAL AND DISSOLVED ORGANIC CARBON :-**

It is the sum measure of the concentration of all organic carbon atoms

Covalently bonded in the organic molecules in waste water

- **TOTAL SUSPENDED SOLIDS ( mg/l) :-**

It is a measure of the concentration of solids in suspension which correlates to the amount of treatment required.

- **CHEMICAL OXYGEN DEMAND ( COD )( mg/l):-**

It is defined as the amount of dissolved oxygen required to oxidize and stabilize organic and inorganic content of the waste water



# MAKE UP WATER IN CLOSED SYSTEM

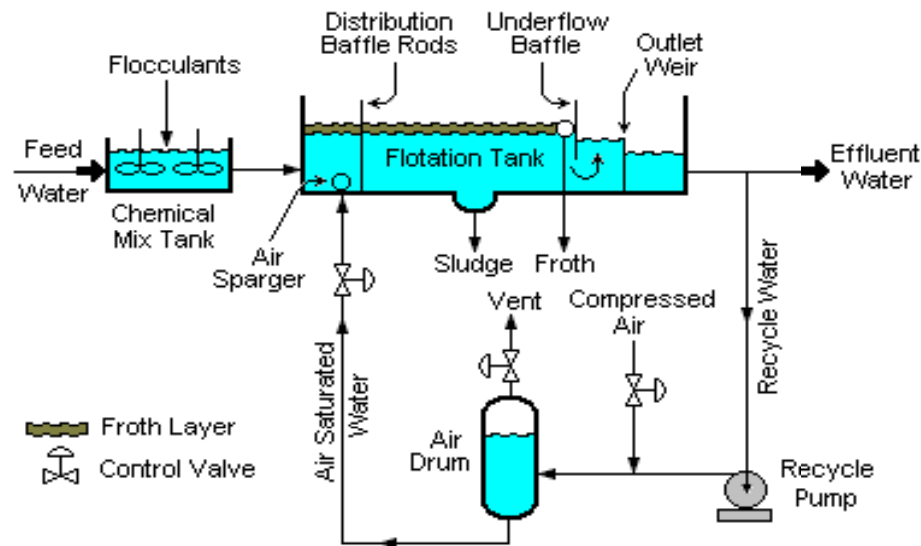
## REQUIREMENT OF MAKE UP WATER (FRESH WATER)

- |  |   |                         |
|--|---|-------------------------|
| 1. Steam Dryer section                   | – | 144 M <sup>3</sup> /day |
| 2. High pressure shower in Press section | - | 80 M <sup>3</sup> /day  |

## POWER GENERATION

- |   |   |                         |
|---|---|-------------------------|
| 1. Mixed Cooling Water pond<br>(natural evaporation)                          | - | 140 M <sup>3</sup> /day |
| 2. Steam condensate loss in pulp & paper m/c<br>& Boiler continuous blow-down | - | 200 M <sup>3</sup> /day |
| 3. Domestic Use   | - | 10 M <sup>3</sup> /day  |

# KROFTA - MECHANISM



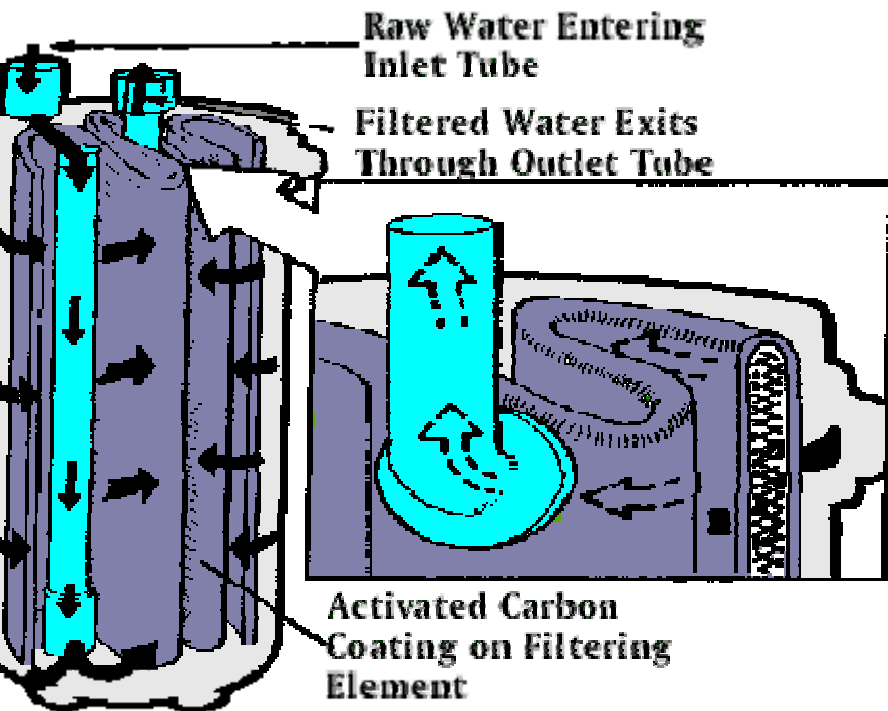
## ADVANTAGES of DISSOLVED AIR FLOTATION METHOD:

**Low Retention time**

**High specific clarification capacity (160 – 220lpm / sq mt.)**

Clarified water extracted contains < 150 ppm of suspended solids.

# ACTIVATED CARBON FILTER



## • PROPERTIES:-

- High degree of microporosity, just 1gm of activated carbon has a surface area in excess 500 m<sup>2</sup>.
- It is usually derived from charcoal

## BENEFITS :-

1. Carbon is generally activated with a positive charge and is designed To attract negatively charged water contaminants.
2. It usually used to remove sediments and volatile organic compounds.

# ETP

**TSS: 1800 to 3000 mg/lit**  
**MLSS: 3000 – 4000 mg/lit**  
**COD: 3000 mg/lit**  
**pH: 5 to 6.5**



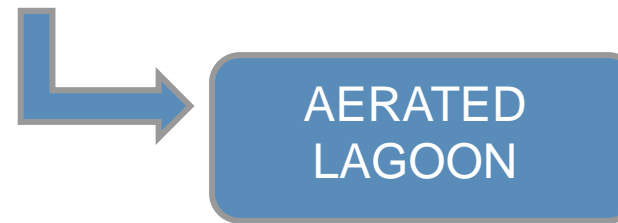
Sludge Removal

**TSS: 600 to 1000 mg/lit**  
**COD 2500 mg/lit**  
**pH: 7.5 to 8 (lime addition)**



Remove organic particles by gravity with addition of poly electrolyte as coagulant & for better sedimentation.

**TSS: 150 to 250 mg/lit**  
**COD: 1600 - 2000 mg/lit**  
**pH :- 7.0**



Micro-organisms + O<sub>2</sub> used to oxidise organic pollutants in water to separate waste sludge

**TSS: 150 to 250 mg/lit**  
**COD: < 100 mg/lit**

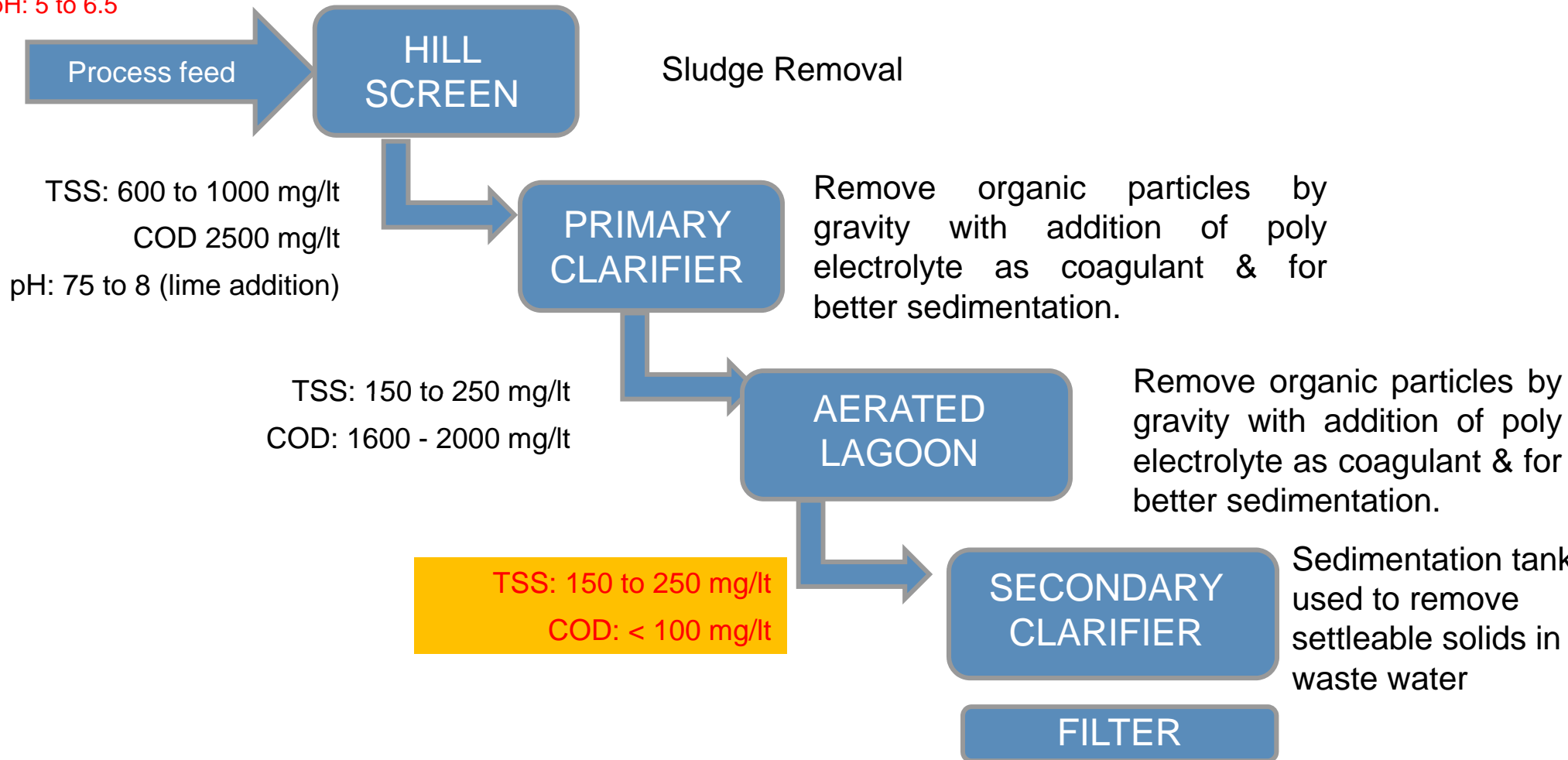


Sedimentation tank used to remove settleable solids in waste water

FILTER

# ETP

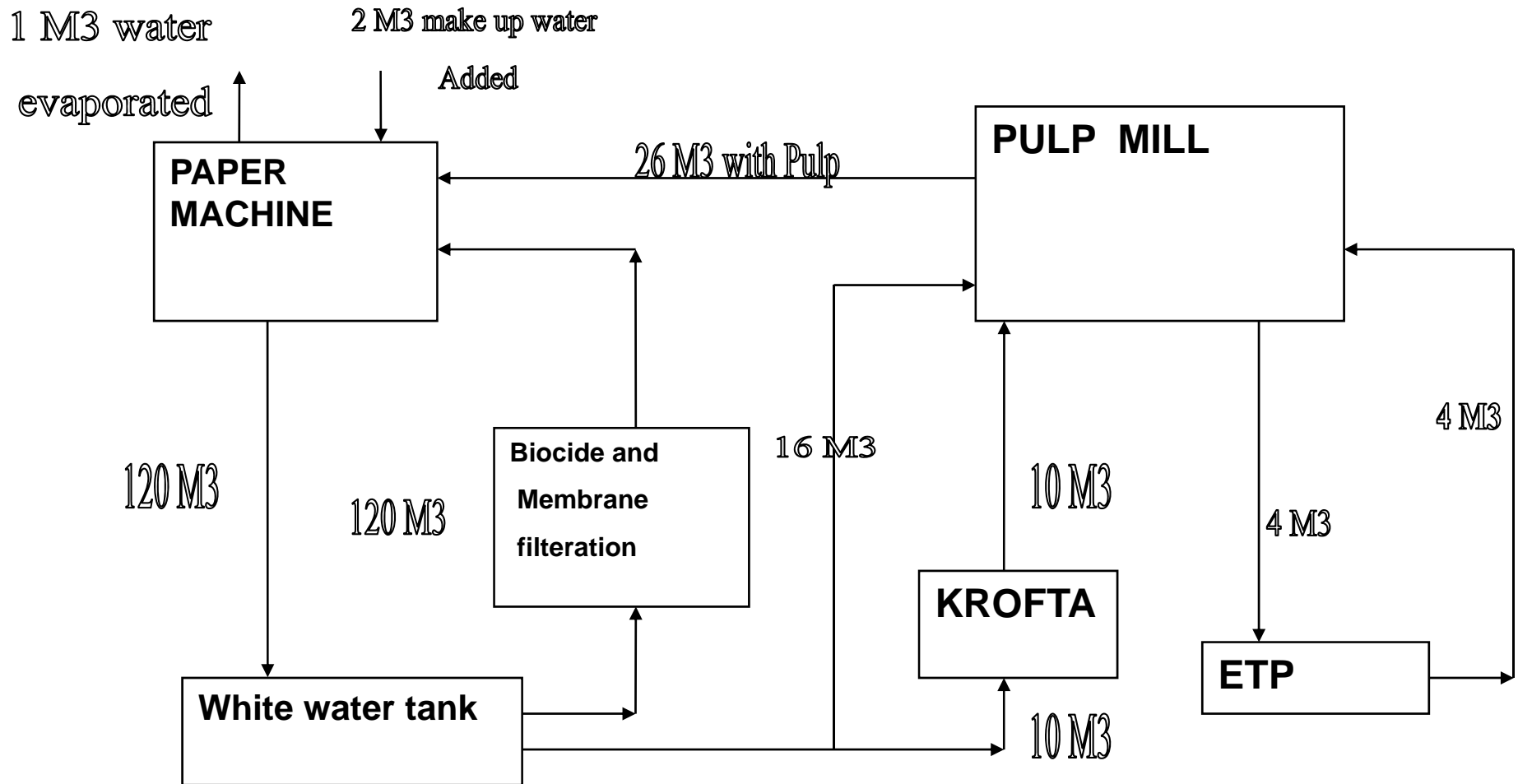
- TSS: 1800 to 3000 mg/l
- MLSS: 3000 – 4000 mg/l
- COD: 3000 mg/l
- pH: 5 to 6.5



# TYPICAL WATER BALANCE IN KRAFT PAPER PLANT WITH RECYCLED WASTE PAPER.

COURTSEY :- [BALLAVPUR PAPER MFG. LTD](#)

## • 150 TPD KRAFT LINER



SAVE WATER -- SAVE EARTH

