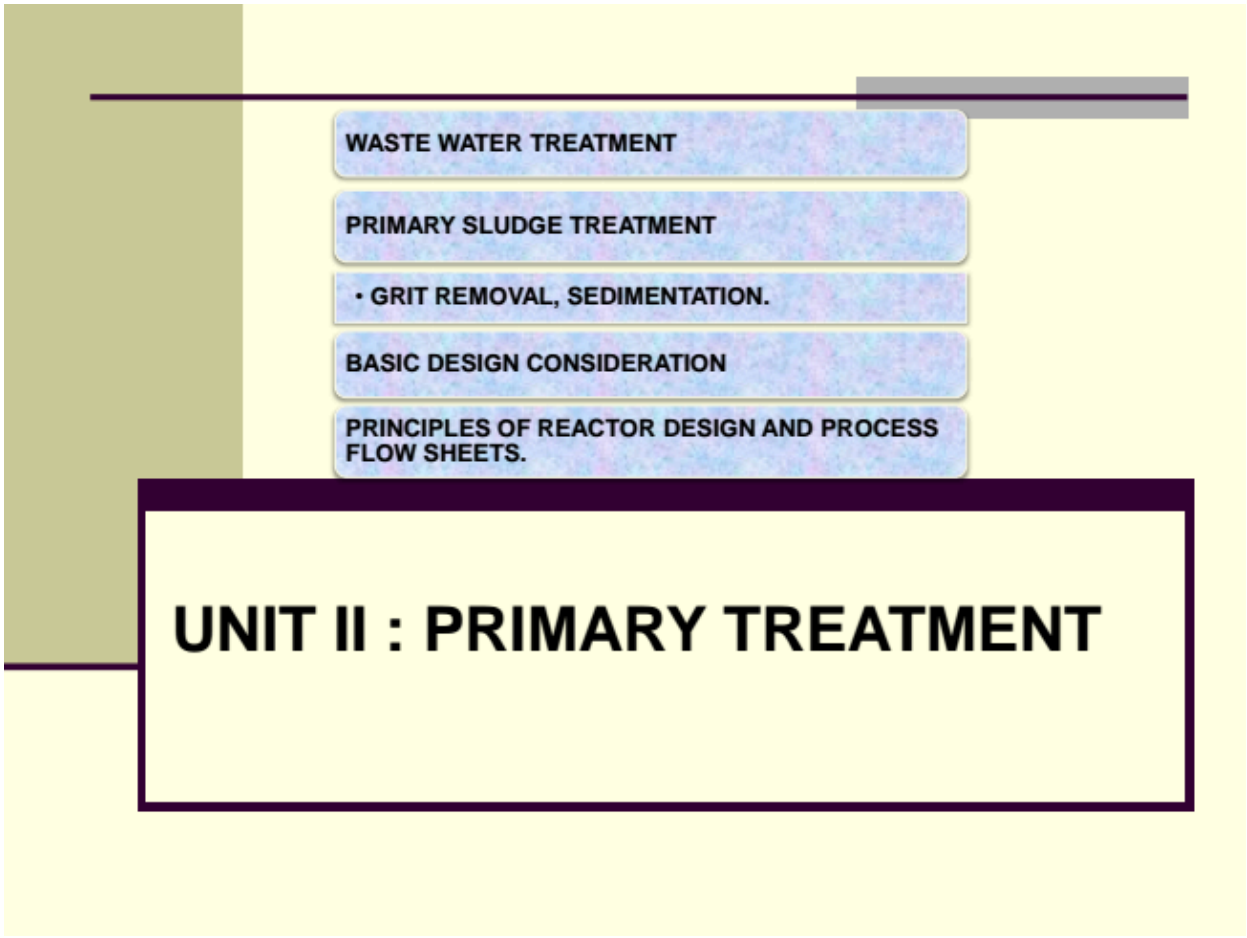


UNIT II : PRIMARY TREATMENT

WASTE WATER TREATMENT

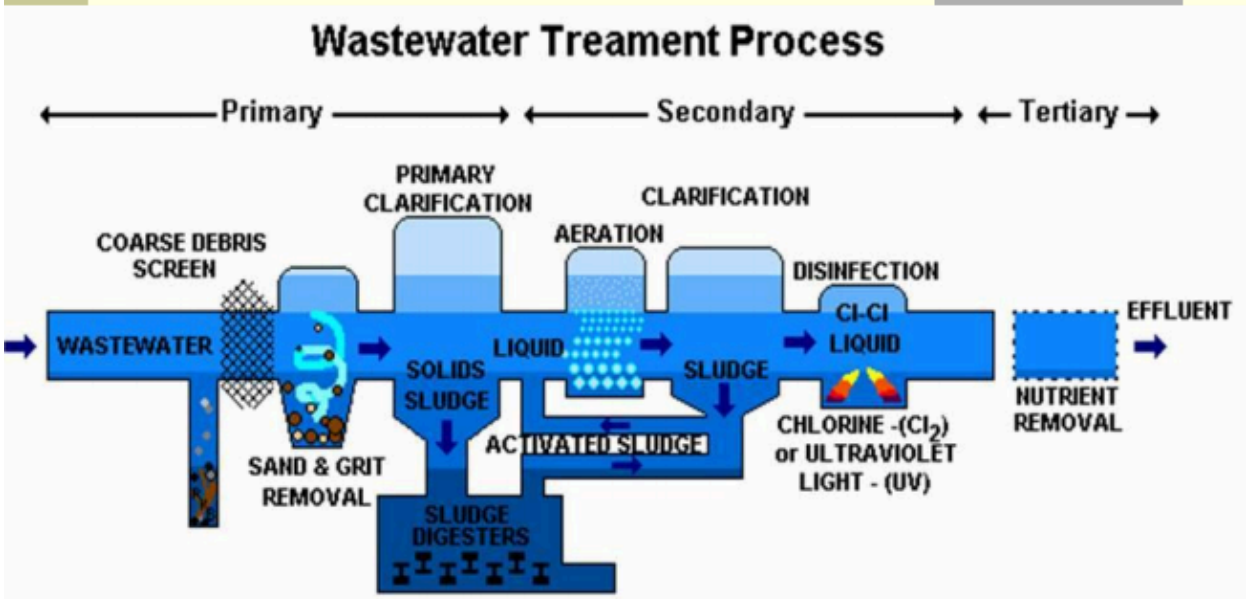
PRIMARY SLUDGE TREATMENT

BASIC DESIGN CONSIDERATION

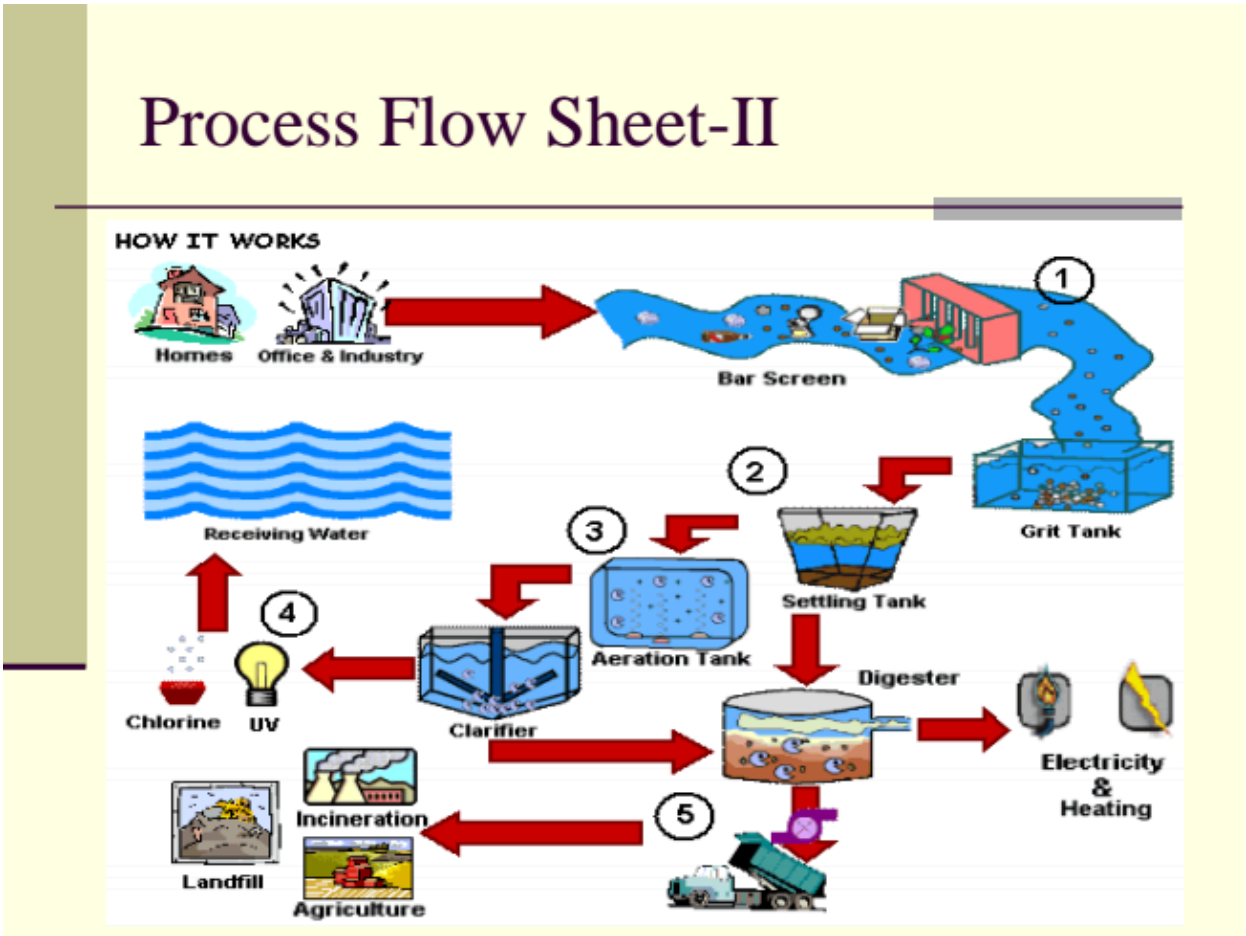
PRINCIPLES OF REACTOR DESIGN AND PROCESS FLOW SHEETS.

• GRIT REMOVAL, SEDIMENTATION.

Process Flow Sheet-I

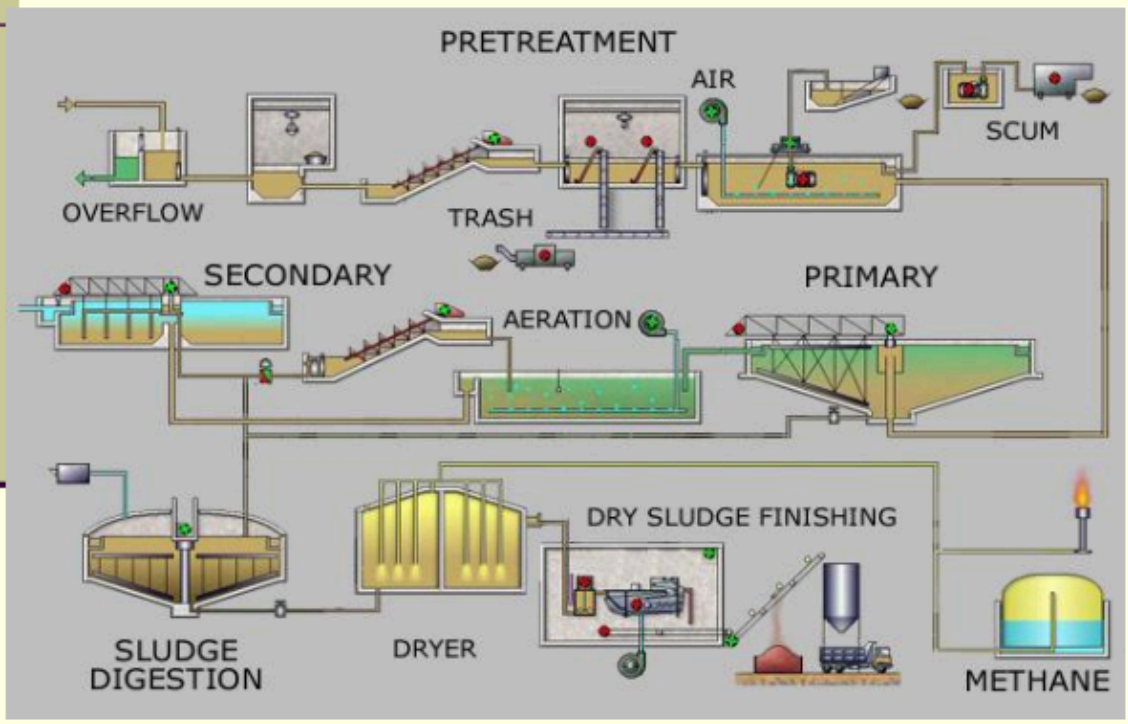


Process Flow Sheet-I



Process Flow Sheet-II

Process Flow Sheet-III



Process Flow Sheet-III

Unit operation Efficiencies

Type of treatment	Purification effected	process or unit employed	%BOD removal	%Solids removal	%bacterial removal
Preliminary Treatment	removal of floating materials	Coarse/fine screens	5-10%	2-20%	10-20%
	removal of heavy settleable inorganics	Grit chamber or detritus tank	10-20%	20-40%	10-20%
	removal of fats & grease	Skimming tank	20-30%	20-40%	10-20%
Primary Treatment	removal of suspended settleable organic solids	sedimentation tank	30-35%	60-65%	25-75%
		septic tank	20-30%	40-60%	25-75%
		Imhoff tank	30-40%	60-65%	25-75%
Secondary treatment	removal of fine suspended non-settleable solids and colloids including dissolved organic matter	chemical flocculation and sedimentation (seldom used)	50-85%	70-90%	40-80%
		Intermittent sand filter with sedimentation (seldom used)	90-95%	85-95%	95-98%
		Low rate trickling filter w/sedimentation	90-95%	70-92%	90-95%
		high rate trickling filter w/sedimentation	65-95%	65-92%	80-95%
		activated sludge treatment w/sedimentation	75-95%	85-90%	90-98%
		oxidation pond	85-90%	85-90%	90-98%
Tertiary treatment	removal of pathogens and very fine dissolved organics	chlorination	100.00%	100.00%	100.00%

Unit operation Efficiencies

Type of treatment Purification effected

process or unit

%BOD

%Solids employed

removal

removal

%bacterial removal

Preliminary Treatment

removal of floating materials Coarse/fine screens 5-10% 2-20% 10-20%

removal of heavy settleable inorganics

Grit chamber or detritus

tank 10-20% 20-40% 10-20%

removal of fats & grease Skimming tank 20-30% 20-40% 10-20%

Primary Treatment

sedimentation tank 30-35% 60-65% 25-75%

septic tank 20-30% 40-60% 25-75%

Imhoff tank 30-40% 60-65% 25-75%

Secondary treatment

removal of suspended settleable organic solids

chemical flocculation and sedimentation (seldom

used) 50-85% 70-90% 40-80%

Intermittent sand filter with sedimentation (seldom

used) 90-95% 85-95% 95-98%

Low rate trickling filter

w/sedimentation 90-95% 70-92% 90-95%

high rate trickling filter

w/sedimentation 65-95% 65-92% 80-95%

activated sludge treatment

w/sedimentation 75-95% 85-90% 90-98%

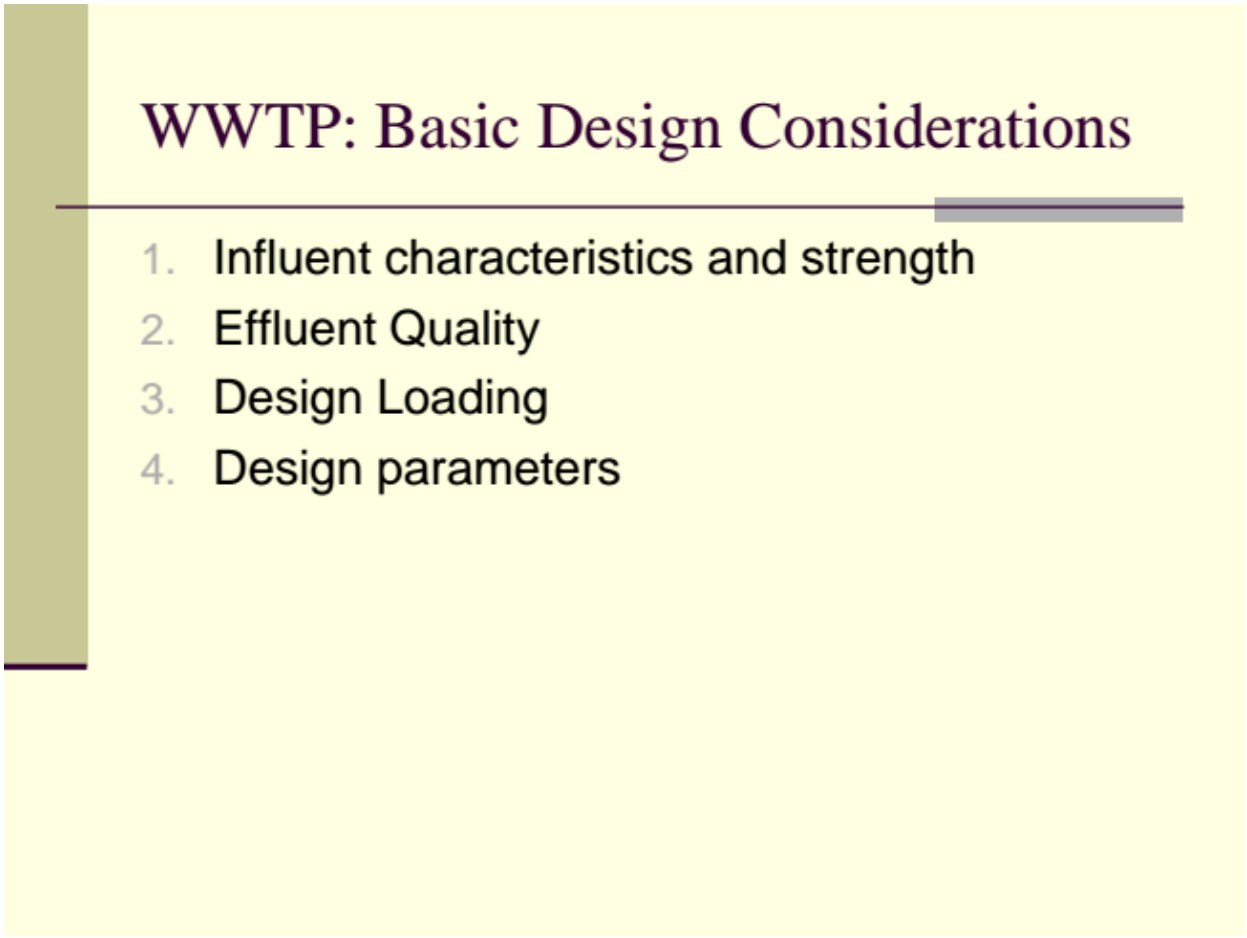
oxidation pond 85-90% 85-90% 90-98%

Tertiary treatment

removal of fine suspended non-settleable solids and colloids including dissolved organic matter

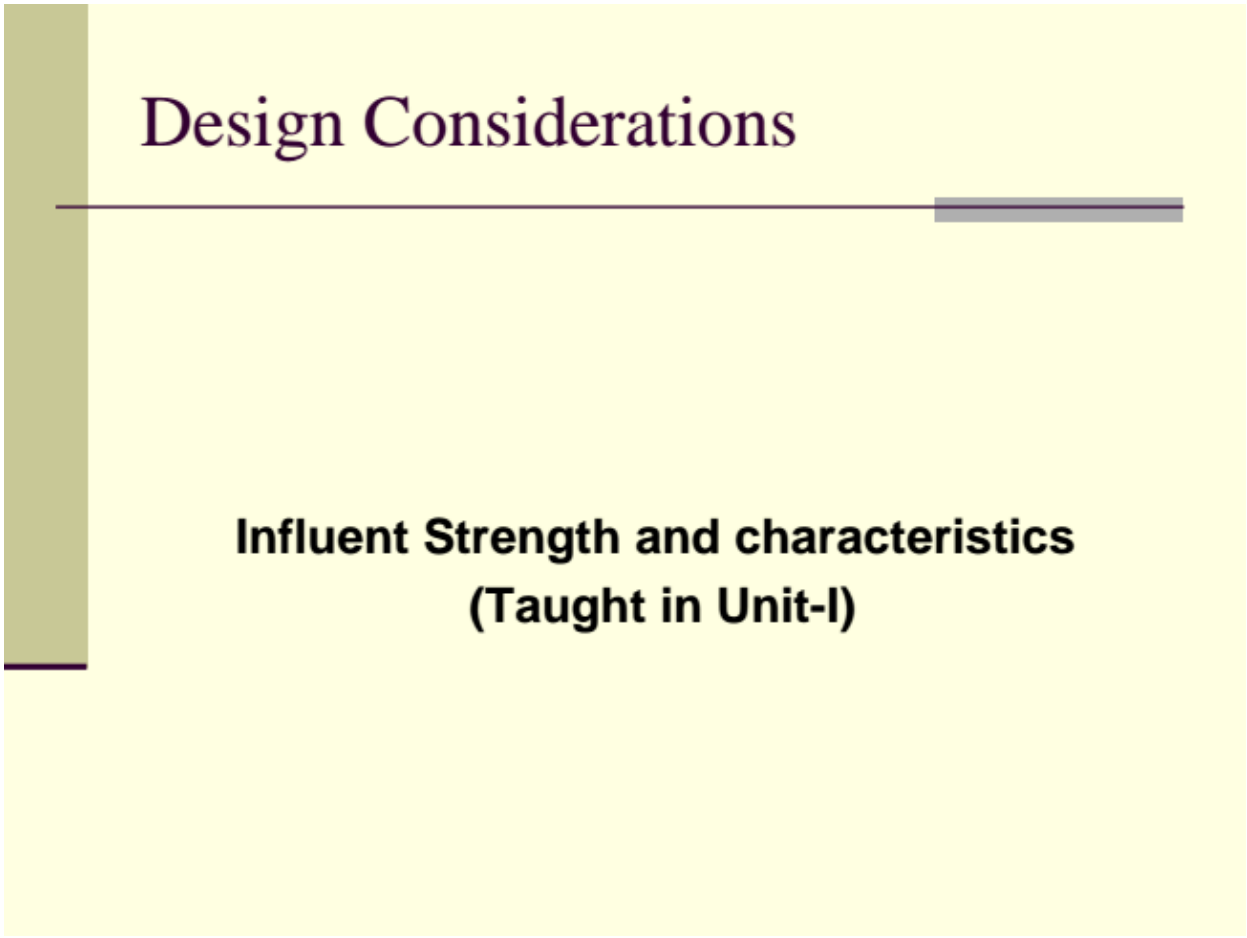
removal of pathogens and very

fine dissolved organics chlorination 100.00% 100.00% 100.00%



WWTP: Basic Design Considerations

1. Influent characteristics and strength 2. Effluent Quality 3. Design Loading 4. Design parameters



Design Considerations

Influent Strength and characteristics (Taught in Unit-I)

Design Considerations: Effluent Quality

- Based upon ultimate disposal/reuse
- Basis for selection of treatment process, unit

operations and their design

Efficiency of treatment

Disinfection vs no-disinfection

Design Considerations: Design Loading

1. Hydraulic Loading
    1. In terms of volumes
2. Mass Loading
    1. In terms of mass of BOD or SS

3. Average, Maximum, Minimum loading???
4. Daily, Monthly, yearly??
5. Dry weather runoff (no stormwater runoff) or wet weather runoff (stormwater in rainy season)??

Design Considerations: Design Loading

1. Hydraulic Loading

1.

In terms of volumes 2. Mass

Loading

1.

In terms of mass of BOD or SS

3. Average, Maximum, Minimum loading??? 4. Daily, Monthly, yearly?? 5. Dry weather runoff (no stormwater runoff) or

wet weather runoff (stormwater in rainy season)??

Design loading (contd..)

- Hydraulic loading: pump, pipes and hydraulically limited equipment design
- Mass loading: aeration, sludge digestion equipment
- Peak flow factor= Max flow/avg flow = 1.5 – 3.0
- Minimum flow factor= Min flow/avg flow = 0.1 – 0.3
- Check for max., min and average conditions. Units may be shut off during minimum flow. Scouring to be avoided during min. flow.
- Max design: capacity underutilization, Min design: process overloading
- **Design multiple units**

Design loading

(contd..)

▌Hydraulic loading: pump, pipes and hydraulically limited

equipment design ▌Mass loading: aeration, sludge digestion equipment

❙ Peak flow factor= Max flow/avg flow = 1.5 – 3.0 ❙ Minimum flow factor= Min flow/avg flow = 0.1 – 0.3

❙ Check for max., min and average conditions. Units may be shut off during minimum flow. Scouring to be avoided during min. flow. ❙ Max design: capacity underutilization, Min design: process overloading

❙ **Design multiple units**