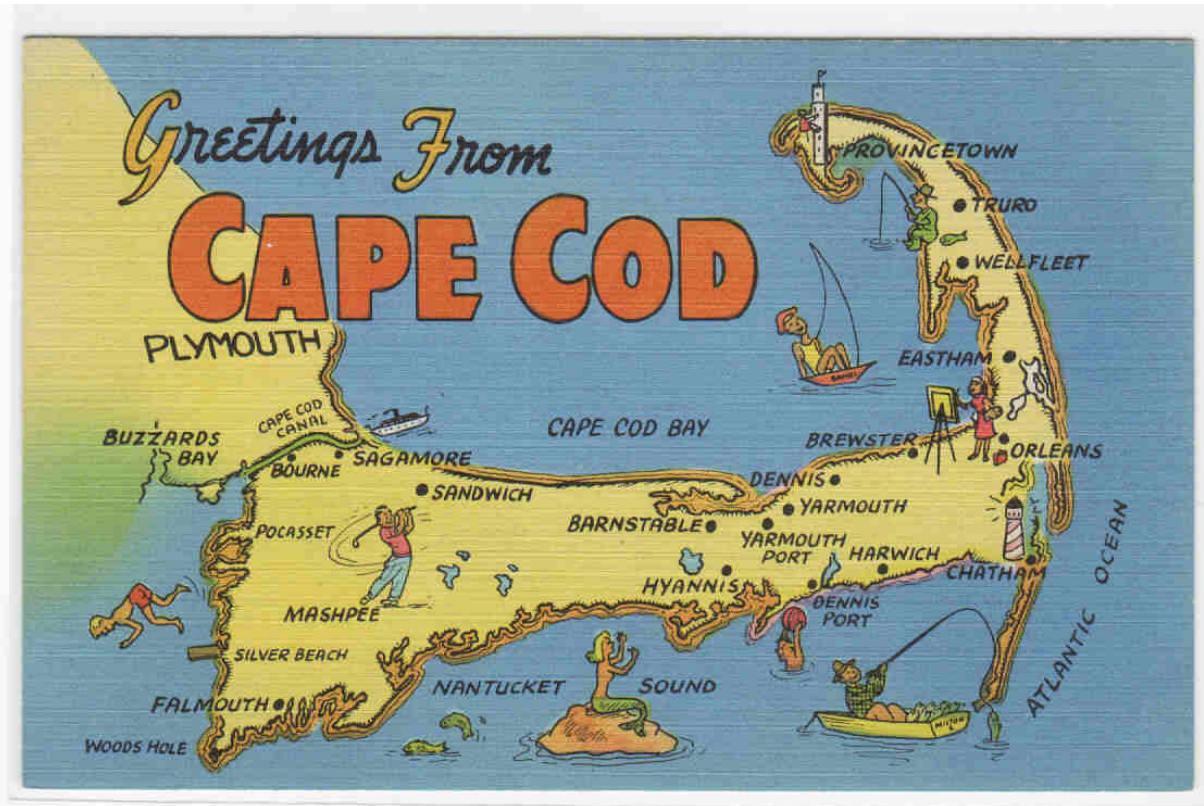


Effects of Flow Fluctuations on Cape Cod Package Plants

Chris Hayward

Cape Cod



Facility Types



Elderly Housing



Shopping Malls



Schools



Seasonal Resorts

Scale Comparison

**Deer Island Wastewater
Treatment Plant**



Package Plant



Scale Comparison

Deer Island WWTP

- Capacity: 848 MGD (339 Olympic swimming pools)
- Budget: Over \$600M
- Staffing: Large crew
- Technology: Activated sludge with tertiary treatment

WhiteWater Package Plants

- Capacities up to 300,000 gpd (the kiddy pool)
- Budget: Up to \$100,000
- Staffing: One operator
- Technology: Varies, primary and secondary treatment only

Package Plant Challenges

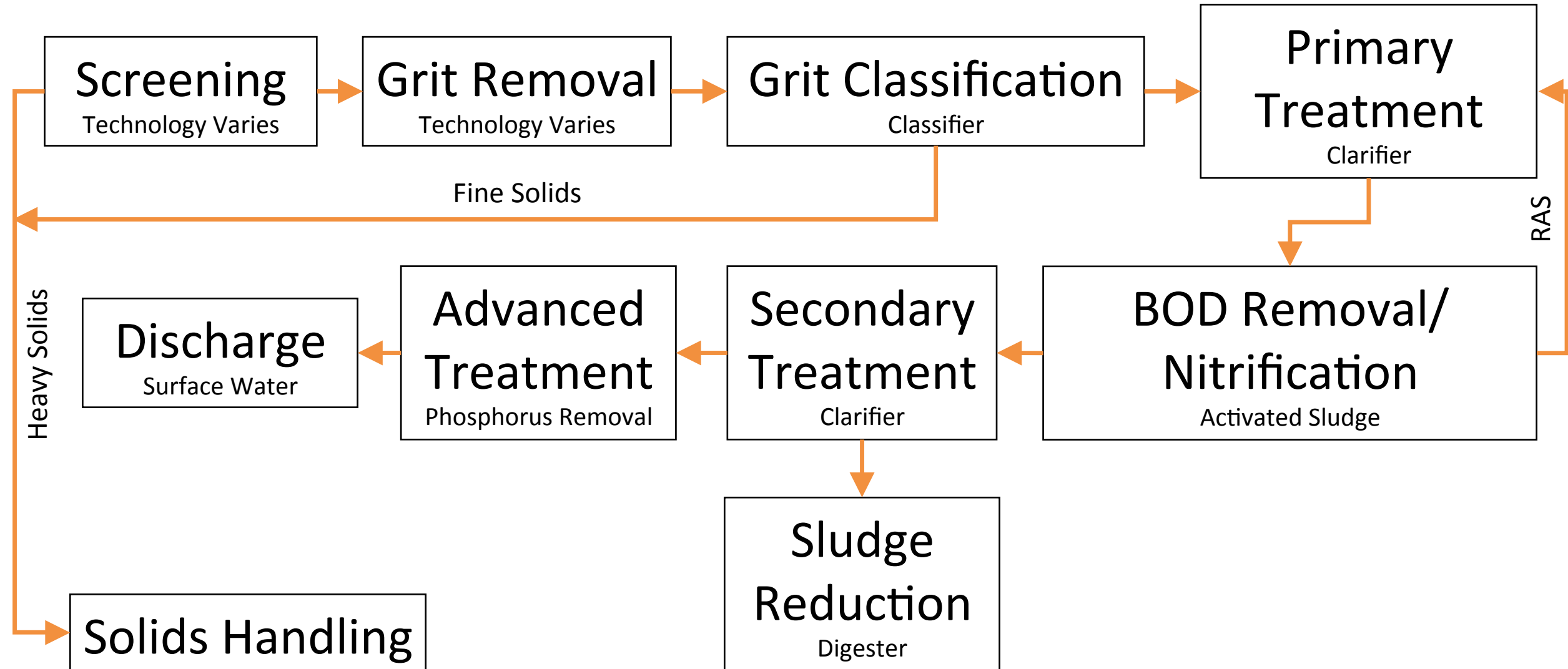
Municipal WWTP

- Small change yields small result
- Adequate redundancy
- Large staff
- Many plants upgraded to newer technologies
- Larger budgets

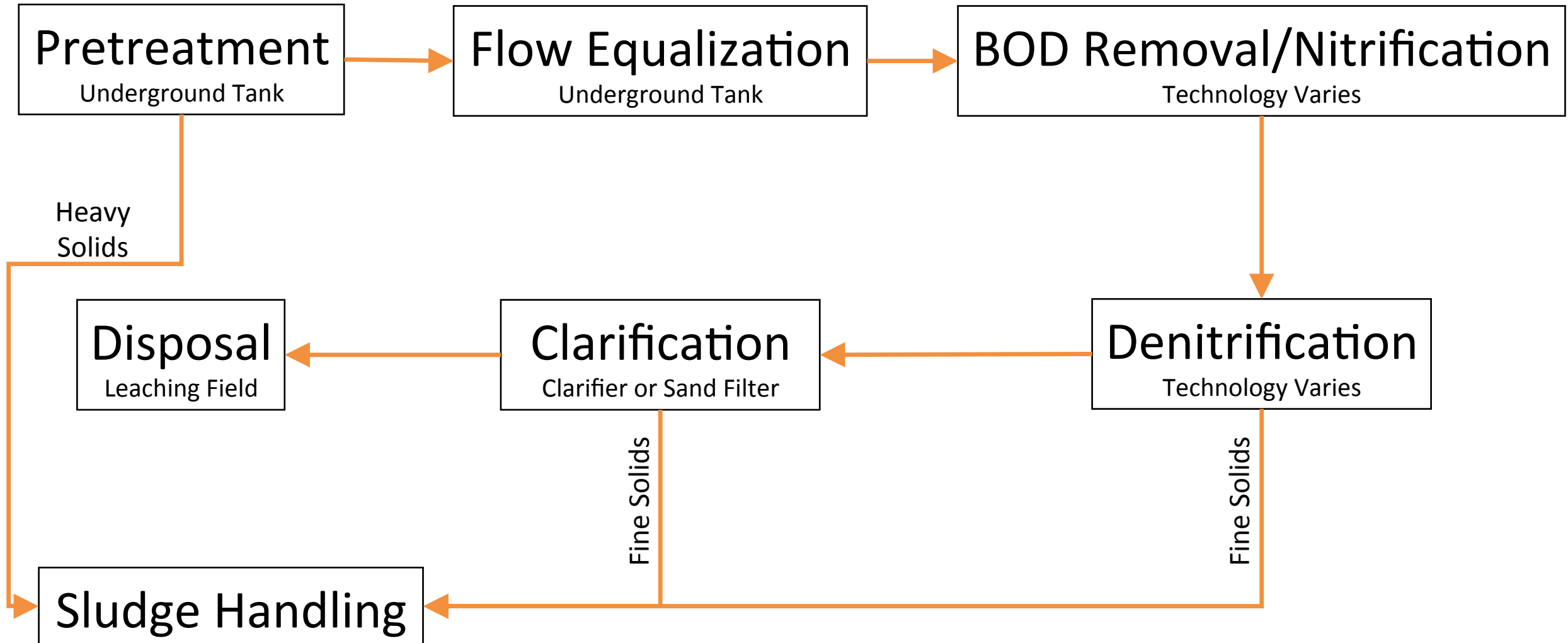
WhiteWater Package Plants

- Small change has significant effect
- Adequacy of redundancy varies
- One-man show
- Most plants retain original technologies
- Smaller budgets

Large Plant Process Overview



Package Plant Process Overview



Package Plant Technologies



Sequential Batch Reactor



Rotating Biological Contactor



Amphidrome®



Membrane Bioreactor

Fluctuations



- Sudden, but often predictable
- High and low
- Daily flow changes by as much as 50%
- Content changes

Fluctuation Effects

Flow Increase

- Higher BOD and ammonia
- Lower need for recirculation
- Carbon supplement dosage increase
- Improves bacterial growth

Flow Decrease

- Less food for microorganisms
- Heavier reliance on recirculation
- Less carbon supplement required
- Possible loss of bacterial mass

Mitigating Factor

Diligence

END