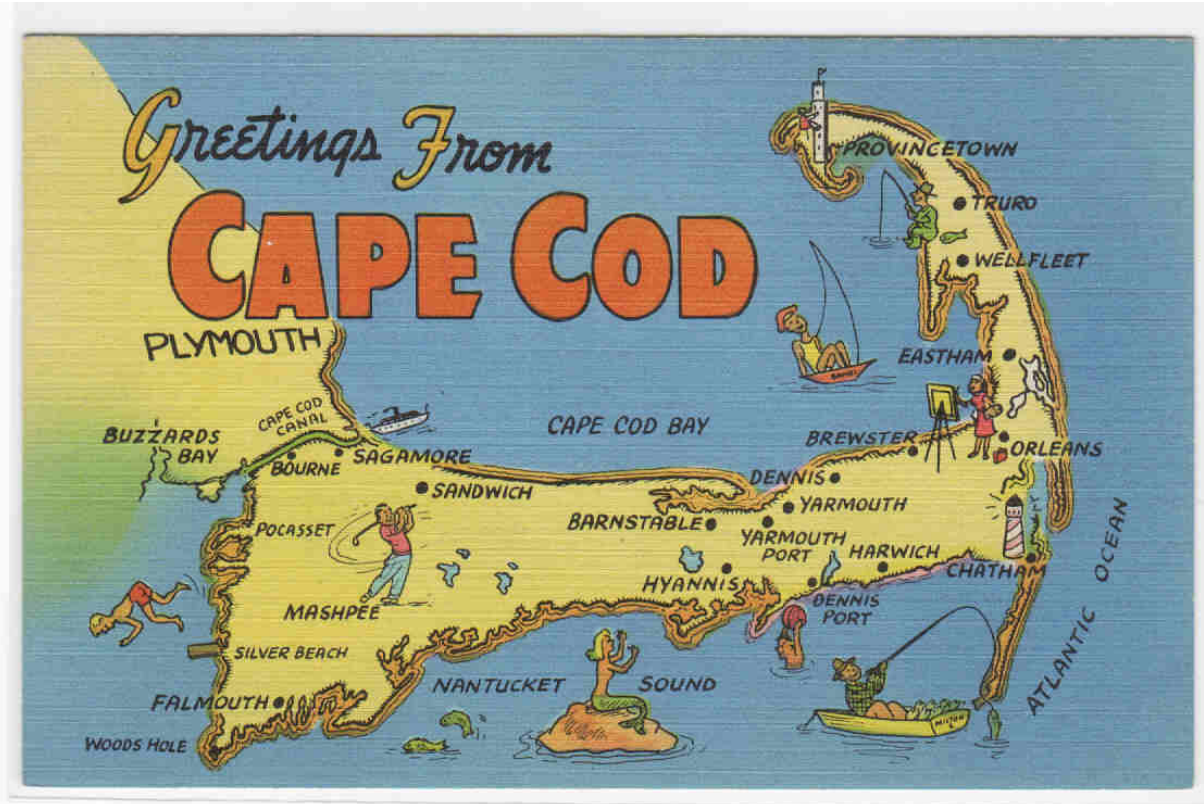


# Effects of Flow Fluctuations on Cape Cod Package Plants

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

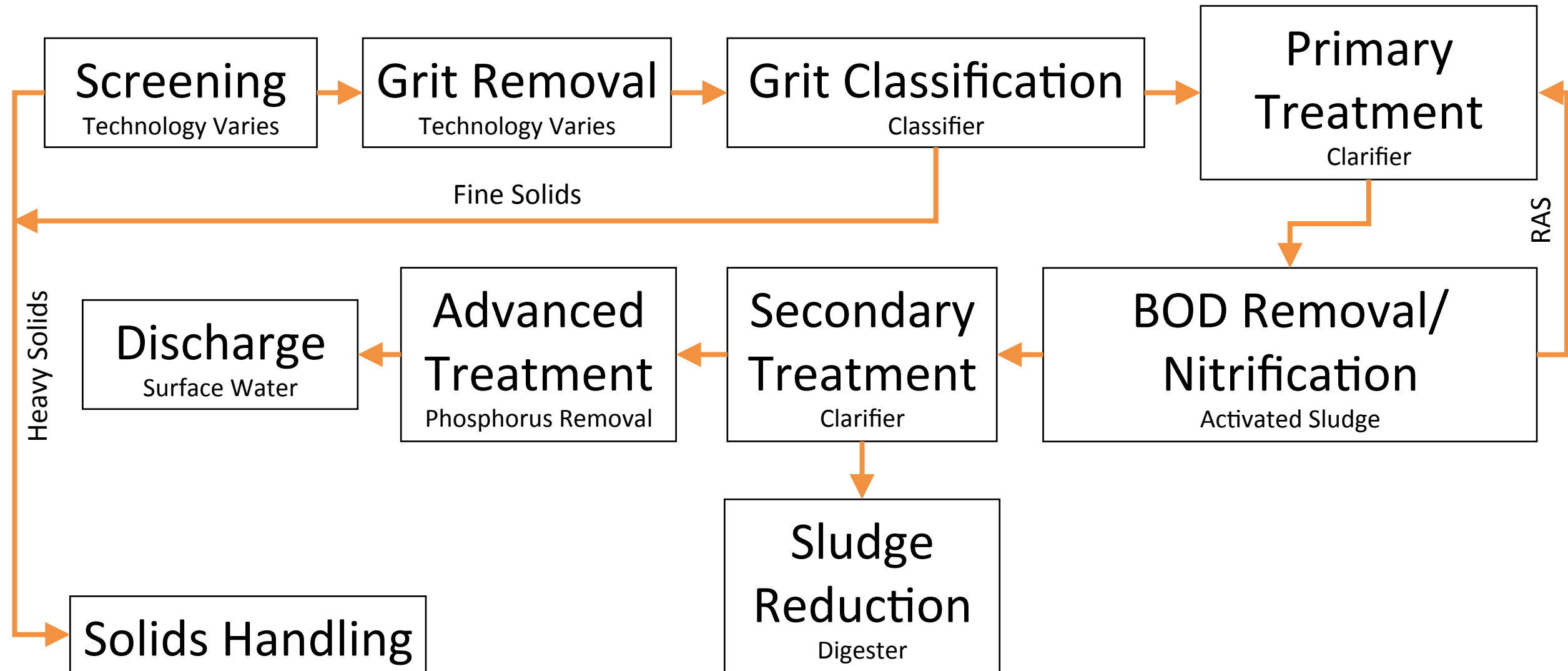
## **Municipal WWTP**

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

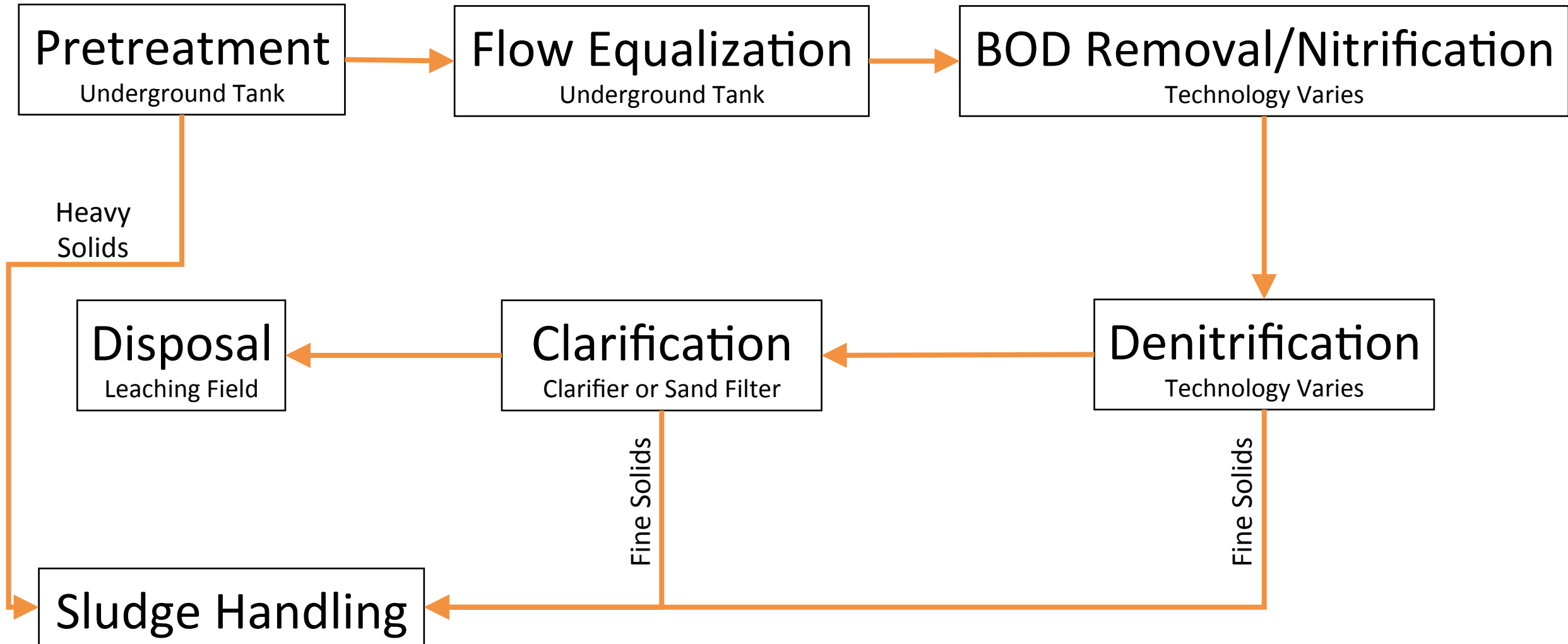
## **WhiteWater Package Plants**

- 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