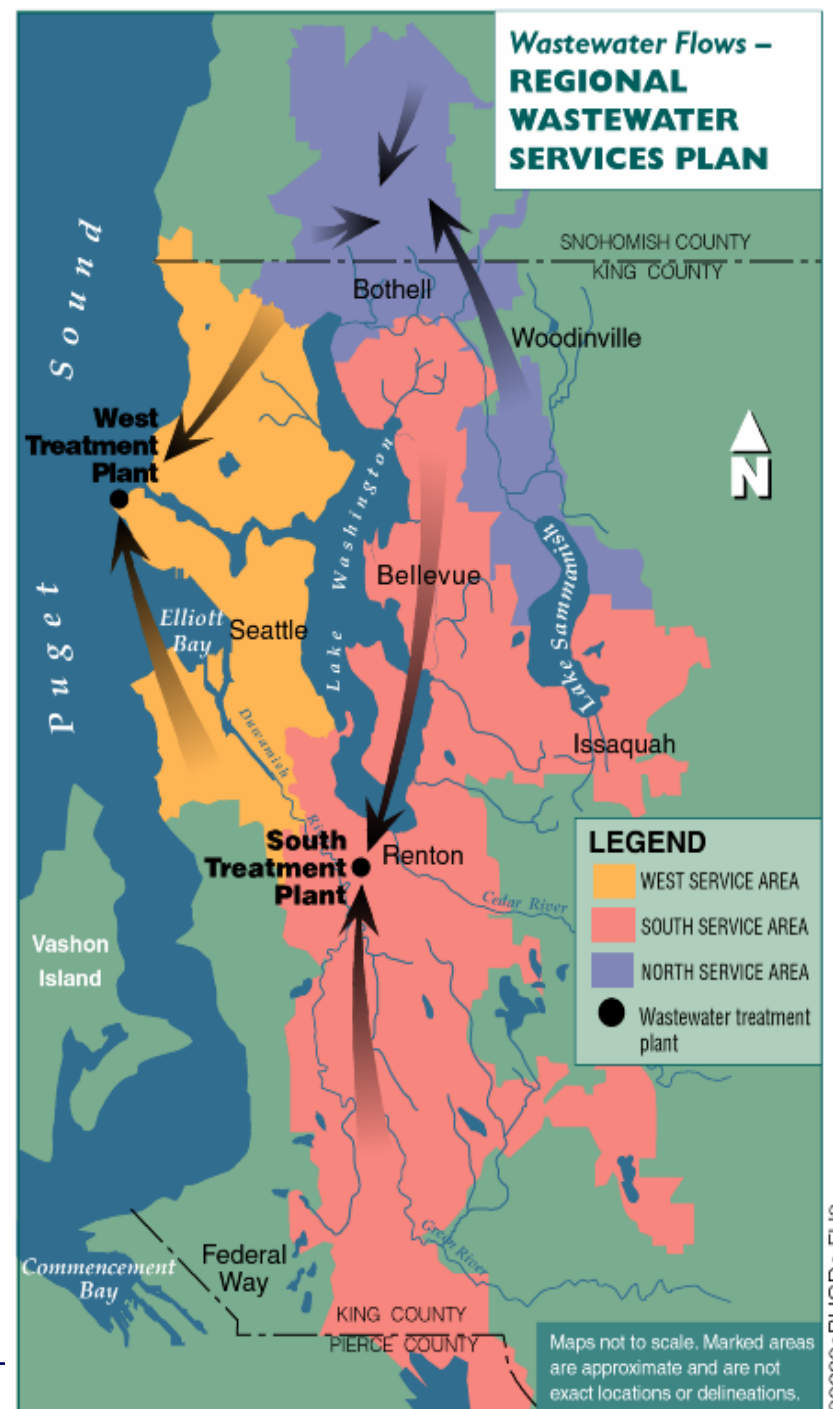
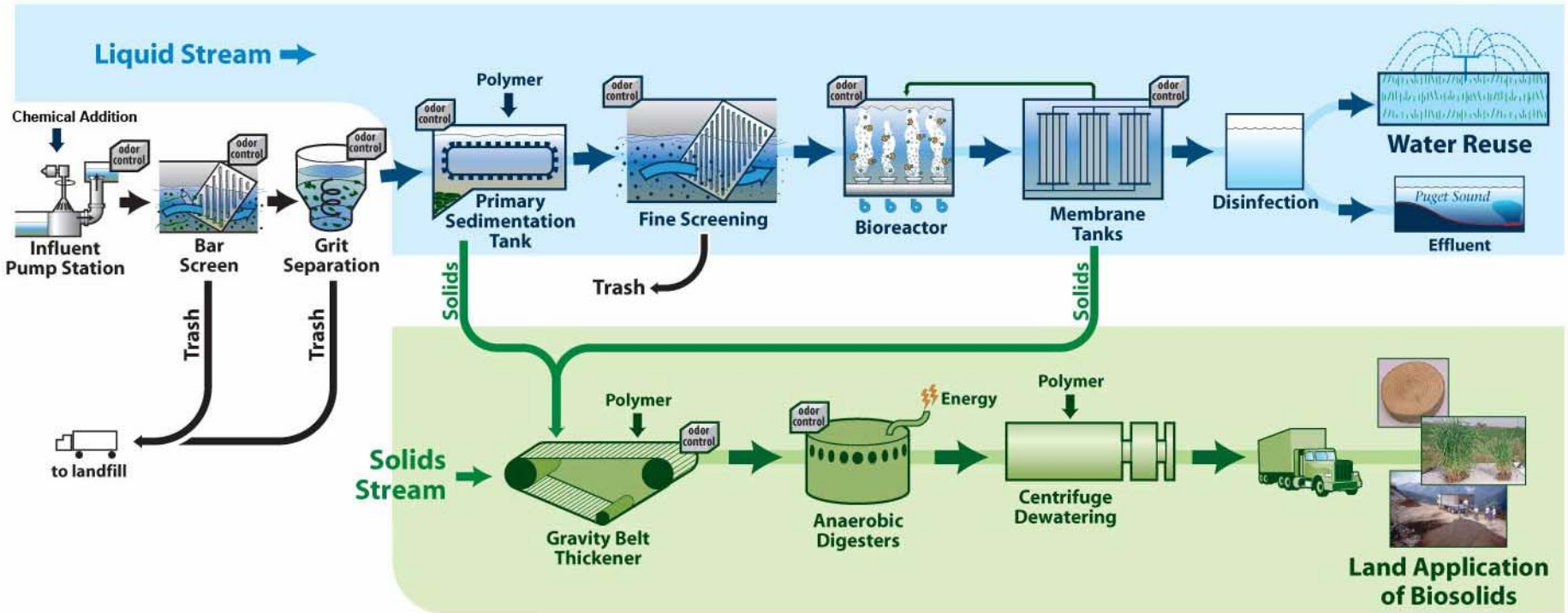


# Brightwater

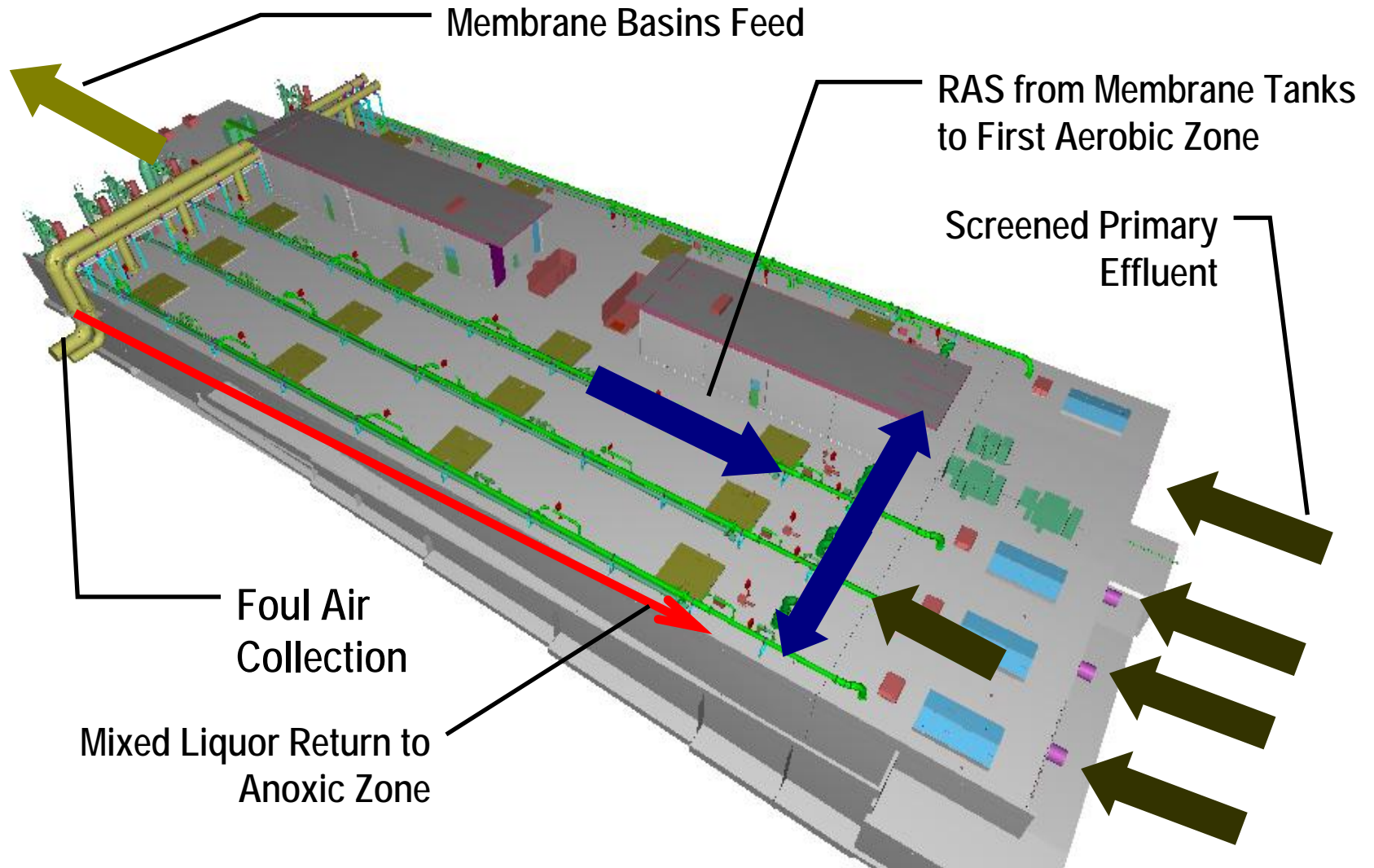
- 💧 New regional wastewater system
- 💧 Serves rapidly growing suburban areas northeast of Seattle
- 💧 Includes conveyance, treatment and marine discharge
- 💧 Will produce Class A reclaimed water



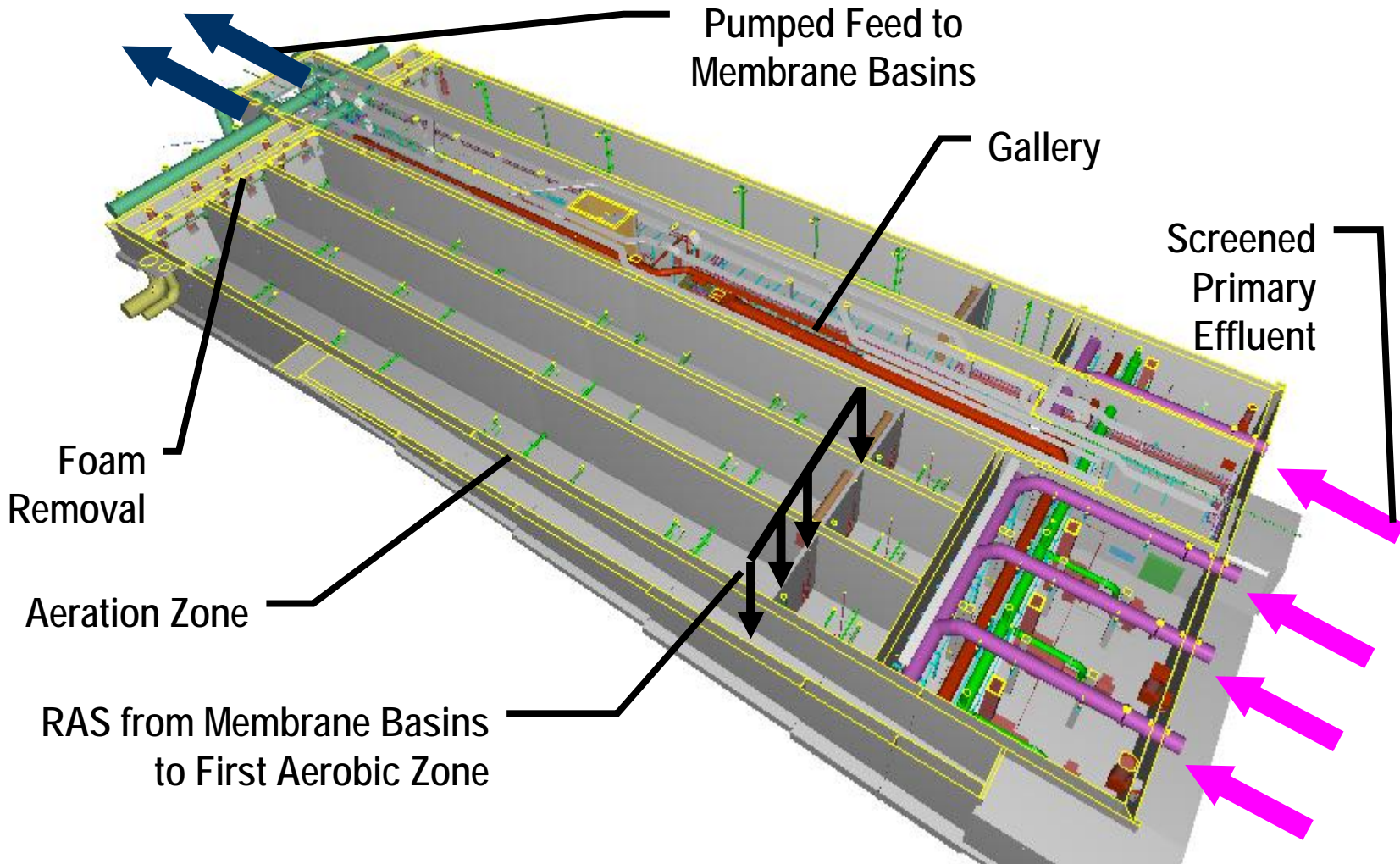
# General Treatment Process Schematic



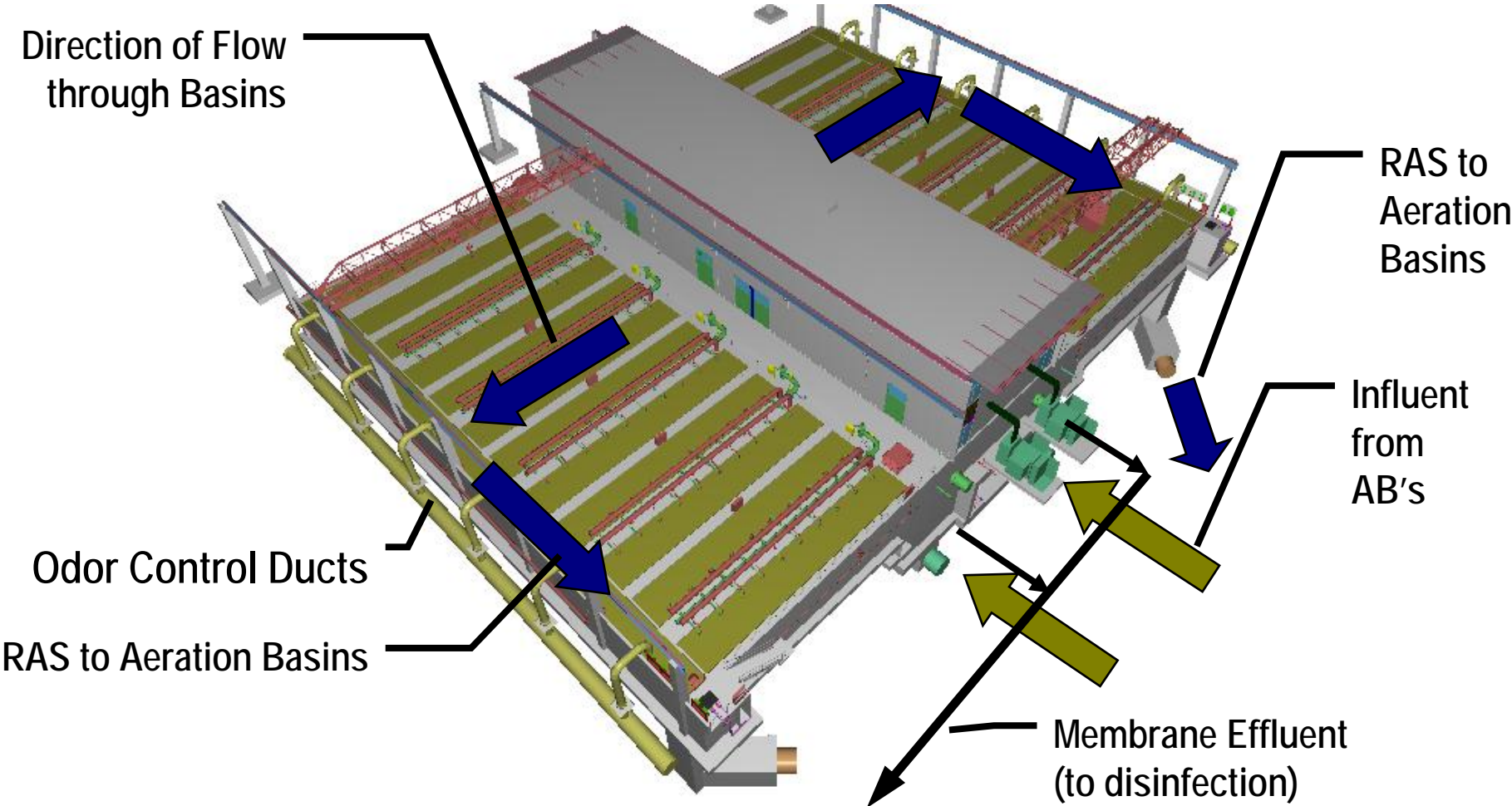
# Aeration Basins (bioreactor)



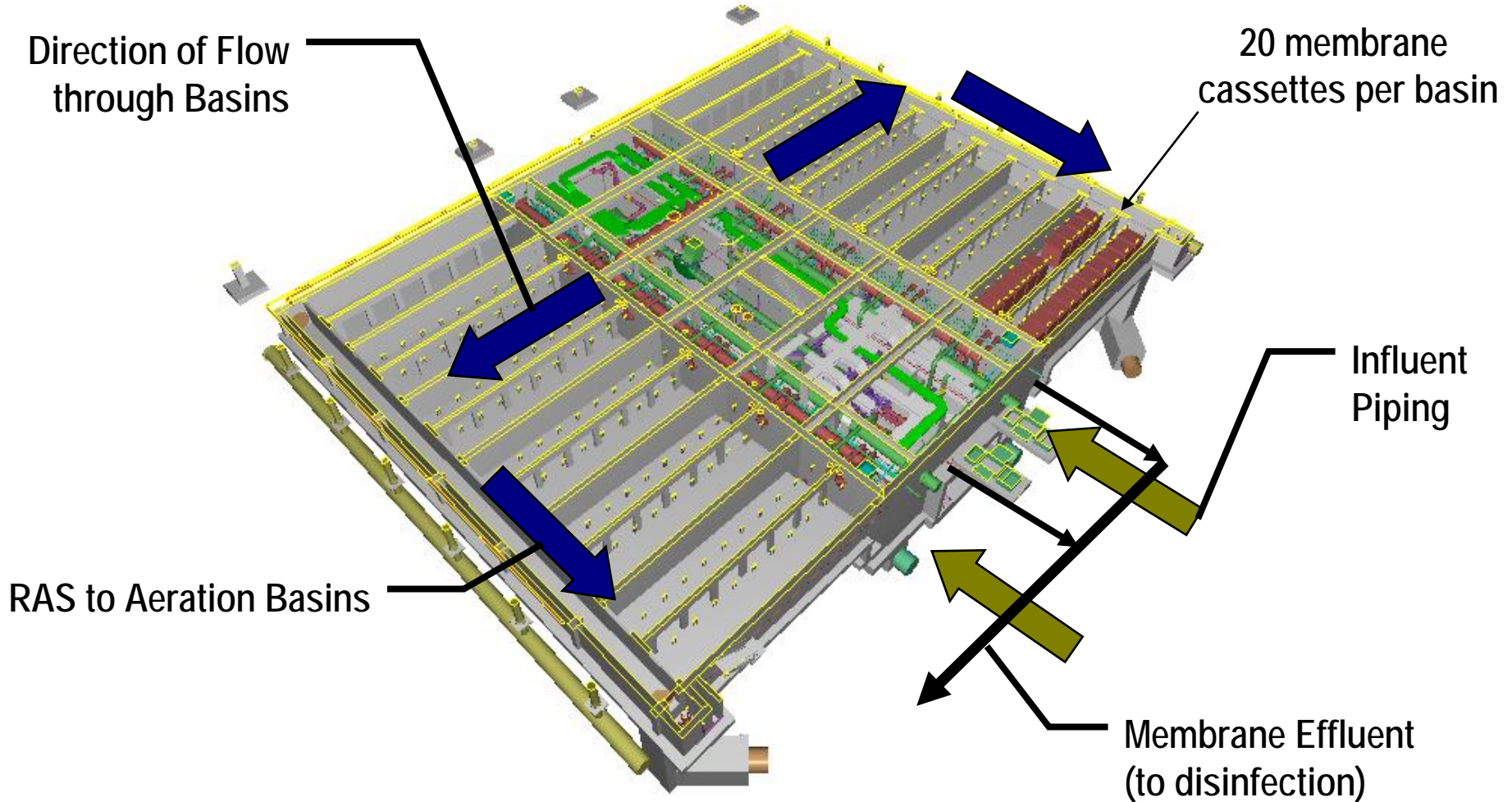
# Aeration Basins Below Covers



# Membrane Basins

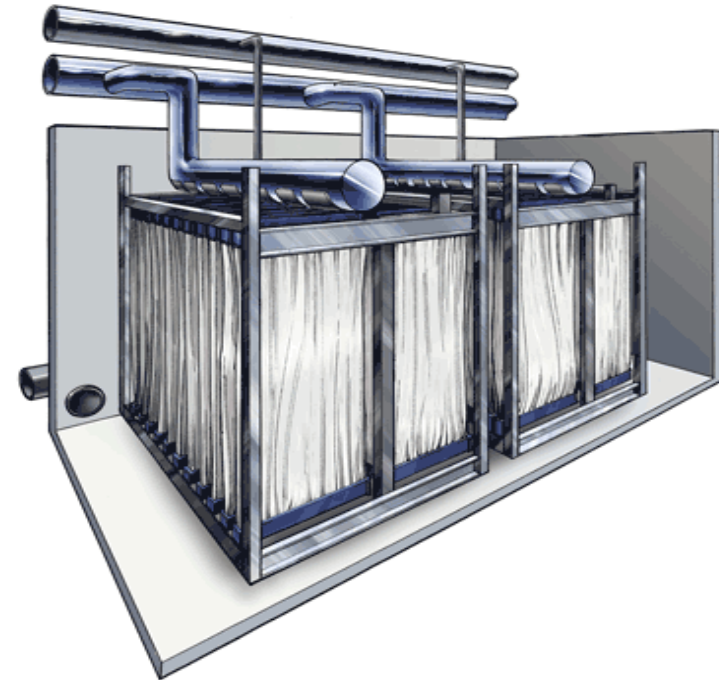
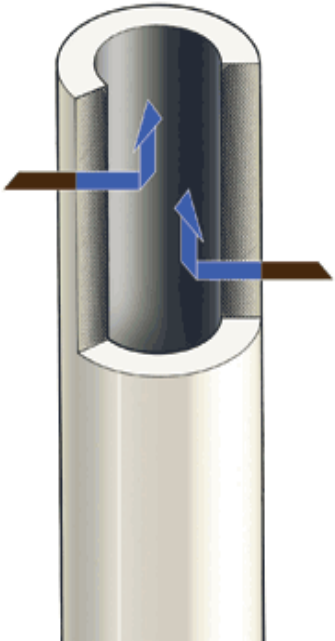


# Membrane Basins Below Covers



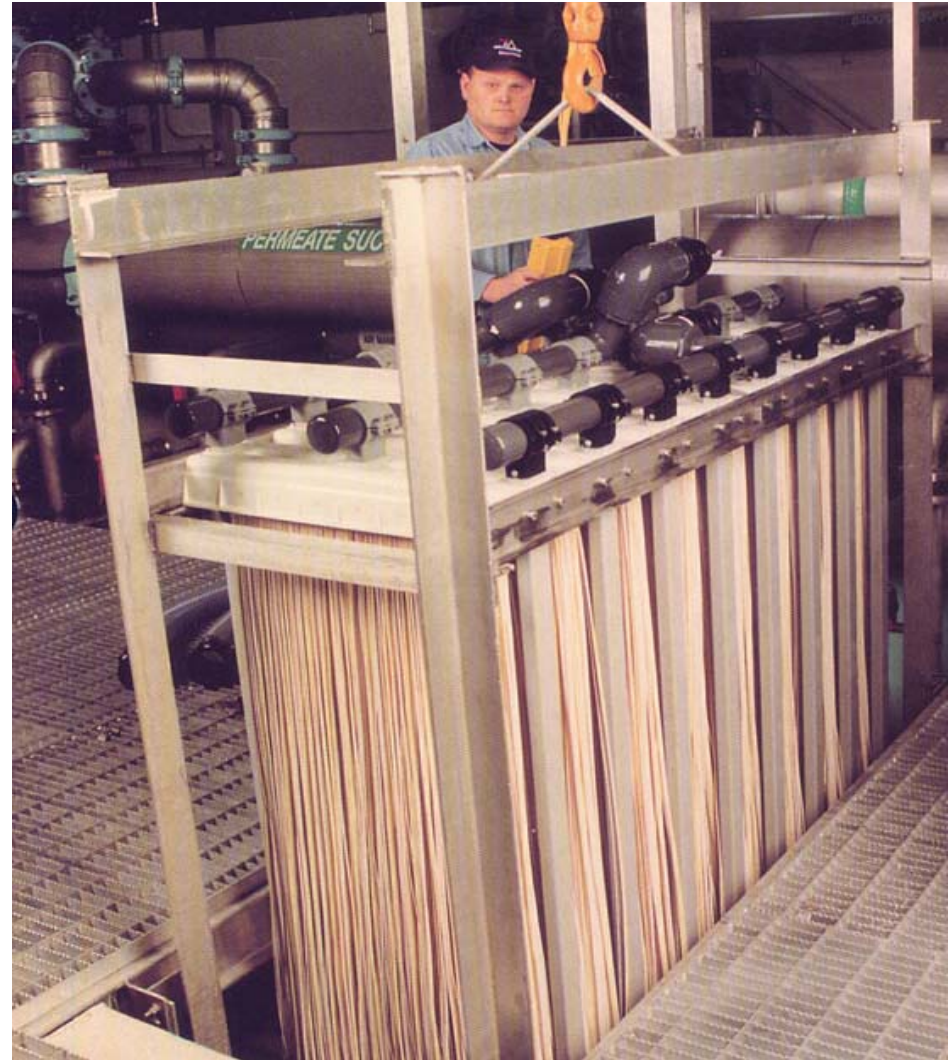
# Membrane Cassettes

- ◆ Strands of hollow, tubular membranes are placed in biologically active aqueous effluent
- ◆ Membranes filter very fine solids from wastewater
- ◆ Effluent is 7-10 times cleaner than secondary effluent
- ◆ Product meets Class A standards for water reuse



# Membrane Maintenance

- 💧 Agitation air
- 💧 Relax mode
- 💧 Backpulse
- 💧 Maintenance cleans
- 💧 Recovery cleaning



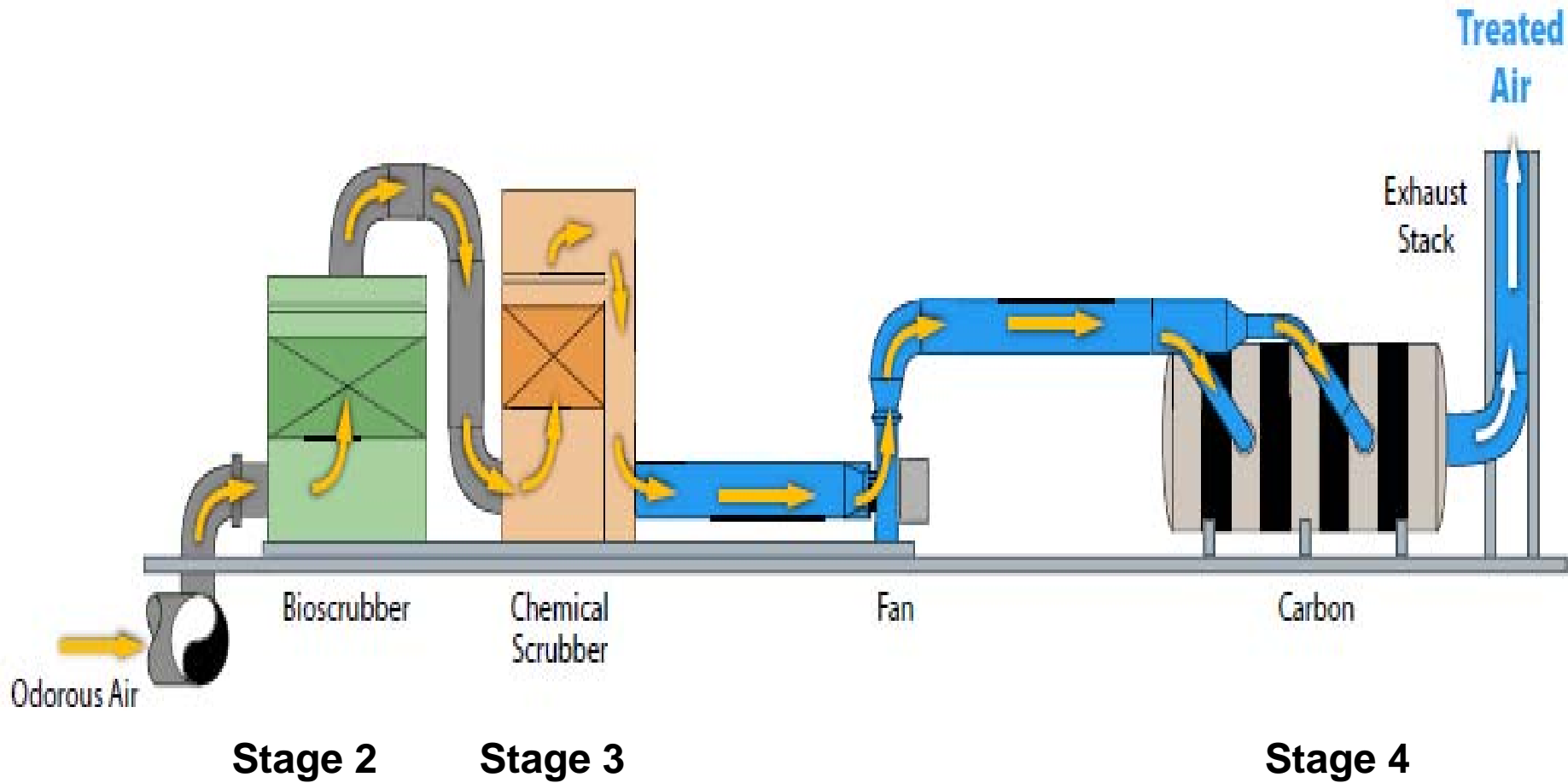
# Odor Control

- Committed to “no odors at the property boundary”
  - \$65 million investment
  - Four Stage (liquid & vapor phase) Odor Control
    - Stage 1: Wastewater will be pretreated in the collection system to reduce formation of odors
    - Stage 2: Bioscrubbers will remove the majority of hydrogen sulfide and odor compounds
    - Stage 3: Chemical scrubbers will remove remaining odor compounds
    - Stage 4: Carbon scrubbers will remove any trace odor emissions
-

# Odor Treatment Phases

## Stage 1

(Liquid Phase Treatment) Wastewater influent pretreated with a strong form of household bleach to reduce odors

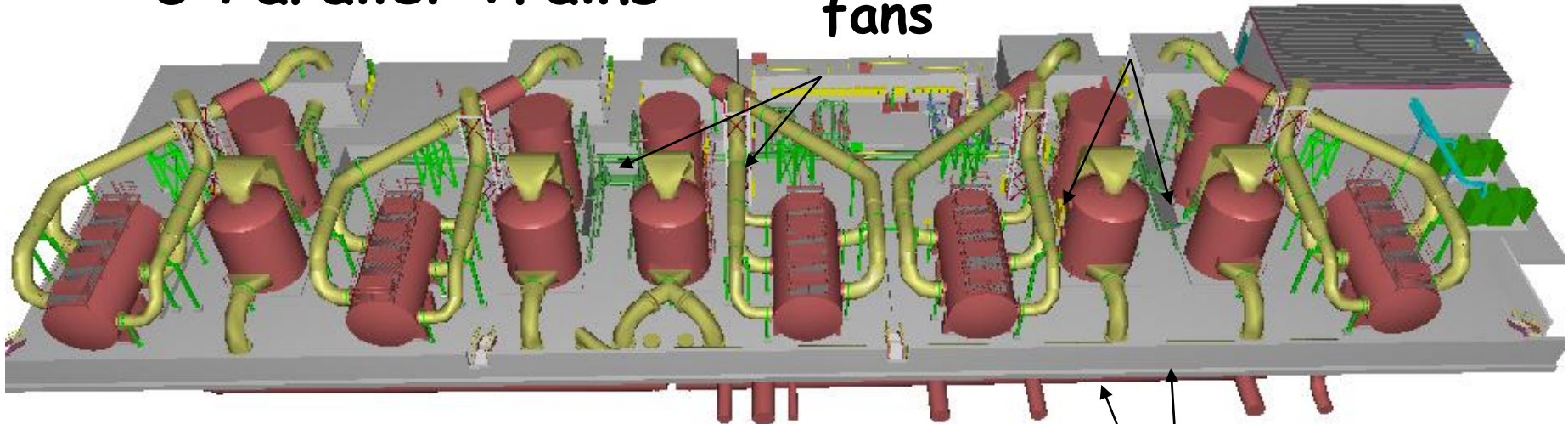


# Plan View Odor Control Facility

5 Parallel Trains

fans

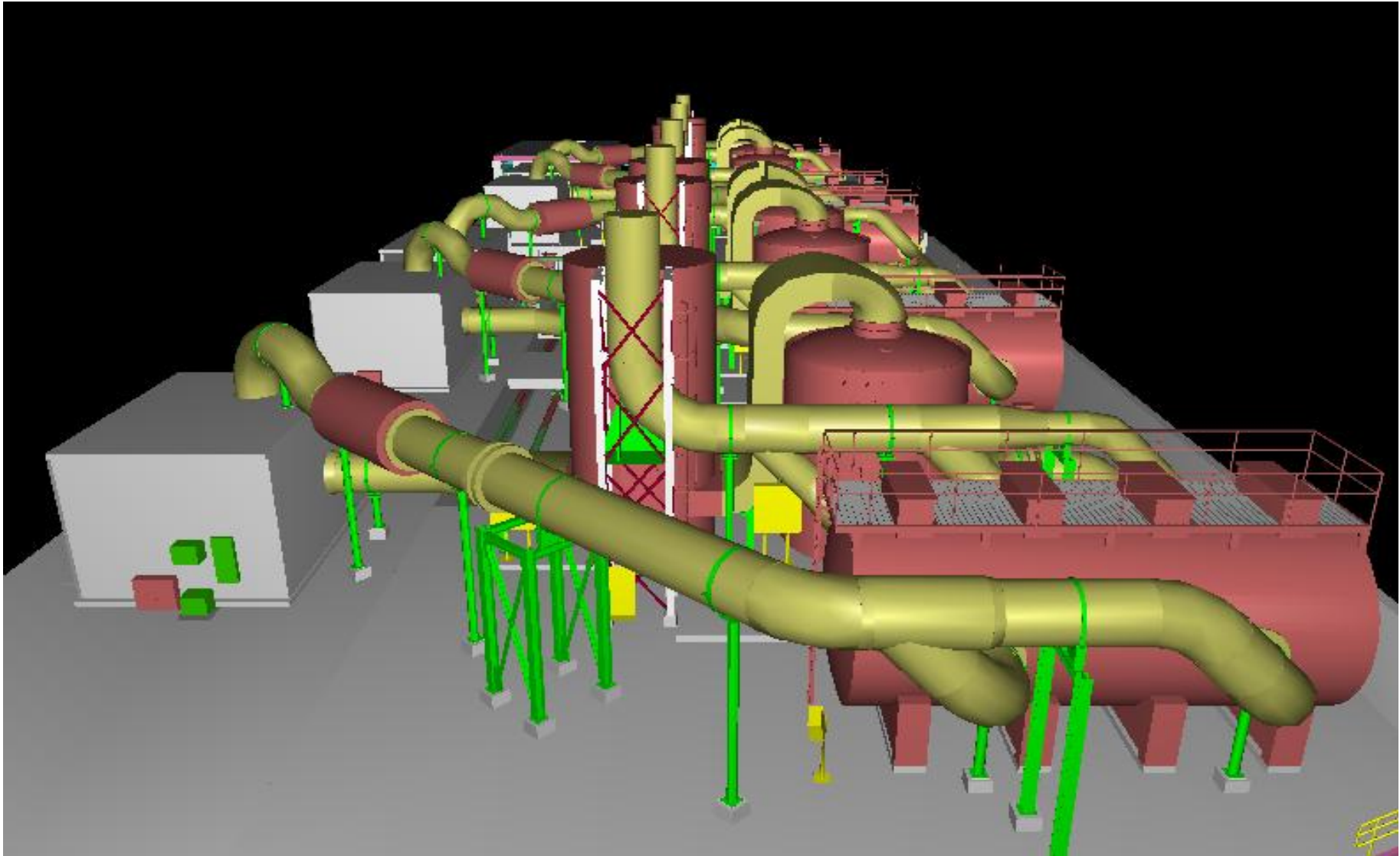
chemical scrubbers



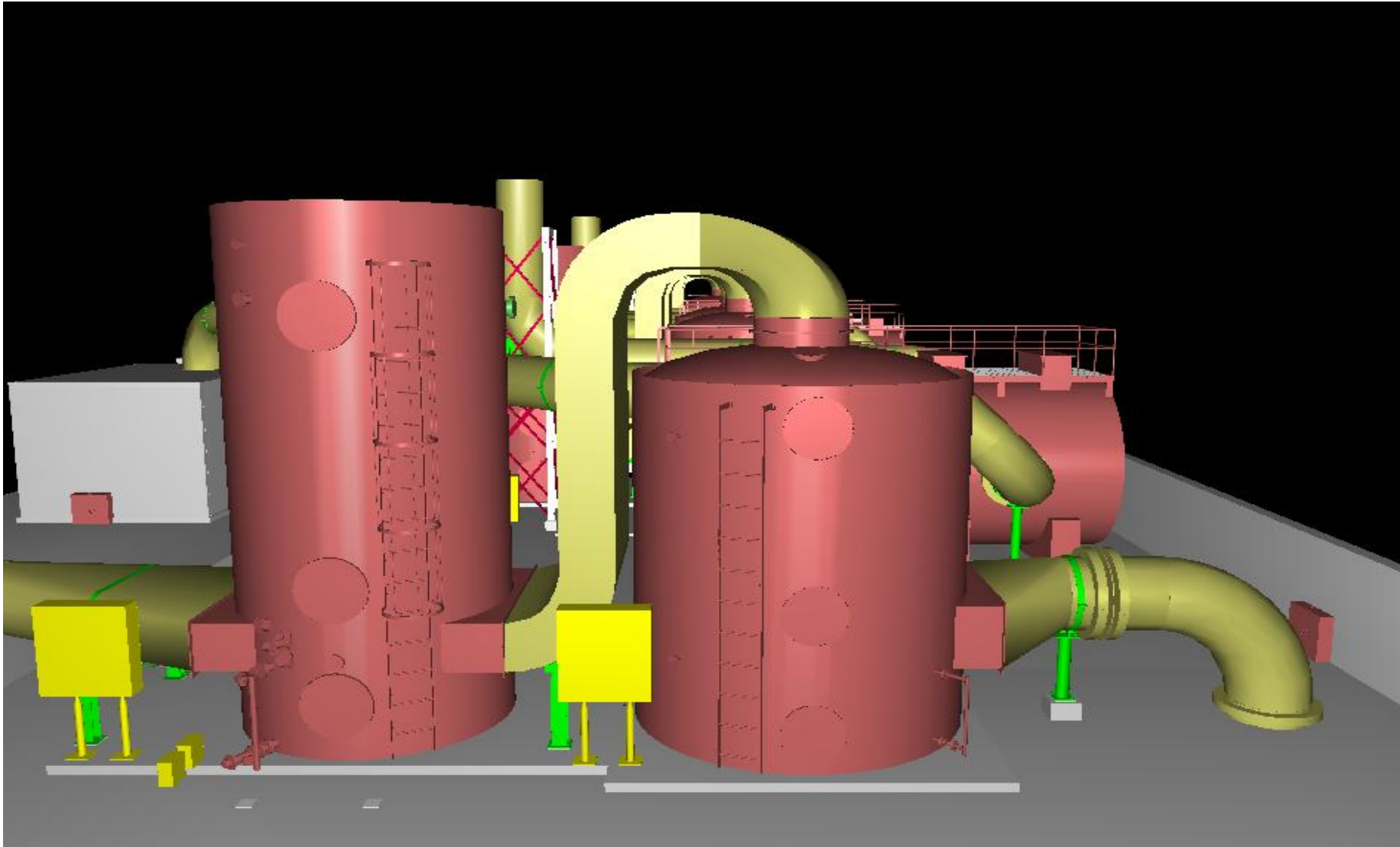
carbon filters

bioScrubbers

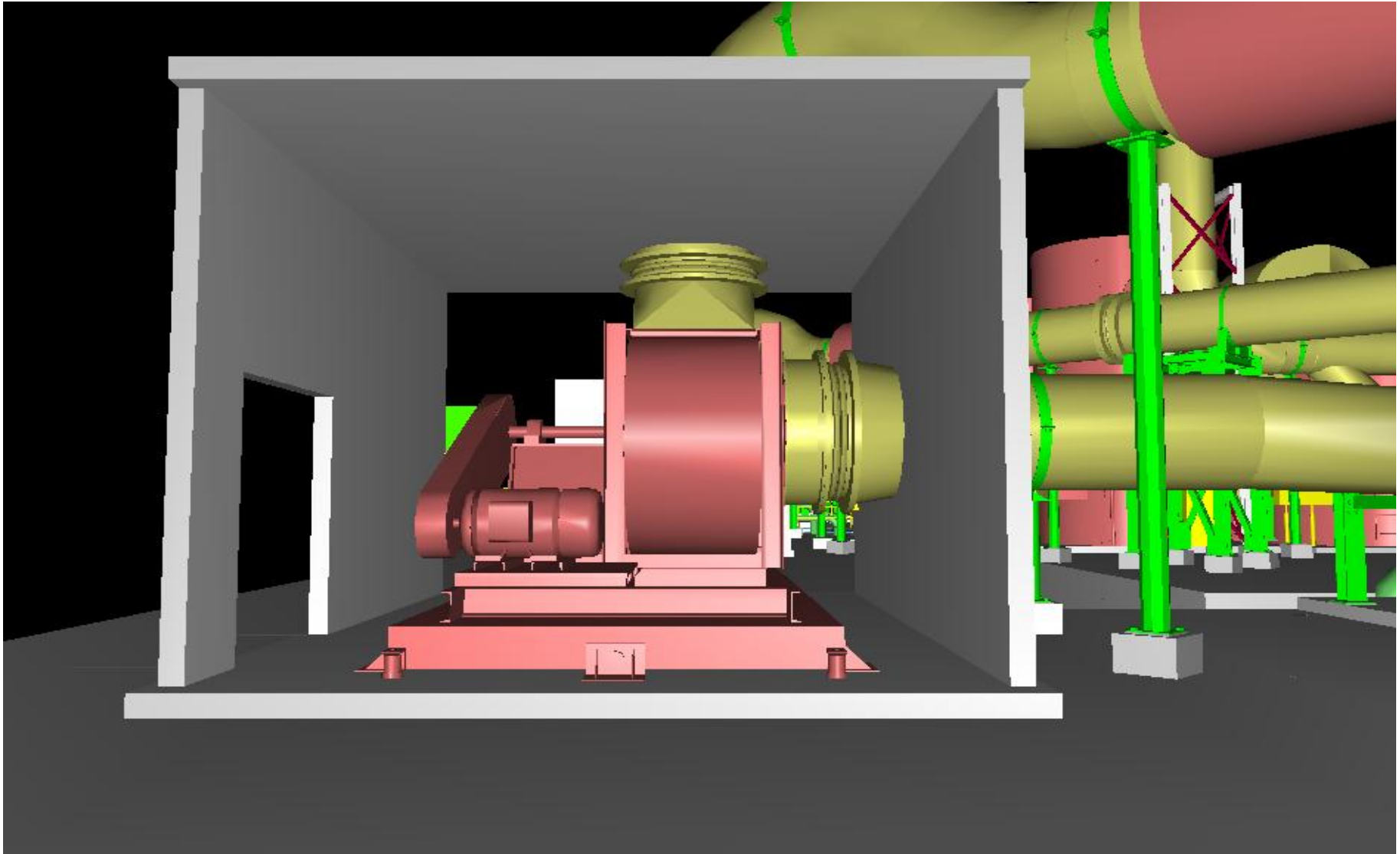
# Odor Control Facility



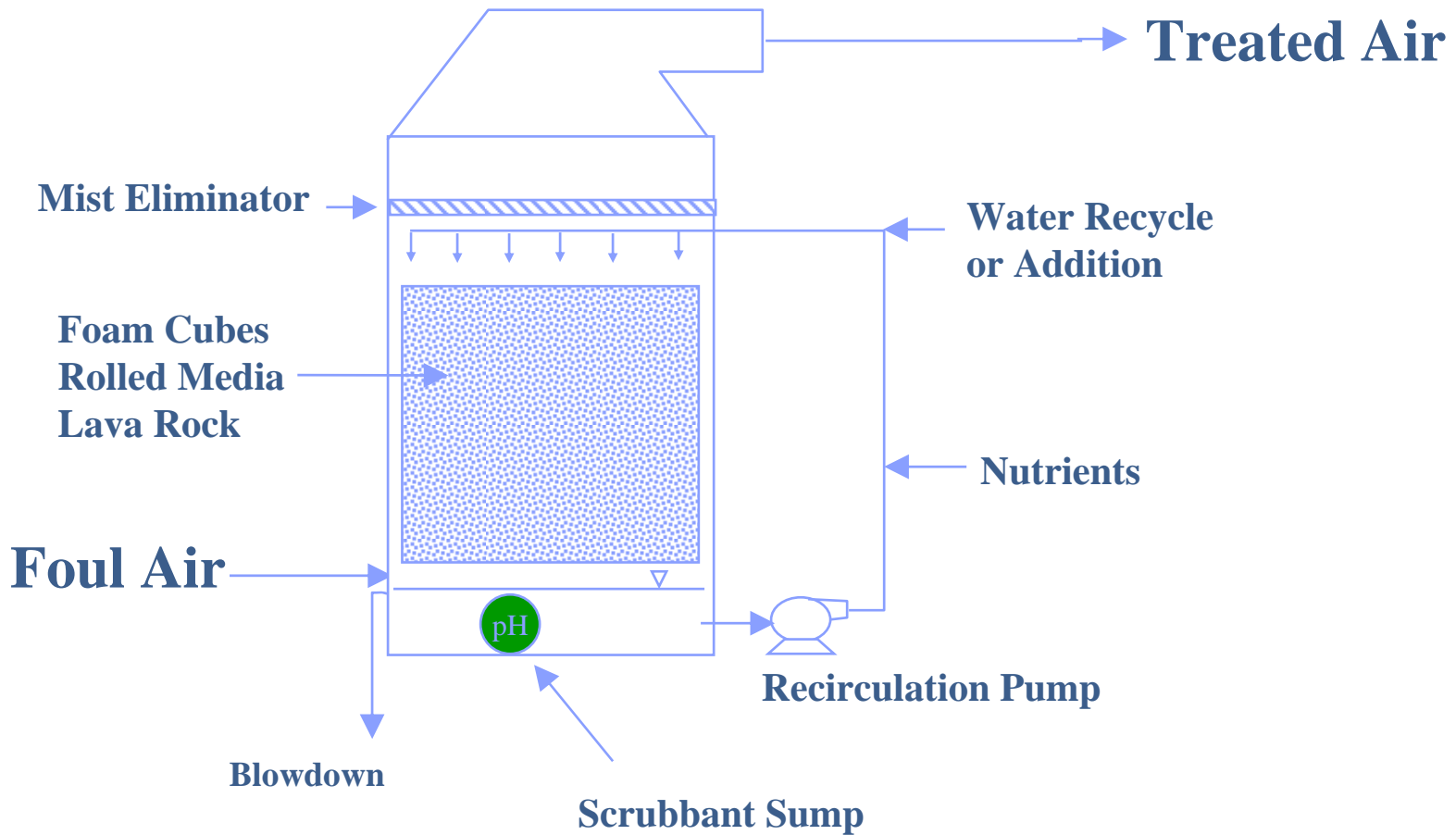
# Chemical and BioScrubbers



# Odor Control Fan in Enclosure



# Typical BioTower (countercurrent flow)



# Brightwater Project Schedule

- **Selected Zenon as membrane vendor**
  - **Clearing, rough grading, ESC and mitigation 2006**
  - **Earthwork, EDS in 2007**
  - **Begin installing membranes 2009**
  - **Plant testing & startup late 2010**
  - **Commissioning early 2011**
-

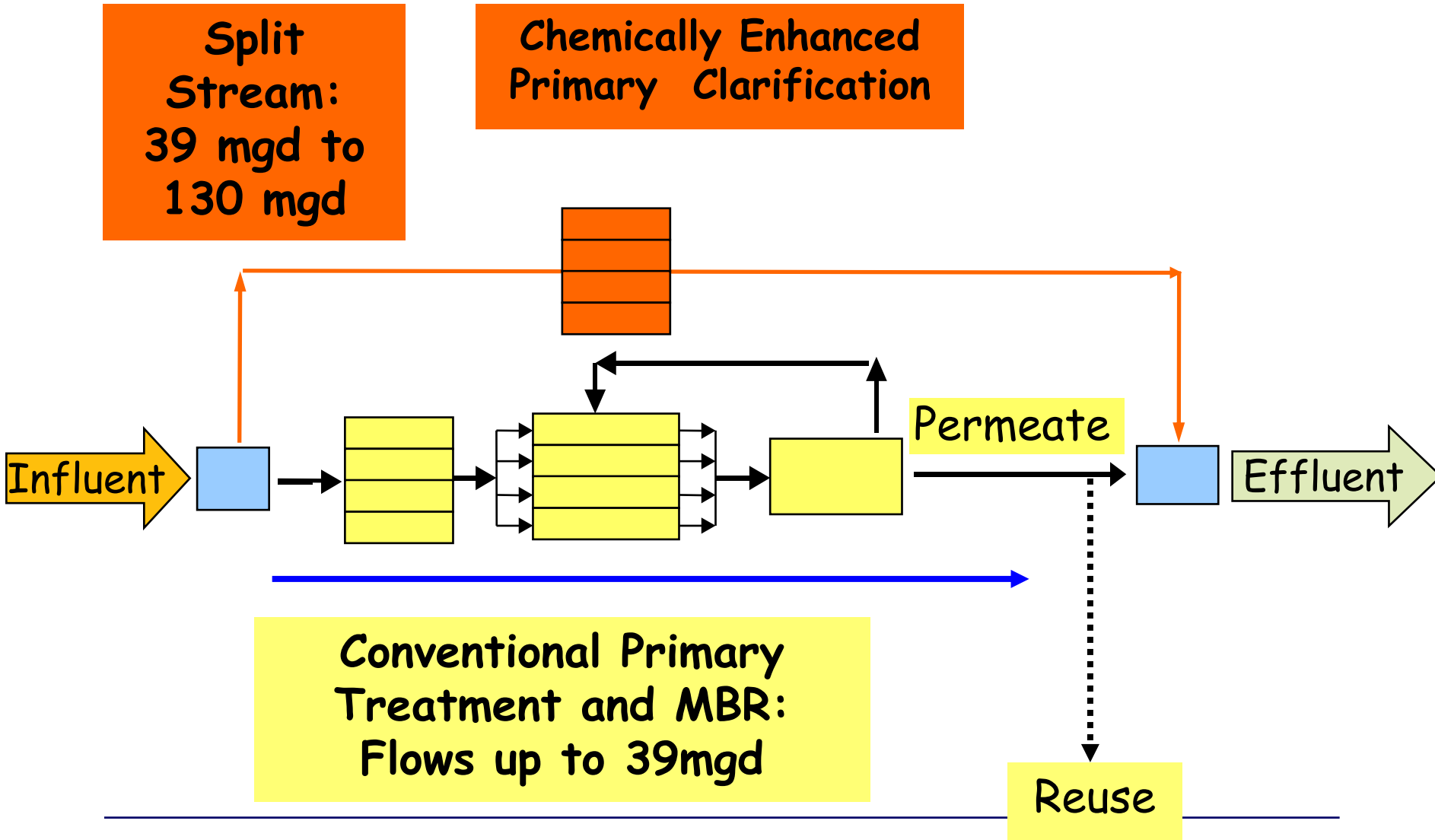
# Drivers for Selecting Membrane BioReactor

- ◆ Produces Class A reclaimed water to meet growing reuse demand
- ◆ Benefits Puget Sound through reduced annual pollutant load (“net environmental benefit”)
- ◆ MBR’s smaller footprint facilitates odor control, future expansion and mitigation
- ◆ Cost competitive with conventional activated sludge (CAS) when configured as split flow process

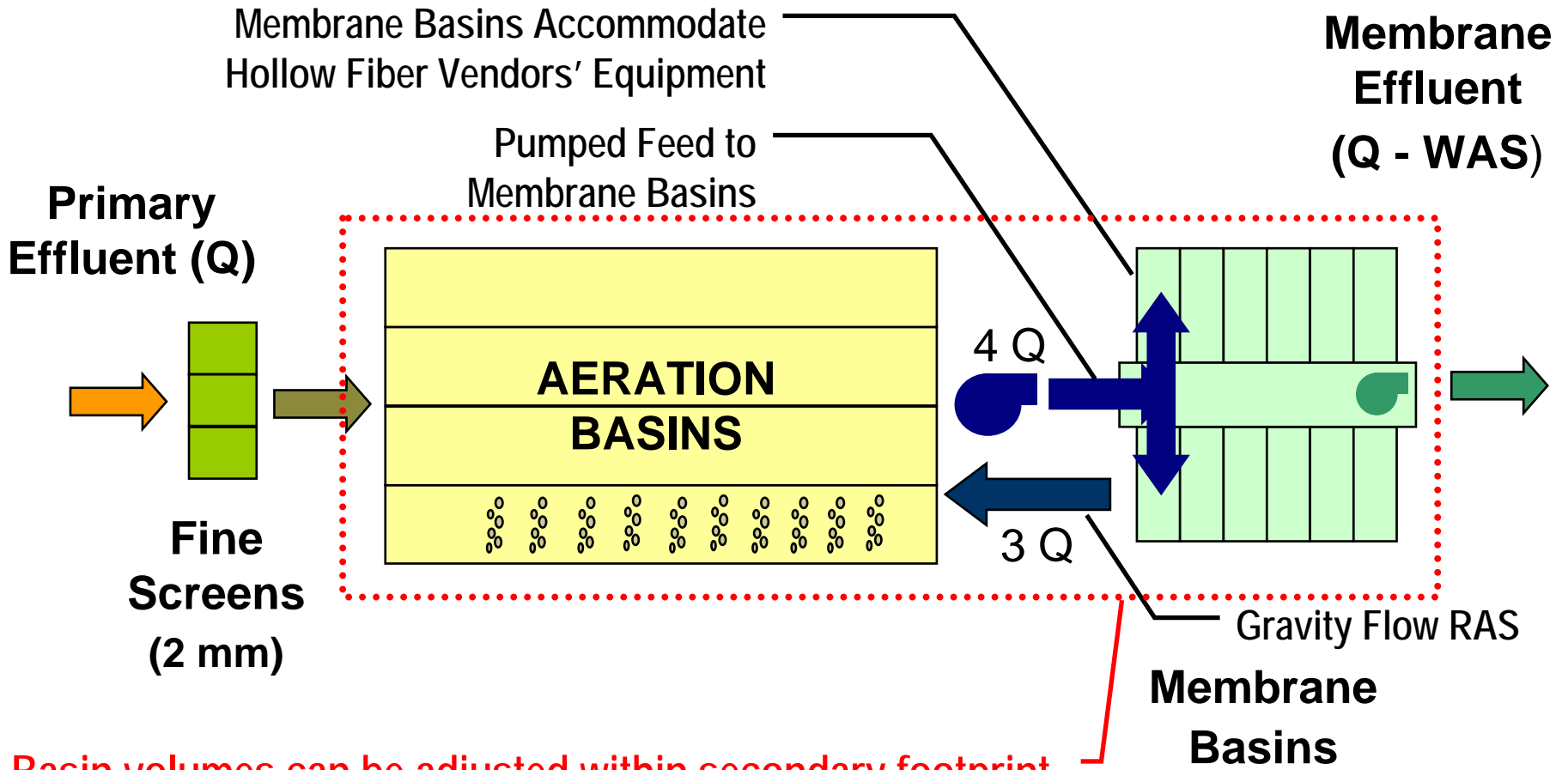
**MBR = Membrane BioReactor**

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# Split Flow Treatment Concept



# Key Elements of Generic Membrane BioReactor



Basin volumes can be adjusted within secondary footprint to accommodate different membrane configurations