Improving Process Water Efficiency: How to Implement Industrial Water Reuse

A Systematic Approach & Case Study

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Today's Water Environment

- Water availability and wastewater disposal options are becoming increasingly more restrictive
- Increased Emphasis on Sustainability
- Water reuse has become a preferred option for some facilities
  - Other sources of water are not available
  - Regulations make permitting new sources difficult
  - Costs for (process) water production and wastewater disposal exceed the cost (and reliability) of reusing treated wastewater

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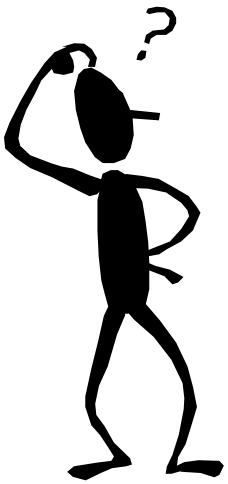
Drivers: Why Reuse/Conserve Water?



- Limited Availability of Water
- Raw Cost
- Ancillary Costs (chemicals, energy, etc.)
- Water Source Reliability
- Regulations/Executive Orders (13123)
- Environmental Stewardship/Public Image

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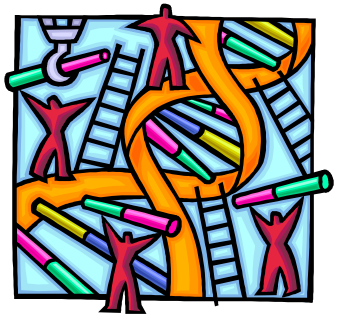
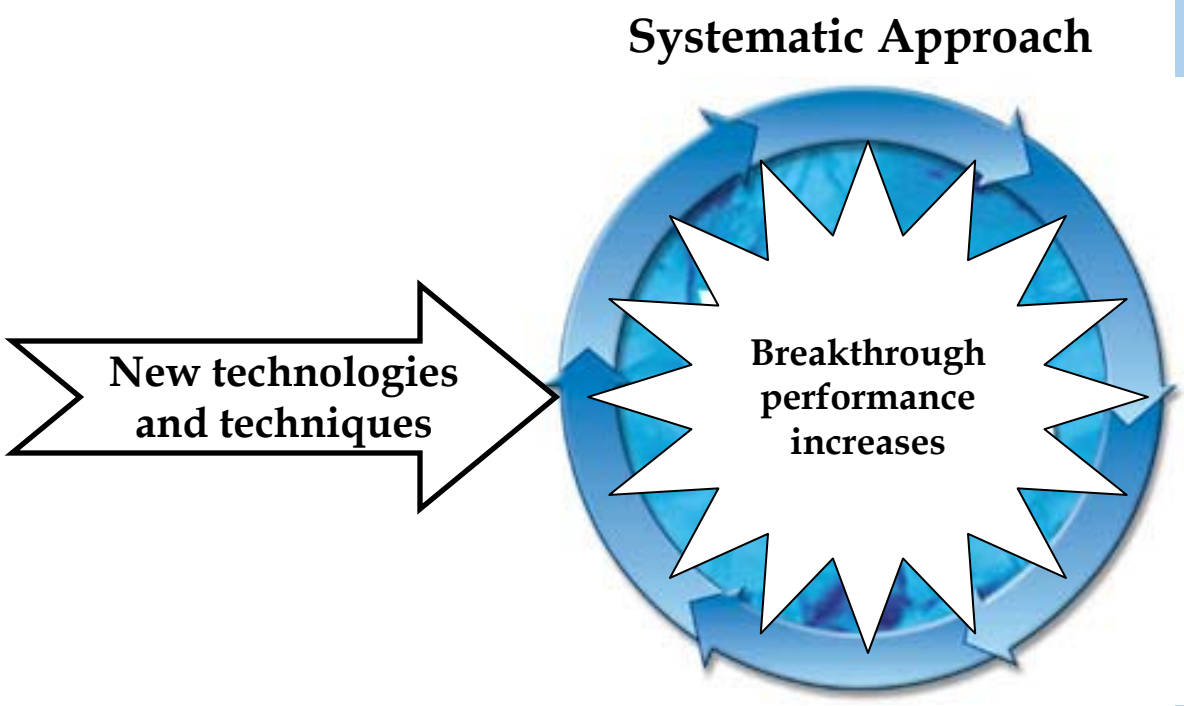
Integrated Systematic Approach

- Water streams of differing quality
- Water management strategies,
- Treatment technologies
- Systems thinking across departments and processes
- Systematic approach



The Power of Systems Thinking

- Thinking across departments and processes
- Understanding economic, technological, and environmental drivers
- Modeling an entire plant (or even neighboring plants)
- Understanding the interdependencies

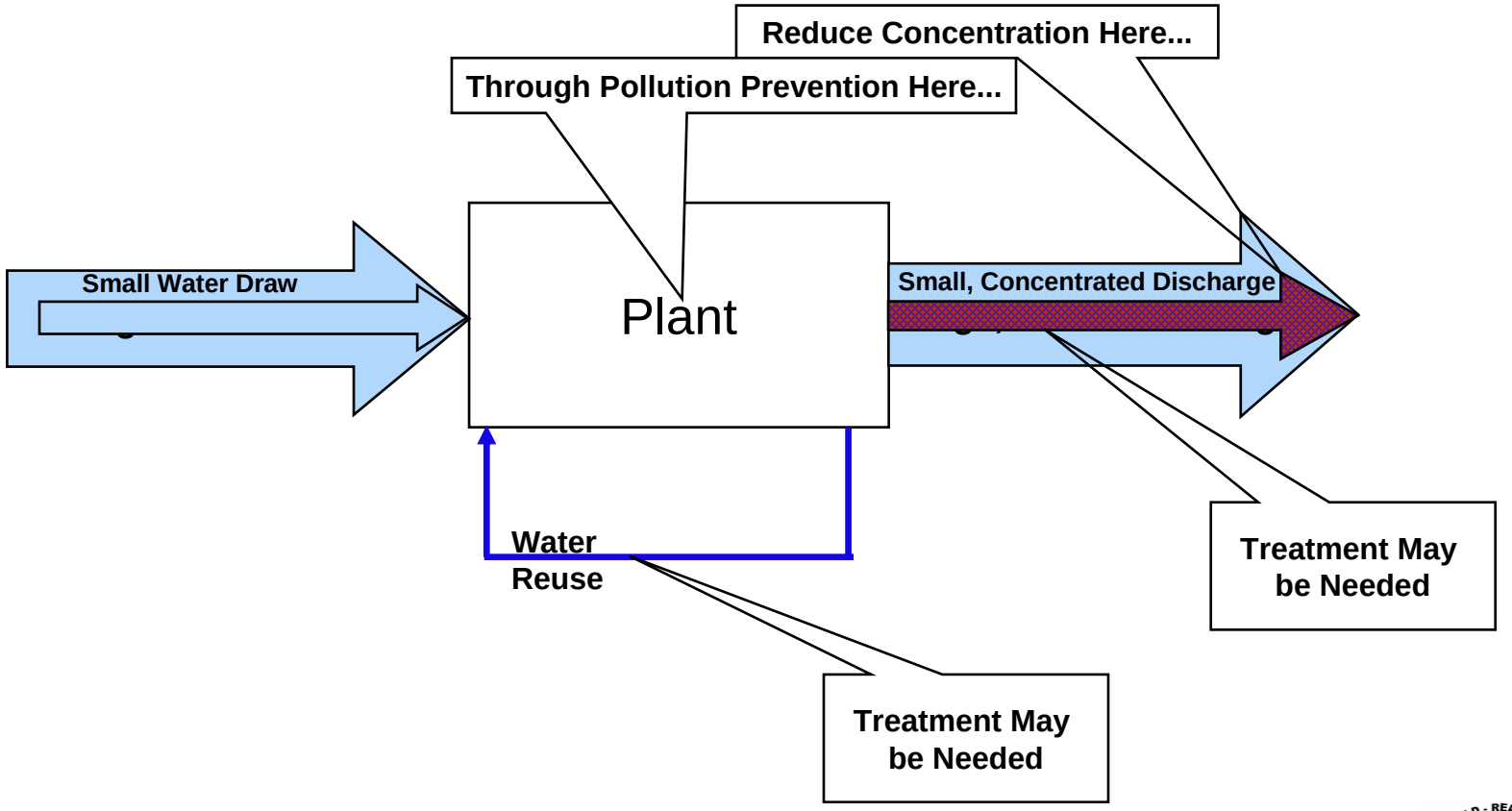


Benefits of Water Reuse

- Materials Recovery
- Reduced Energy Consumption.
- More Siting Options.
- Elimination of Discharge Permit.
- Reduction in Process Water Treatment Needed.
- Financial Incentives.
- Enhanced Public Image.

Water Reuse Can Help…but:

- There are Upsides and Downsides



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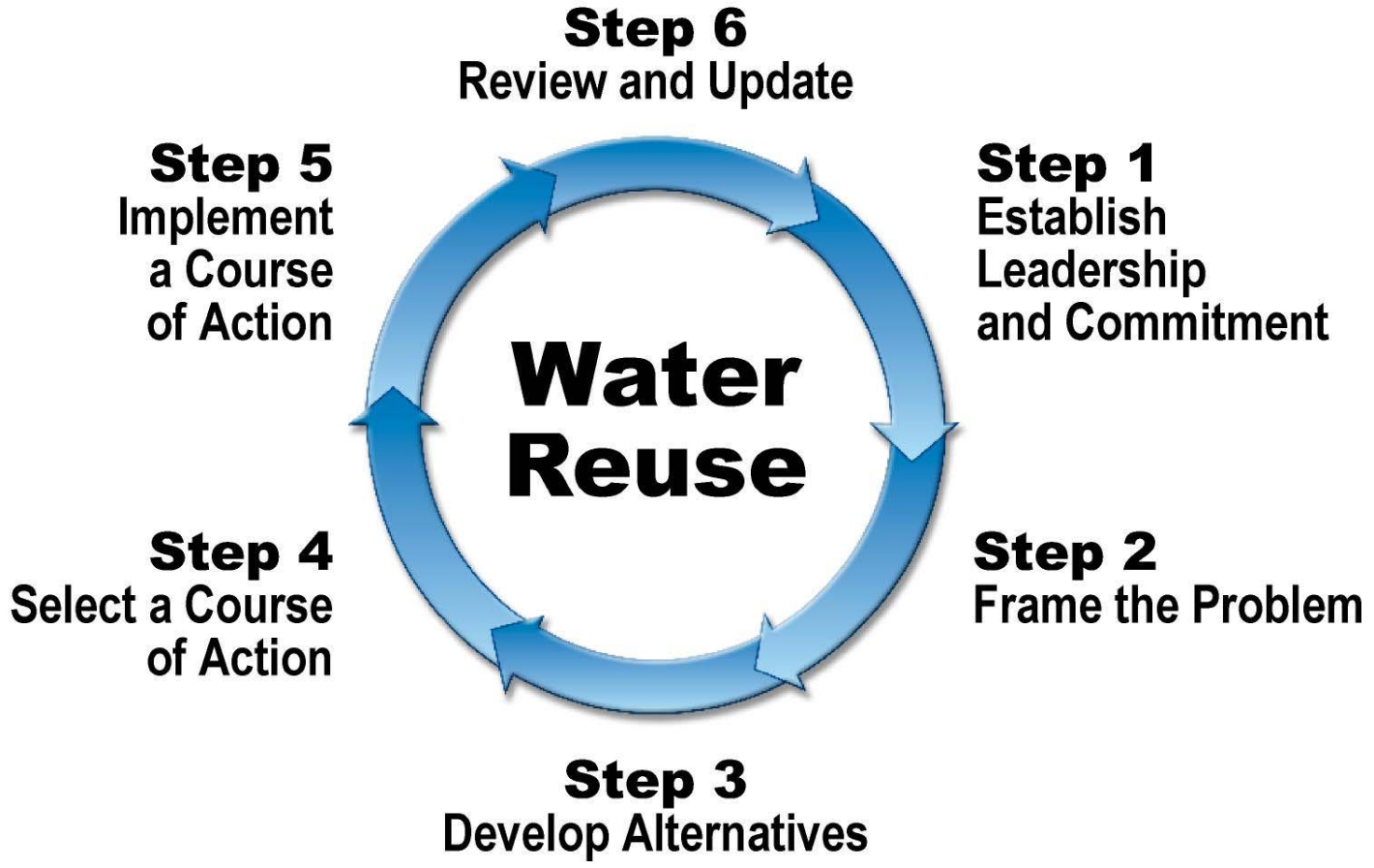
The Systematic Approach



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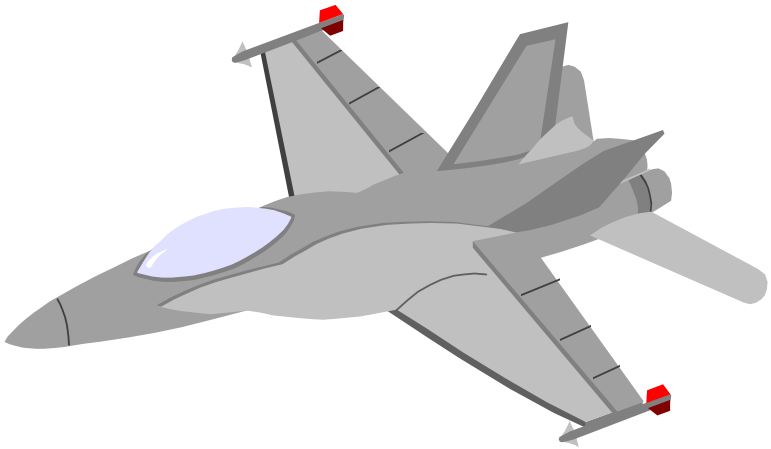
Six-Step Approach to Water Reuse

- **Step 1: Establish leadership and commitment for the effort.**
- **Step 2: Frame the problem and set boundary limits for the study.**
- **Step 3: Evaluate technical opportunities and water reuse techniques, develop alternatives, and define potential problems and contingencies.**
- **Step 4: Select a course of action.**
- **Step 5: Implement the new course of action.**
- **Step 6: Review and update the model or design as needed.**



Aerospace Manufacturer

- Aerospace Manufacturer implements water reuse and:
  - Lowers purchased water consumption
  - Reduces wastewater discharges
  - May result in less stringent discharge concentration limits.
  - Results in annual operating cost savings.
  - Demonstrates environmental stewardship.

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Facility Description

- AFP 6 - government-owned, contractor-operated facility.
- Constructed in 1943, located in Marietta, Georgia, operated by LM Aero.
- Military aircraft, (C-5 and C-130 transports, F-22 fighter) manufactured and/or refurbished at AFP 6.

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Facility Description

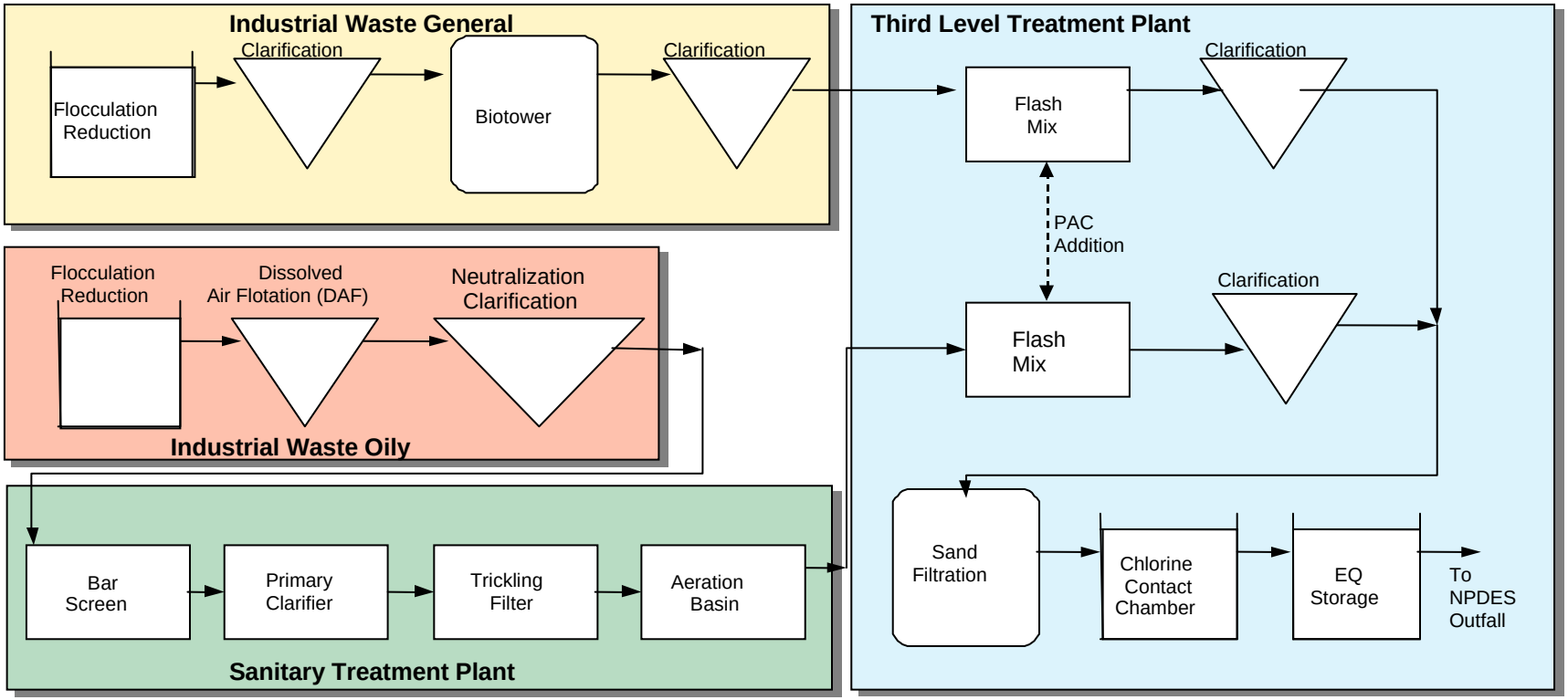
- Manufacturing operations divided into six major areas:
  - Machining and grinding
  - Solvent degreasing
  - Metal finishing (cleaning, electroplating, anodizing, conversion coating)
  - Spray painting
  - Aircraft assembly
  - Utilities including Steam plant (16 boilers), Cooling towers (131), Wastewater treatment plant

Step 1: Establish Leadership and Commitment (Motivation)

- Effluent Receiving Water Limitations.
- Low Discharge Limits, Especially for Metals.
- Reissue of NPDES Permit
- Compliance Issues Associated With Increasing Production.
- Reduce Amount of Purchased Water ($$)
- Increase Available Withdrawal Amounts for Downstream Users - Important for Interstate Water Compact Negotiations.
- Environmental Stewardship

Step 2: Frame the Problem

- Plant Overview



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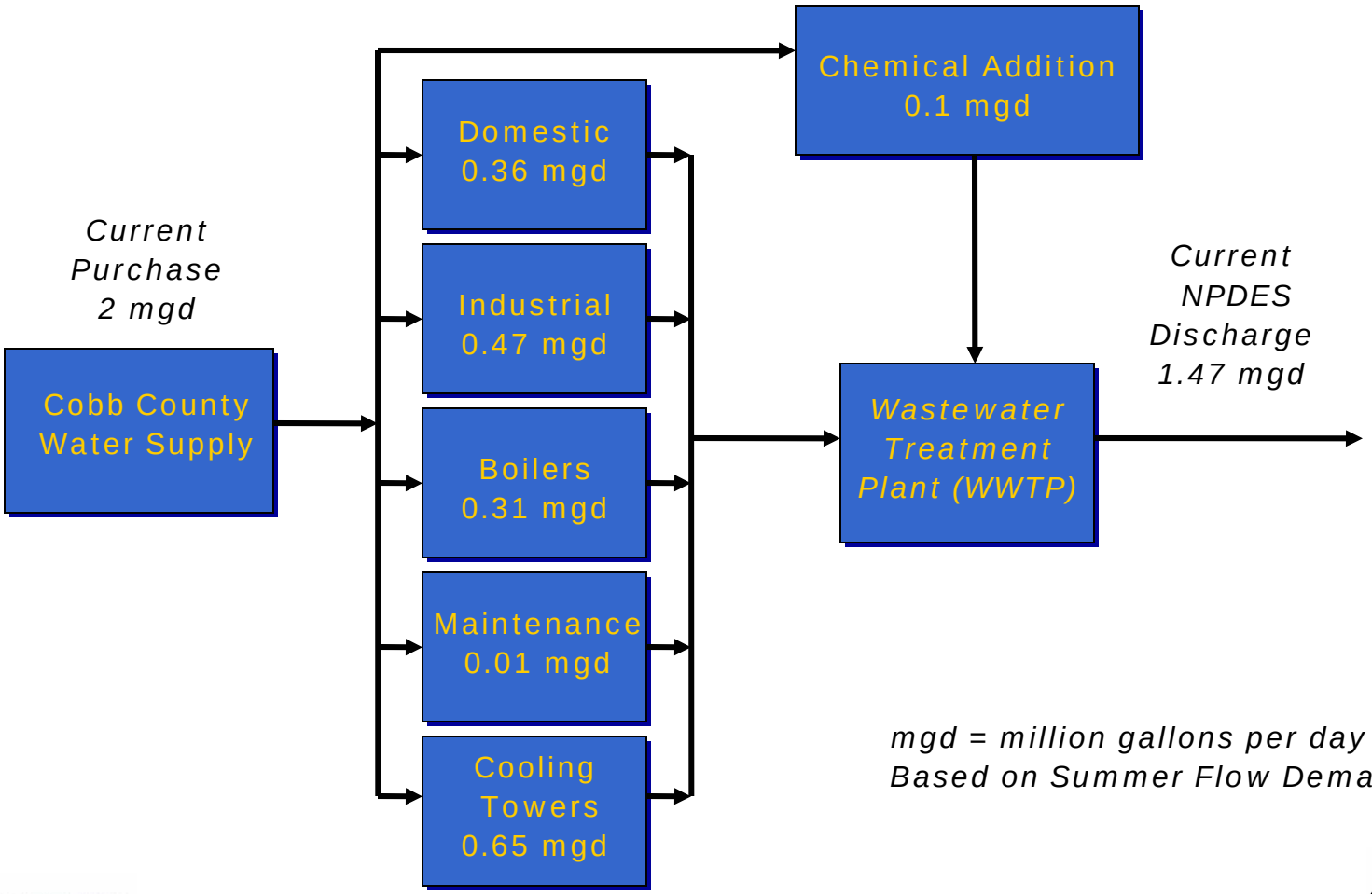
Data and Water Balance



mgd = million gallons per day
Based on Summer Flow Demands

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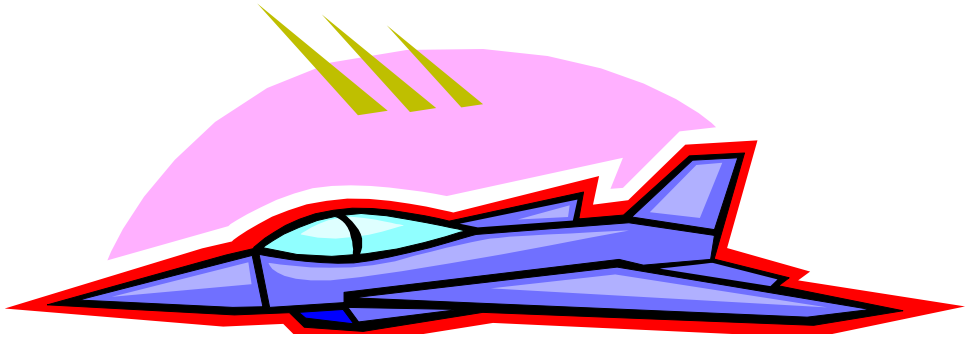
Step 3: Develop Alternatives

- Objectives:
  - Supply for reuse 240-720 gpm water of drinking water quality,
  - Up to 55 gpm water with low TDS and oil & grease, and
  - Up to 90 gpm water with low alkalinity, hardness, silica, iron, copper, and 7<pH<8.5.



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Constraints and Evaluation

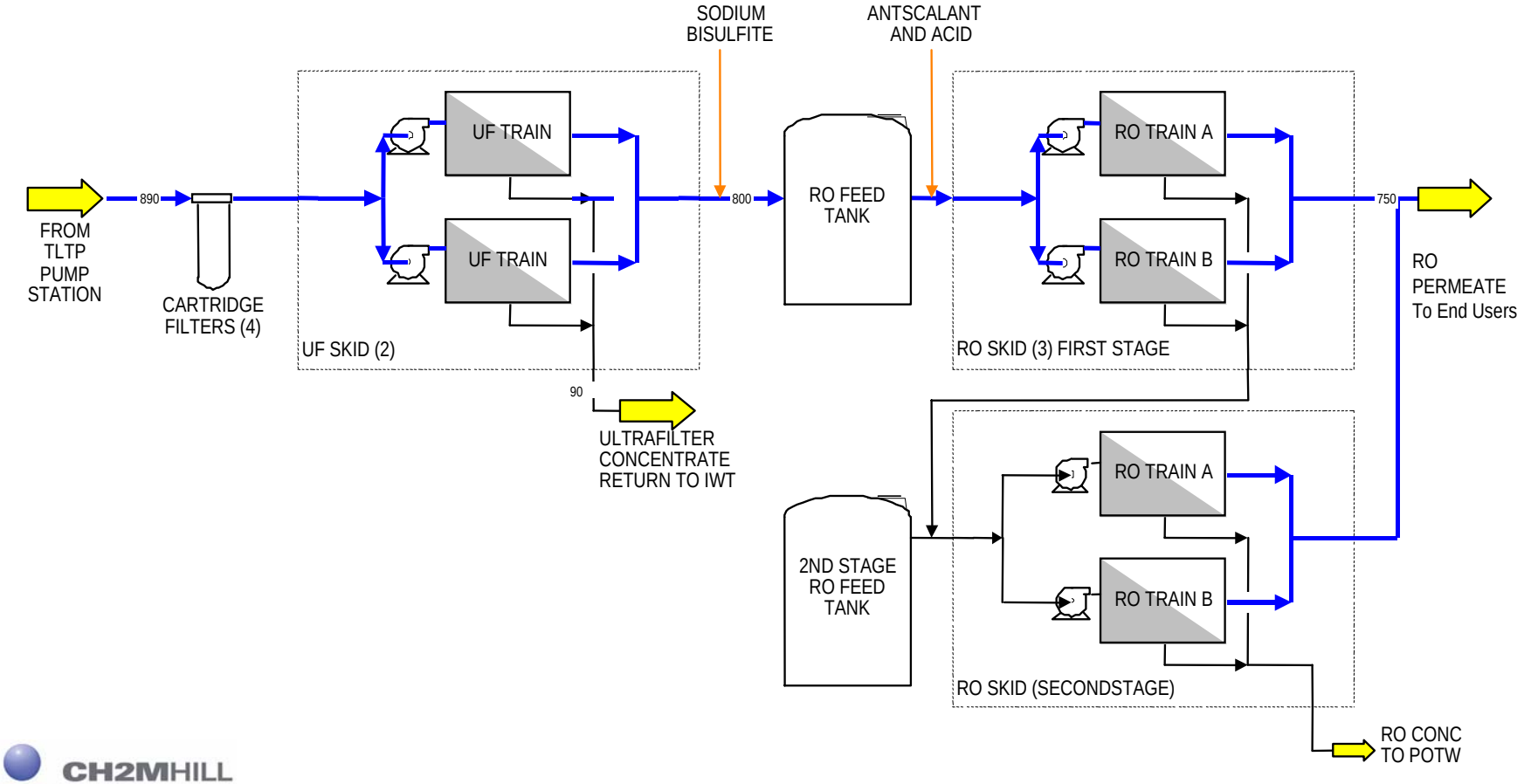
- Minimize installation costs for water reuse.
- Use surplus ultrafiltration (UF) and RO equipment found at AFP 44.
  - Modifications required due to differences in water source and changes in membrane technology.
- Original concept envisioned supplying two different waters to end-users (high and low quality effluent)
  - Would require two separate distribution systems
  - Decided to supply all end-users with RO treated water.

Step 4: Select a Course of Action

- Identify end-users.
- Conceptually configure equipment.
- Pilot-test UF and RO using LM aero's wastewater.
- Evaluate RO concentrate disposal
- Design UF/RO System
- Design conveyance systems
- Construct RO and conveyance systems

Step 5: Implement Course of Action

- **LM Aero System Design**



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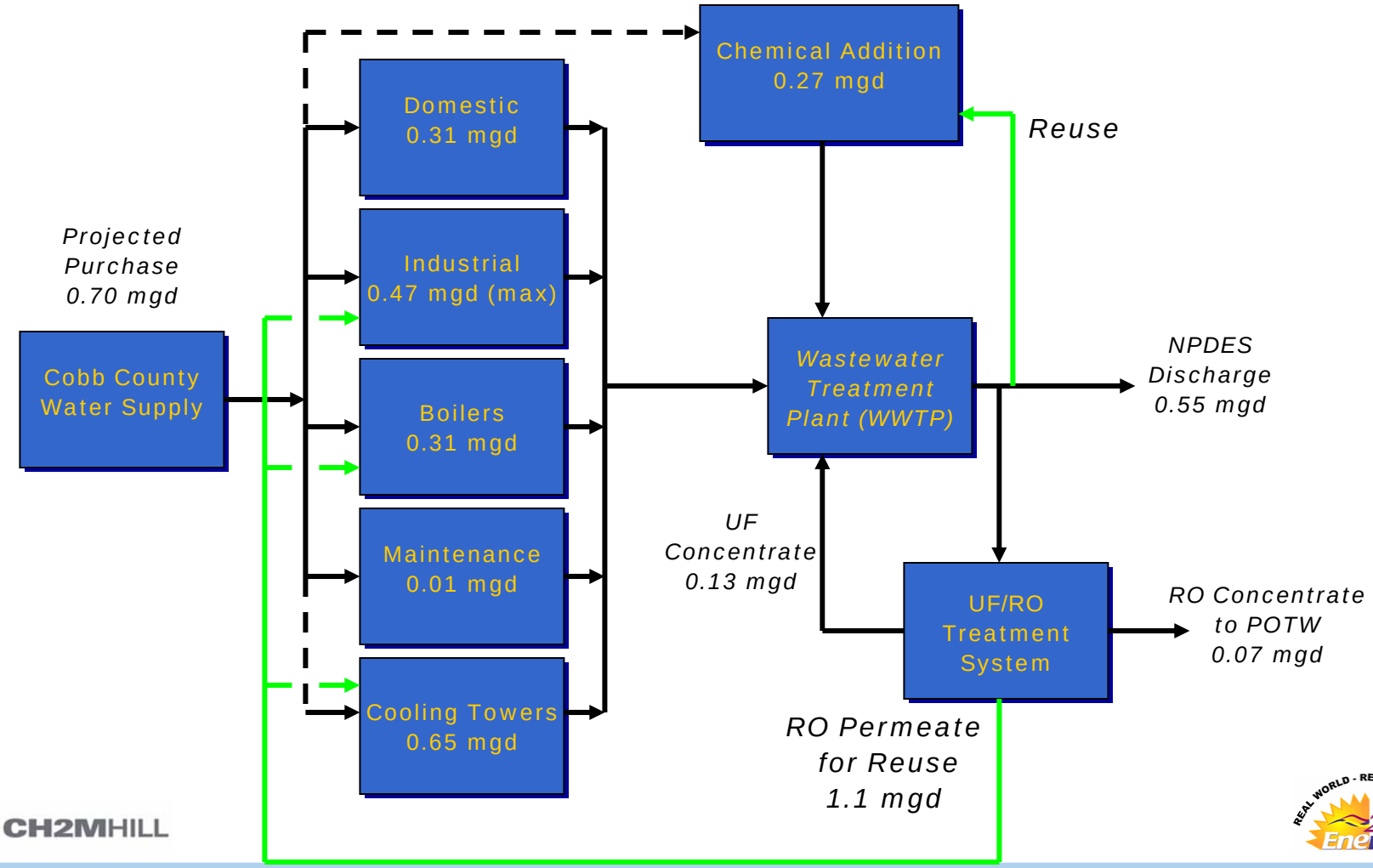
Step 5: Implement Course of Action



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Step 6: Review and Update

- Results and Findings:
  - Approximately, 0.6 mgd of wastewater treated and reused initially.
  - As much as 1.08 mgd of wastewater can be reused under system design.
  - Better Quality/Quantity
  - Amount of purchased water reduced by 0.6–1.08 mgd, - capacity for new or expanded local drinking water customers.
  - Savings in annual operating costs estimated at $50,000–$100,000.