

Stretching Technologies

for

Cost Effective Reuse

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Water Reuse Demonstration Study

- Performed for King County, Seattle
- Reclaimed water program
 - Meet water supply needs
 - Endangered species protection



Project Goals

- Identify best treatment technologies for:
 - 0.5 - 5 mgd seasonal satellite scalping WWTP
 - Irrigation
 - Dual function CSO treatment
 - High-end use facilities
 - Stream-flow augmentation
 - Groundwater recharge



Water Quality Classifications for Reclamation End Uses







Water Quality	BOD (mg/L)	Total P (mg/L)	NH ₃ -N (mg/L)	Total N (mg/L)	TSS (mg/L)	Turb. (NTU)	Metals, Organics
Class A	30	--	--	--	30	2	--
Wetlands	20	1	--	3	20	2	--
Groundwater Recharge (non- potable)	5	--	--	--	5	2	--
Large Stream	30	0.1	2-3	--	30	2	--
Small Stream	10	0.1	1	--	10	2	--
Lake Discharge – Anticipated	10	0.01	1	--	10	2	--
Lake Discharge – Worst Case	10	0.01	0.02	0.6	10	2	--

Project Divided into Two Phases

- **Phase 1:** *Technology Evaluation and Selection*
- **Phase 2:** *Technology Demonstration*



Key Issues for Class A Facility

-  Small footprint
-  High automation
-  Remote operation
-  Non-continuous operation
-  Dual function
-  Neighbor friendly

Step 1: Technology Evaluation

- In-depth review of treatment technologies
 - Literature review
 - Pretreatment => disinfection
 - Categorized: established, emerging, developing
 - No conventional secondary treatment
- Individual “White Paper” per technology (23)
- Review of Reuse Plants (15)

White Papers included

- Application points and performance
- Development status
- Reliability
- Automation potential
- O&M considerations
- Benefits
- Limitations
- Cost
- Vendors
- Operating facilities

Step 2: Screen Technologies

- Workshop with King County, consultants, technical experts, regulators
- Screening criteria
 - Potential or demonstrated performance
 - Automation potential
 - Seasonal operation
 - O&M



Processes Selected



Step 3: Identify Candidate Treatment Trains

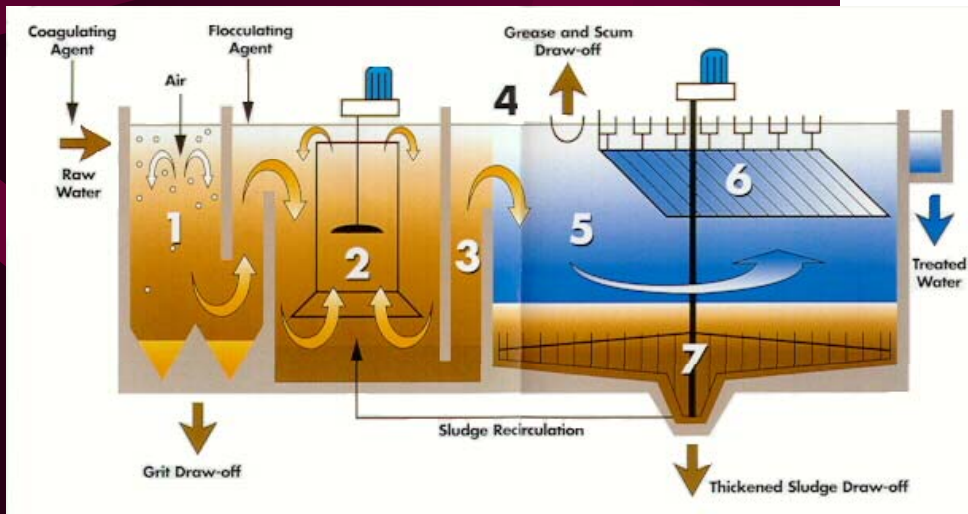
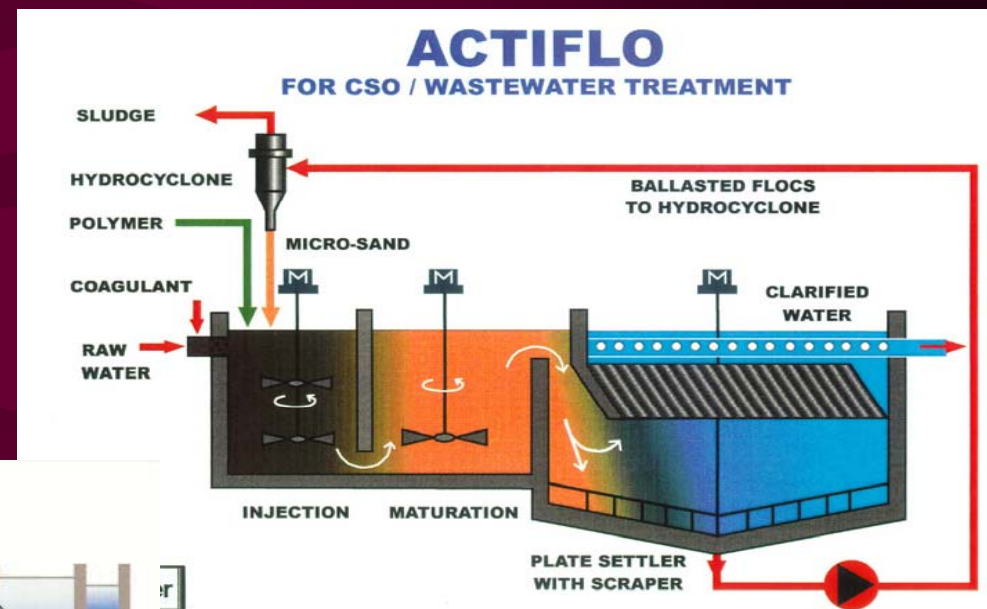
- 14 trains identified
- White Paper per train
 - Compatibility between processes
 - O&M
 - Reliability
 - Class A compatibility
 - Upgrade to advanced treatment
 - Public impact
 - Cost
 - Pilot issues

Why Pilot Test?

- Demonstrate the effectiveness of various treatment trains to meet Class A
- Understand interaction of different processes
- Verify the performance and O&M issues of each technology
- Identify the range of treatment
- Regulatory and public acceptance
- Assess ability to upgrade to Advanced Treatment

Step 4: Select Technologies for Pilot Testing

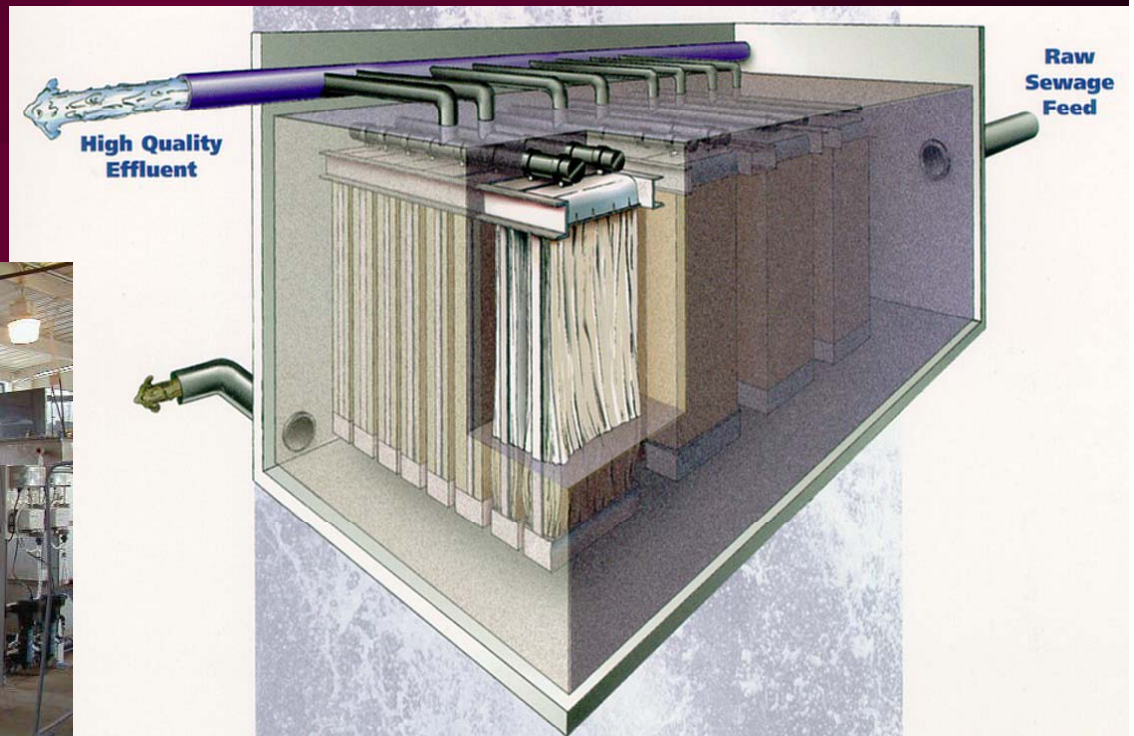
- Ballasted flocculation
 - Primary treatment
 - CSO treatment



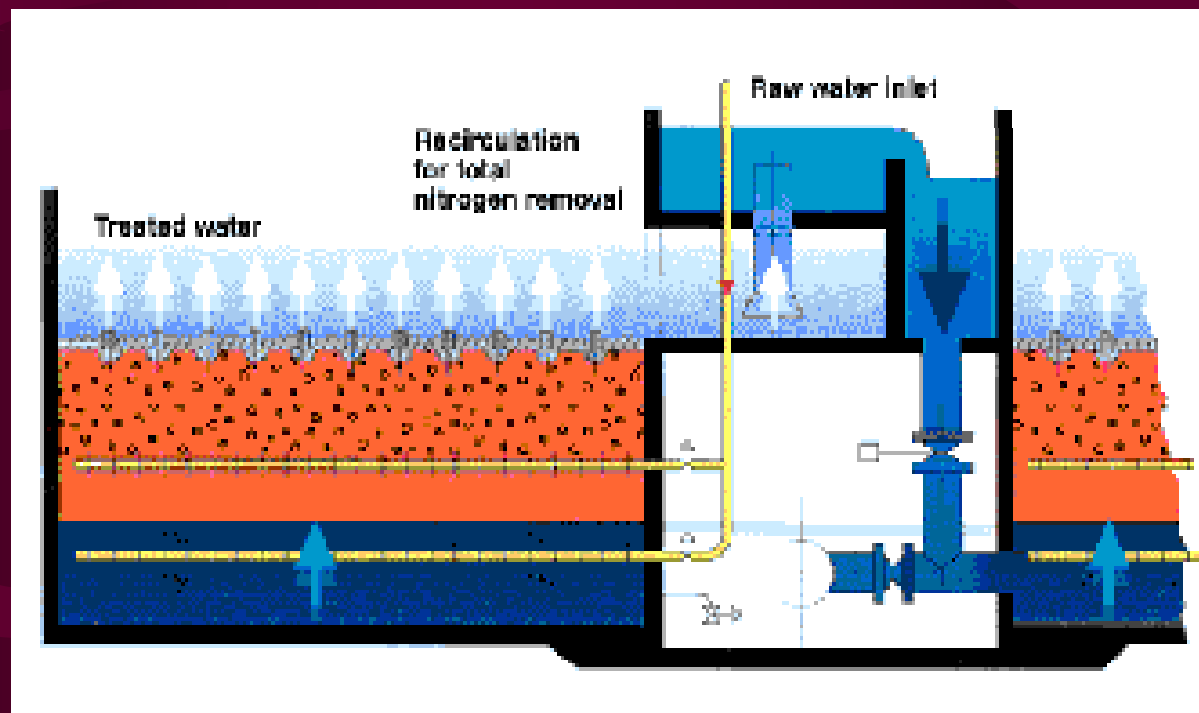
- Fuzzy Filter
 - Tertiary filtration
 - Primary treatment
 - CSO treatment



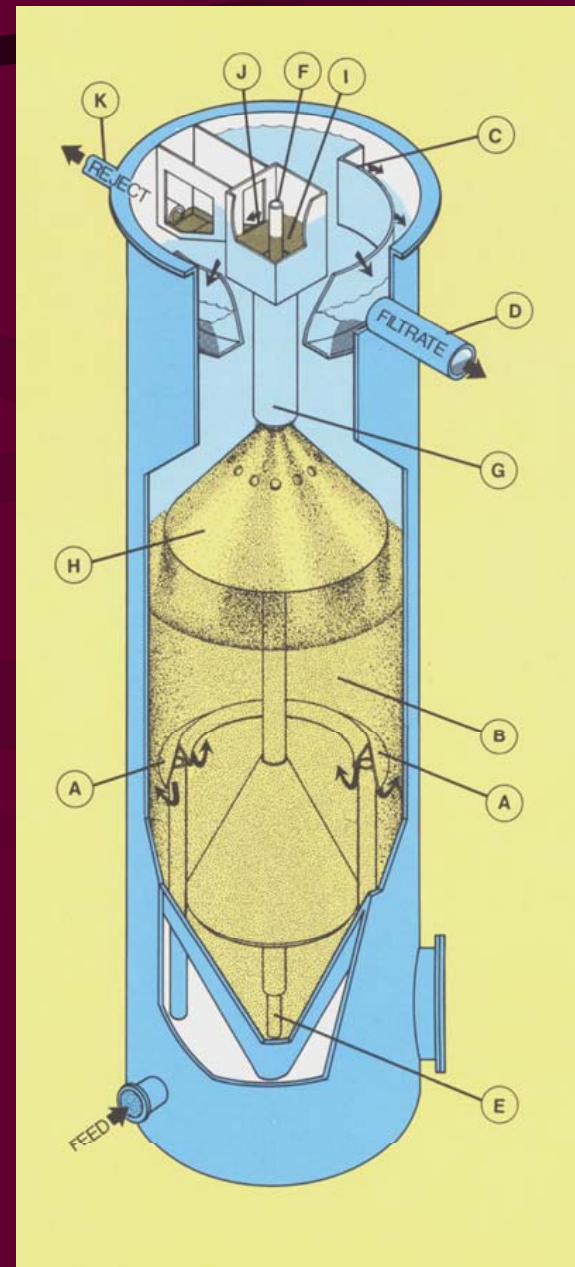
- Membrane bioreactor (MBR)
 - with and without Primary treatment



- BAF
 - Carbon removal
 - Nitrification
 - Denitrification



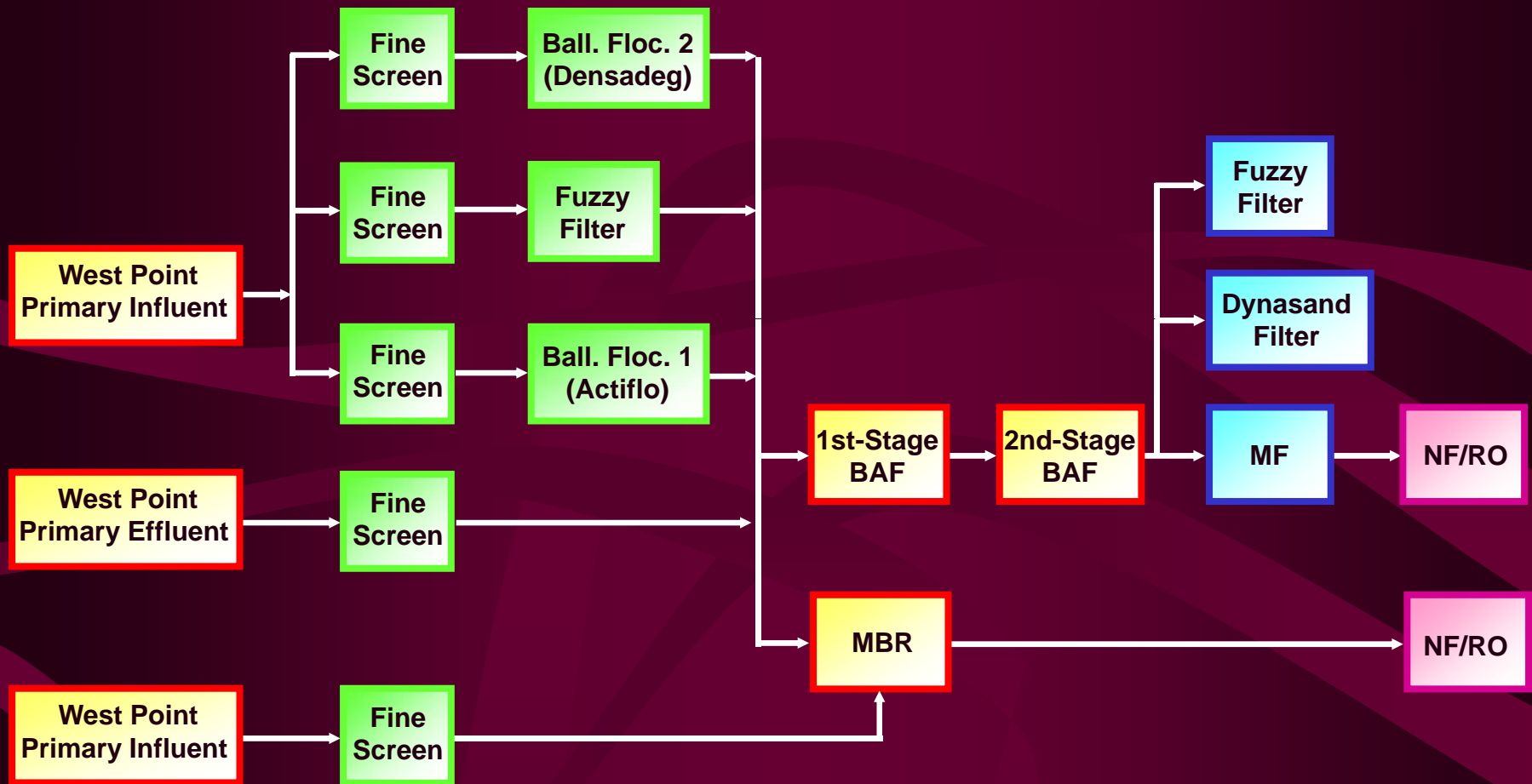
- Dynasand
 - Effluent Filtration
 - Current method



- Advanced Treatment
 - Microfiltration
 - Reverse osmosis



Simplified Pilot Plant Schematic



**Wastewater
Source
Options**

**Primary
Treatment
Options**

**Biological
Treatment
Options**

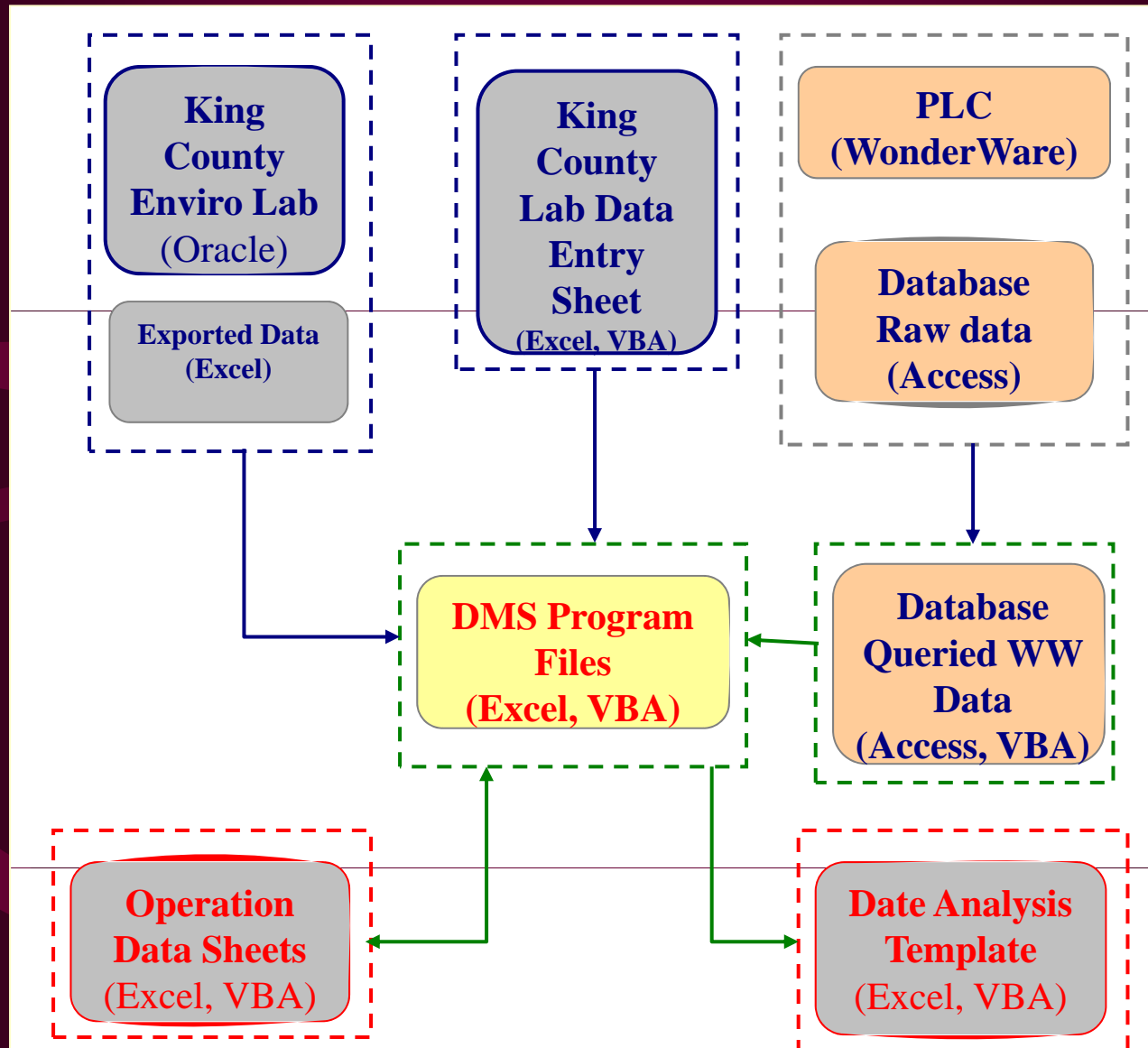
**Tertiary
Treatment
Options**

**Advanced
Treatment
Options**

Unit Process Performance Metrics

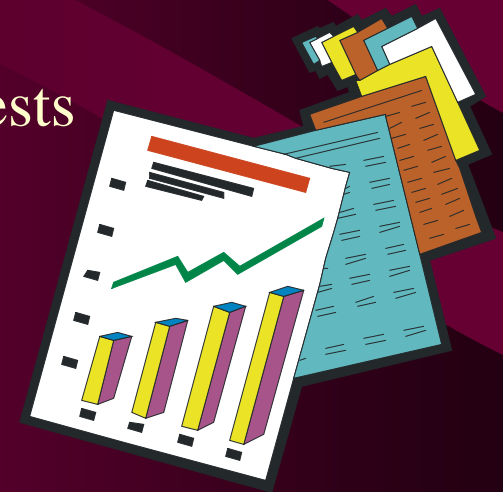
- Key performance questions
- Operational/design criteria
- Key process control parameter
- Process measurements
- Water quality measurements
- O&M requirements
- Performance goals

Pilot Data Management System



9 month Pilot Plant Schedule

- **Month 1** – Start-up and shakedown of MBR/BAF
- **Month 2 and 3**
 - Fuzzy Filter for primary and tertiary treatment
 - Test MBR/BAF w/West Point P.E.
- **Month 4 and 5**
 - Class A reclaimed water demonstration tests
 - Actiflo testing



9 month Pilot Plant Schedule

- **Month 6, 7 and 8**
 - Nutrient removal
 - MF and RO
 - Densadeg 4D testing
- **Month 9 – Optional testing period**
 - CSO treatment,
 - Further nutrient removal options
 - Reexamine earlier components of the testing program



**Pilot start up:
June 2001**