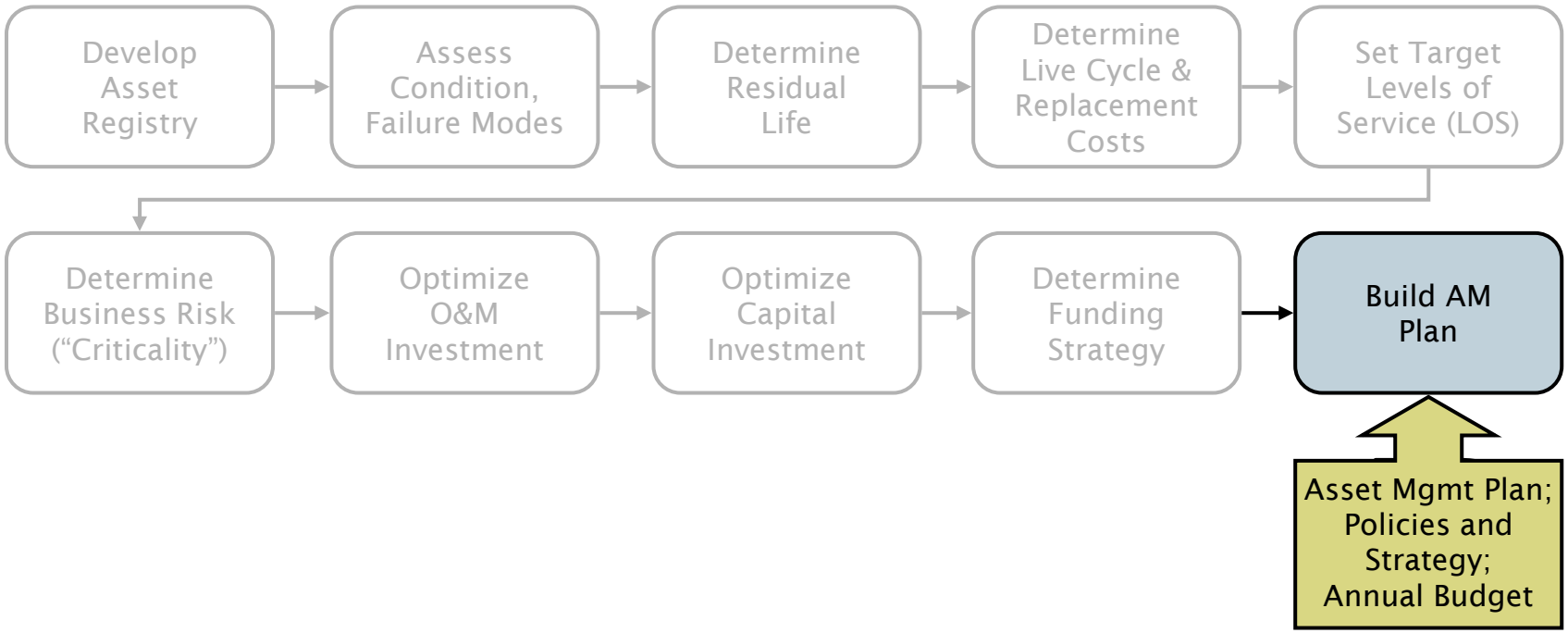
# Fundamentals of Asset Management

*Step 10. Build Asset Management Plan*

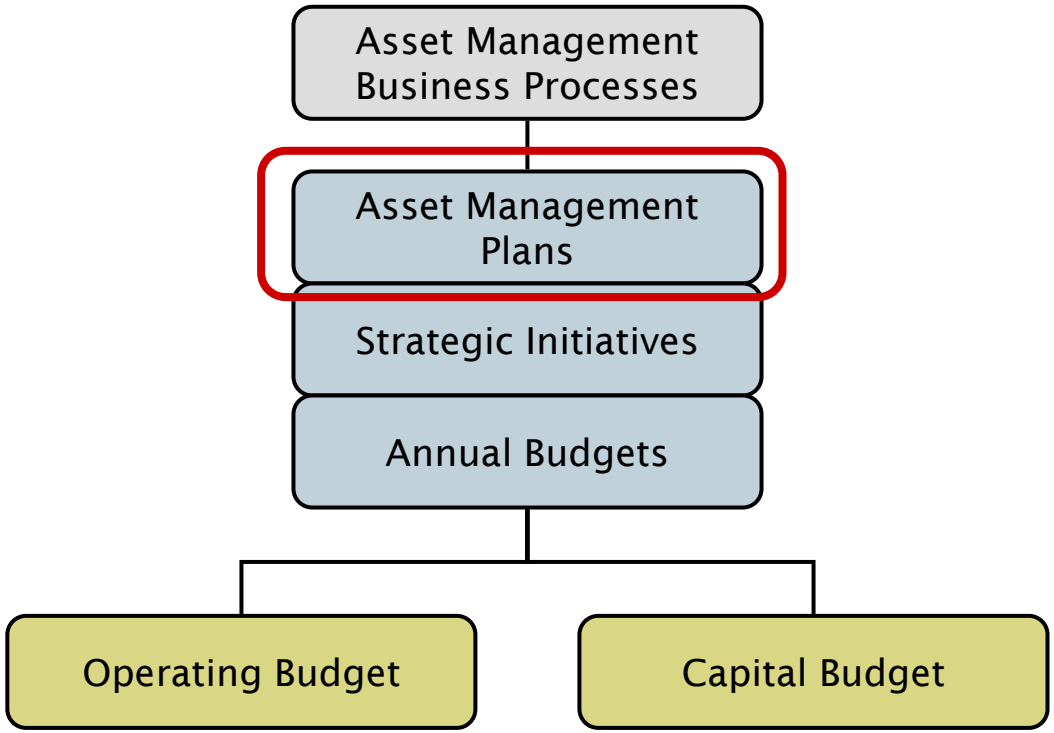
*A Hands-On Approach*

# Tom’s bad day…

# AM plan 10-step process



# Recall View 4: Management framework



# Asset decision framework

*Big picture*

- Whole portfolio perspective
  - Trends
  - Macro forces
- Policy framework
- Budget arena

*Micro view*

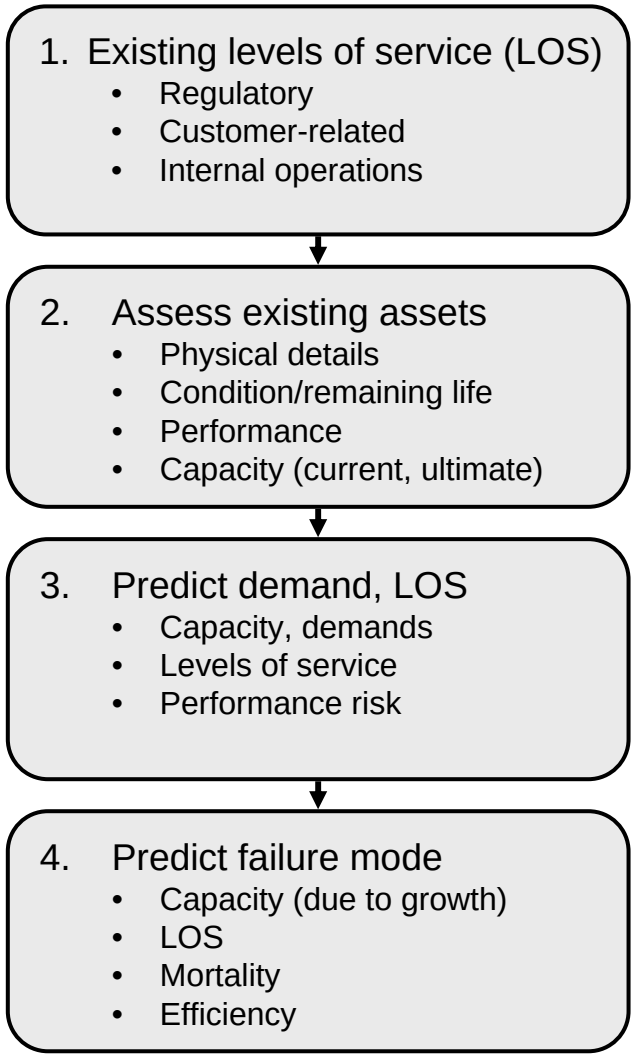
- Event based
- Specific asset focus
- Case-by-case decision points

*Repair? Refurbish? Replace? Augment?*

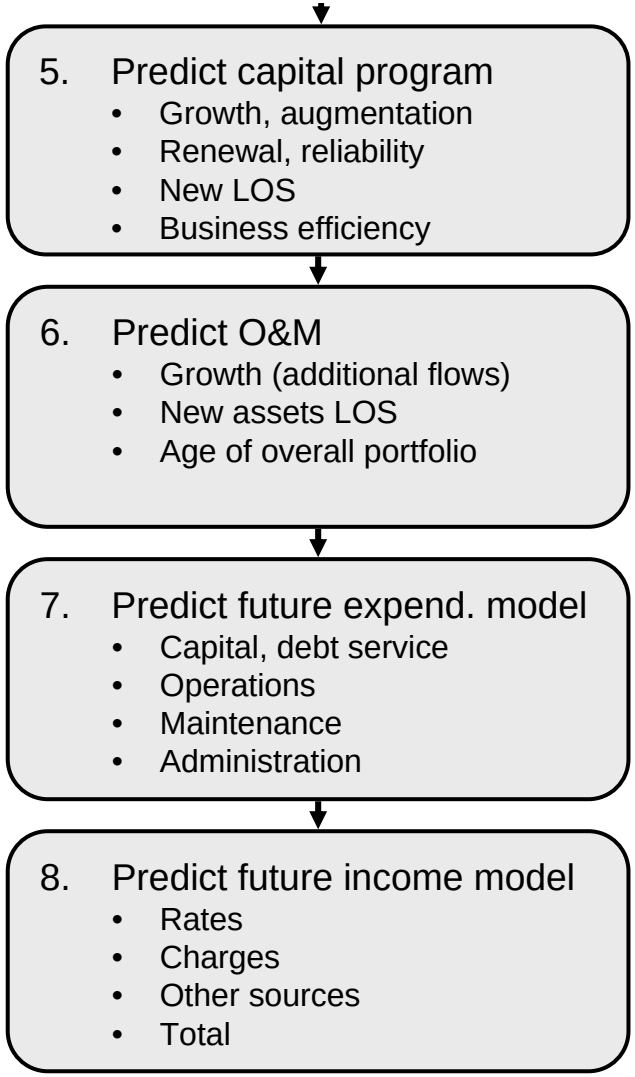
# Tom's Jones Street asset management plan: Key points

- *State of the facility*
  - Facility is well into mature stage of life cycle
  - Most imminent major failure mode—capacity
    - Assume two years before peak design flow is exceeded—growth
    - Additional capacity can not be feasibly added
- *Required LOS*
  - Stop SSOs
  - Meet Whispering Oaks flow requirements
- *O&M/CIP investment strategies*
  - Keep lift station running for two years, then decommission
  - All replacement equipment sized for reuse in new lift station
  - Move to predictive maintenance (monitor intervals) for dynamic (mechanical/electrical) equipment based on root cause
  - Run to failure with effective reactive response plan for rest
  - Assure that reactive response plan provides for continuous functioning (bypass/supplemental power/supplemental pump)

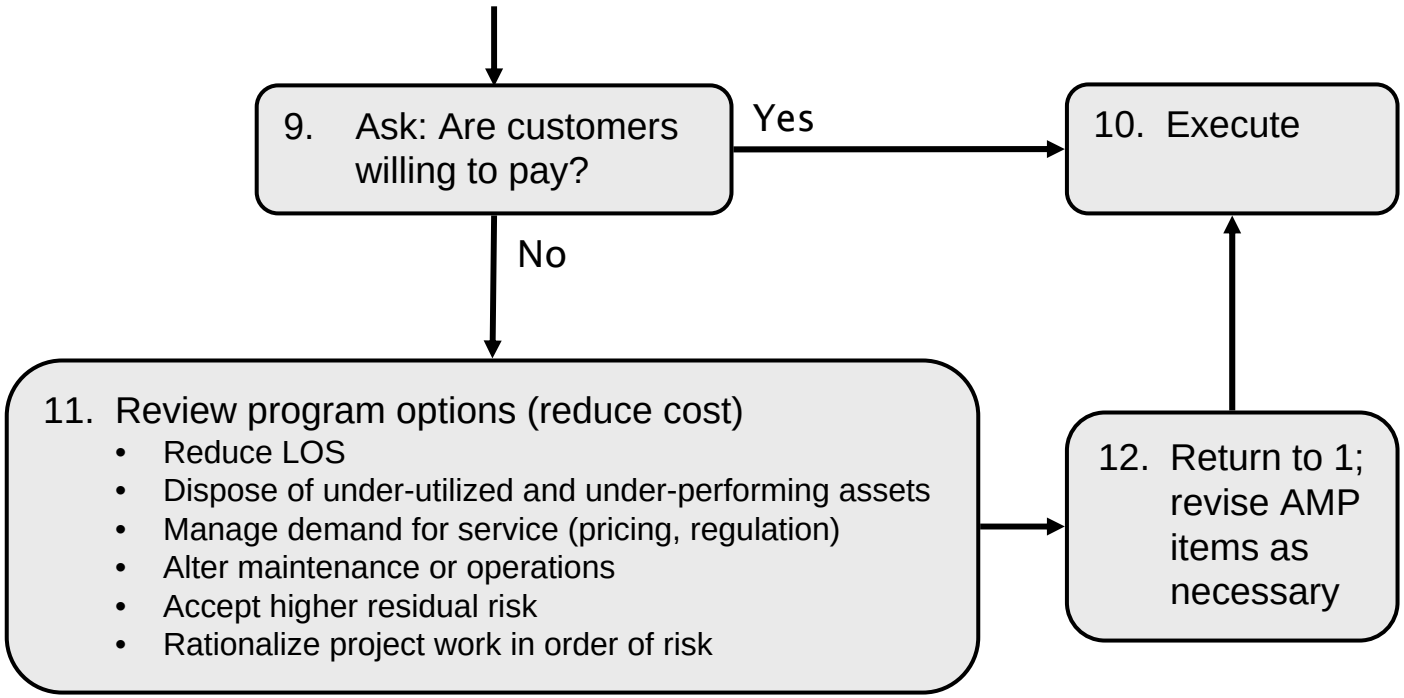
# Steps in developing your AMP



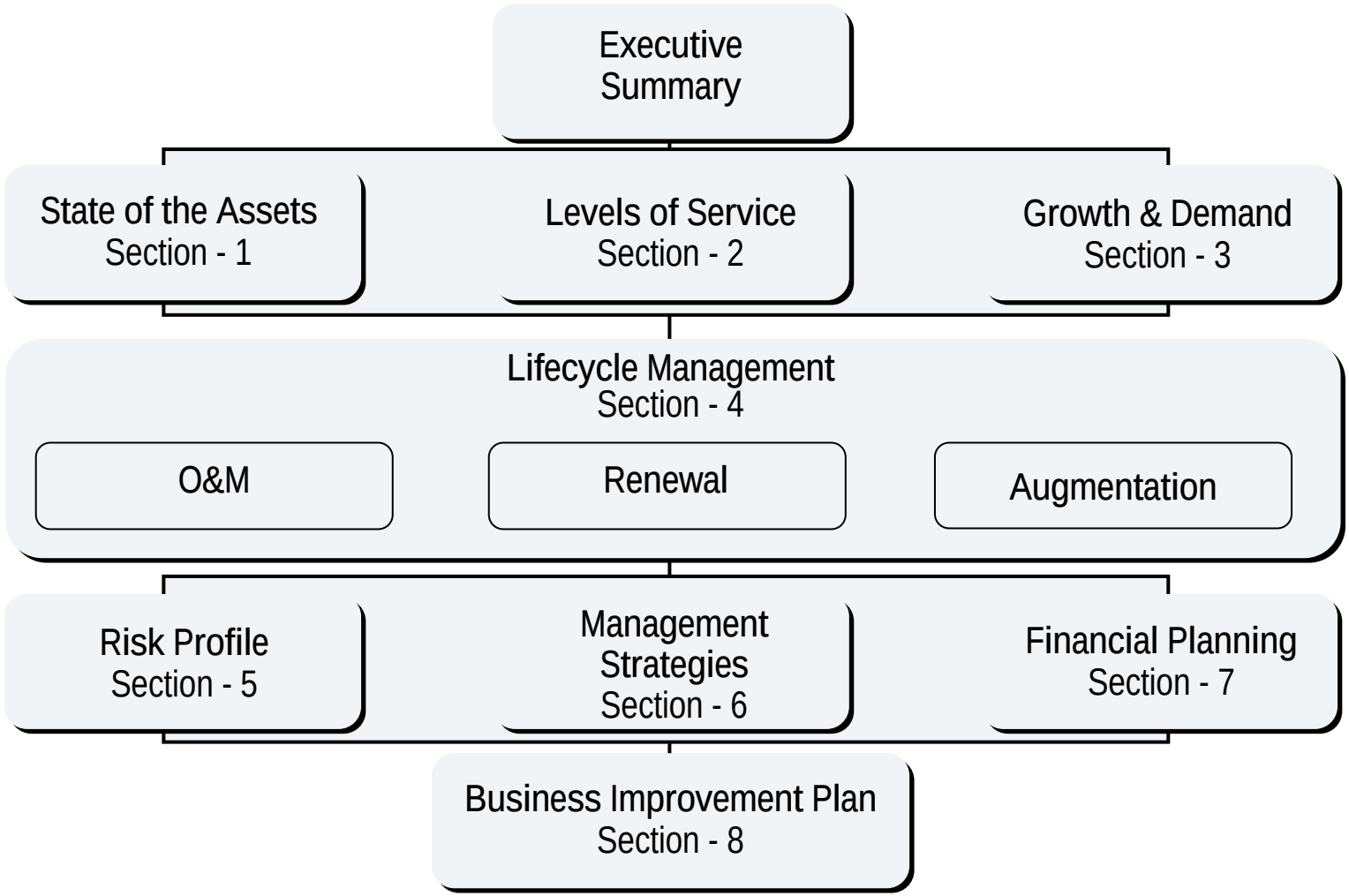
# Steps in developing your AMP, cont.



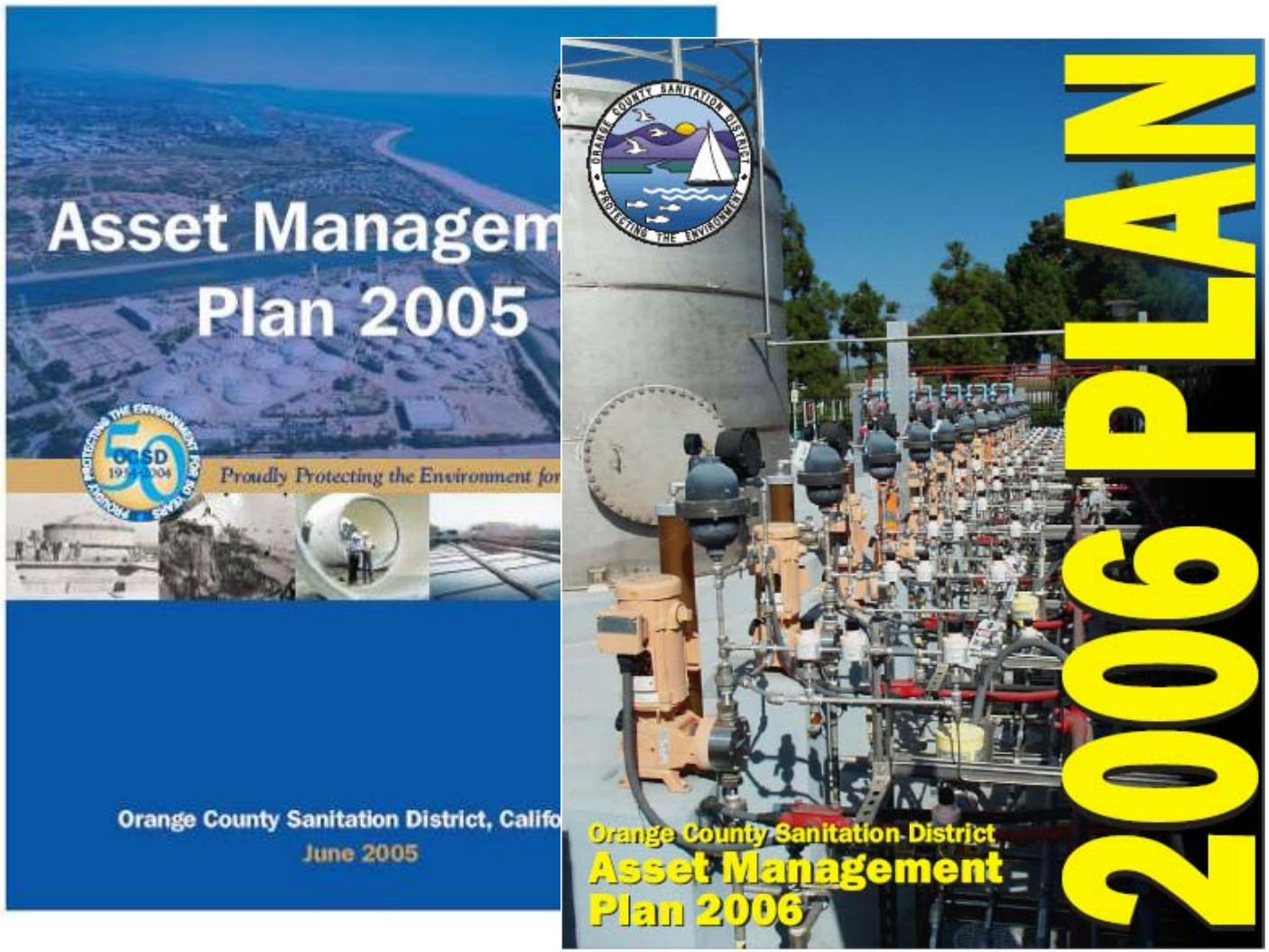
# Steps in developing your AMP, cont.



# The Enterprise Asset Management Plan

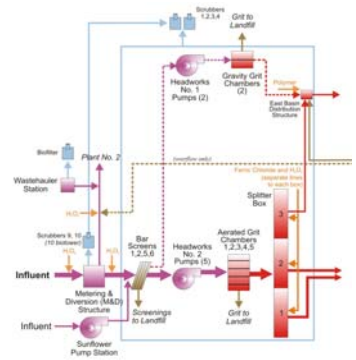


# The Enterprise Asset Management Plan



# The Enterprise Asset Management Plan—asset system summary

## 1. Asset Profile




**Metering & Diversion Structure**

A total of six influent trunk lines bring influent into the metering and diversion structure at Plant No. 1. This structure contains magnetic flow meters, pH meters and electro-conductivity meters along with gates that can be raised or lowered to move flows from one trunk-line to another as necessary. A portion of the influent can also be diverted to Plant No. 2 through an interplant pipeline to regulate flow into Plant No. 1.

**Headworks #1 & #2**

There are two Headworks at Plant 1, which have a total rated pump capacity of 210 mgd with 130 mgd of stand by. Headworks #2 can be increased by another 70 mgd in the future by addition of another pump. It has two support generation units with a power rating of 1000 KW. Headworks #2 is the newest and is the operated system and Headworks #1 is the standby system. Three key processes for Headworks are bar screens, influent pumps, and grit removal.

**Screening Station (Bar screens)**

Flow from the Metering and Diversion Structure is routed to the influent channel for the mechanically-cleaned bar screens at Headworks #2. There are four individual bar screen channels containing automatically cleaned screens. Two of the screens are operated and the other two are standby. The structure contains space to accommodate two additional screens in the future.

**Main Sewage Pumps**

After passing through the Headworks #2 bar screens, wastewater flows into the Influent Pump Station wet well. The Influent Pump Station lifts screened wastewater to the influent channel serving the grit removal chambers. There are four 70 mgd variable speed pumps at Headworks #2 and two 30 mgd constant speed pump at Headworks #1, which services as stand by pumps. A sluice gate in this wet well can be opened to allow screened wastewater to flow to the Headworks #1 Influent Pump Station wet well if required allowing the wet wells at Headworks #2 and Headworks #1 to act as one large wet well under extreme wet weather conditions.

**Grit System (Grit Removal)**

There are five aerated grit removal chambers at Headworks #2 and two at Headworks #1 that are standby. The purpose of these is to remove inorganic solids that are present in the wastewater. The removal of this grit helps prevent clogging in pipes, protects mechanical equipment, and reduces the amount of material that collects in the sludge digesters. Each grit chamber contains four grit collection hoppers. Grit is removed from the chambers using telescoping valves that continuously discharge grit slurry by gravity to classifiers. Grit from the classifiers discharged to the conveyor belt carrying screens normally or to a separate grit bin for off-site disposal. Flow from the Headworks #2 grit removal chambers is collected in an effluent channel that discharges to the Primary Influent Distribution Structure (Splitter Box).

**Splitter Box**

The splitter structure discharges to the Primary Clarifier Basin # 1 to 5 through a 72 inch-diameter pipeline and/or to the rectangular PCB # 6 to 15 through two 90 inch-diameter pipelines. Splitting is accomplished using the sluice gates.

## 2. Demand Profile and Performance

**Table 1 Peak, Average and Standby Design Capacities**

| System<br>Sub System(s) | Design Capacity (Min, max, peak and/or average) | Actual Performance |
|---|---|---|
| **Metering & Diversion Structure** | Max. Flowrate 490 MGD | |
| Hydrogen Peroxide | Max. Pressure 150 psi | |
| Sunflower Pump Station | 30 MGD duty<br>30 MGD standby? | |
| **Headworks No. 1** | 30 MGD duty | |
| Main Sewage Pumps | 30 MGD duty<br>30 MGD standby | |
| Grit Removal | 2 chambers | |
| **Headworks No. 2** | 210 MGD duty | |
| Main Sewage Pumps | 280 MGD duty<br>70 MGD standby | |
| Bar Screens | 4 units (+allowance for 2 units to be constructed)<br>234 MGD max<br>1 unit standby | |
| Grit System | | |
| • Grit Chambers | 87 MGD duty<br>25 MGD standby<br>5 tanks<br>2 tanks standby | |
| • Grit Washers | Hydraulic 1800 gpm<br>Overflow Rate 12,000 gpd/ft2<br>1 duty and 1 standby | |
| • Grit Storage Capacity | 2 days | |
| Splitter Box | 325 MGD | |
| Odor Control Facilities (Bleach) | 3 @ 24000 cfm duty<br>1 @ 24,000 cfm standby | |
| • Feed Pumps | 3 @ 11.3 gph duty<br>1 @ 20 gph standby | |
| • Recirculation Pumps | 4 @ 600-700 gpm duty<br>4 @ 600-700 gpm standby | |
| • Muriatic Acid Scrubbing Cleaning Pumps | 1 @ 30 gpm duty<br>1 @ 30 gpm standby | |
| Trunk Line Scrubbers<br>1 * Caustic<br>1 * Biotower | 24,000 CFM duty<br>24,000 CFM standby | Insufficient performance |
| Ferric Chloride<br>• Feed Pump | 3 @ 200 gph duty<br>1 @ 200 gph standby | |
| Hydrogen Peroxide | | |
| • Headworks | 4 duty (See 10H-120, Pump information)<br>4 standby pumps<br>Flowrate Capacity 85 gpm<br>Pressure 116 psi | |
| • Splitter Box | Max. Flowrate Capacity 325 gpd<br>Max. Pressure 150 psi | |
| **Support Generators** | Power Rating 1000 KW | |
| **Scrubbers** Headworks | 2 on trunk lines | |

## 3. Failure Mode

**Table 2 Failure Summary**

| Process | Area | Rating | | | | |
|---|---|---|---|---|---|---|
| | | Condition | Capacity | Function | Reliability | Efficiency |
| **Metering & Diversion Structure** | 10A | 2 | | | | |
| **Headworks #1** | 10B | 5 | | | 5 | |
| **Headworks #2** | 10C | 3 | | | | |

## 4. Key Issues for Further Investigation

**General**

Project I-10 to increase flow to Plant 1 by 40 MG/D

**Metering & Diversion Structure**

Concerns about the reliability and accuracy of meters exist due to meter failures. Proper operation of the meters is important because treatment costs are allocated to the various revenue areas based on influent meter readings.

**Headworks No. 1**

Questions have been raised as to the ability of the headworks to operate properly under emergency conditions.

**Headworks No. 2**

Grit Chamber No. 2 is out of service.

## 6. Investment Program

**Table 3 5-Year Summary**

| Investment (thous.) | Total Projected Budget | Cost to date | 2005-06 | 2006-07 | 2007-08 | 2008-09 |
|---|---|---|---|---|---|---|
| P1-105 | 4,920 | 240 | 393 | 320 | 3,430 | 537 |
| **Total** | **4,920** | **240** | **393** | **320** | **3,430** | **537** |

**Table 4 O&M Cost Summary**

| Cost (thous.) | 2002-03 | 2003-04 | 2004-05 | 2005-06 | 2006-07 |
|---|---|---|---|---|---|
| Maintenance | | | 208 | | |
| Operations | | | 1108 | | |

## 5. Current Program

**Study**

TBA

**Planning**

TBA

**Design & Construction**

**P1-105 - Headworks Rehabilitation and Expansion at Plant No. 1**

This project rehabilitates and refurbishes process equipment and infrastructure within the Plant 1 Headworks facility, to ensure that the facility continues to be operational. Several studies have been conducted on the Headworks facility and a number of non-critical items have been identified for repair and upgrade. The bulk of the project includes upgrades to existing bar screens, an additional bar screen, a screenings compressor, improvements to the grit removal facilities, improvements to the power distribution system including three new larger emergency generators, and miscellaneous process, mechanical, structural and I&C upgrades.

This project is in keeping with industry practices as required for reliable and dependable plant operations. The capital budget identified on this sheet is based on the non-critical items necessary to ensure the facility continues to function and conforms to the ultimate layout of the facility. The FY 2004/05 budgets for P1-71 and P1-105 have been reallocated after further evaluation of critical and non-critical work. P1-105 will address increases in the facilities capacity to meet expected increases in wastewater flow projected in the 2001 Interim Strategic Plan Update.

**P1-71 - Headworks Rehabilitation/Refurbishment**

The scope of work consists of rehabilitating and refurbishing the VFDs for the main sewage pumps and the cable trays and wiring from the VFDs to the pumps. An evaluation of the pumping capacity of Headworks No. 2 at Plant 1 conducted in 2001. Capacity issues will not be addressed through this project as capacity upgrades are being handled through a separate project (Ellis Avenue). There are other potential tasks items for this project which includes: a grit characterization study based on a computer model, gate operators, and installation of ventilation in Headworks 1 to meet NFPA 820. Other tasks that were previously part of this project have been moved to Job No. P1-105.

This project is in keeping with industry practices as required for reliable and dependable plant operations. These reliability of these VFDs must be restored by late 2008 such that Plant 1 may reliably accept diverted flow from Plant 2 during Plant 2 Headworks changeover.

**P1-104 – Regional FOG Control Collection at Plant 1**

**J71-8 – Headwork Scrubbing Replacement**

**Management Strategies**

TBA

# Detail, left page

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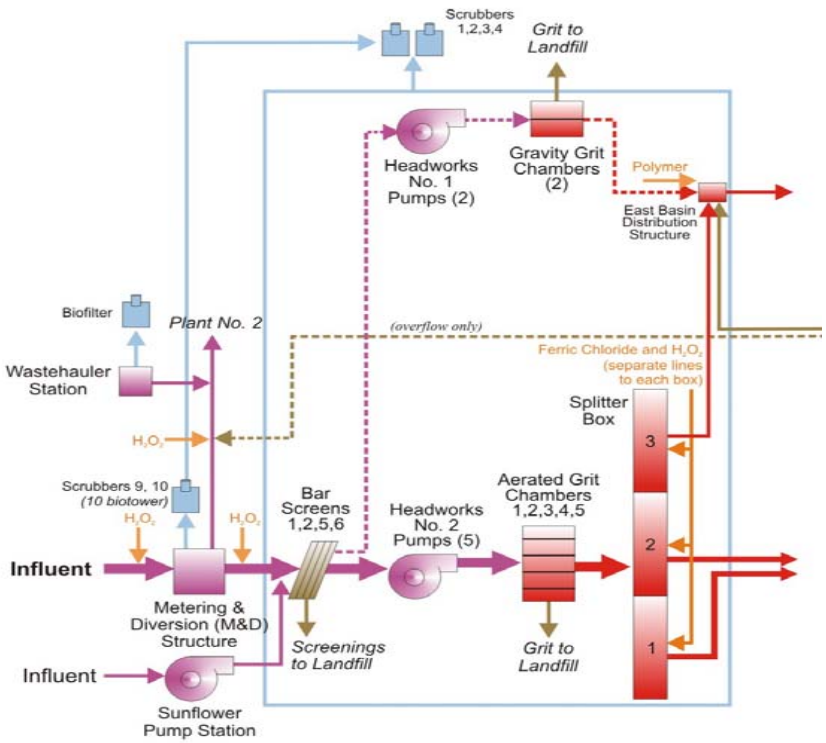


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# Detail, right page

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TBA

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# The asset management improvement plan section

**OCSD Asset Management Improvement Program**
**Staff Lead Program 2005/06 Budget - Overall Timeline**

| Project No. | Project Name | June | July | Aug | Sept | Oct | Nov | Dec | Jan | Feb | Mar | April | May |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11 & 12 | Data Standards Asset Registers | | | | (GHD) | | CMMS | | | | | | |
| 8 | AMIS Function Applications and Strategy | | | | | | | | | (GHD) | | | |
| 13 | Condition Assessment Guidelines | | | | | | (GHD) | | | | | | |
| 2 | CIP Validation Stage 4 | | | | | (JB) | | | | | | | |
| 4 | BRE Collections | | | (NA) | | | | | | | | | |
| 5 | BRE Plant | | | | | | (JB) | | | | | | |
| 6 | LOS Stage 2 | | | | | | | | | (JH) | | | |
| 7 | 4 Box Model | | | | | | | | | (DS) | | | |
| 1 | Asset Management Plan 2 | | | | | | | | | (AMT-DS) | | | |
| 10 | ORDM / LLCCA | | | | | (AMT-DS) | | | | | | | |
| 9 | Risk Policy | | | | | | | (AMT-DS) | | | | | |
| 14 | Organizational Alignment | | | | | | | | | | (AMT-DS) | | |
| 3 | Reliability Centered Management | | | | | | | | | | | | |

# Example: Organizational AM strategies

| No. | Description | Remarks /Deliverables | Benefits |
|---|---|---|---|
| 1 | Asset Management Plan 2006 | Increase confidence level rating with better accurate data on condition and performance, more defined management strategies, improve future predictions on changed levels of service overall results / outputs etc including rate modeling. Complete updated asset management plan analysis and assess improvements made. Links and inputs from most projects. | ◗ Asset Management Plan output improvements.<br>◗ Improved Confidence Level Rating.<br>◗ Improved Business Risk Exposure assessments, funding and rate models, operations and maintenance budgets.<br>◗ Expenditure prediction Tool enhancements and improved Business Risk Exposure modeling. |
| 2/10 | Capital Improvement Program Validation Stage 4 (2005/06) | Add life cycle costs, Business case analysis methodology, including improved maintenance budgets /options and improve risk model to full economic cost and Triple Bottom | ◗ Significant benefits derived for 2004 program ($25M in capital) and over $50M in life cycle costs. |

# The AM “charter”

## Over-Arching TEAM* Principles

- **Asset Inventory.** We will know the assets that we own, or for which we have legal responsibility, and will maintain an accurate computerized asset register developed around an asset hierarchy that supports advanced asset management functions.
- **Condition Assessment.** We will gather, record, and analyze condition assessment data; store and analyze it using user friendly computerized systems; design these systems to support high confidence level asset related decision making; and create a comprehensive and dynamic condition index.
- **Maintenance.** We will retain a detailed maintenance policy, and operate a user friendly, accurate, and comprehensive enterprise asset management system (that includes a Computerized Maintenance Management System) to ensure that the assets, facilities, and systems perform to their design criteria and meet their design lives.
- **Information Technologies and Analysis and Evaluation.** We will store and analyze our data and knowledge in integrated or interconnected, user friendly, efficient, and effective computerized business information systems that support our total organization and our TEAM Program responsibilities, vision, and goals.
- **Levels of Service (LOS).** We will thoroughly understand and record our current levels of service, including customer service elements, and will report our performance in meeting these in annual asset management plans. These plans will include service level options and costs, and likely future LOS requirements necessary for sustained performance. We will assess the indirect or ancillary cost impacts of inadequate asset condition or performance on our customers and the community in terms of the economic consequences of failing to meet our established levels of service.
- **Financial Planning.** We will understand the value and costs of our assets and the financial resources needed to appropriately sustain them (short and long term). We will make our decisions based on Total Life Cycle costs, and will have appropriate pricing and funding strategies that match our business needs and targeted levels of service. We will measure and report full economic costs of our activities and apply them to the relevant service. We will link the condition index to our customer's expectations, financial capacity, and our levels of service goals.
- **CIP and Annual Budget Funding Processes and Procedures.** We will have uniform processes across our whole organization for the evaluation of our investments in capital projects, maintenance, or operations. These processes will include risk and benefit costs, impact on levels of service, and asset management decision making quality confidence levels. We will make our funding decisions about individual projects when all service programs within the business have completed their capital and annual operating budgets, and the impacts of our decisions on levels of service, asset and service sustainability, and rates are known. We will link our organizational goals to our investments and ultimate action plans.

# The AM “charter”, cont.

Northeast Ohio Regional Sewer District

**Asset Management Assessment Program**

## Charter Statement

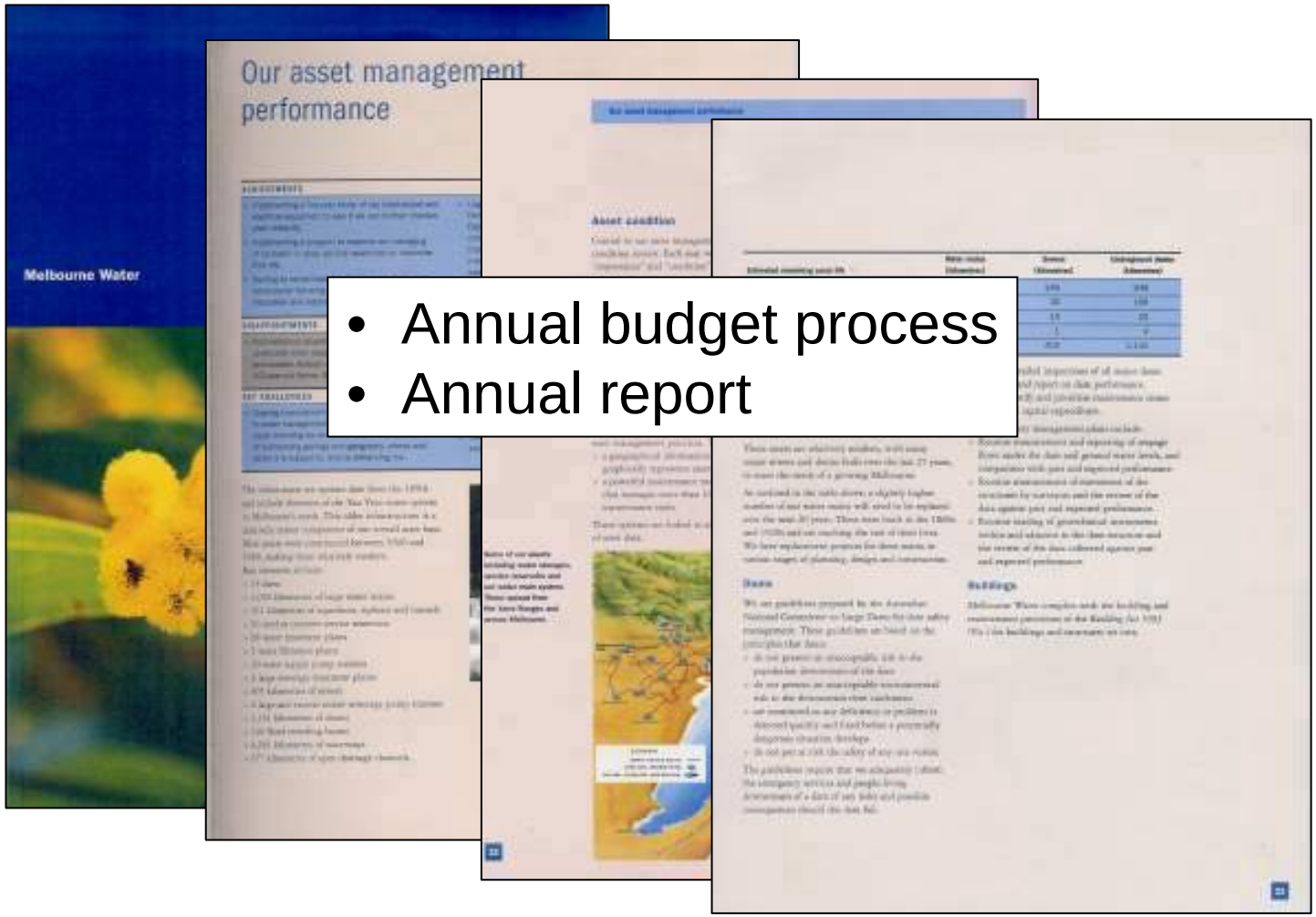
and associated funding strategies. We will use future level of service options in our public/customer consultation programs.

7. Link our level of service with our stakeholder expectations, through customer consultation, at a cost that our customers are willing to pay.
8. Understand customer expectations including the non-regulatory aspects of our business (e.g., noise, customer service, appearance, cleanliness, customer outreach).
9. Identify, understand, and manage the risks associated with running our business.
10. Understand the total cost of asset service delivery including the total cost of renewal.
11. Understand the real growth of our business and the way service demands will change in the future. We will systematically project long term (>20 years) funding needs to meet business requirements in both capital and recurrent investment.
12. Develop pricing and funding strategies that balance the needs of the District to ensure our sustainability. We will monitor and report in triple bottom line terms (financial, environmental, social).
13. Link our strategic goals to our investments and action plans.
14. Implement systematic validation processes to evaluate all investment in capital projects, maintenance programs, operations and associated support services, as well as their impact on rates.
15. Recommend necessary renewal and regulatory agency-required programs to sustain the existing levels of service **before** other investments, providing they are justified through our systematic analysis process.
16. Work with other agencies to leverage asset investment when cost effective.

# The AM charter

***Asset Inventory*** We will know the assets that we own, or for which we have legal responsibility, and will maintain an accurate computerized asset register developed around an asset hierarchy that supports advanced asset management functions.

# Telling the story—institutionalization




- Annual budget process
- Annual report

# Key points from this session

***What does my asset management plan look like?***

Key Points:

- AM focuses relentlessly on providing sustained performance at the lowest life-cycle cost to the organization
- AM is both a way of thinking and a set of specific practices
- The more we understand about our assets, the better we can mange them
- Understanding our assets starts with asking the right questions

Associated Techniques:

- The Enterprise Asset Management Plan
- The Total Enterprise Asset Management Improvement Program
- Best AM Practices; Best Appropriate Practices
- The Five Core AM Questions
- The 10 Step Process to an asset management plan