

***“An invasion of armies can be resisted,
but not an idea whose time has come.”***

***Victor Hugo
Les Miserables***

Advancing Asset Management in Your Utility: A “Hands-on” Approach

Day 2

AGENDA

Day 1

- *Welcome, Introductions & Housekeeping Details*
- *Background And Context*
- *Overview Of Fundamental Concepts & Core Practices*
- *The "Storyline": Tom's Really Bad Day*
- *Core Question 1: What Is The Current State Of My Assets?*
- *Core Question 2: What Is My Required "Sustainable" Level Of Service?*
- *Core Question 3: Which Assets Are Critical To Sustained Performance?*
- *Core Question 4: What Are My Minimum "Life-cycle-cost" CIP and O&M Strategies?*
- *Discussion/Q & A; Review of Self-audit*

Day 2

- *Summary of Day 1; Outline of Day 2*
- *Core Question 4 (Continued)*
- *Core Question 5: Given The Above, What Is My Best Long-term Funding Strategy?*
- *Case Study 1: Deploying An AAM Program*
- *Case Study 2: Meeting The IT Challenge – Toward An Enterprise Asset Management System (EAMS)*
- *Summary, Addressing Your Questions, Comments, Self-audit*

AGENDA

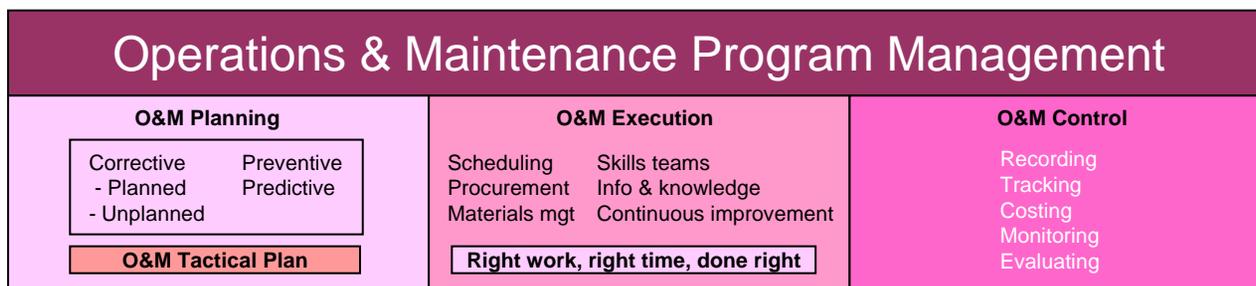
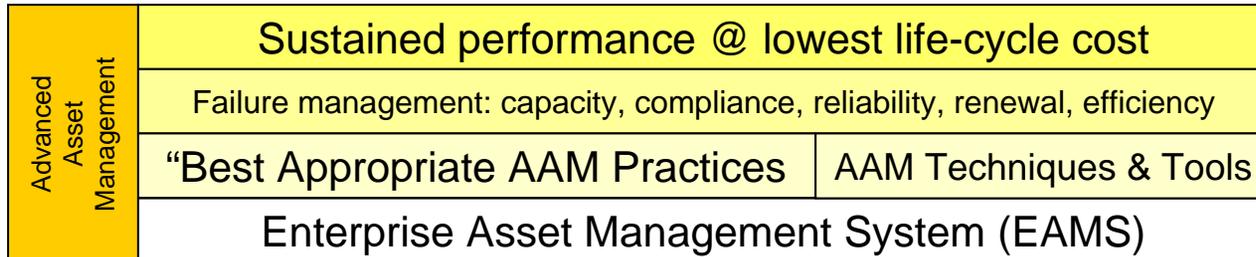
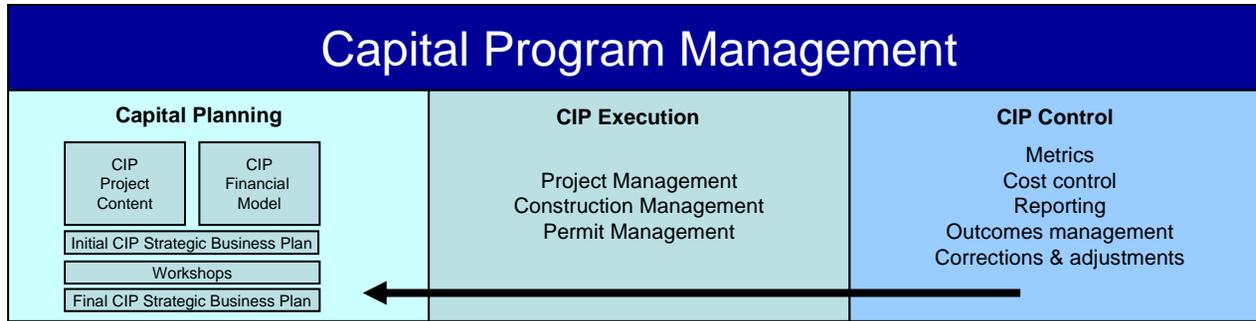
Day 2

- *Summary of Day 1; Outline of Day 2*
- *Core Question 4: What Are My Minimum “Life-cycle-cost” CIP and O&M Strategies? (Continued from Day 1)*
- *Core Question 5: Given The Above, What Is My Best Long-term Funding Strategy?*

- *Lunch*

- *Case Study 1: Deploying An AAM Program*
- *Case Study 2: Meeting The IT Challenge – Toward An Enterprise Asset Management System (EAMS)*
- *Summary, Addressing Your Questions, Comments, Self-audit*

Parsons/GHD AAM Model



Continuous Learning/Knowledge Management
"AAM University"

The Five Core AM Questions

Core Questions

1. What is the current state of my assets?

- What do I own?
- Where is it?
- What condition is it in?
- What is its remaining useful life?
- What is its economic value?

2. What is my required sustained Level Of Service?

3. Given my system, which assets are critical to sustained performance?

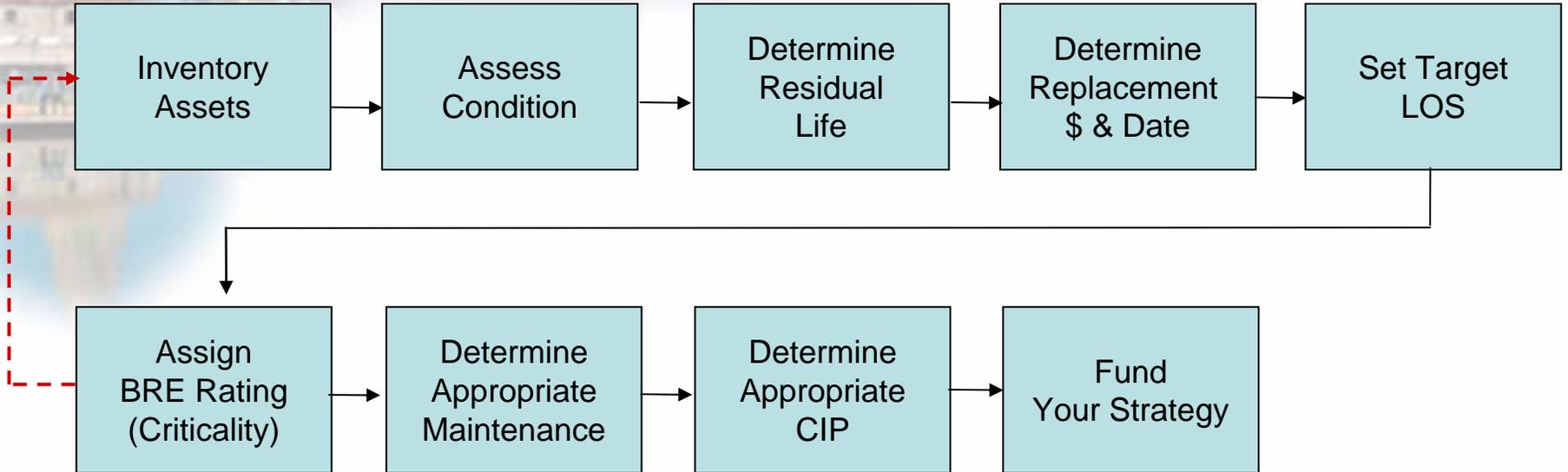
- How does it fail? How can it fail?
- What is the likelihood of failure?
- What does it cost to repair?
- What are the consequences of failure?

4. What are my best “minimum life-cycle-cost CIP and O&M strategies?

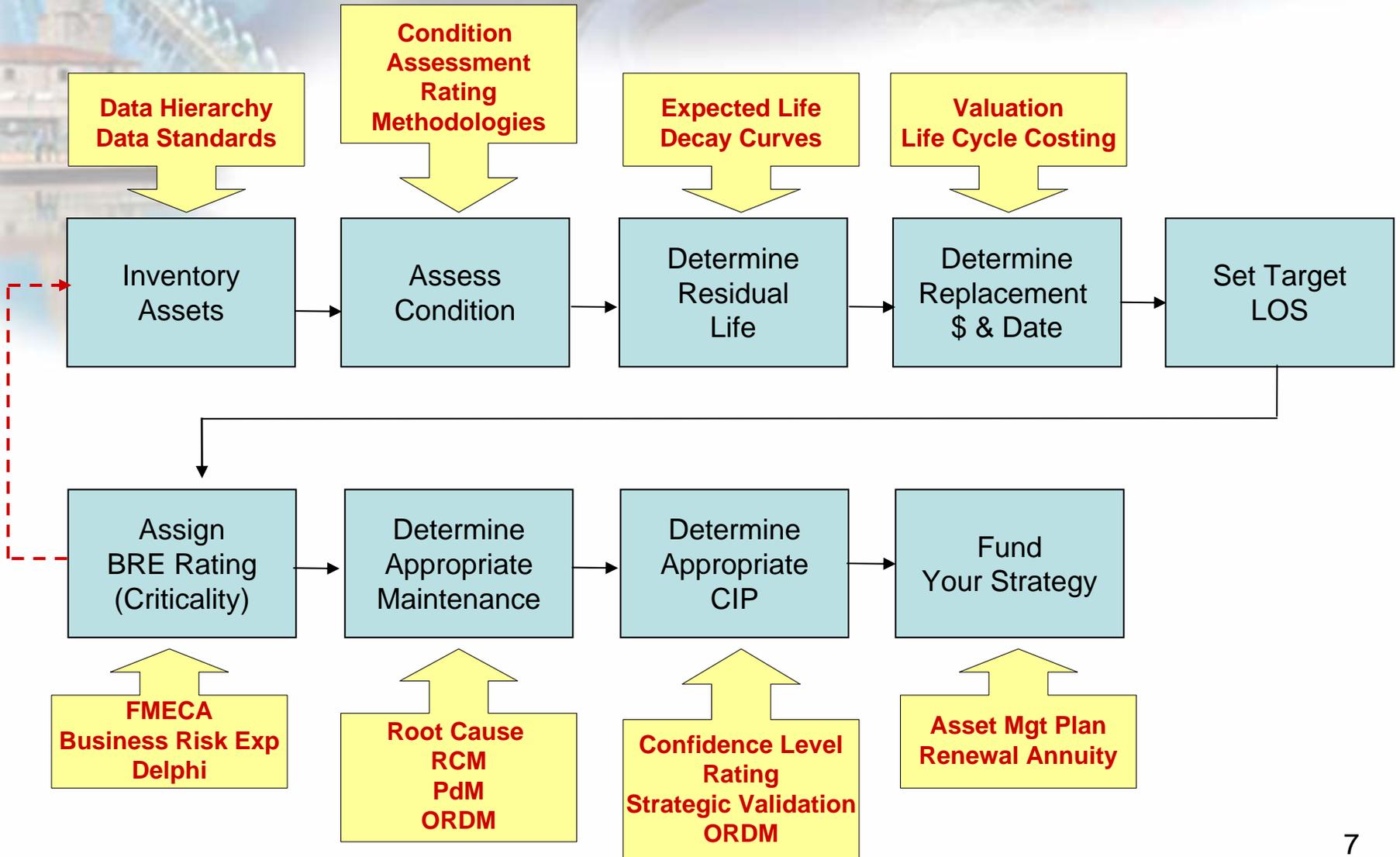
- What alternative treatment options exist?
- Which are most feasible?

5. Given the above, what is my best long-term funding strategy?

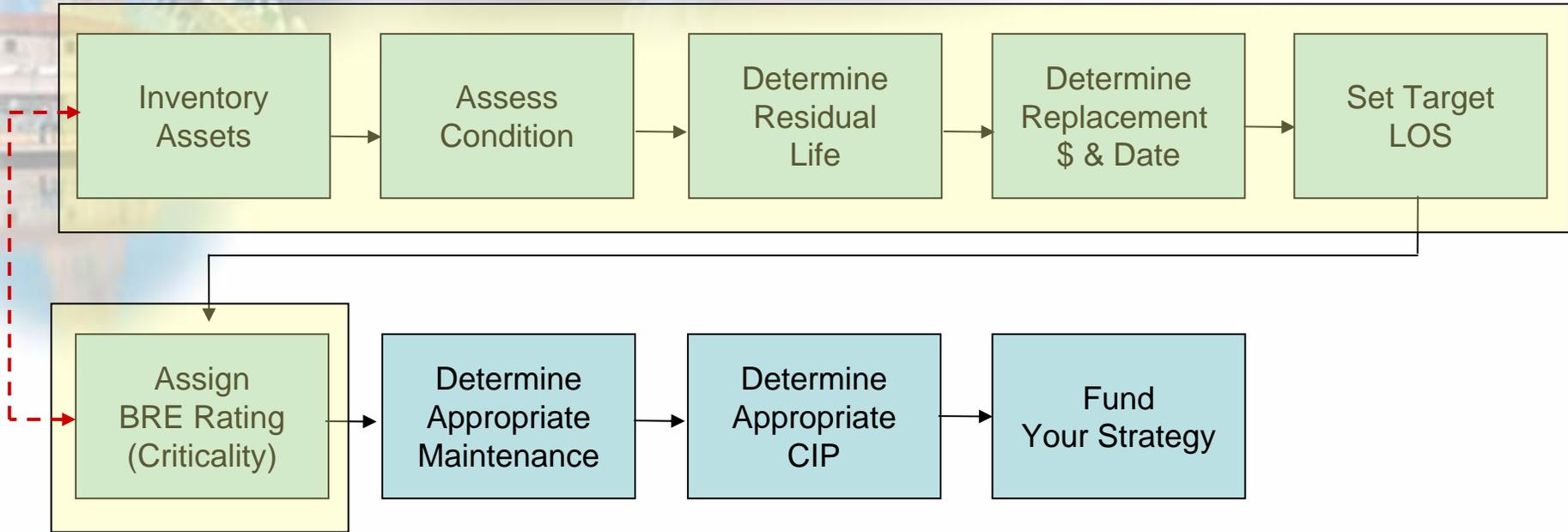
The AAM Program Process



Core AAM Program Process Tools



AAM Program Process



AGENDA

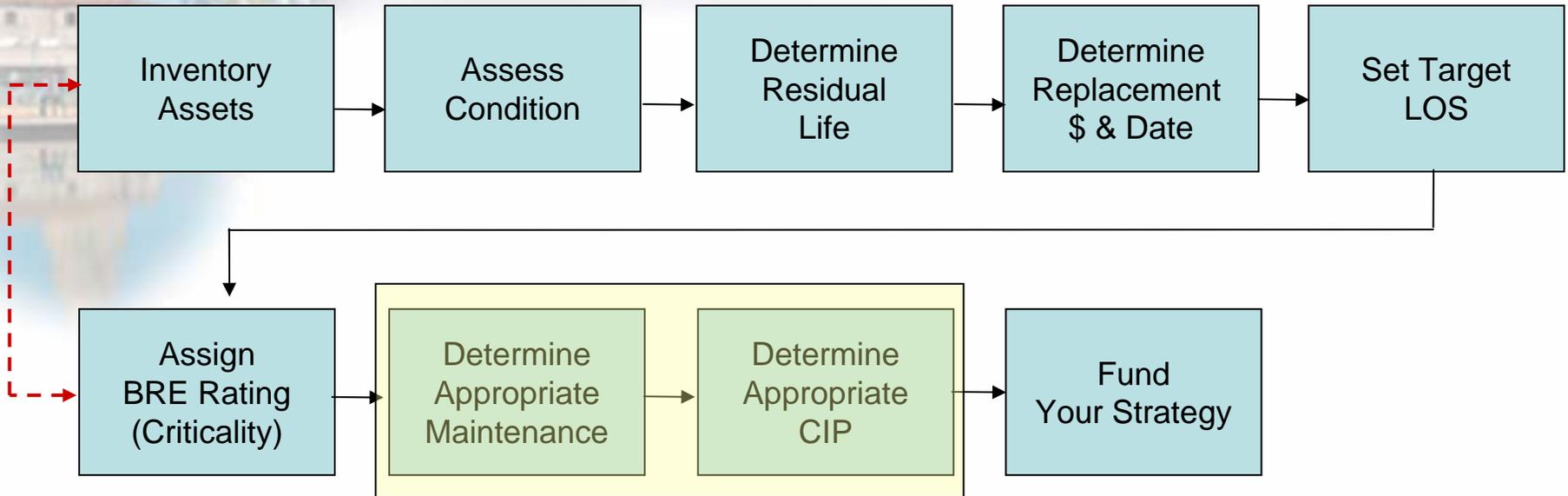
Day 2

- *Summary of Day 1; Outline of Day 2*
- *Core Question 4: What Are My Minimum “Life-cycle-cost” CIP and O&M Strategies? (Continued from Day 1)*
- *Core Question 5: Given The Above, What Is My Best Long-term Funding Strategy?*

- *Lunch*

- *Case Study 1: Deploying An AAM Program*
- *Case Study 2: Meeting The IT Challenge – Toward An Enterprise Asset Management System (EAMS)*
- *Summary, Addressing Your Questions, Comments, Self-audit*

AAM Program Process

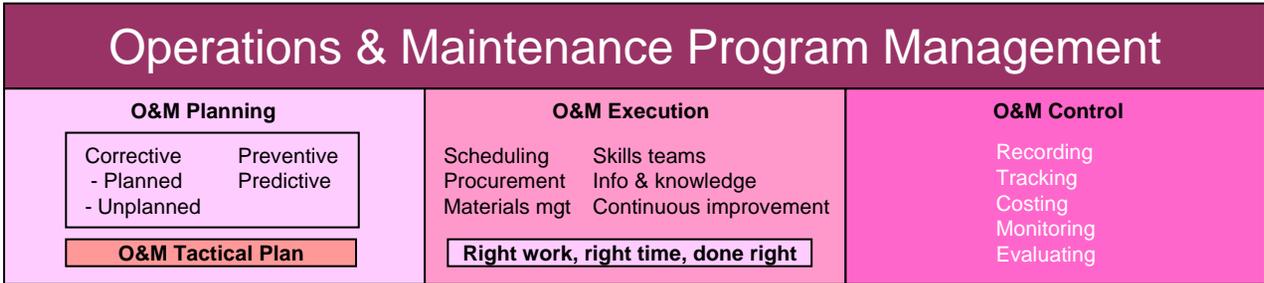
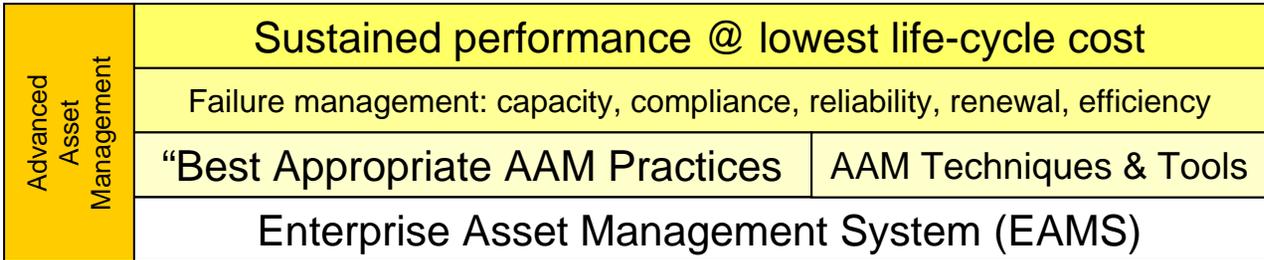
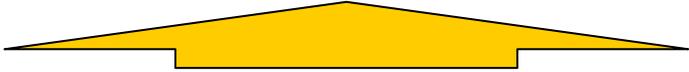
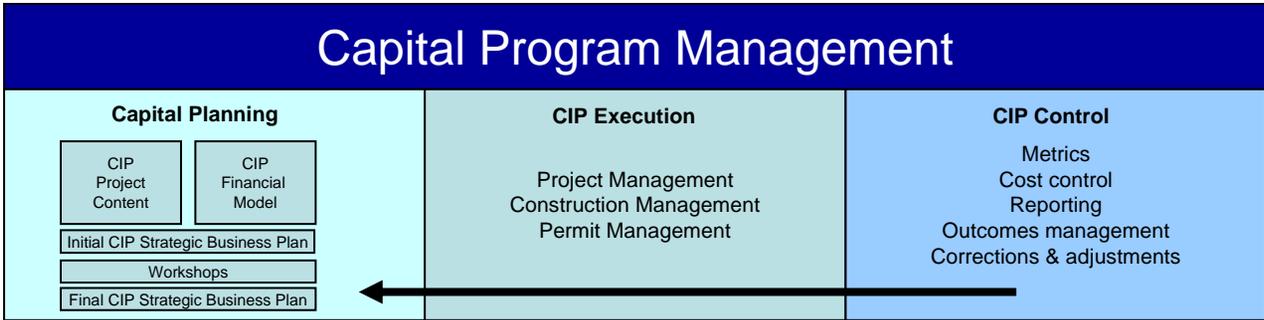




Q4: What Are My Best Minimum Life-Cycle-Cost Strategies?

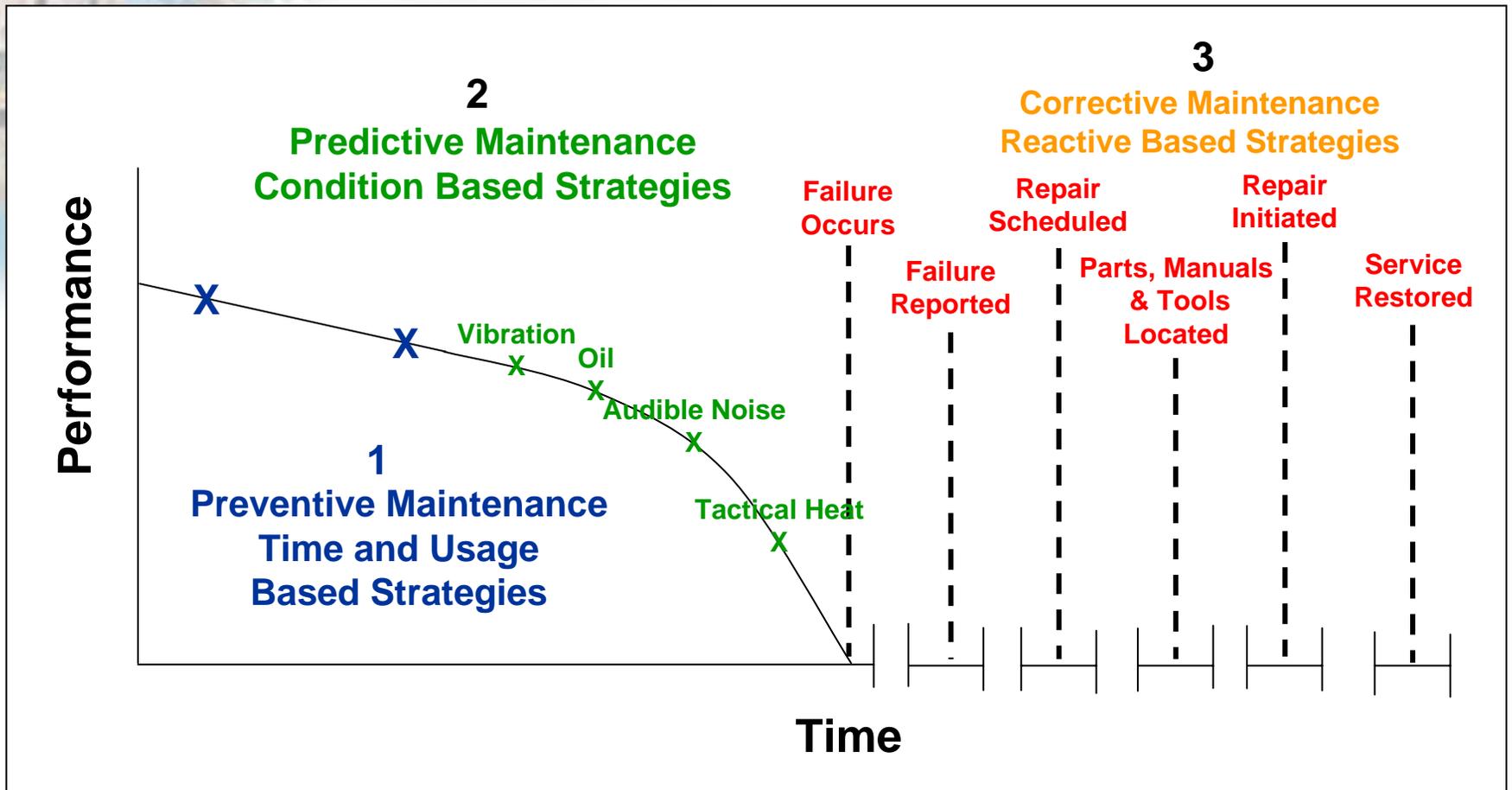
Q1a: Applied to O&M

Parsons/GHD AAM Model

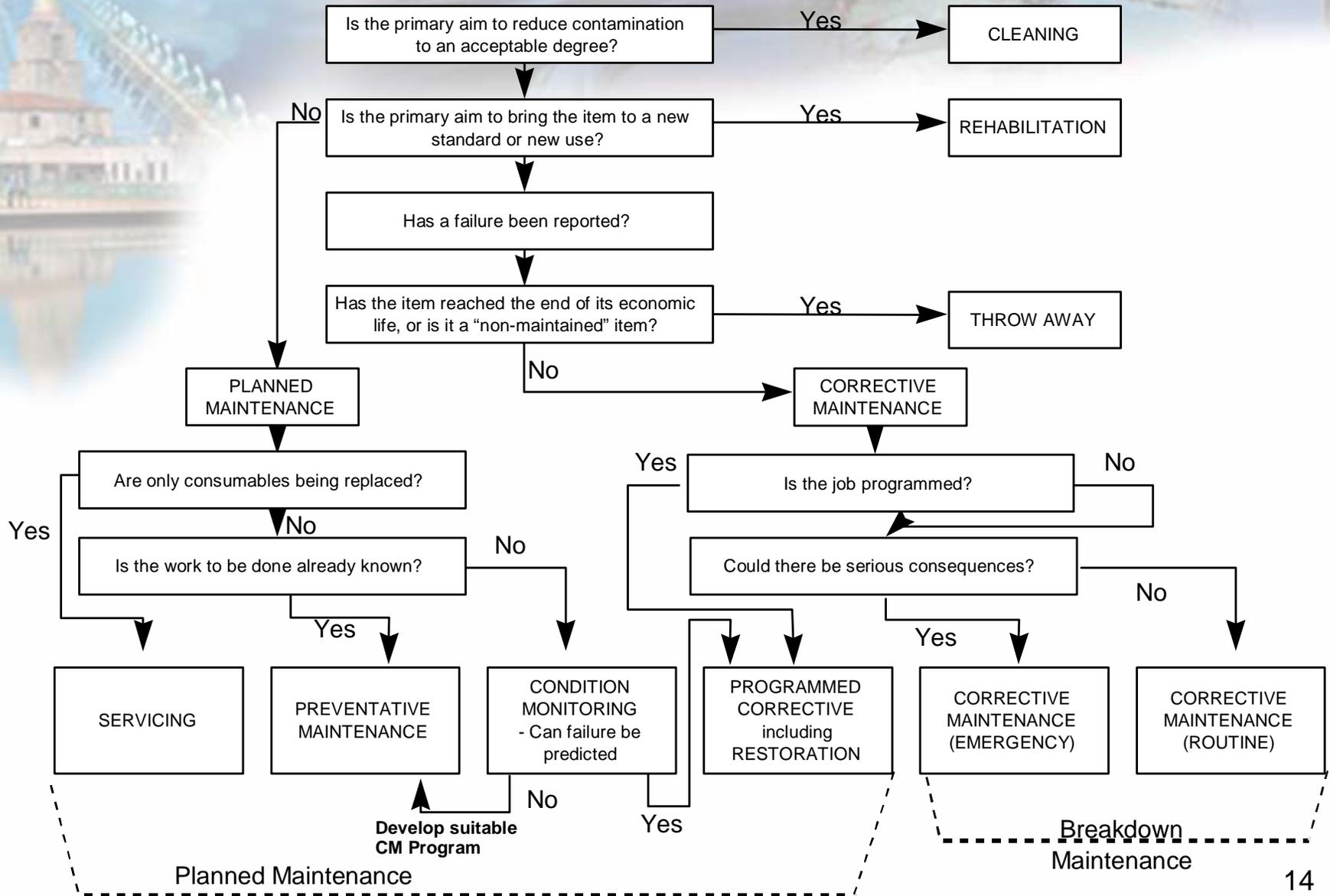


Continuous Learning/Knowledge Management
"AAM University"

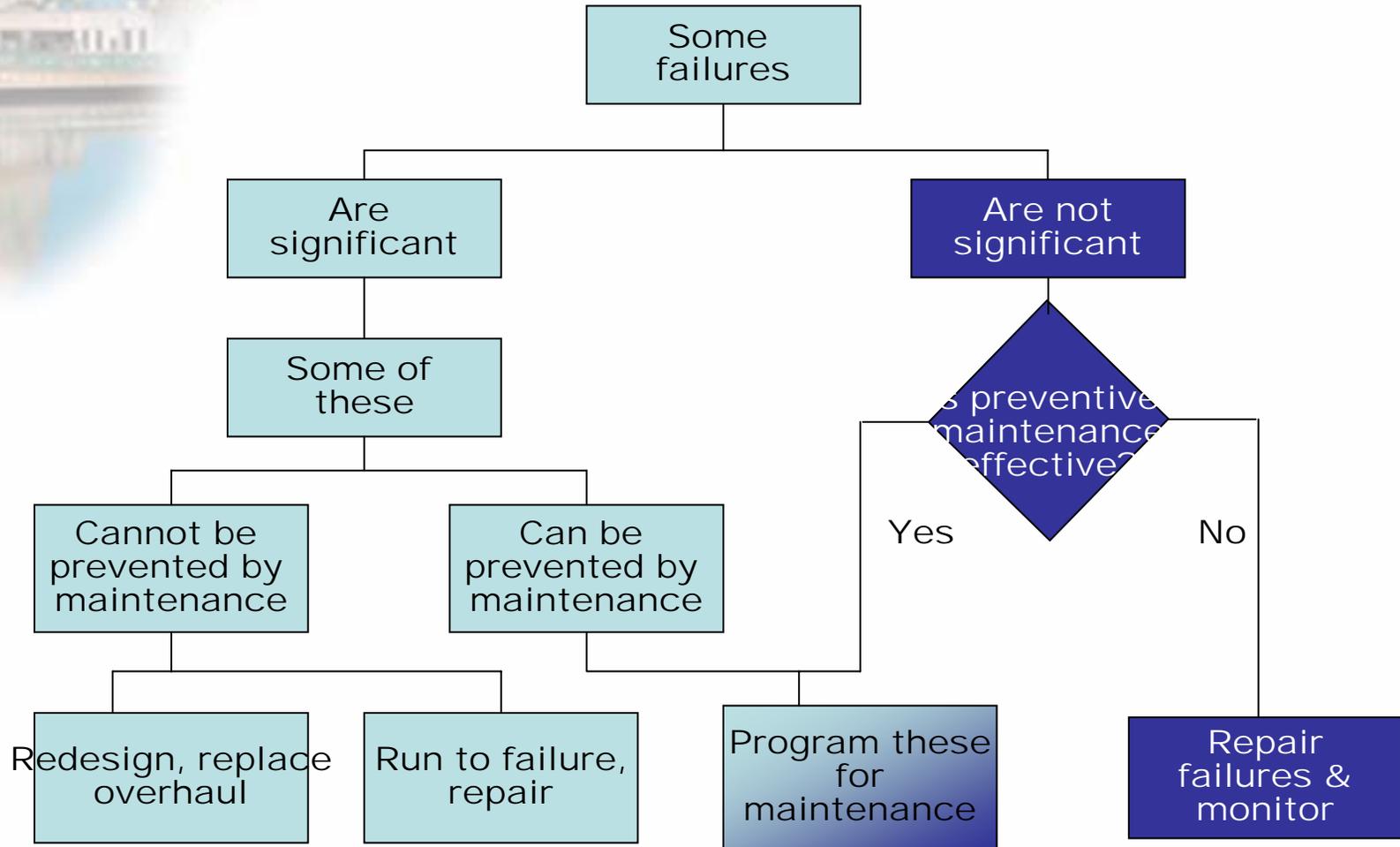
Better Understanding of the Asset Life-Cycle Drives Improved Management Strategies



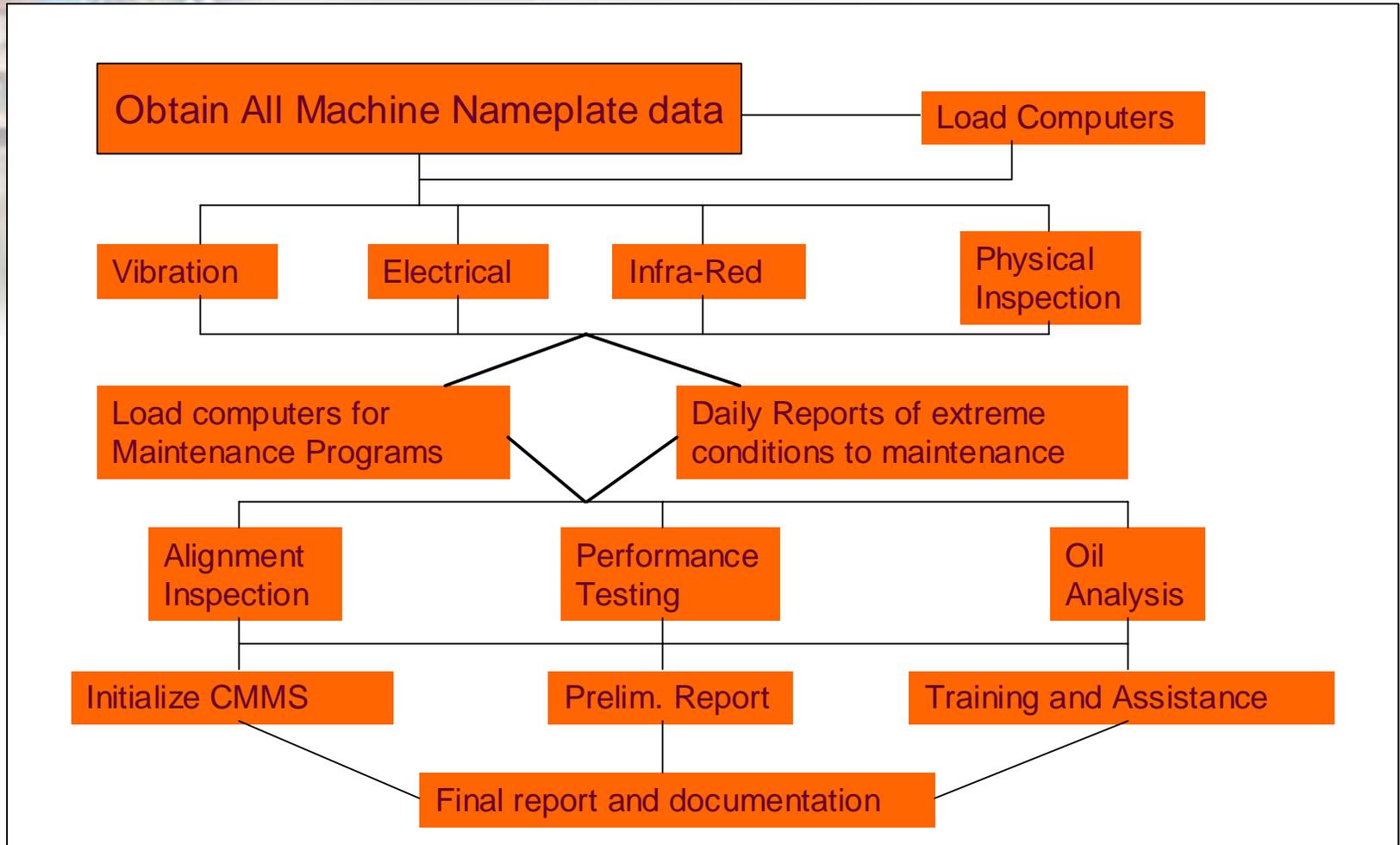
Maintenance Definitions



Failure-mode Based Management Logic

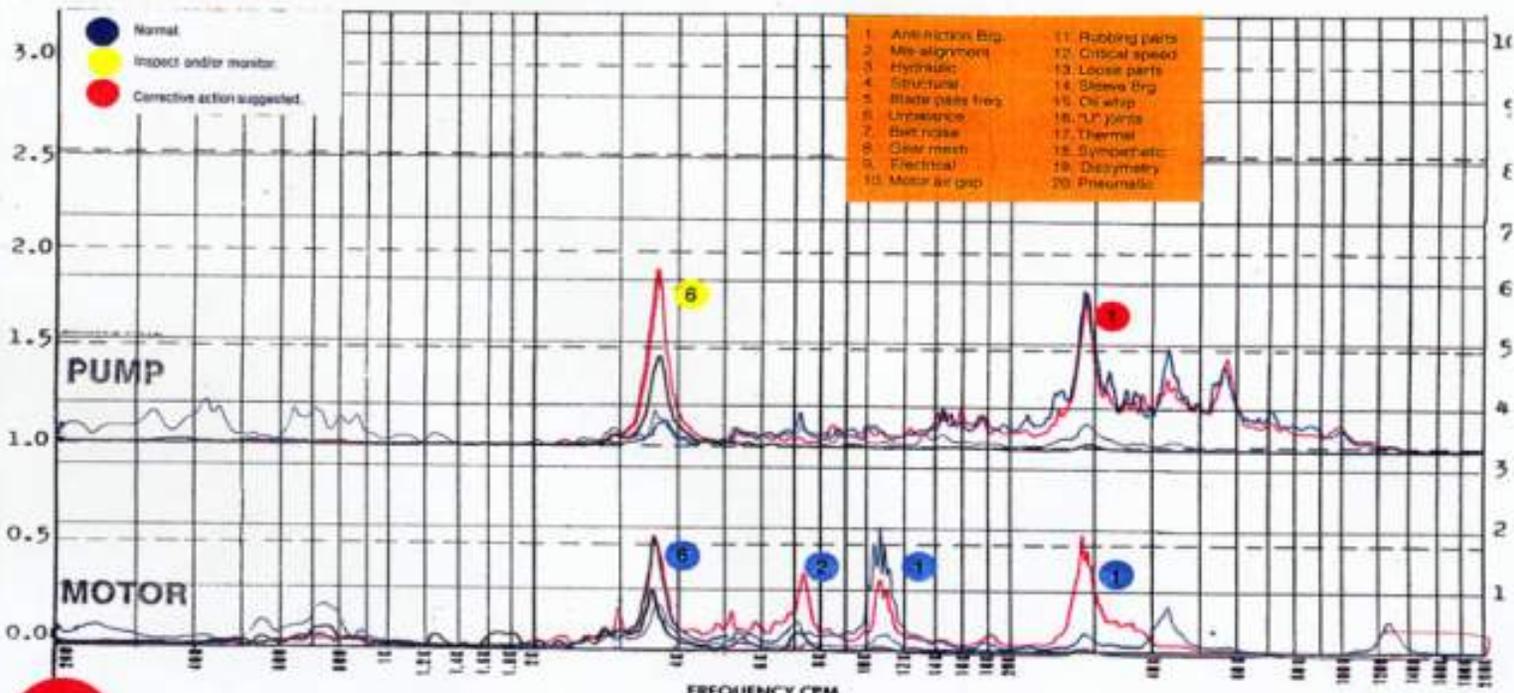
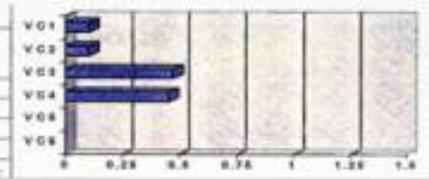


Condition-Based Maintenance (CBM)



Vibration Analysis - The Vibration Profile

| | | | | | | | | | | | | | | | | | | |
|-------------------|-------------------------------|-----------|-----------------|-----------|----------------------|--|-----------|-----------|---------------------|-----------|-----------|-----------|-----------|----------|-----------|-----------|----------|-----------|
| EQ Num | HHP72020 | | Site No. | 182 | | Mechanical Remarks | | | | | | | | | | | | |
| Name | REUSE DISTRIBUTION PUMP No. 2 | | | | | Alignment must be corrected. Pump bearings are showing signs of distress. See alignment report. Motor fan backwards. See report. | | | | | | | | | | | | |
| EQ Type | HORIZONTAL CENTRIFUGAL PUMP | | | | | | | | | | | | | | | | | |
| 02-Feb-98 | Lower Curves | | | | Middle Curves | | | | Upper Curves | | | | | | | | | |
| POS | Dr | 1V | Vc | Dr | 2V | Vc | Dr | 3H | Vc | Dr | 4H | Vc | Dr | 5 | Vc | Dr | 6 | Vc |
| Full Scale | 3.0 | 0.3 | 3.0 | 0.3 | 10.0 | 1.0 | 3.0 | 1.0 | | | | | | | | | | |
| Complex | 0.51 | 0.10 | 0.35 | 0.10 | 2.00 | 0.47 | 0.65 | 0.45 | | | | | | | | | | |
| Color | Black | Red | Blue | Green | Black | Red | Blue | Green | Black | Red | Blue | Green | | | | | | |



VIBRATION — PROFILE

WILCOX CONSULTANTS
7190 56th ST. NO
PINELLAS PARK, FL 33565

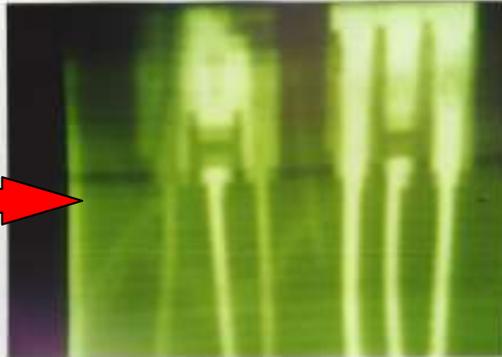
Power Evaluation

| Sample County - Waste Water Utilities Systems | | | | | | | | | | | | | | | | |
|---|----------------------|--------|--------|----------|------|------|---------------|------|------|------------|------|------|------|-----------------------------|-------|---------|
| Sewage Lift Stations - Electrical Report - Data as Recorded, June, 1998 | | | | | | | | | | | | | | | | |
| Equip. Number | Voltage Line to Line | | | Amperage | | | Voltage Drops | | | Power Data | | | | Horsepower and Load Percent | | |
| | A to B | B to C | C to A | A | B | C | A | B | C | KVA | KVAR | KW | PF | Calc. | Rated | Percent |
| 20LS-RSP-002 | 244.0 | 243.0 | 244.0 | 24.2 | 23.7 | 24.3 | 0.09 | 0.08 | 0.09 | 9.7 | 6.9 | 6.8 | 90.0 | 9.1 | 15.00 | 60.7 |
| ABLS-RSP-001 | 474.0 | 473.0 | 475.0 | 24.1 | 25.1 | 25.7 | | | | 17.5 | 2.8 | 17.2 | 98.7 | 23.1 | 25.00 | 92.4 |
| ABLS-RSP-002 | 474.0 | 474.0 | 475.0 | 27.5 | 26.7 | 29.1 | | | | 18.8 | 3.2 | 18.5 | 98.8 | 24.8 | 25.00 | 99.2 |
| ABLS-RSP-003 | 474.0 | 475.0 | 475.0 | 25.4 | 25.8 | 29.5 | | | | 17.8 | 2.9 | 17.6 | 98.7 | 23.6 | 25.00 | 94.4 |
| BELS-RSP-001 | 239.0 | 240.0 | 242.0 | 59.8 | 52.6 | 65.7 | 0.19 | 0.19 | 0.18 | 23.9 | 12.7 | 20.3 | 84.9 | 27.2 | 25.00 | 108.8 |
| BELS-RSP-002 | 240.0 | 242.0 | 240.0 | 60.5 | 51.3 | 55.4 | 0.16 | 0.16 | 0.18 | 21.5 | 13.6 | 16.7 | 77.6 | 22.4 | 25.00 | 89.8 |
| BGLS-RSP-001 | 242.0 | 241.0 | 242.0 | 8.5 | 8.6 | 8.8 | 0.30 | 0.30 | 0.35 | 3.6 | 2.4 | 2.7 | 74.5 | 3.8 | 3.00 | 120.0 |
| BGLS-RSP-002 | 242.0 | 241.0 | 242.0 | 9.4 | 9.3 | 9.6 | 0.24 | 0.18 | 0.17 | 3.9 | 2.1 | 3.3 | 84.2 | 4.4 | 3.00 | 148.7 |
| BLLS-RSP-001 | 479.0 | 475.0 | 468.0 | 3.9 | 3.8 | 3.9 | 0.08 | 0.08 | 0.07 | 3.0 | 2.0 | 2.3 | 75.3 | 3.1 | 2.00 | 155.0 |
| BLLS-RSP-002 | 482.0 | 483.0 | 485.0 | 4.0 | 3.9 | 4.0 | 0.08 | 0.06 | 0.13 | 3.1 | 2.1 | 2.3 | 73.8 | 3.1 | 2.00 | 155.0 |
| CMLS-RSP-001 | 457.0 | 456.0 | 458.0 | 6.6 | 6.6 | 7.2 | 0.40 | 0.40 | 0.42 | 5.1 | 3.6 | 3.7 | 71.3 | 5.0 | 7.50 | 66.7 |
| CMLS-RSP-002 | 457.0 | 458.0 | 458.0 | 6.0 | 6.0 | 6.1 | 0.27 | 0.27 | 0.63 | 4.7 | 3.8 | 2.7 | 58.0 | 3.6 | 7.50 | 48.0 |
| DWLS-RSP-001 | 486.0 | 485.0 | 486.0 | 22.1 | 22.9 | 24.0 | 0.14 | 0.21 | 0.14 | 19.0 | 10.9 | 15.8 | 82.0 | 20.9 | 20.00 | 104.5 |
| DWLS-RSP-002 | 485.0 | 486.0 | 486.0 | 21.3 | 22.0 | 22.8 | 0.16 | 0.14 | 0.15 | 18.3 | 10.7 | 14.8 | 81.1 | 19.8 | 20.00 | 99.0 |
| FDLS-RSP-001 | 239.0 | 239.0 | 239.0 | 21.1 | 22.1 | 22.8 | 0.21 | 0.26 | 0.20 | 9.0 | 6.6 | 6.1 | 68.2 | 8.2 | 10.00 | 82.0 |
| FDLS-RSP-002 | 240.0 | 239.0 | 240.0 | 23.9 | 24.0 | 25.8 | 0.26 | 0.26 | 0.31 | 10.0 | 7.0 | 7.1 | 70.9 | 9.5 | 10.00 | 95.0 |
| FRLS-RSP-001 | 212.0 | 213.0 | 215.0 | 4.9 | 5.4 | 5.9 | 0.23 | 0.22 | 0.26 | 2.0 | 1.6 | 1.3 | 66.5 | 1.7 | 2.00 | 85.0 |
| FRLS-RSP-002 | 212.0 | 213.0 | 215.0 | 5.2 | 5.8 | 6.1 | 0.25 | 0.25 | 0.27 | 2.1 | 1.5 | 1.4 | 70.0 | 1.8 | 2.00 | 95.0 |
| FSLS-RSP-001 | 239.0 | 240.0 | 240.0 | 33.7 | 36.8 | 42.7 | 0.14 | 0.14 | 0.13 | 14.8 | 10.3 | 10.8 | 71.7 | 14.2 | 15.00 | 94.7 |
| FSLS-RSP-002 | 239.0 | 239.0 | 240.0 | 31.4 | 34.7 | 39.8 | 0.17 | 0.18 | 0.19 | 13.9 | 10.7 | 8.9 | 63.9 | 11.9 | 15.00 | 79.3 |
| H5LS-RSP-001 | 244.0 | 242.0 | 242.0 | 9.2 | 8.8 | 9.5 | 0.82 | 0.79 | 0.73 | 3.8 | 2.5 | 2.9 | 74.7 | 3.9 | 3.00 | 130.0 |
| H5LS-RSP-002 | 242.0 | 242.0 | 241.0 | 10.2 | 9.5 | 10.0 | 0.49 | 0.81 | 0.60 | 4.1 | 2.9 | 2.9 | 70.8 | 3.9 | 3.00 | 130.0 |
| HCLS-RSP-001 | 242.0 | 242.0 | 243.0 | 28.4 | 27.1 | 26.0 | 0.12 | 0.10 | 0.12 | 11.2 | 9.0 | 6.7 | 59.3 | 9.0 | 15.00 | 60.0 |
| HCLS-RSP-002 | 243.0 | 242.0 | 243.0 | 28.3 | 28.9 | 25.8 | 0.12 | 0.11 | 0.12 | 11.2 | 8.6 | 7.1 | 63.6 | 9.5 | 15.00 | 63.3 |
| HKLS-RSP-001 | 241.0 | 241.0 | 242.0 | 60.3 | 60.1 | 36.2 | 0.45 | 0.30 | 0.72 | 27.1 | 20.6 | 17.7 | 65.1 | 23.7 | 40.00 | 59.3 |
| HKLS-RSP-002 | 240.0 | 241.0 | 241.0 | 62.4 | 63.2 | 66.0 | 0.23 | 0.36 | 0.66 | 26.6 | 15.9 | 21.3 | 80.2 | 28.6 | 40.00 | 71.6 |
| HSLS-RSP-001 | 208.0 | 208.0 | 208.0 | 240.3 | 26.2 | 28.1 | 0.19 | 0.19 | 0.28 | 9.0 | 5.8 | 6.9 | 76.6 | 9.2 | 10.00 | 92.0 |
| HSLS-RSP-002 | 208.0 | 206.0 | 208.0 | 24.1 | 26.4 | 27.7 | 0.17 | 0.18 | 0.20 | 9.0 | 5.7 | 6.7 | 77.4 | 9.0 | 10.00 | 90.0 |
| JHLS-RSP-001 | 244.0 | 243.0 | 243.0 | 50.9 | 52.4 | 51.6 | 0.21 | 0.65 | 0.19 | 21.4 | 15.4 | 14.9 | 69.6 | 20.0 | | |
| JHLS-RSP-002 | 245.0 | 244.0 | 245.0 | 44.1 | 42.9 | 45.1 | 0.38 | 0.54 | 0.32 | 18.4 | 12.7 | 13.4 | 72.7 | 18.0 | | |
| MWLS-RSP-001 | 241.0 | 240.0 | 241.0 | 11.0 | 11.6 | 12.4 | 0.19 | 0.13 | 0.14 | 4.7 | 2.5 | 4.0 | 84.8 | 5.4 | 7.50 | 72.0 |

CITY OF ** OMITTED **, SEWAGE LIFT STATIONS
EQUIPMENT EVALUATION REPORT, THERMAL CONDITIONS

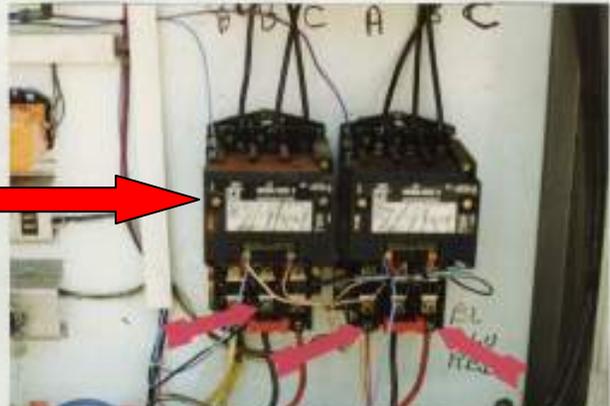
EQUIP. NO. LS1801 GROUP GCP LOCATION L81
138a 8200 WEST SHREKMAN CIRCLE

UNIT 1
CONDITION --- Y

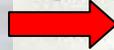


COMPONENT:
STARTERS
DEGREES ABA: 25

--- THERMAL REMARKS ---
... clean and tighten the center phase connections on the load
the #1 starter and both sides of the #1 breaker; and the
... and right phases on the load side of the #2 starter.



Identification



IR View



Remarks



Visual



Severity Code

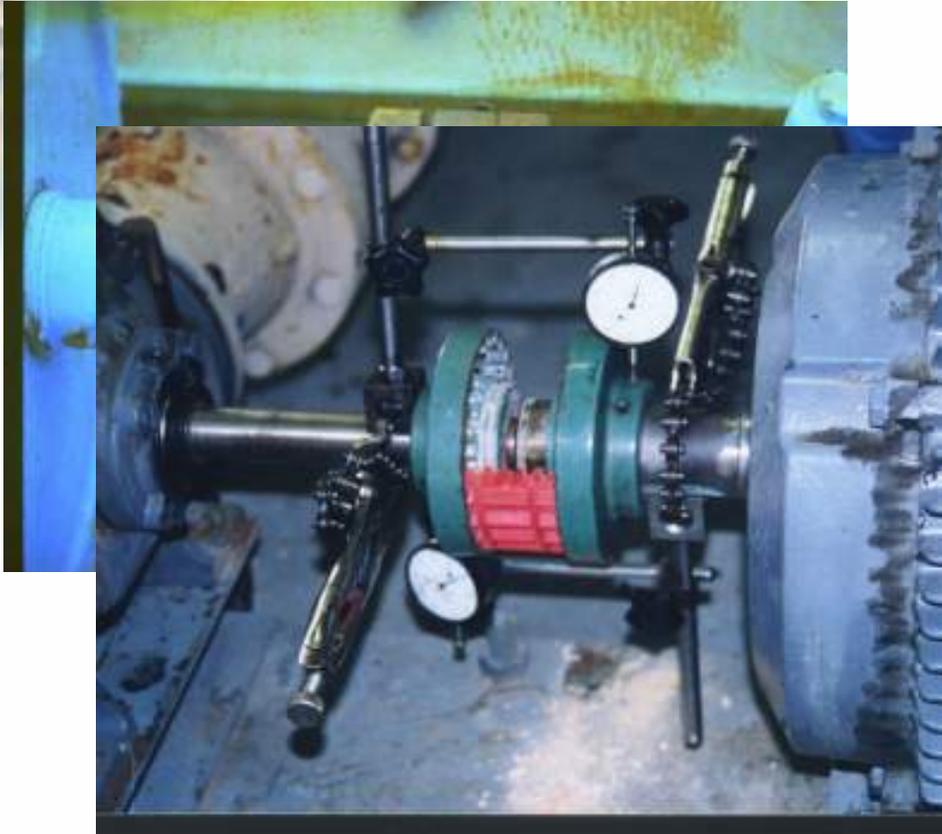


Component
Temp



Typical
Infrared
Report
Sheet

Alignment Inspection and Correction Data



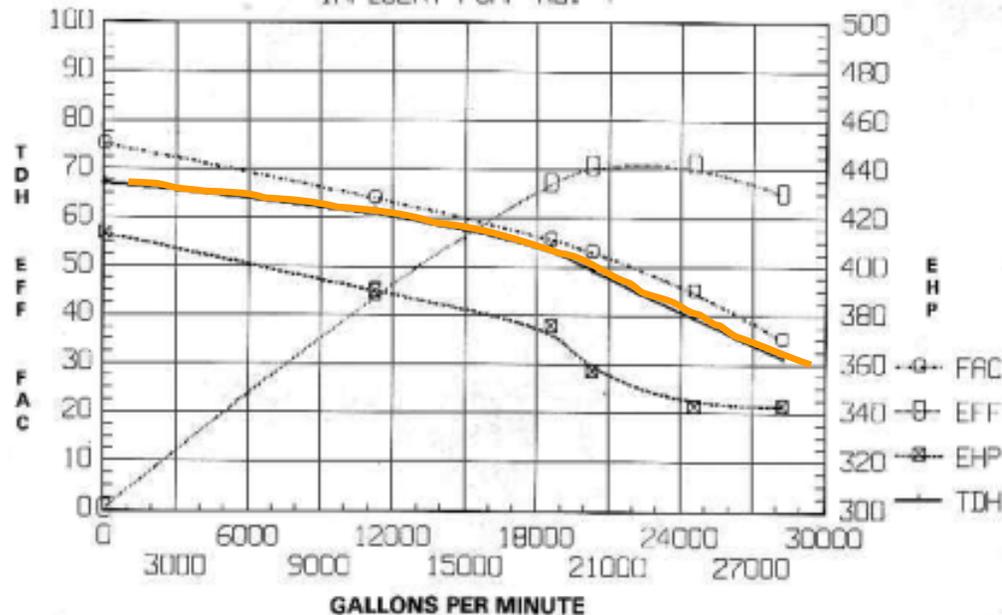
- Coupling Failure
- Bearing Failure

Machine Performance Tests

EQUIPMENT EVALUATION REPORT

PUMP PERFORMANCE CURVE

EXAMPLE
INFLUENT PUMP NO. 4



TDH = TESTED H/Q CURVE
EHP = TESTED ELECTRICAL HORSEPOWER
EFF = TESTED EFFICIENCY
FAC = APPROXIMATE FACTORY H/Q CURVE

DATED: MAY, 1997

WCI

- Full hydraulic testing of selected machines
- Conforms to factory test curves?

The Status Sheet (Summary)

EQUIPMENT STATUS SHEET
CITY OF ** OMITTED **, FLORIDA



SITE NO. 192 RESUSE DISTRIBUTION PUMP No. 2 UNIT 2
EQUIP. NO. HEP 72020 GROUP NO. HCP DATE: 02/02/98

| DRIVER | | | | DRIVEN | | | | | | | | | | |
|-----------------|---|--------------|-----------------|------------|-------------------------|--------|------|------|-------|-----|-----|-----|---------|---|
| MANUFACTURER | D. S. ELECTRIC MOTORS | MANUFACTURER | PAISHANKS MOUSE | MODEL | 44XA | | | | | | | | | |
| GROSSPOWER | 325.00 | SIZE | | TYPE/RATIO | | | | | | | | | | |
| RPM | 3570 | H/Q | | RPM | | | | | | | | | | |
| VOLTAGE | 460 | SERIAL NO. | 062206-0 | | | | | | | | | | | |
| AMPERAGE | 145 | MODEL NO. | | | | | | | | | | | | |
| PHASE/CY. | 3 / 40 | | | | | | | | | | | | | |
| TYPE/FRAME | TC1 / 444 TS | | | | | | | | | | | | | |
| SERIAL NO. | A0425201300-2 | | | | | | | | | | | | | |
| MODEL NO. | BE2217, BEARINGS: 6313 | | | | | | | | | | | | | |
| VOLTS A-E | 465.0 | AMPS A | 120.2 | V DROP A | 0.05 | KW | 92.5 | KVAR | 23.0 | | | | | |
| VOLTS B-C | 477.0 | AMPS B | 130.1 | V DROP B | 0.05 | KVA | 94.6 | PF | 97.8 | | | | | |
| VOLTS C-A | 481.0 | AMPS C | 113.4 | V DROP C | 0.05 | % I.D. | 99.2 | LHP | 124.0 | | | | | |
| ELECT. REMARKS | All thermal and electrical conditions are normal. Yields are no apparent thermal escalation. The electrical load is satisfactory. | | | | | | | | | | | | | |
| | 10c | 10c | 20c | 20c | 30c | 30c | 40c | 40c | 50c | 50c | 60c | 60c | | |
| | 0.51 | 0.10 | 0.75 | 0.10 | 2.00 | 0.47 | 0.65 | 0.45 | | | | | | |
| MECHAN. REMARKS | Alignment must be corrected. Pump bearings are showing signs of distress. See alignment report. Motor fan backwards. See report. | | | | | | | | | | | | | |
| ALIGNMENT: | MAXIMUM RADIAL = 0.2 | | | | MAXIMUM PARALLEL = 44.2 | | | | | | | | | |
| COND: | VIS | R | BLE | B | SHM | S | AGC | H | FOY | K | OIL | K | OVERALL | R |

Overall condition

Picture of machine

Description

All Nameplate Data

Electrical Data

Elect. And Thermal Remarks

Vibration Data

Mech. and Phys. Remarks

Alignment Data

Conditions

Equipment Status List

EQUIPMENT SUMMARY REPORT - STATUS LIST

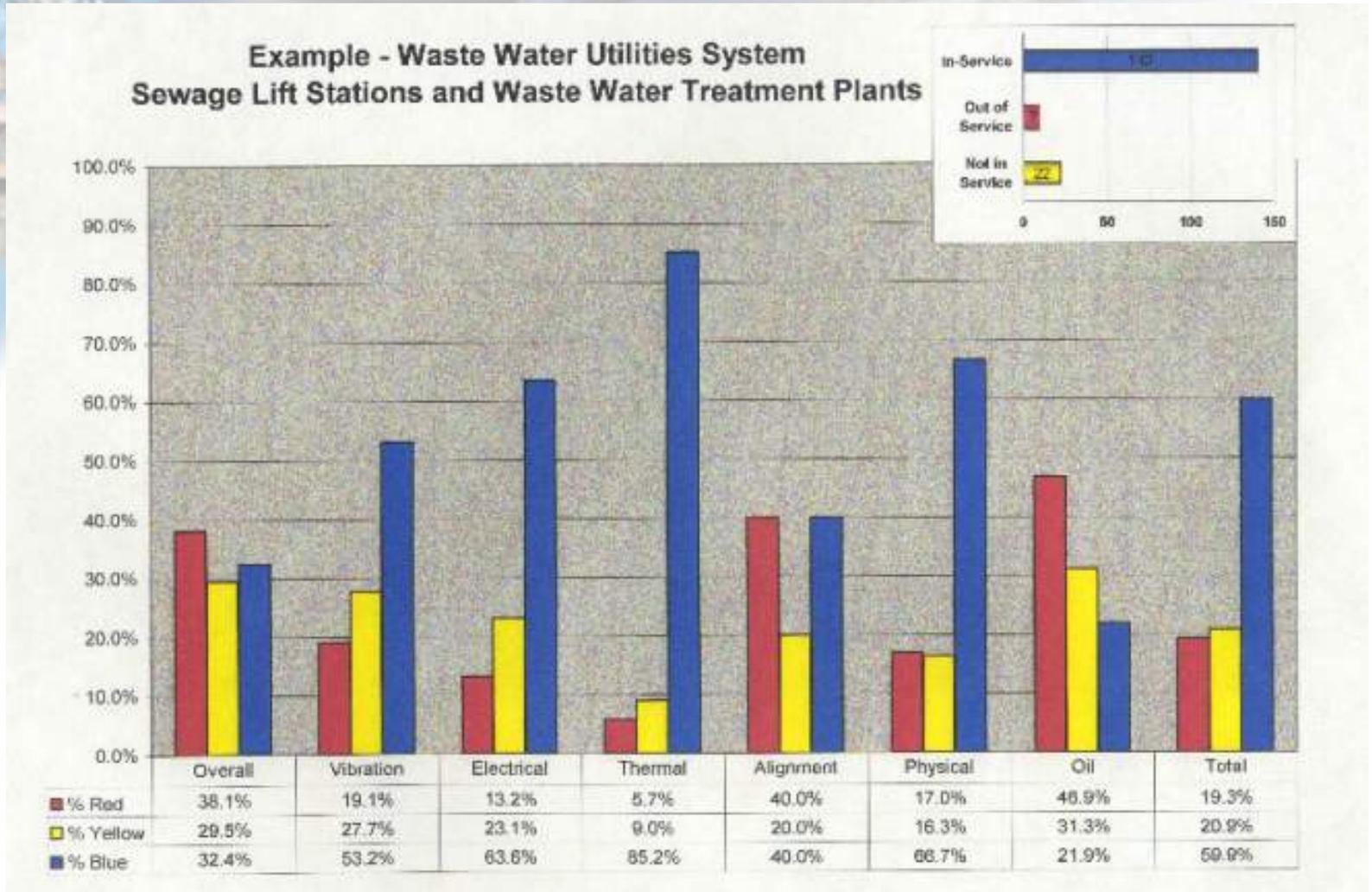
June, 1998

| Equipment Number | Site Number | Overall | Vibration | Electrical | Thermo-graphy | Alignment | Physical | Oil |
|------------------|-------------|---------|-----------|------------|---------------|-----------|----------|------|
| LOCEQ | SITENO | GACC | VIBC | ELEC | THRC | ALGC | PHYC | OILC |
| 20LS-RSP-001 | 113A | G | N | N | N | N | R | N |
| 20LS-RSP-002 | 113B | Y | Y | B | B | N | B | N |
| ABLS-RSP-001 | 101A | Y | B | B | B | N | B | N |
| ABLS-RSP-002 | 101B | Y | Y | B | B | N | B | N |
| ABLS-RSP-003 | 101C | Y | B | N | N | N | R | N |
| ABTP-ADU-001 | 201 | B | B | Y | B | N | B | B |
| ABTP-ADU-002 | 202 | Y | N | N | N | N | B | B |
| ABTP-ADU-003 | 203 | B | N | N | N | N | B | B |
| ABTP-ADU-004 | 204 | R | N | N | N | N | B | B |
| ABTP-BC1-001 | 205 | R | N | N | N | N | B | R |
| ABTP-BC1-002 | 206 | R | N | B | B | N | B | R |
| ABTP-BC1-002 | 207 | R | B | B | B | N | B | R |
| ABTP-MAC-001 | 225 | N | B | B | B | N | B | N |
| ABTP-PFP-001 | 226 | N | B | B | B | N | B | N |
| ABTP-SFP-001 | 223 | N | N | N | N | N | N | N |
| ABTP-SFP-002 | 227 | N | N | Y | B | N | Y | N |
| ABTP-SFP-002 | 224 | N | R | R | B | N | R | N |
| ABTP-TBF-001 | 211 | N | N | B | B | N | B | N |
| ABTP-TBF-002 | 212 | N | N | B | B | N | B | N |
| ABTP-TBF-003 | 213 | N | B | B | Y | N | B | N |
| ABTP-TBF-004 | 214 | N | N | B | B | N | B | N |
| ABTP-TBF-005 | 215 | N | Y | Y | B | N | Y | N |
| ABTP-TBF-006 | 216 | N | N | Y | B | N | Y | N |
| ABTP-THK-001 | 220 | R | N | N | N | N | N | R |
| ABTP-THK-002 | 221 | B | B | R | R | N | R | N |

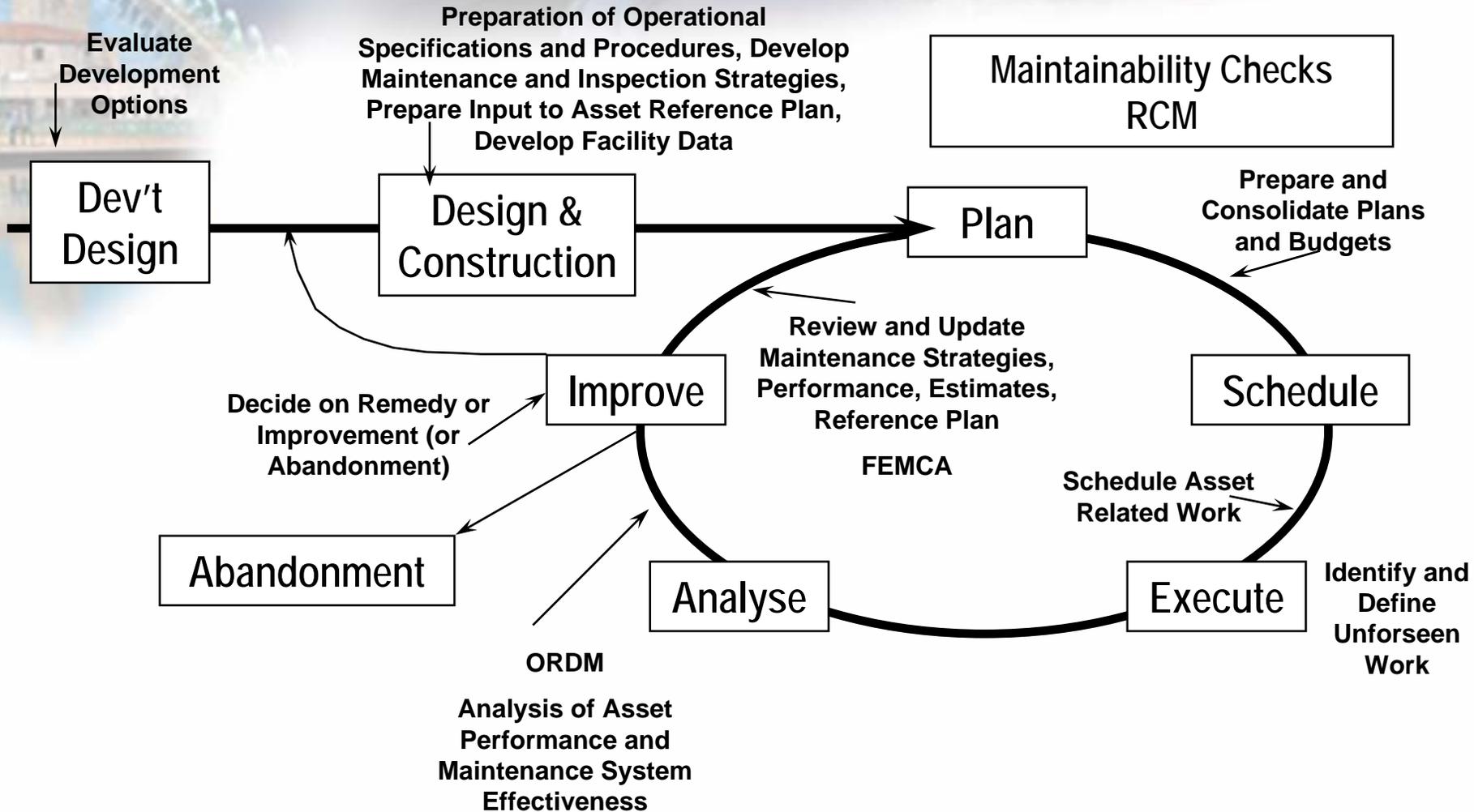
Severity
Color
Code



Graphic Summary - All Machines



Maintenance - Contribution to LCAM



Example RCM Analysis on Headworks Screen

| RCM II INFORMATION WORKSHEET <small>© 1994 Aladon Ltd</small> | SYSTEM <i>Bull screens</i> | | No. 0 | Compiled by | Date 18-Aug-02 | Sheet 1 |  |
|---|--------------------------------------|---------------------------------|--|--------------------|--------------------------|-------------------|---|
| | SUB-SYSTEM | | Ref. <i>Bull screens</i> | Reviewed by | Date | of 49 | |
| FUNCTION | FUNCTIONAL FAILURE | FAILURE MODE (Cause of failure) | FAILURE EFFECT (What happens when it fails) | | | | |
| 1 | A | 1 | <p>Over time the control cable wears and thins, strands start to break and eventually the cable loses enough tensile strength that it can no longer support the shovel's weight when open. The cable breaks and the shovel closes and cannot be opened. During its descent the shovel catches on the scraper and beaks it off. The shovel continues its cycle but does not open and cannot gather foreign matter. The excess material in front of the screen accumulates and the water level differential across the screen rises. The shovel tries to clean the screen more often and eventually the water level in front of the screen rises enough that the "high level" alarm sounds in the control room. With time the channel overflows. Repair time: 4 hours, Downtime: 5 hours. Special tools: mobile scaffolding and security bar. Spare parts: Wire rope in stock.</p> <p>The control cable extension is positioned at the portion of the cable that flexes the most during normal operation. Over time the control cable extension wears and thins, strands start to break and eventually the cable loses enough tensile strength that it can no longer support the shovel's weight when open. The cable breaks and the shovel closes and cannot be opened. During its descent the shovel catches on the scraper and beaks it off. The shovel continues its cycle but does not open and cannot gather foreign matter. The excess material in front of the screen accumulates and the water level differential across the screen rises. The shovel tries to clean the screen more often and eventually the water level in front of the screen rises enough that the "high level" alarm sounds in the control room. With time the channel overflows. Repair time: 4 hours, Downtime: 5 hours. Special tools: mobile scaffolding and security bar. Spare parts: Wire rope in stock from which to make the extension.</p> | | | | |
| 1 | A | 2 | | | | | |

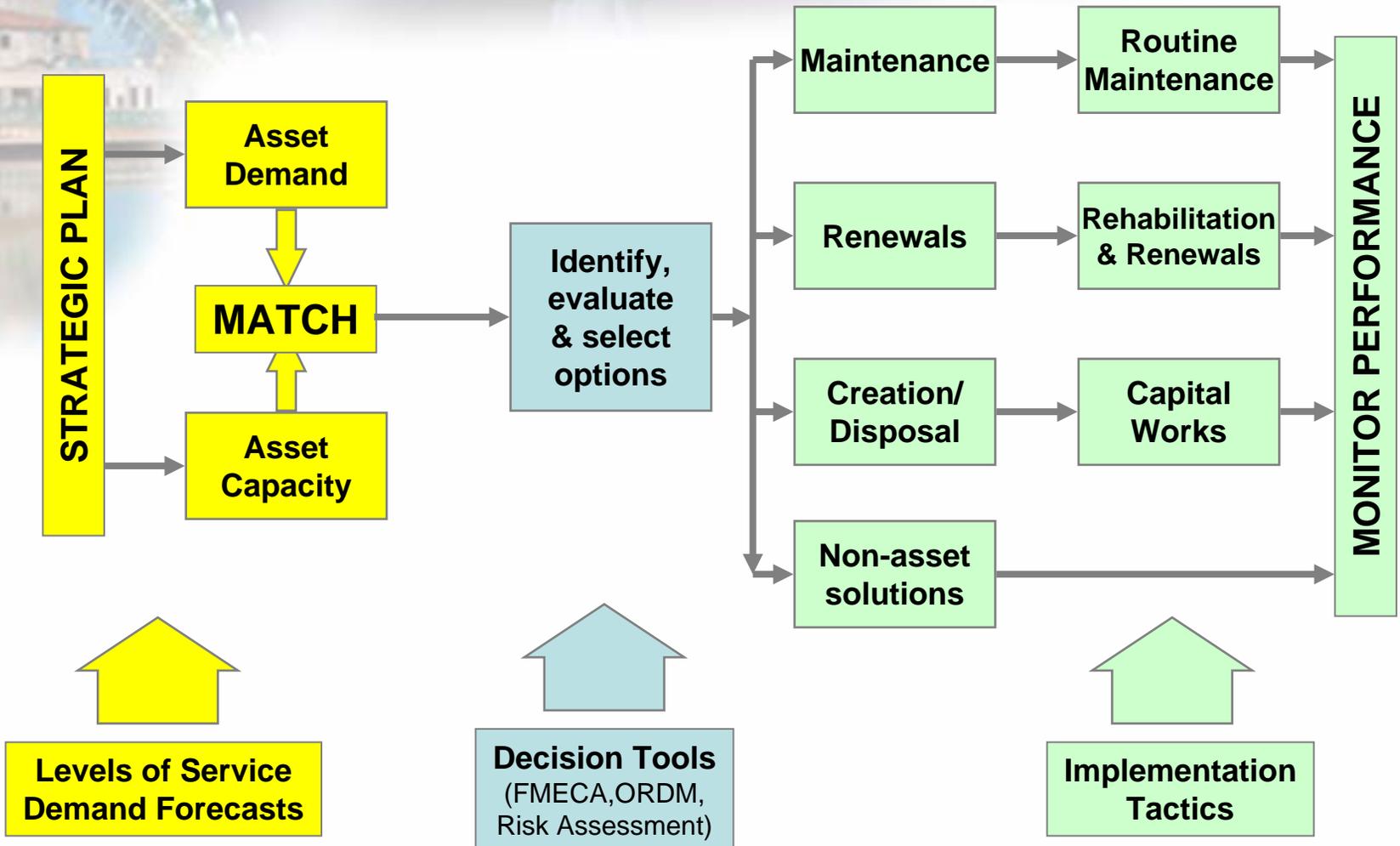


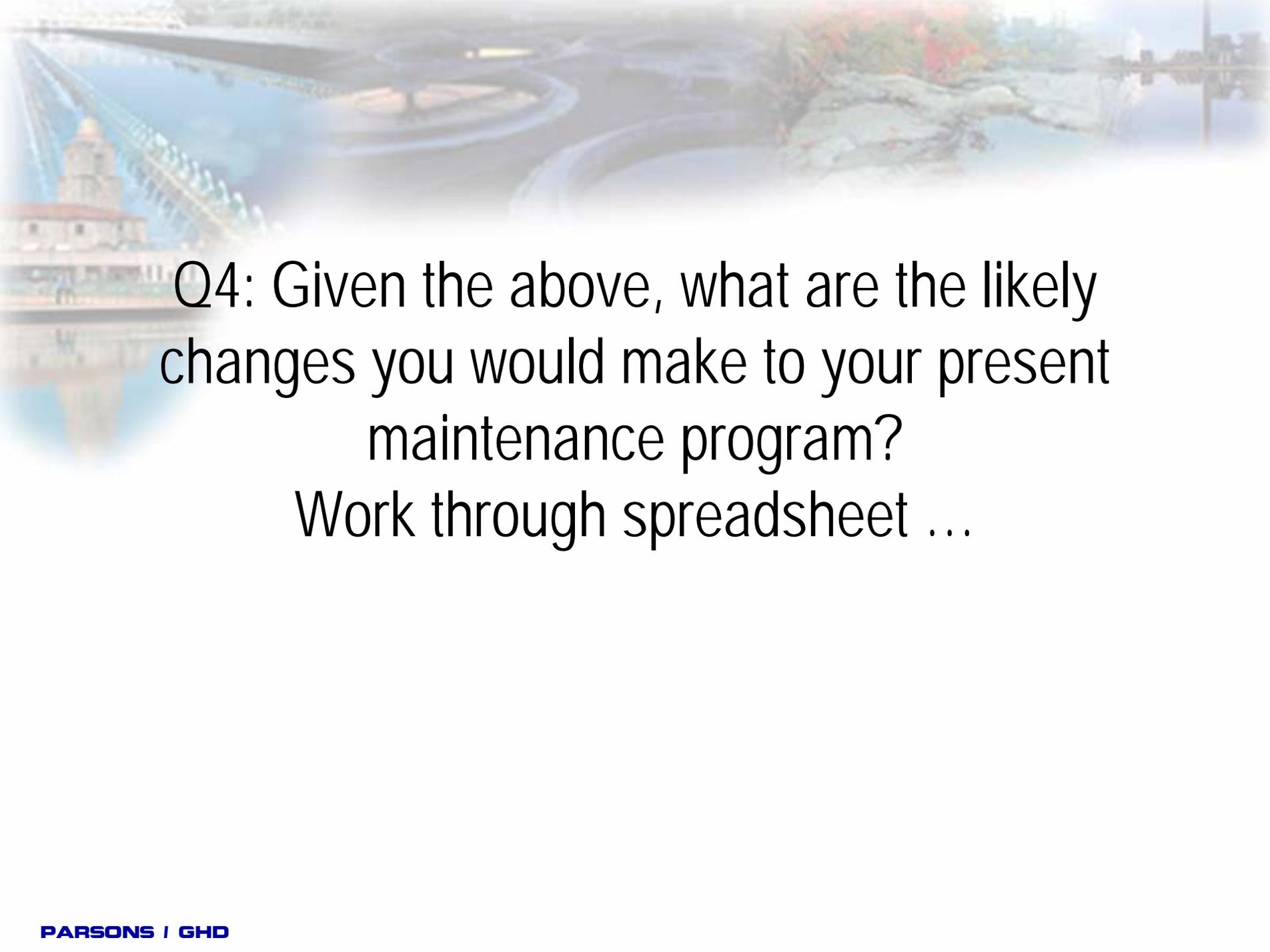
Example RCM Analysis on Headworks Screen

| RCM II DECISION WORKSHEET | | SYSTEM <i>Bull screens</i> | | | | | | | | | | No. | Compiled by | Date | Sheet |
|---------------------------------|----|-------------------------------|---|---|---|----------------------|----------------------|----------------------|---------------|----|----|---------------|--|----------------|----------|
| © 1994 Aladon Ltd | | SUB-SYSTEM | | | | | | | | | | 0 | | 18-Aug-02 | 1 |
| Information reference | | Consequence evaluation | | | | H1 S1 O1 N1 | H2 S2 O2 N2 | H3 S3 O3 N3 | Default tasks | | | Proposed Task | Initial Interval | Can be done by | |
| F | FF | FM | H | S | E | O | | | | H4 | H5 | | | | S4 |
| 1 | A | 1 | Y | N | N | Y | Y | | | | | | Visual inspection of the shovel control cable for broken strands and reduced cable diameter. Standards to be established. Replace cable as needed. | 5000 cycles | Mechanic |
| 1 | A | 2 | Y | N | N | Y | N | N | Y | | | | Replace the bull screen shovel control cable extension | 3500 cycles | Mechanic |
| 1 | A | 3 | Y | N | N | Y | N | Y | | | | | Shorten the bull screen shovel lift cable to eliminate the worn section, from the connector to the curvature. Ensure that both lift cables are the same length. The cable can be shortened twice before a new cable must be installed. | 3500 cycles | Mechanic |
| 1 | A | 4 | Y | N | N | Y | Y | | | | | | Visual inspection of the bull screen shovel lift cables for broken strands and reduced cable diameter. Standards to be established. Replace cable as needed. When replacing the cable, ensure that both lift cables are the same length. | 5000 cycles | Mechanic |
| 1 | A | 5 | Y | N | N | Y | N | N | N | | | | No scheduled maintenance | | |
| 1 | A | 6 | Y | N | N | Y | Y | | | | | | Visual inspection of the bull screen shovel's lift wench's drums for accumulation of foreign matter. Have the drum's surface cleaned when the accumulation affects cable seating. | Mensuel | Operator |
| 1 | A | 7 | Y | N | N | Y | Y | | | | | | Visual inspection of the bull screen shovel's control wench's drum for accumulation of foreign matter. Have the drum's surface cleaned when the accumulation affects cable seating. | Mensuel | Operator |
| 1 | A | 8 | Y | N | N | Y | N | Y | | | | | Lubricate the bull screen shovel wench's bearings. Norms to be established. | Annual | Mechanic |



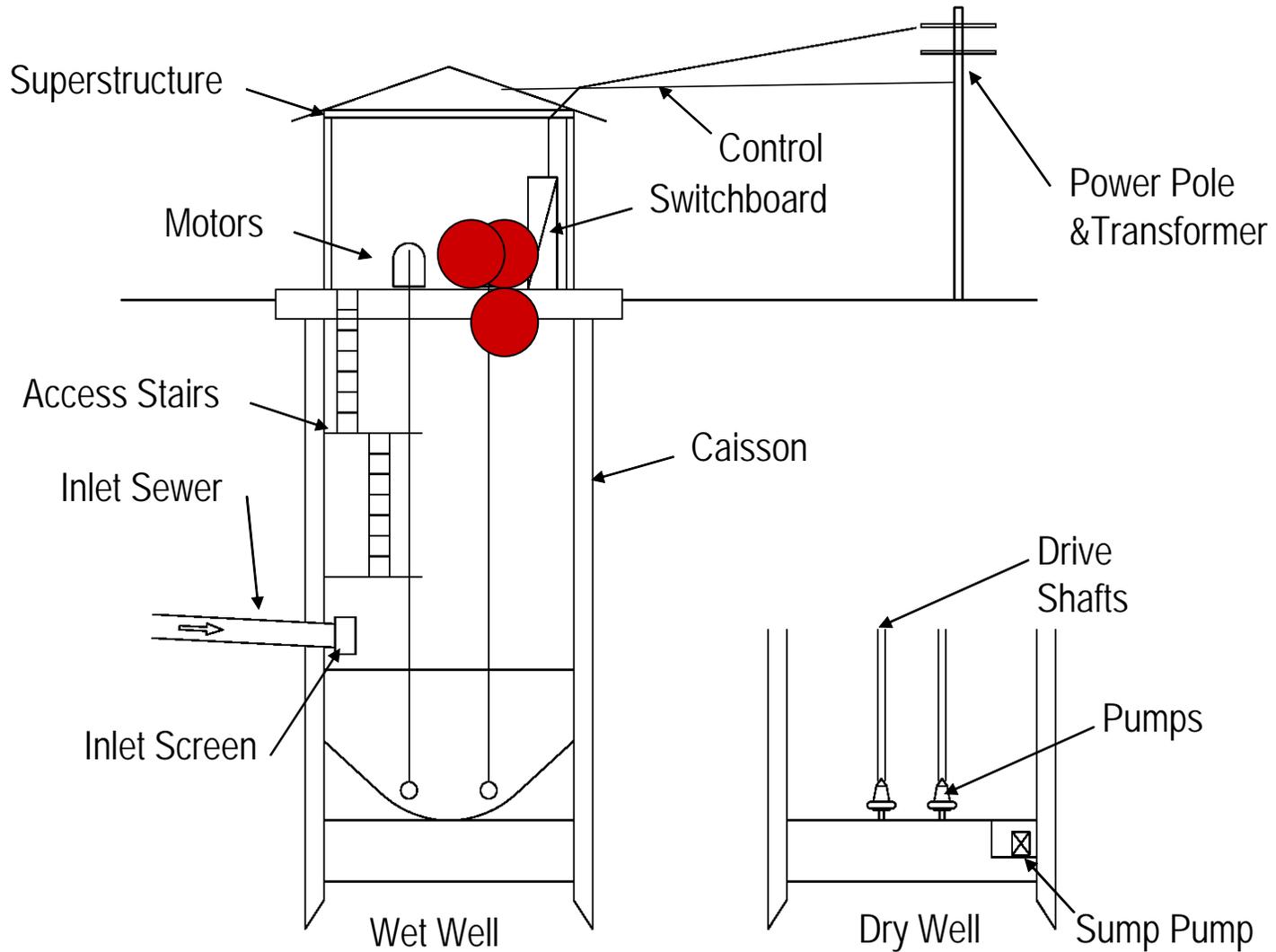
Asset Management Planning Process



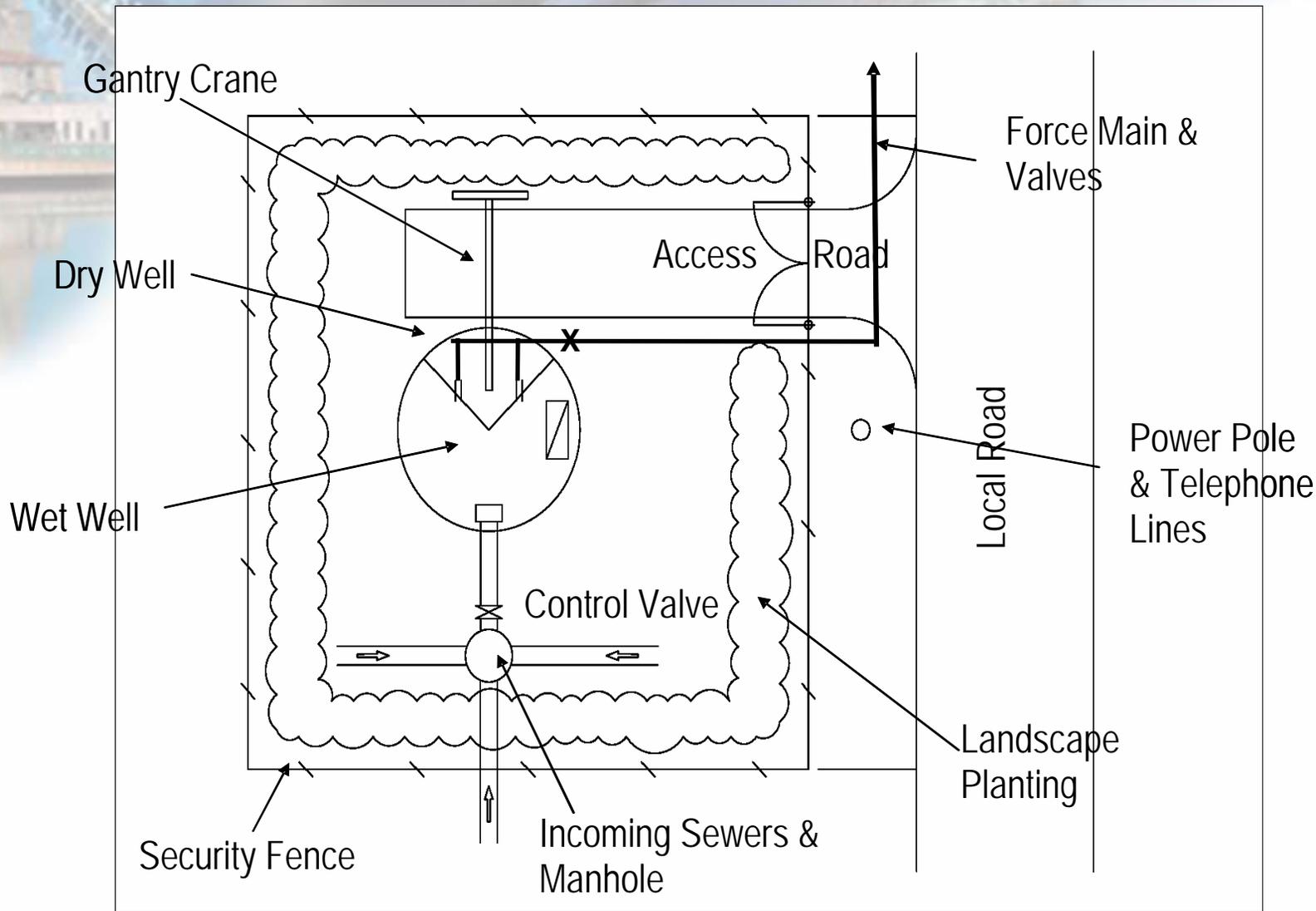


Q4: Given the above, what are the likely changes you would make to your present maintenance program?
Work through spreadsheet ...

The Pump Station



The Layout View

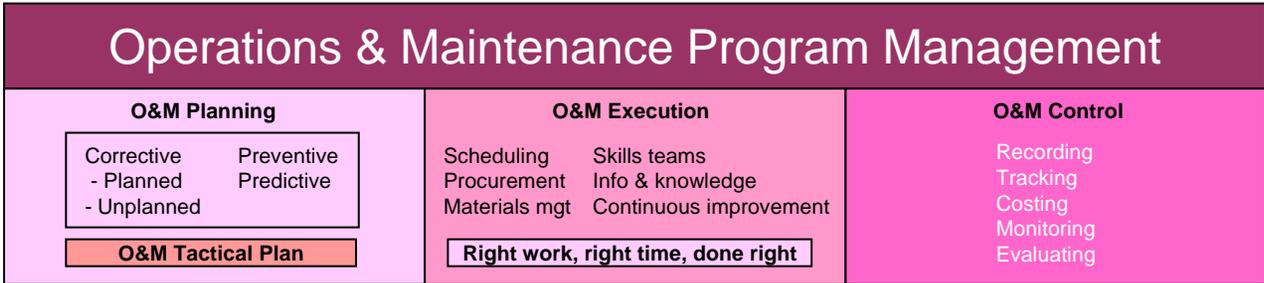
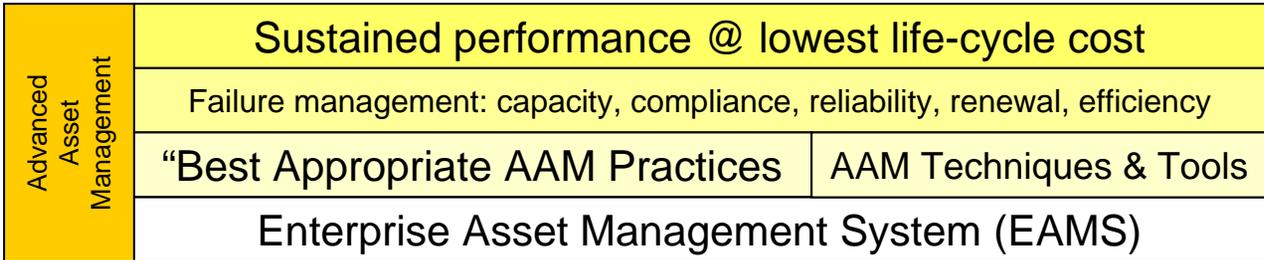
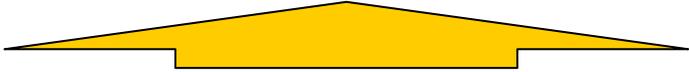
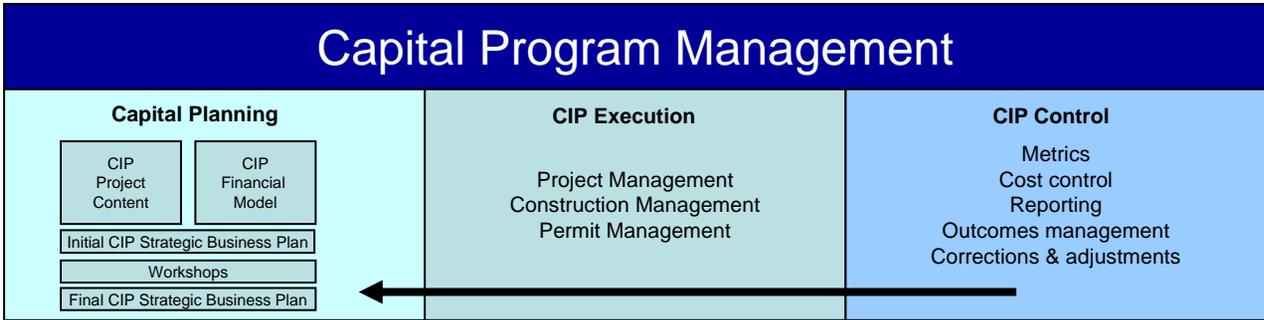


A background image showing a bridge with a suspension tower and a building with a dome, possibly a government building, reflected in water. The image is slightly faded and serves as a backdrop for the text.

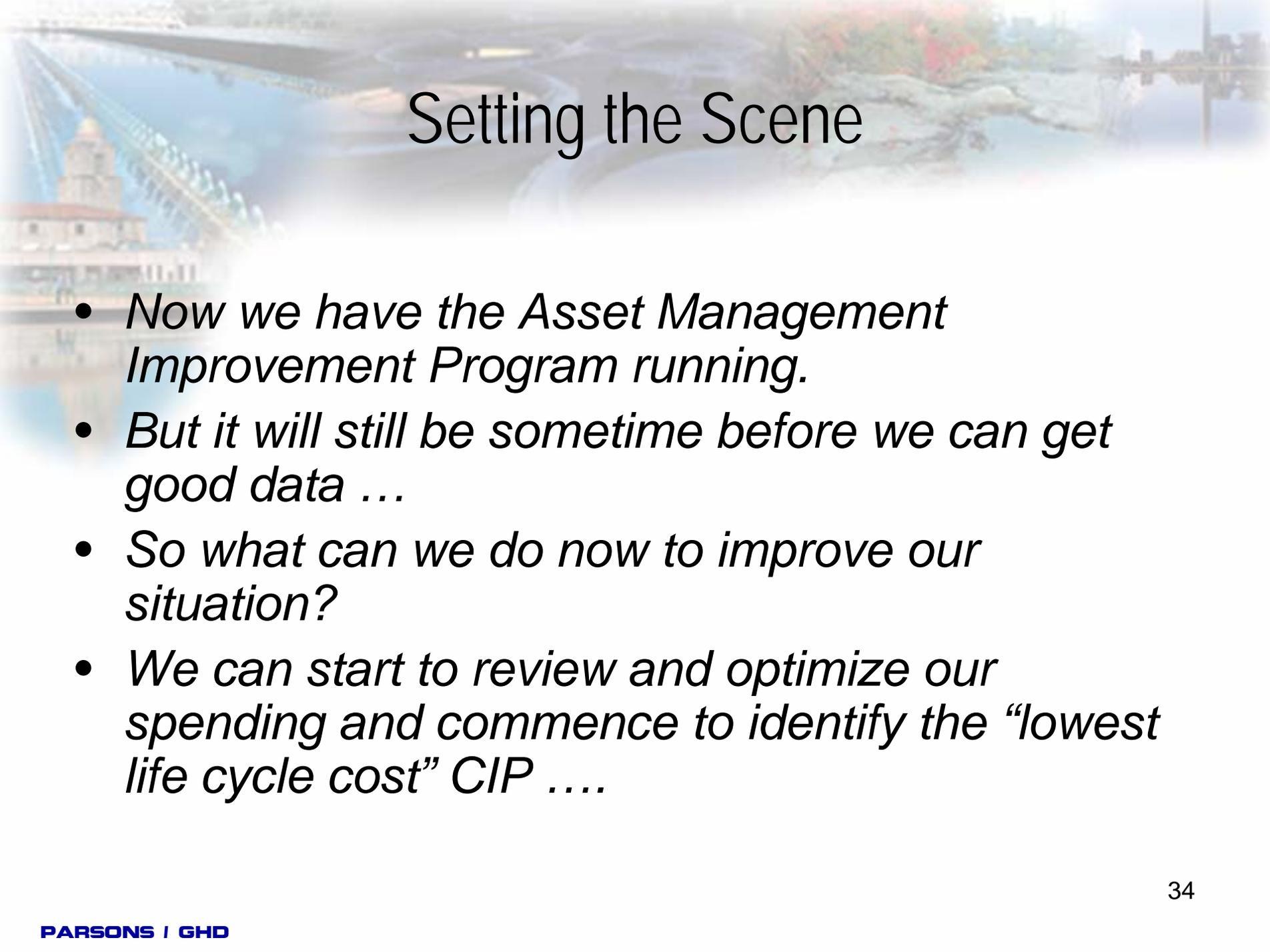
Q4: What Are My Best Minimum Life-Cycle-Cost Strategies? (continued from yesterday)

Q1b: Applied to CIP

Parsons/GHD AAM Model



Continuous Learning/Knowledge Management
"AAM University"



Setting the Scene

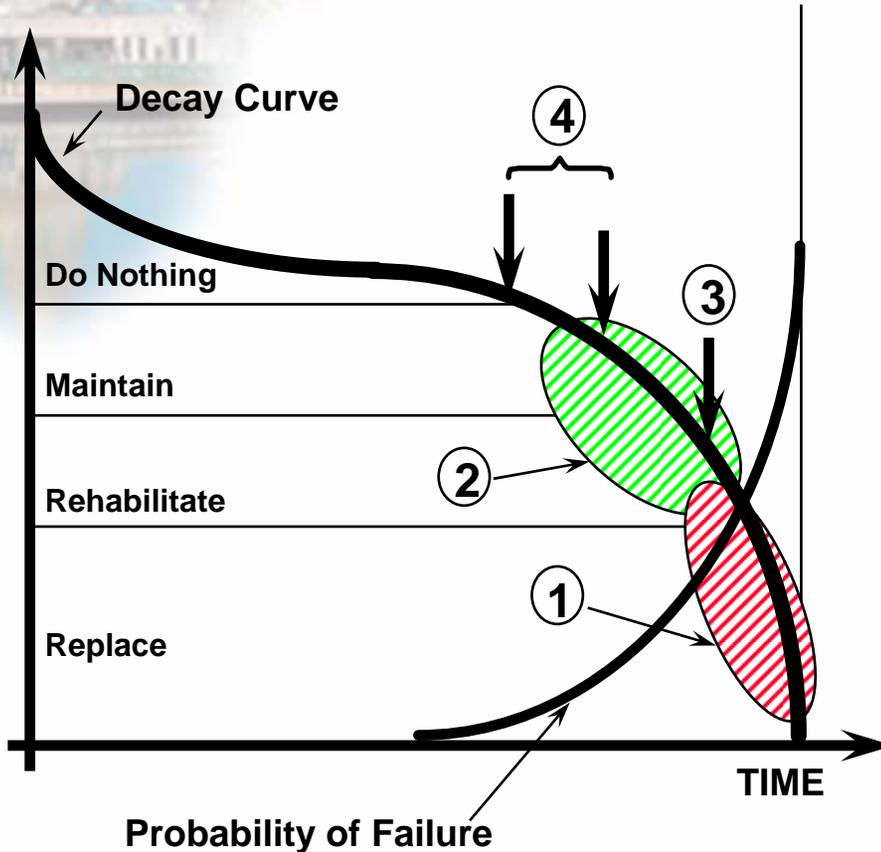
- *Now we have the Asset Management Improvement Program running.*
- *But it will still be sometime before we can get good data ...*
- *So what can we do now to improve our situation?*
- *We can start to review and optimize our spending and commence to identify the “lowest life cycle cost” CIP*

Key Strategies

- 1. Start your first Asset Management Plan. Build your first system-wide – a “full portfolio” funding model...*
- 2. Then – optimize the investments we are making now – Use advanced AM techniques to validate and approve your CIP projects & programs.*

Implementation Priority

CONDITION

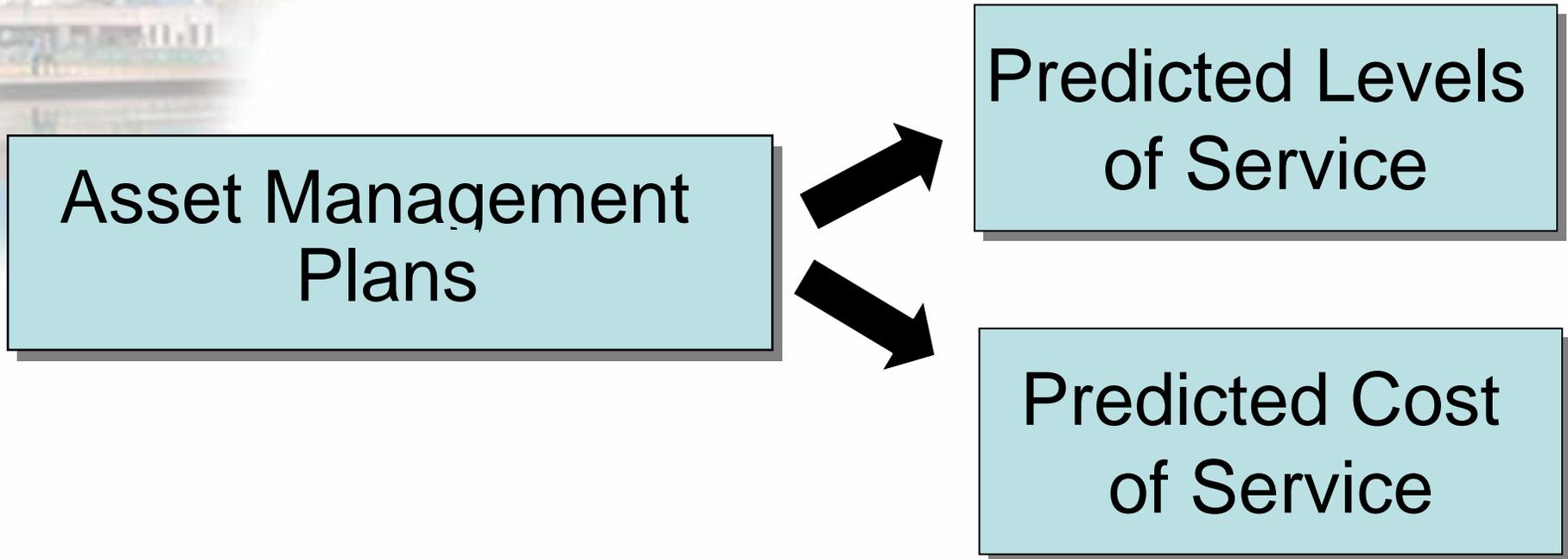


Benefit Based Priorities

Priority order

- 1 Assets with a high probability or history of failure (reliability).
- 2 Assets with a high business risk cost (consequence).
- 3 Assets where rehabilitation intervention is beneficial.
- 4 Assets where more appropriate maintenance is beneficial (eg. with high unplanned maintenance).

Asset Management Plans



Steps In Developing Your AMP

1

Existing Levels of Service:

- *Regulatory*
- *Customer related*
- *Internal operations*

2

Assess Existing Assets:

- *Physical Details*
- *Condition/Remaining Life*
- *Performance*
- *Capacity (Current / Ultimate)*

3

Predict Demand / Levels of Service:

- *Capacity / Demands*
- *Levels of Service*
- *Performance / Risk*

4

Predict Mode of Failure

- *Capacity (Due to Growth)*
- *Performance / Reliability*
- *Condition (Age) Integrity*
- *Cost of Service*

Steps In Developing Your AMP

5

Predict Capital Program :

- *Growth / augmentation*
- *Renewal / Reliability*
- *New levels of service*
- *Business Efficiency*

6

Predict Operations & Maintenance

- *Growth (additional flows)*
- *New assets Levels of Service*
- *Age of overall portfolio*

7

Predict Future Expenditure Model

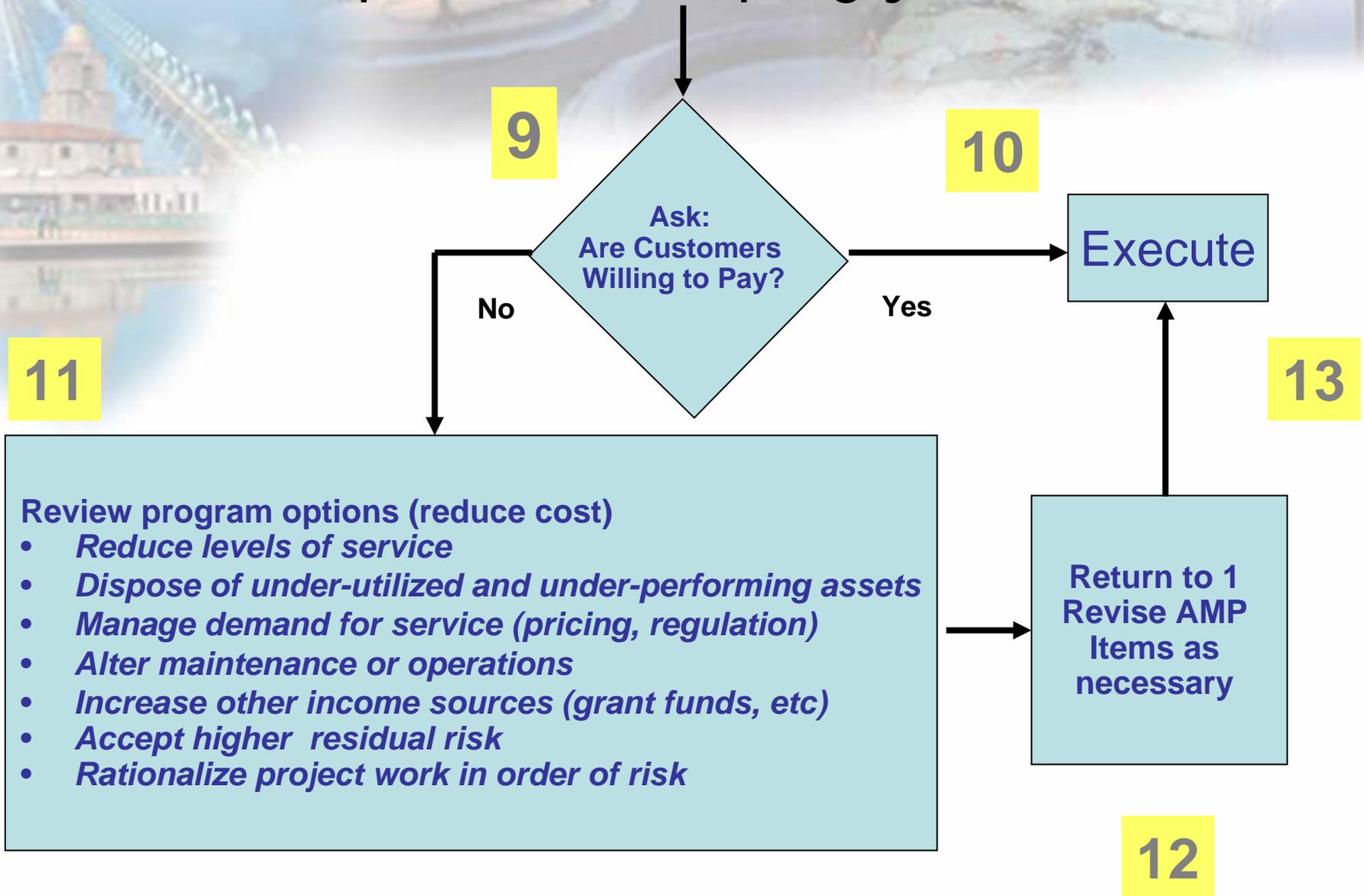
- *Capital*
- *Operations*
- *Maintenance*
- *Administration*

8

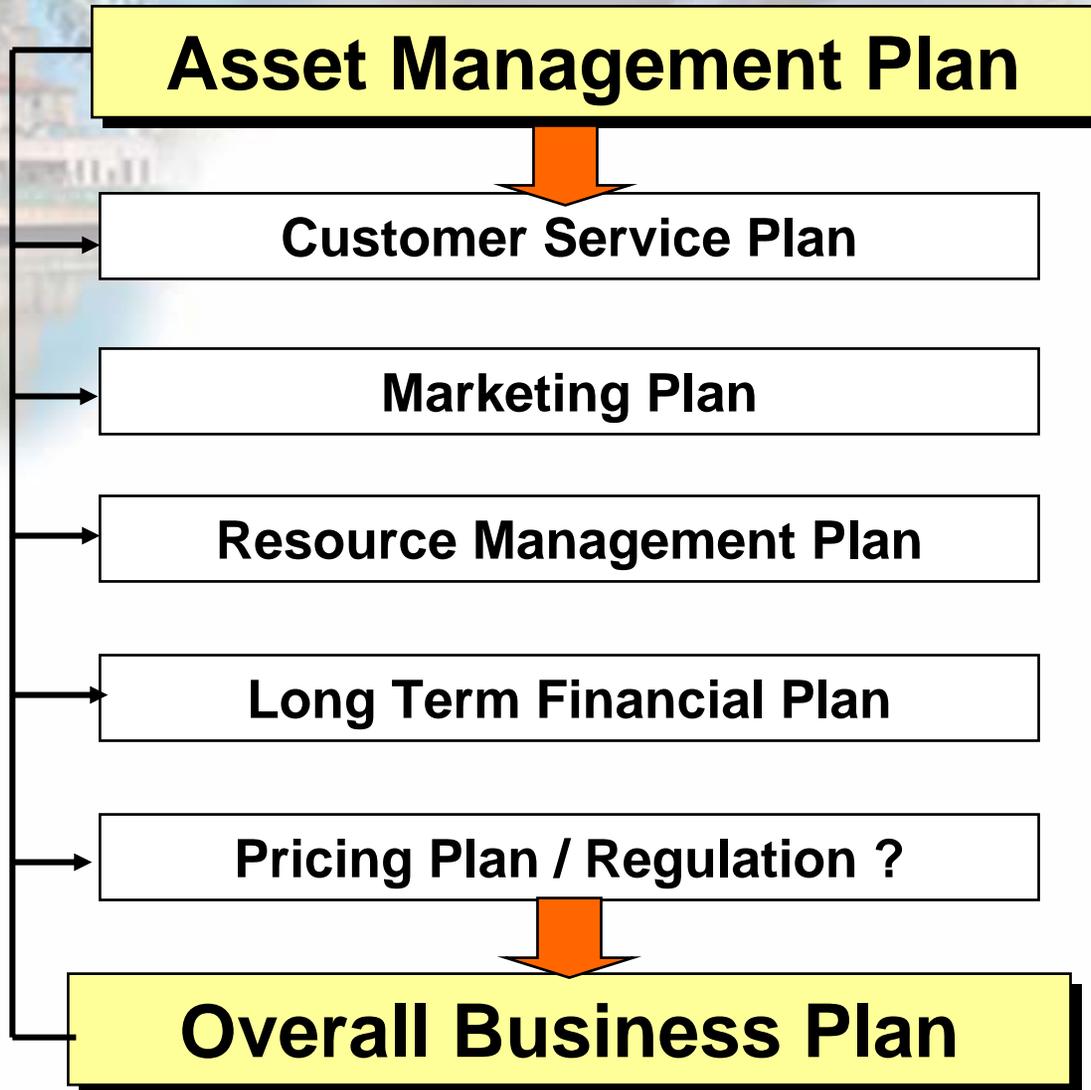
Predict Future Income Model

- *Rates*
- *Charges*
- *Other sources*
- *Total*

Steps In Developing your AMP



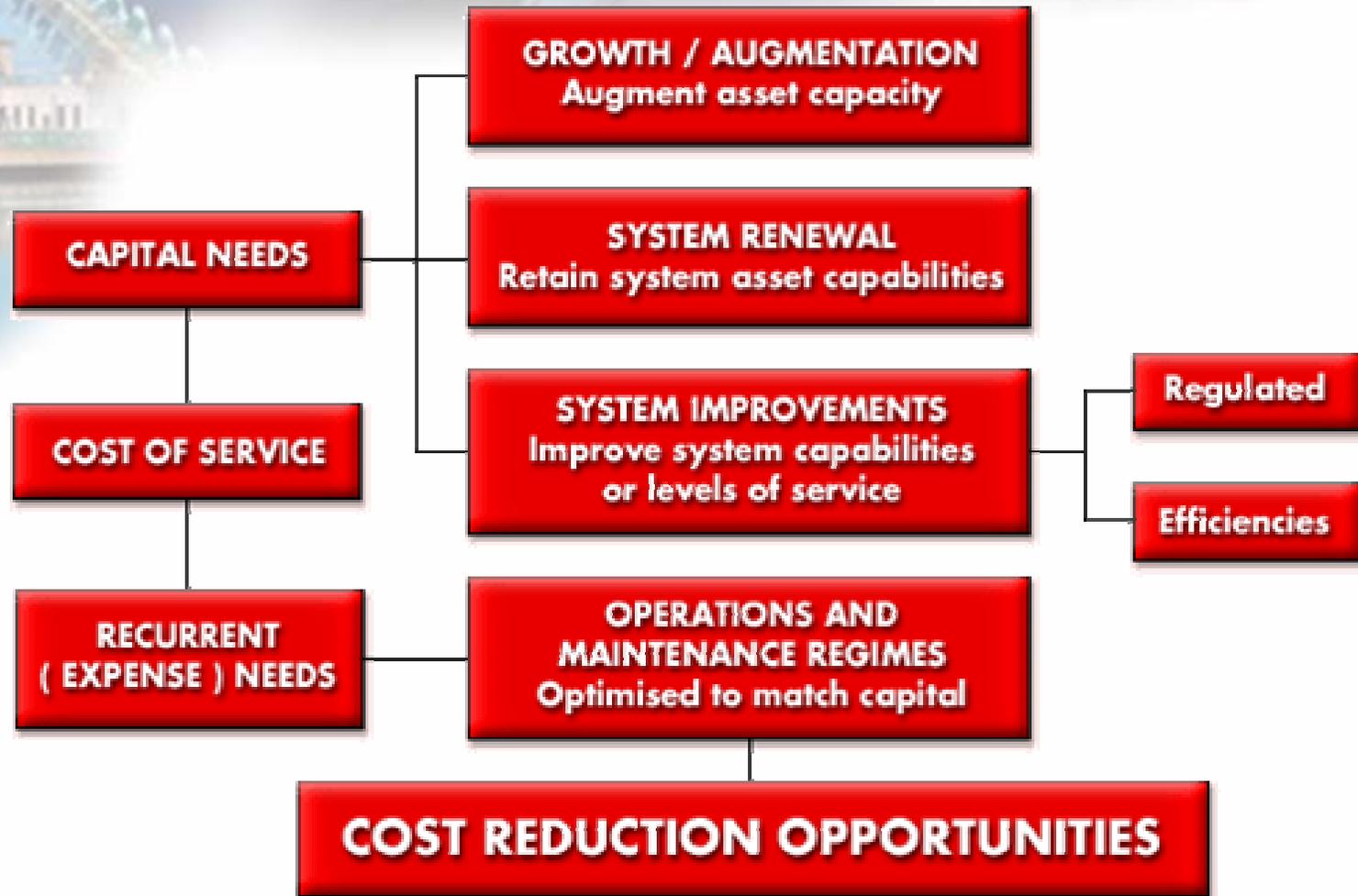
Role of the AM Plan



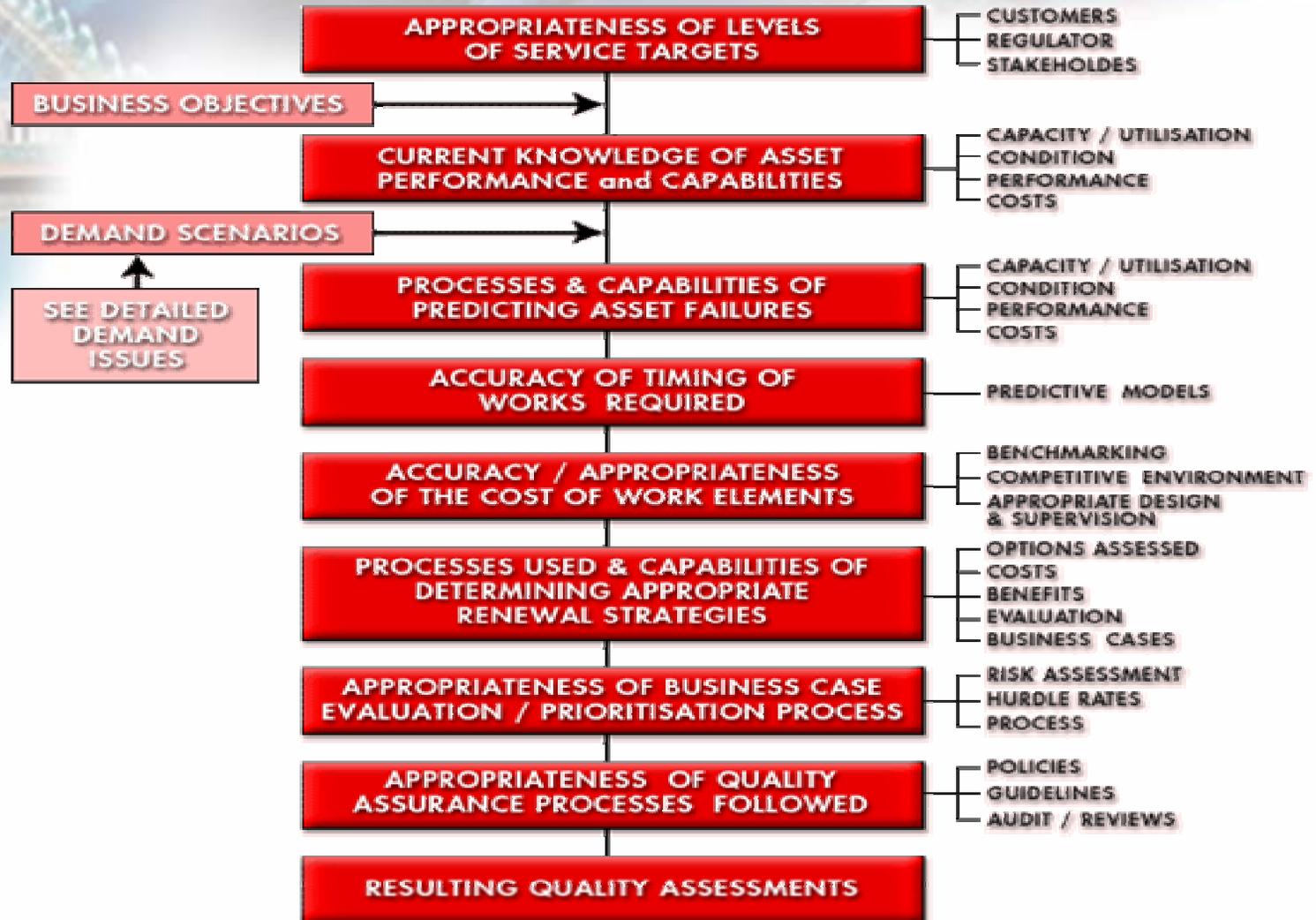
Key Outputs:

- Costs
- Performance

The CIP Decision Framework

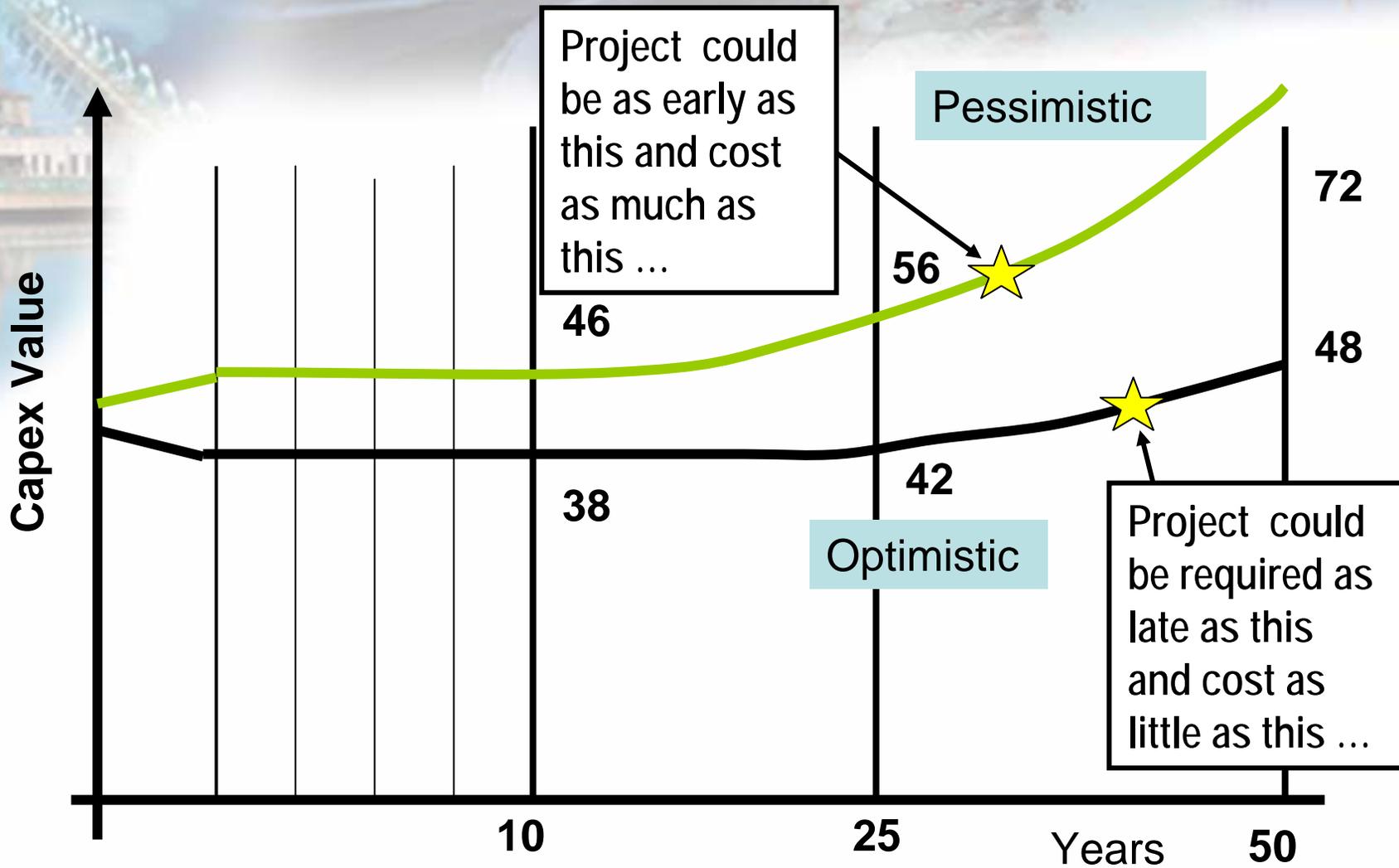


An AAM Based CIP Decision Model

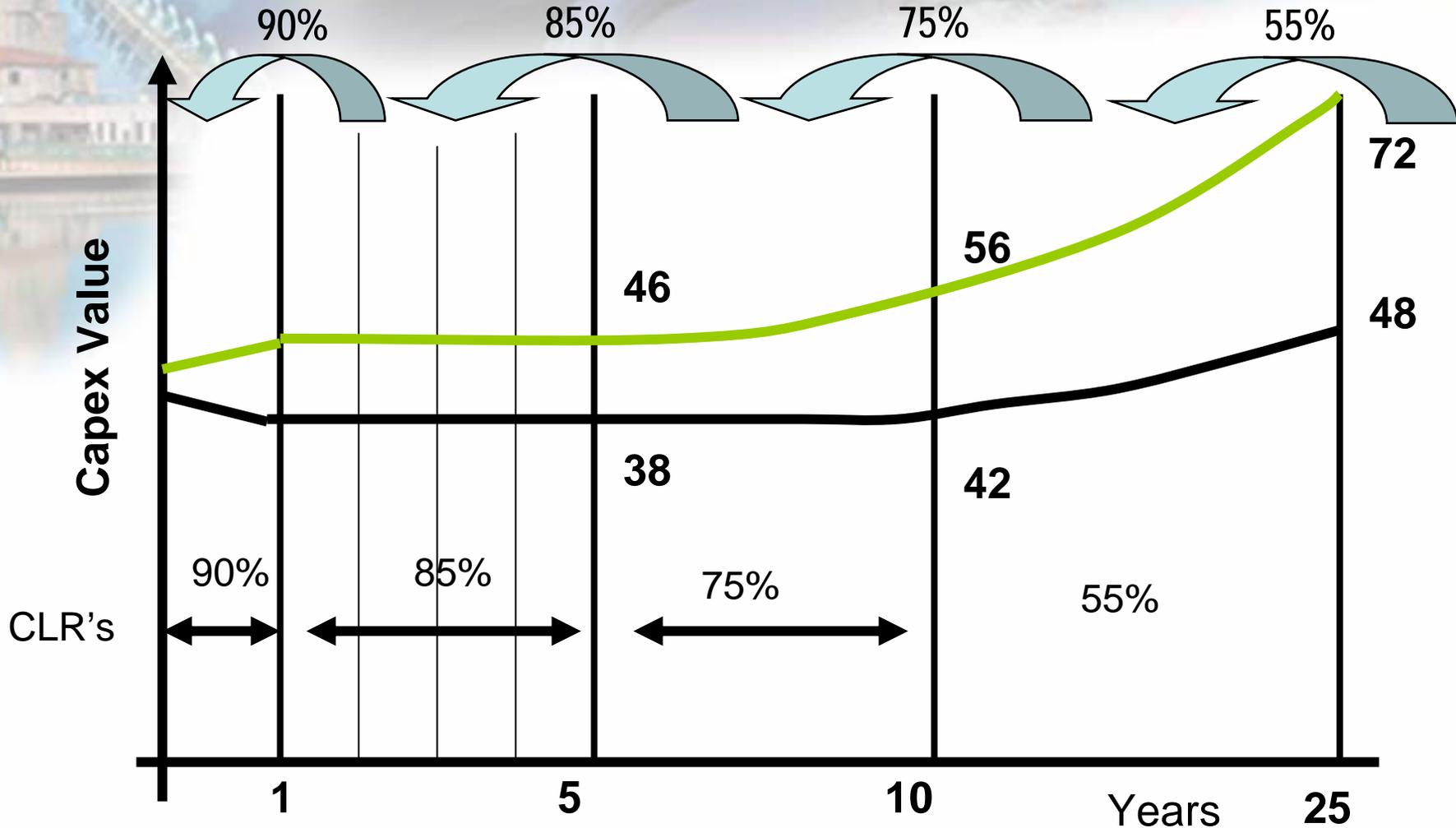


REVIEW PROCESS

Building the Funding Envelope

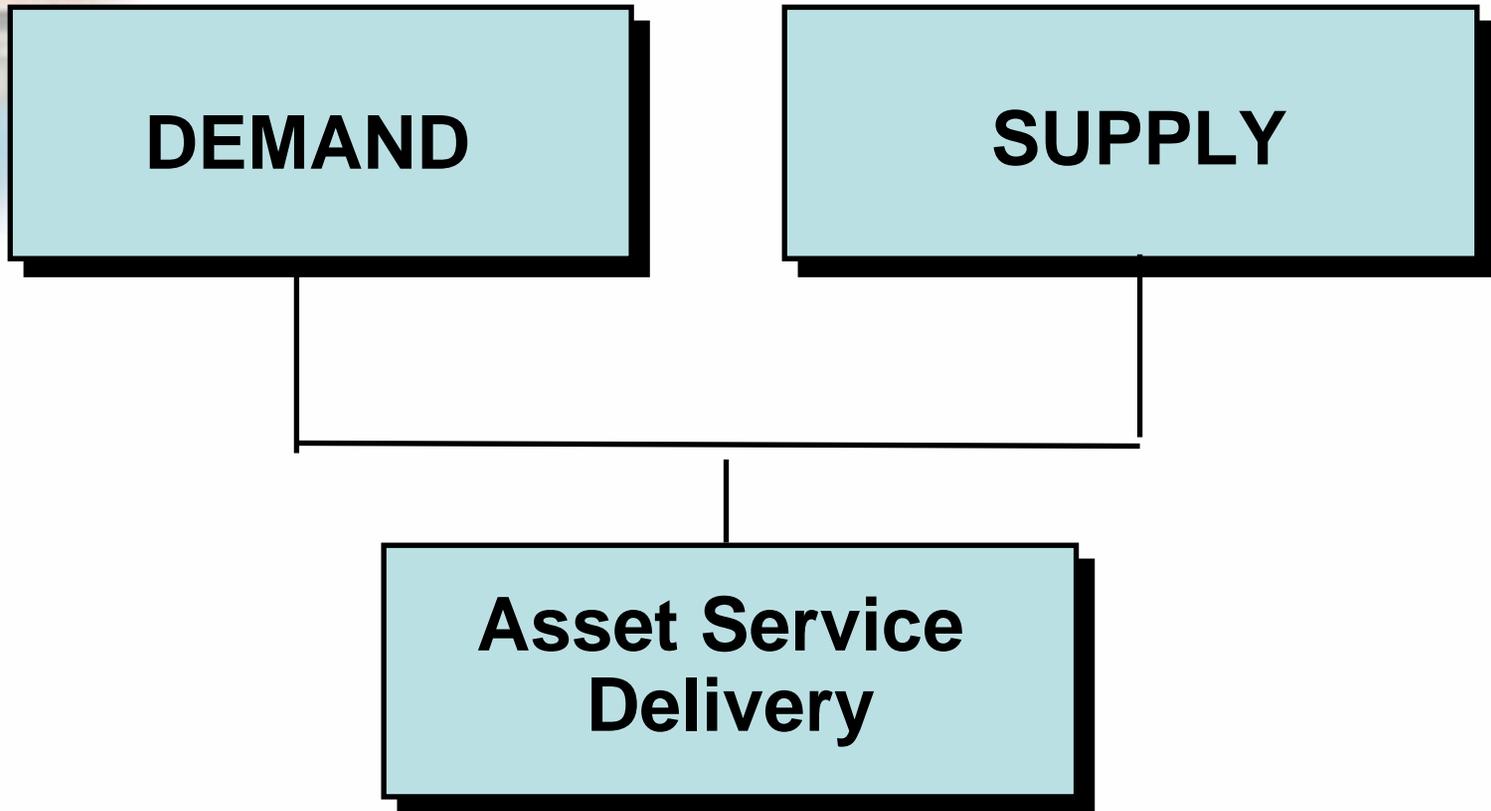


The AMP Process – Phase



Clearing the Hurdles

The Supply and Demand Elements



Supply and Demand Quality Elements

DEMAND

Understand

SUPPLY

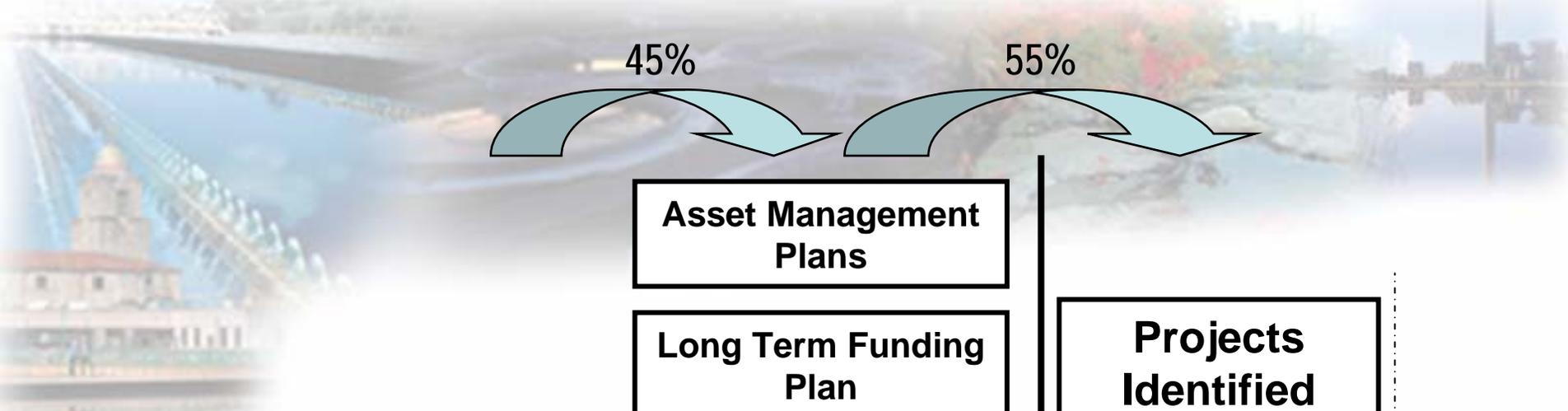
- Demand for service and LoS
- Understand system capacity
- Understand rate of decay
- Understand the accurate Probability of failure (the timing)
- Understand the consequence (cost) to the business in TBL terms

Supply and Demand Quality Elements

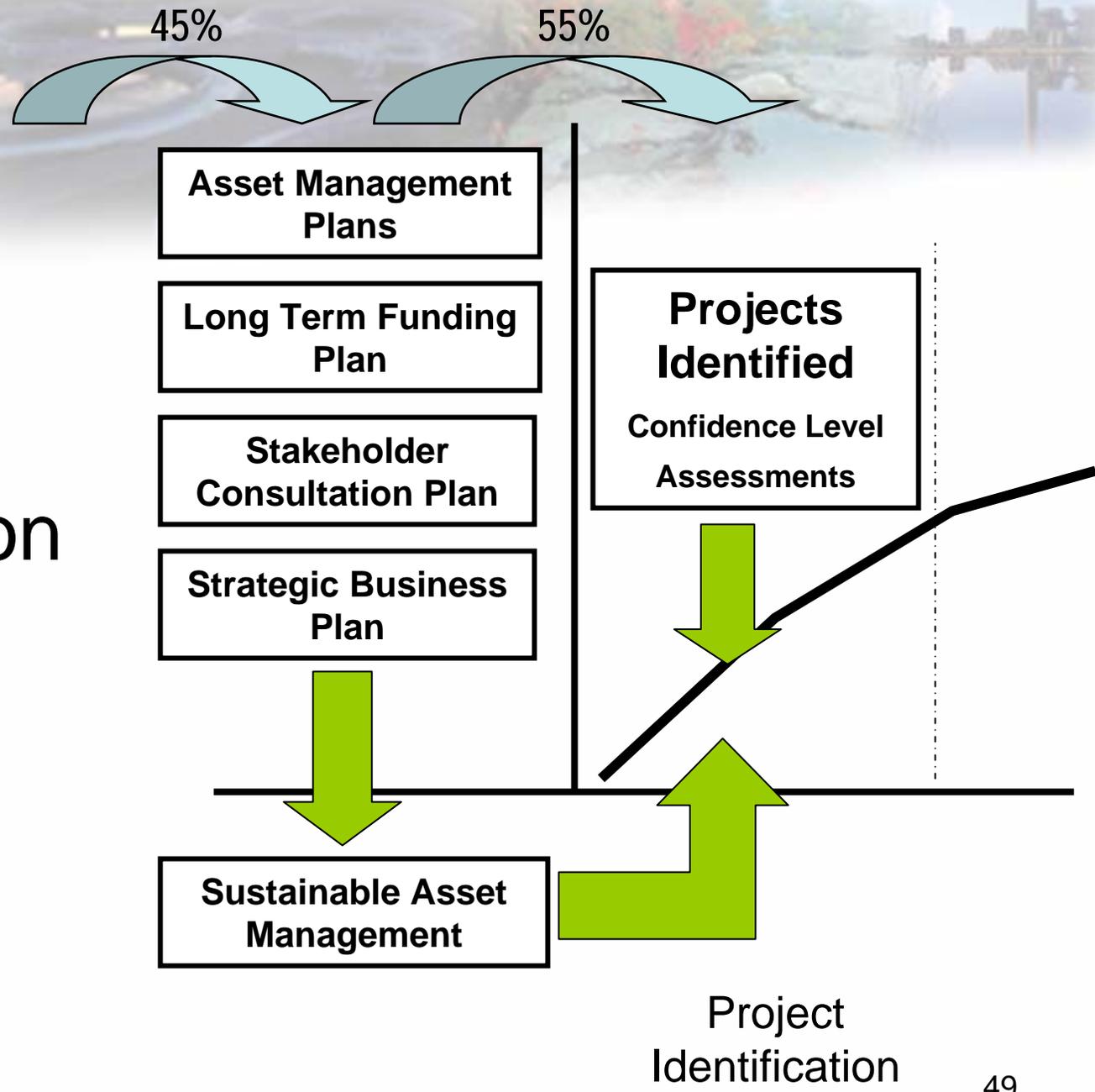
DEMAND

SUPPLY
Analyze Options

- Construct New Assets
 - Refurbish / augment existing assets
 - Operate differently
 - Maintain differently
 - Non asset Options
- Lowest Sustainable Life Cycle Cost Option

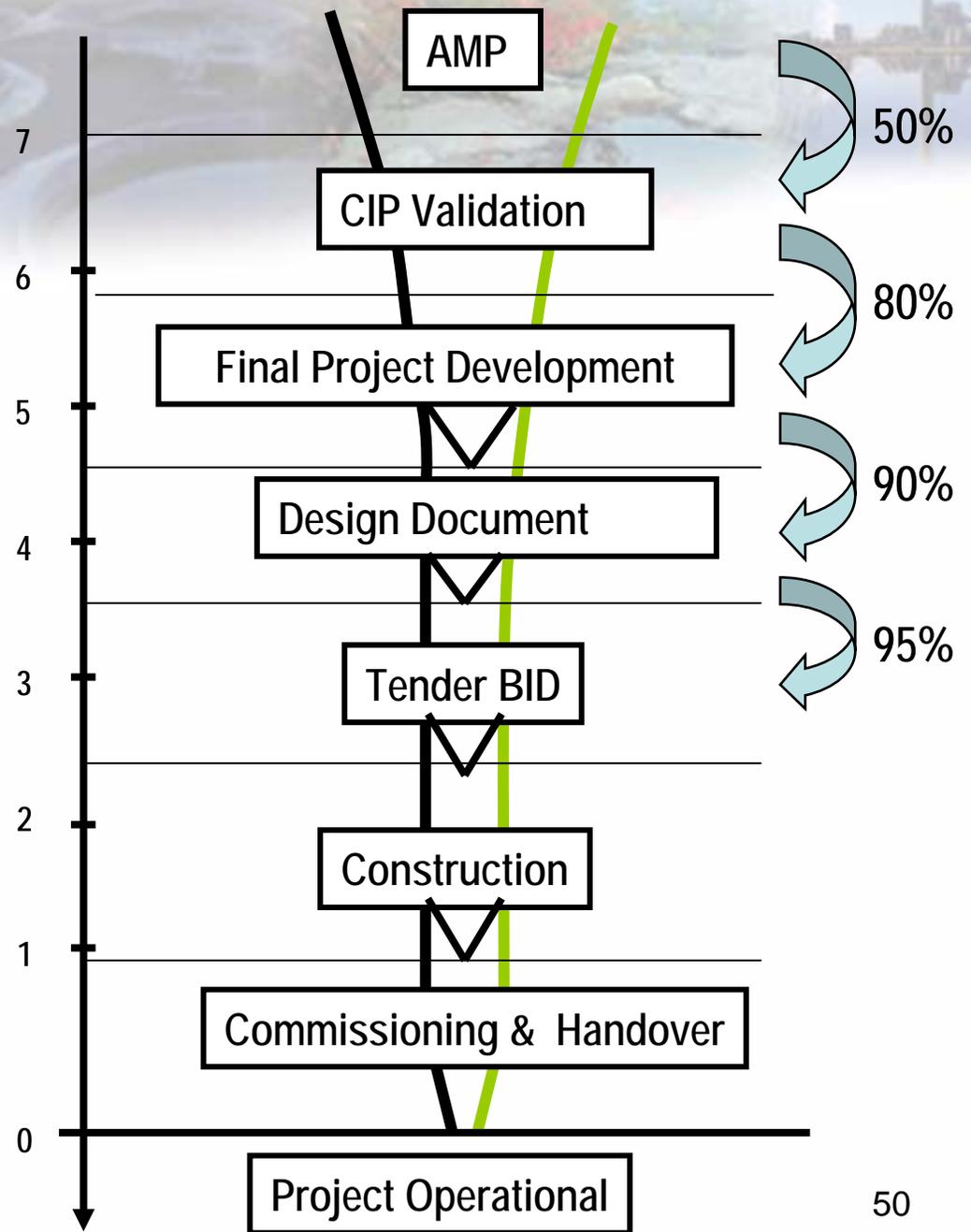


Project Identification Phase



The Critical Timing Issues “Clearing the Hurdles”

Time to Start

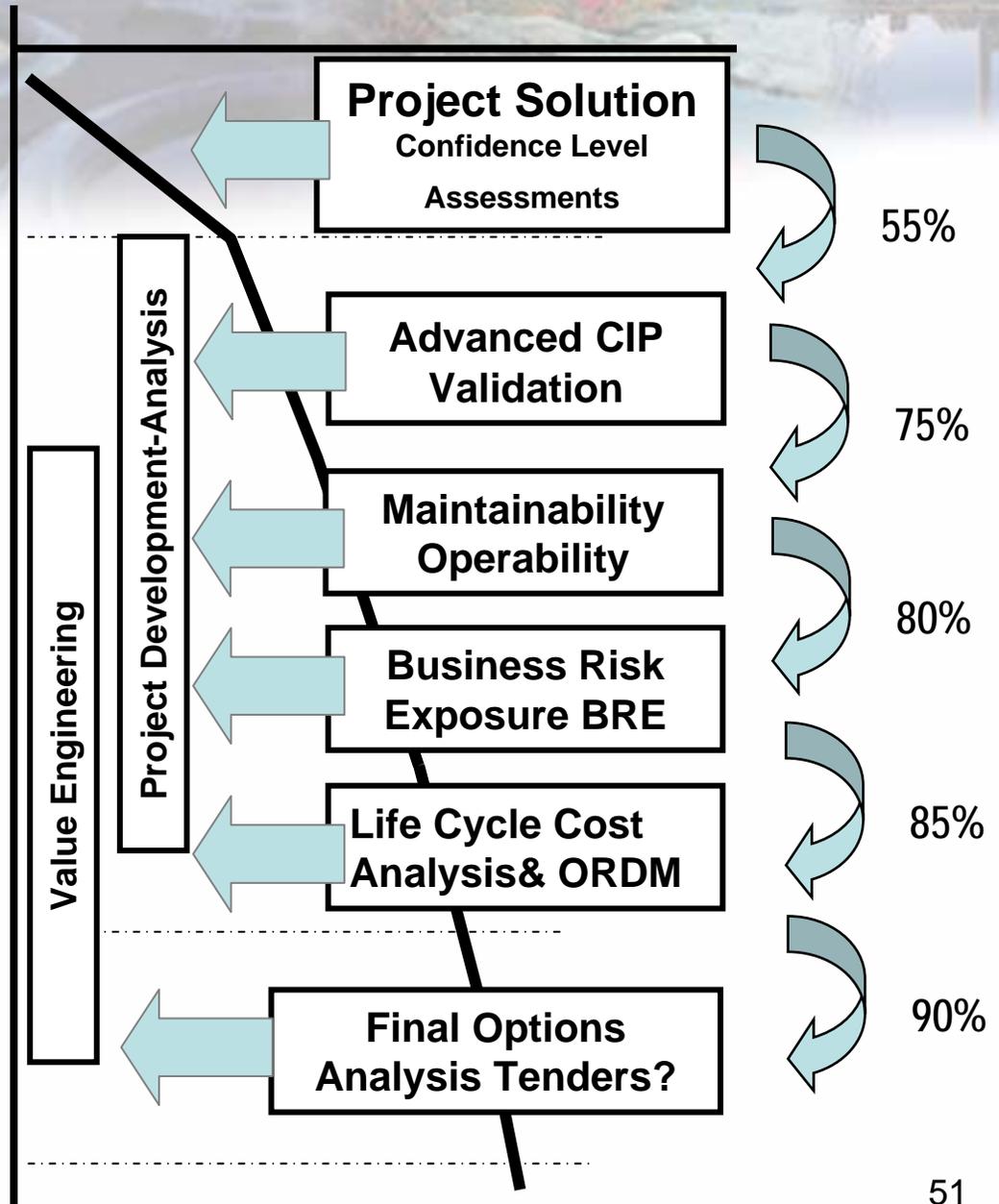


Project Validation Phase

Project Identification

Project Validation

Preliminary Design



ORANGE COUNTY SANITATION DISTRICT



CAPITAL IMPROVEMENT PROGRAM CHARTER

VISION

To develop and implement a well-planned and sustainable Capital Improvement Program (CIP) that achieves the District's public health and environmental objectives.

MISSION

We, the Program Management Team (PMT), commit to realizing the Program vision by:

- Identifying and committing resources to deliver quality projects on time and on budget while balancing and integrating those resources with other District initiatives
- Developing and maintaining an optimized and balanced CIP-planning and budgeting process
- Minimizing impacts on the community and the environment
- Incorporating appropriate technologies that support Program objectives
- Developing repeatable and sustainable management and operating processes and procedures

CRITICAL SUCCESS FACTORS AND PERFORMANCE MEASURES

- ✓ By March 30, 2003: Define an expeditious schedule for achieving secondary treatment standards in balance with other District commitments
- ✓ Annually: Identify and commit the necessary resources to deliver the CIP as planned
 - By April 15, 2003: Develop 1-yr resource plan
- ✓ Annually: Achieve Board endorsement of CIP needs and priorities
 - By March 30, 2003: Review, validate, and finalize a defensible CIP
- ✓ By June 30, 2003: Develop and implement a communications plan that secures stakeholder endorsement
- ✓ By June 30, 2003: Develop a plan to identify, prioritize, and deliver 'facilities-engineering projects'
- ✓ By June 30, 2003: Develop a plan to identify, prioritize, and deliver 'other capital projects'
- ✓ By June 30, 2003: Develop business processes to integrate technology evaluations into CIP planning process
 - By March 30, 2003: Incorporate ongoing research projects into CIP validation and planning
- ✓ Continuously: Comply with all Board directives, codes, and regulations

GUIDING PRINCIPLES

- Share all that we learn honestly and respectfully, and in an understandable and clear manner—total transparency;
- Consult and listen to each other and strive for consensus before choosing a path forward
- Hold ourselves and each other accountable
- Commit to and actively participate in Program implementation
- Be open to new ideas and apply lessons learned
- Embrace and support the OCSD vision and mission
- Learn from each other and help develop individual and organizational skills and competencies

Handwritten signatures of the Program Management Team members, including names like Jim Borer, Robert A. Cappel, and others.

CIP (CAPEX) Validation AM Review

The background of the slide features a blurred image of a large suspension bridge with a prominent tower on the left side, set against a cityscape and a body of water. The image is semi-transparent, allowing the text to be clearly visible.

Quality Elements To Be Considered

1. Current Standards of Service
2. Knowledge of Existing Assets
3. Current Asset Demand/Utilisation
4. Projected Future Demand/Performance Expectations
5. Predicted Modes of Service Delivery Failure

Quality Elements (Cont)

6. Timing/Probability of Failure
7. Consequence of failure to Business
8. Accuracy of Predicted Operational Costs
9. Accuracy of Predicted Maintenance Costs
10. Appropriateness of Renewal Options

Quality Elements (Cont)

11. Accuracy of Cost Estimates
12. Appropriateness of Renewal Economic Evaluations
13. Relationship Between Plan and Customer Acceptance
14. Ability to Modify Plan to Suit Available Resources
15. Appropriateness of Plan Action Links to Corporate Goals

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|---|---|--|--|---------------|----------------|-------------|
| 1 | CLIENT: <i>Orange County Sanitation District</i> | | | COMPRESS ROWS | SHOW BEST WINS | Renewal - F |
| 2 | COMMISSION: <i>Initial Capex Evaluation Project</i> | | | | | |
| 3 | PROJECT: <i>Magnolia Trunk Sewer Rehabilitation</i> | | | EXPAND ROWS | Renewal - S | |
| 4 | PROJECT NO: <i>03-35-R2</i> | | | | | |

Overall Confidence Levels RENEWAL - RELIABILITY / MORTALITY MODEL Capex Projects

| No. | Quality Element | Process Effectiveness | Data Quality | Element Quality Rating | Secondary Quality Weightings | Primary Quality Weightings | P Con L |
|---|--|-----------------------|--------------|------------------------|------------------------------|----------------------------|---------|
| Existing Standards of Service | | | | | | | |
| 1.1 | <i>Customer Service Standards Available & Complete</i> | | | 0% | 0% | | |
| 1.2 | <i>Detailed Policies Regarding Reliability and Mortality</i> | 60% | 80% | 70% | 10% | | |
| 1.3 | <i>Clear Understanding of Regulatory and LoS Requirements</i> | 90% | 90% | 90% | 50% | | |
| 1.4 | <i>Understanding of External Levels of Service/Performance Standards</i> | 80% | 80% | 80% | 30% | | |
| 1.5 | <i>Appropriateness of Internal Design Standards</i> | 80% | 90% | 85% | 10% | | |
| 1 | Existing Standards of Service | 83% | 86% | 85% | 100% | 4% | |
| Knowledge of Existing Asset / Facility | | | | | | | |
| 2.1 | <i>Appropriateness of Level of Asset Register Hierarchy (MMI)</i> | 50% | 50% | 80% | 10% | | |
| 2.2 | <i>Component Descriptions/Attributes</i> | 75% | 75% | 75% | 0% | | |
| 2.3 | <i>Asset Condition Assessment</i> | 50% | 25% | 38% | 60% | | |
| 2.4 | <i>Asset Performance/Reliability Recording System</i> | 75% | 70% | 73% | 20% | | |
| 2.5 | <i>Understanding of links between condition and performance</i> | 50% | 50% | 50% | 10% | | |
| 2 | Knowledge of Existing Asset / Facility | 55% | 39% | 47% | 100% | 15% | |
| Current Demands | | | | | | | |
| 3.1 | <i>Understand of existing condition and/or reliability records</i> | | | 0% | 0% | | |
| 3.2 | <i>Ability to identify and understand reliability drivers</i> | | | 0% | 0% | | |
| 3.3 | <i>Understanding of current rate of decay / reliability</i> | 50% | 40% | 45% | 100% | | |
| 3 | Current Demands | 50% | 40% | 45% | 100% | 5% | |

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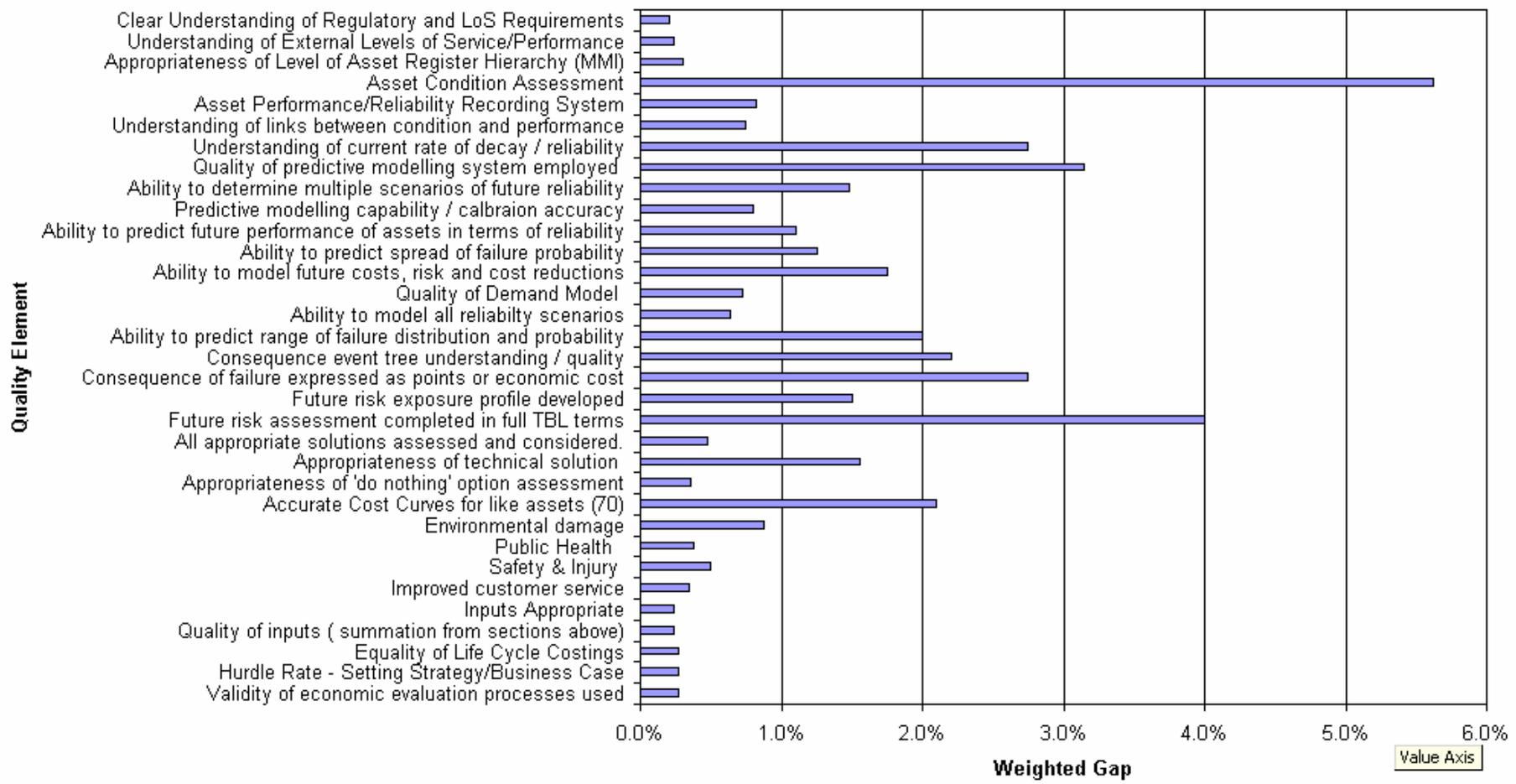
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| | | | | | | |
|---|---|--|--|---------------|----------------|---------------|
| 1 | CLIENT: <i>Orange County Sanitation District</i> | | | COMPRESS ROWS | SHOW BEST WINS | Renewal - PQE |
| 2 | COMMISSION: <i>Initial Capex Evaluation Project</i> | | | | | Renewal - SQE |
| 3 | PROJECT: <i>Magnolia Trunk Sewer Rehabilitation</i> | | | EXPAND ROWS | | |
| 4 | PROJECT NO: <i>03-35-R2</i> | | | | | |

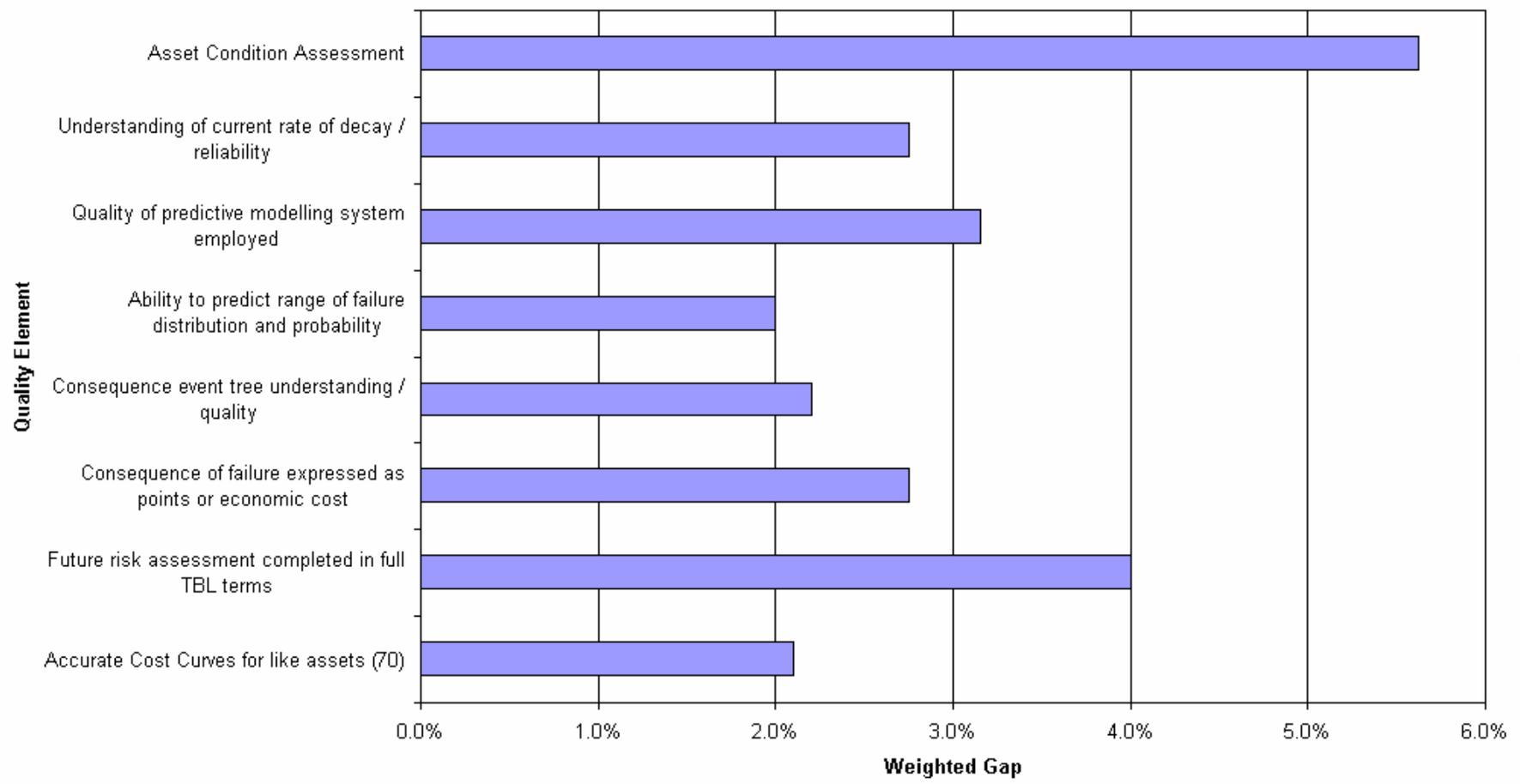
Overall Confidence Levels RENEWAL - RELIABILITY / MORTALITY MODEL Capex Projects

| No. | Quality Element | Process Effectiveness | Data Quality | Element Quality Rating | Primary Quality Weightings | Project Confidence Level |
|-----|---|-----------------------|--------------|------------------------|----------------------------|--------------------------|
| 15 | 1 Existing Standards of Service | 83% | 86% | 85% | 4% | 3.4 |
| 23 | 2 Knowledge of Existing Asset / Facility | 55% | 39% | 47% | 15% | 7.5 |
| 29 | 3 Current Demands | 50% | 40% | 45% | 5% | 2.3 |
| 36 | 4 Future Demands / Reliability | 50% | 47% | 49% | 9% | 4.4 |
| 43 | 5 Prediction of Reliability / Renewal Failure Mode | 50% | 52% | 51% | 10% | 5.1 |
| 50 | 6 Timing of Reliability/ Renewal Failure | 61% | 55% | 58% | 8% | 4.6 |
| 57 | 7 Consequence of Reliability / Renewal Failure | 46% | 50% | 48% | 20% | 9.6 |
| 63 | 8 Quality of proposed Maintenance Program | 73% | 77% | 75% | 0% | 0.0 |
| 70 | 9 Appropriateness of Recurrent Budgets | 80% | 85% | 83% | 2% | 1.7 |
| 79 | 10 Appropriateness of Renewal Solution Adopted | 80% | 80% | 80% | 12% | 9.6 |
| 86 | 11 Assessment of capital cost estimates | 70% | 70% | 70% | 7% | 4.9 |
| 97 | 12 Assessment of Benefits (Risk Reduction) | 57% | 56% | 57% | 5% | 2.8 |
| 105 | 13 Appropriateness of Economic Evaluation Processes | 54% | 60% | 57% | 3% | 1.7 |
| 108 | TOTALS | | | | 100% | 57.5 |
| 109 | | | | | 100% | |

Reliability Renewal - Weighted Gap

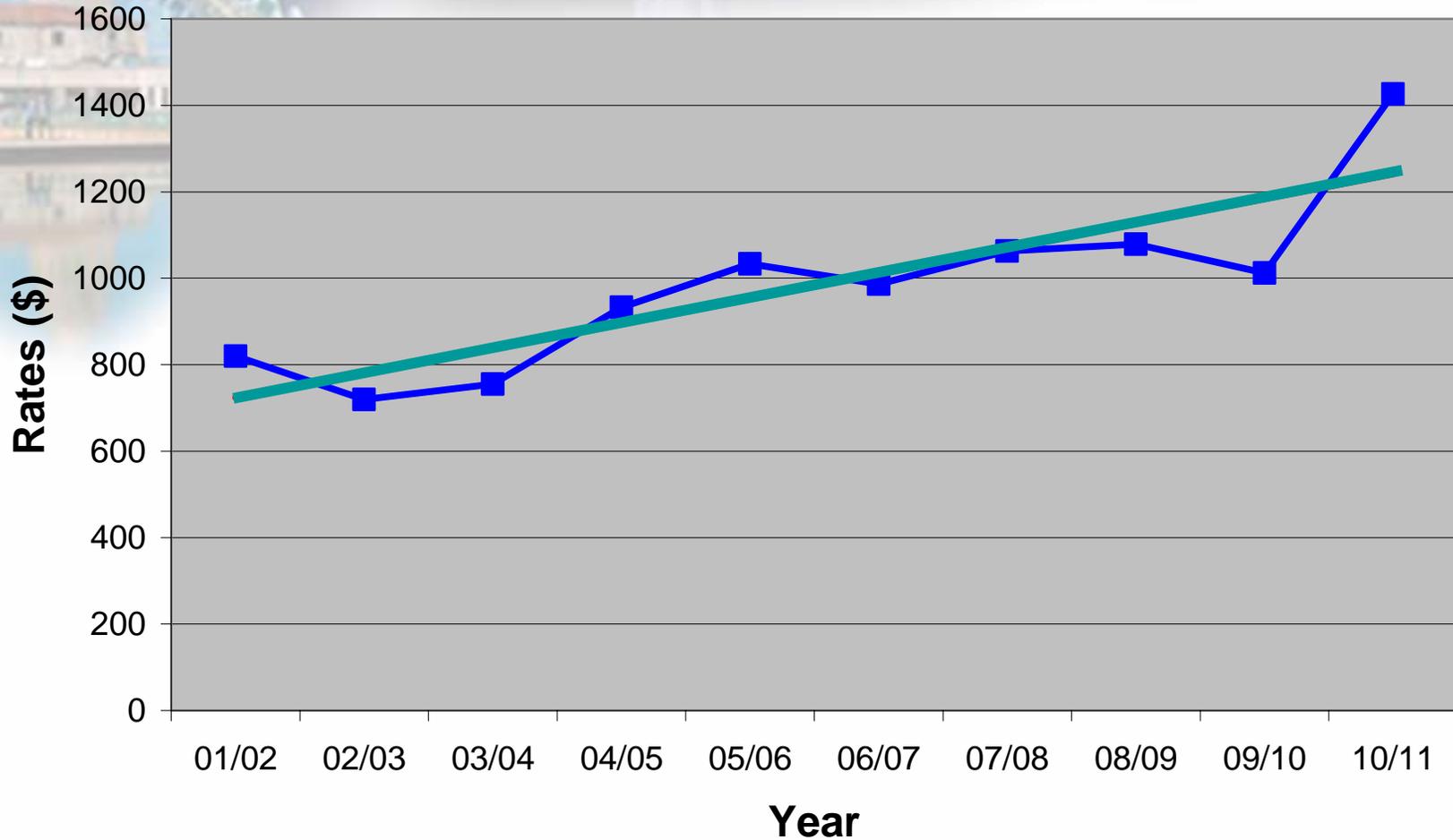


Reliability Renewal - Weighted Gap



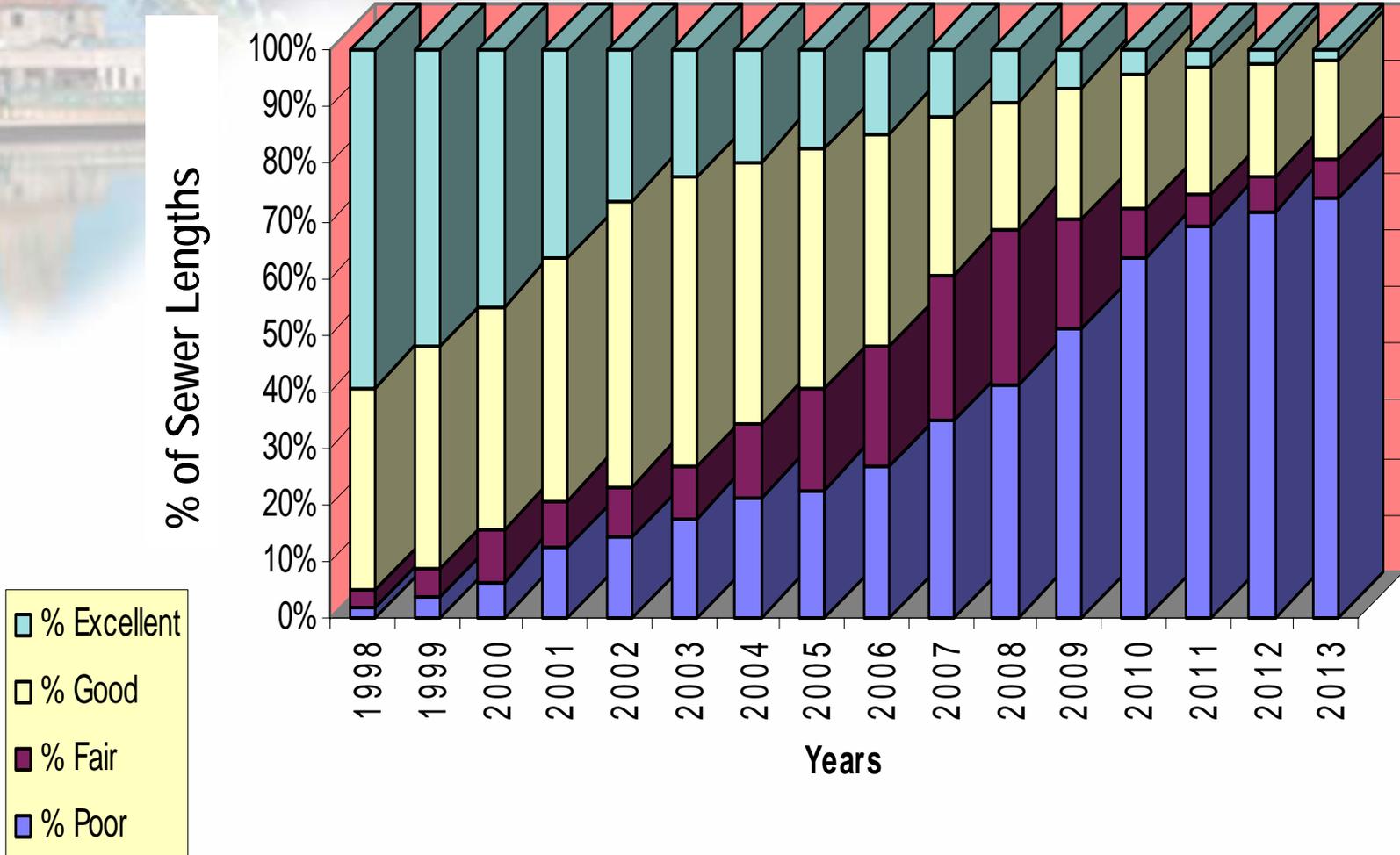
Long Term Impact on Rates

Rates with Time



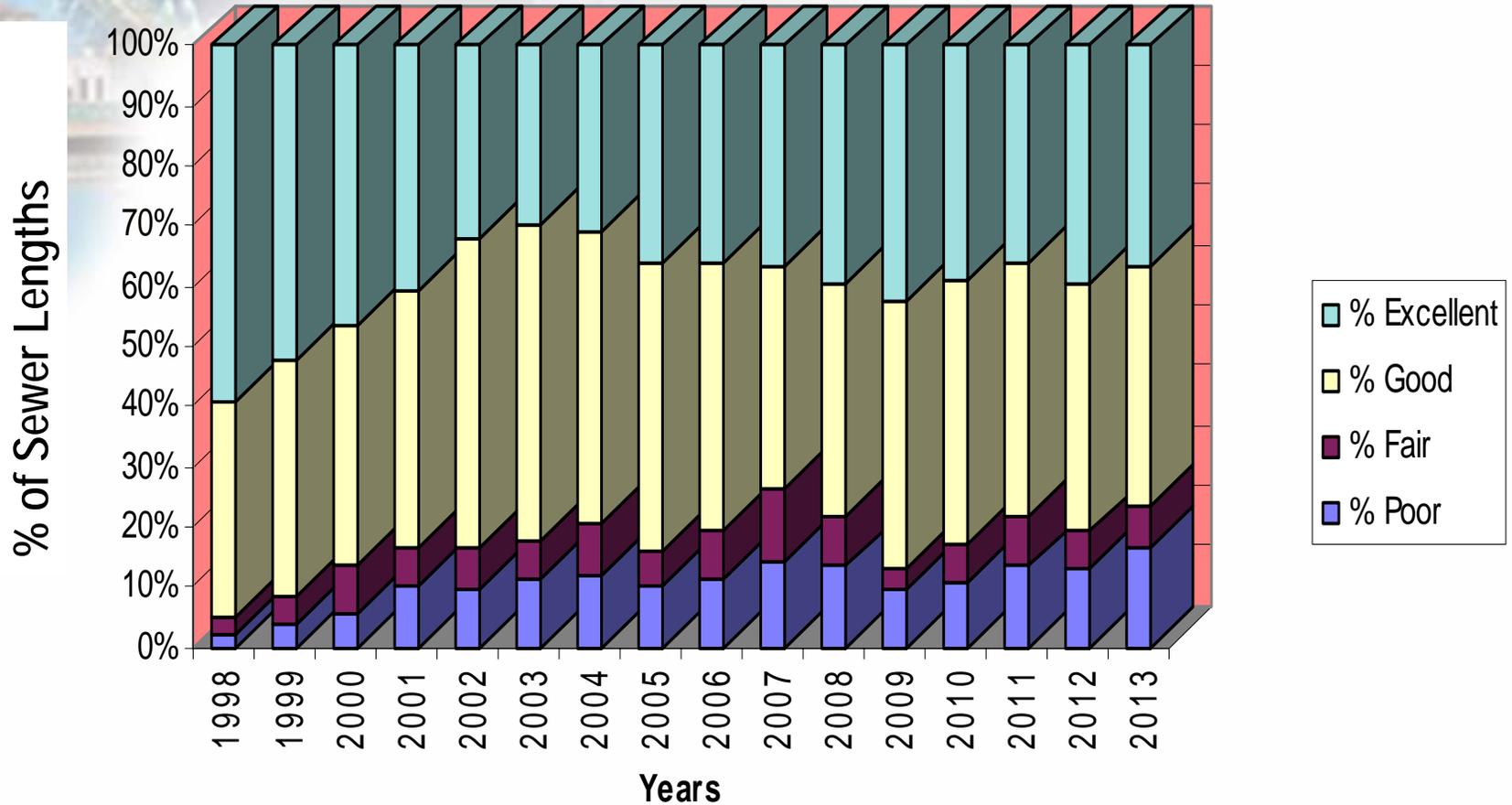
Sewer System – Status Quo

Scenario 0 - Based on PCI Values



Sewer System – Optimal Strategy

Scenario 4 - Based on PCI Values



Key Benefits of Advanced CIP Validation

Defer capital works

Reduce scope or size of works

Reduce unjustified redundancy

Reduce operations

Reduce maintenance

Meet operating requirements

Key Benefits



Case Study - OCSD CIP Review

Recall:

60% Capital & 85% of all Life-Cycle Costs are "Locked-In" When Decisions are Made on...

- ✓ Project Identification
- ✓ Strategic CIP Planning

\$2.4 Billion in 10 years

Case Study - OCSD CIP Review

- Pilot project – 15 selected from 190 CIP projects
- Collections to treatment plant projects
- Compared current OCSD practices to AM best practices
- Purpose – show insight to better ways to select projects and build CIP

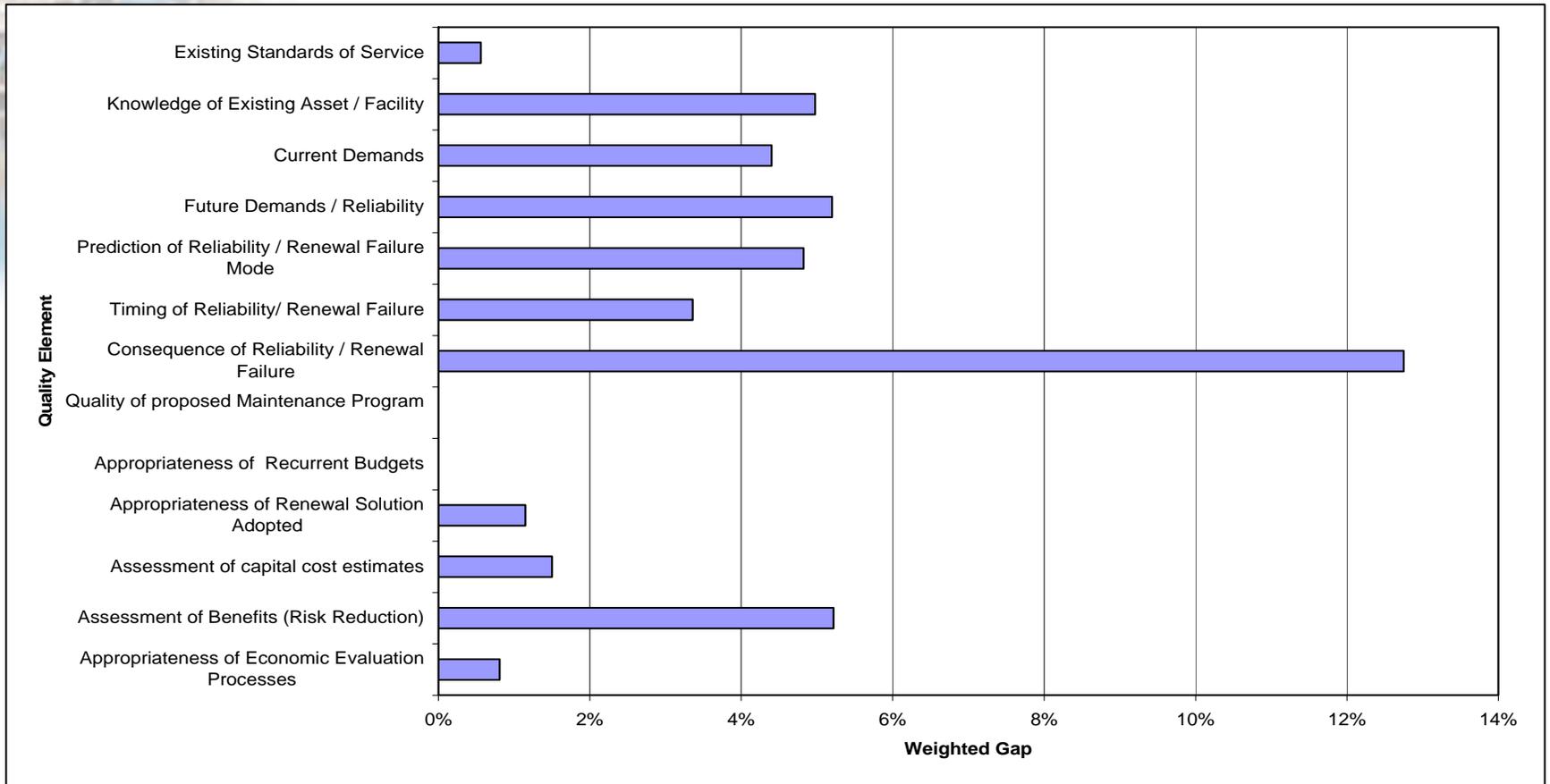
CIP Review (cont)

- Projects audited
 - Quality of processes and practices
 - Quality of data
- Confidence level generated for each project
- Identified weaknesses in projects
- Showed where future improvements could be made

Quality Assessment

| No. | Quality Element | Process Effectiveness | Data Quality | Element Quality Rating | Primary Quality Weightings | Project Confidence Level |
|-----|--|-----------------------|--------------|------------------------|----------------------------|--------------------------|
| 1 | Existing Standards of Service | 84% | 84% | 84% | 4% | 3.4 |
| 2 | Knowledge of Existing Assets / Portfolio | 63% | 56% | 59% | 12% | 7.8 |
| 3 | Current Demands | 78% | 78% | 78% | 8% | 6.3 |
| 4 | Future Demands / Changes in LOS | 85% | 85% | 85% | 10% | 8.5 |
| 5 | Prediction of Failure Mode | 77% | 77% | 77% | 2% | 1.5 |
| 6 | Timing of Capacity Failure | 78% | 78% | 78% | 8% | 6.2 |
| 7 | Consequence of Capacity Failure | 58% | 53% | 55% | 20% | 11.0 |
| 8 | Quality of proposed Maintenance Program | 58% | 53% | 56% | 2% | 1.1 |
| 9 | Appropriateness of Oper. & Maintce. Costs | 75% | 75% | 75% | 2% | 1.5 |
| 10 | Appropriateness of Capital Solution Adopted | 79% | 79% | 79% | 15% | 11.8 |
| 11 | Assessment Of Capital Cost Estimates | 85% | 85% | 85% | 7% | 6.0 |
| 12 | Assessment of Benefits | 72% | 72% | 72% | 5% | 3.6 |
| 13 | Appropriateness of Economic Evaluation Processes | 70% | 70% | 70% | 5% | 3.5 |
| | TOTALS | | | | 100% | 72 |

Weighted Gap Improvements



CIP Evaluation Stages

| Source | Period (Years) | Quality Rating |
|------------------------|----------------|----------------|
| AMP | 16- 25 | 60% |
| AMP | 11- 15 | 70% |
| 10 Yr CIP | 6 - 10 | 80% |
| 5 Yr CIP | 2 - 5 | 85% |
| Investment Approved | 1 | 90% |

OCSD CIP Recommendations

- Better “business case” for projects – “Triple Bottom Line” (financial, social, economic impact)
- Clearer understanding :
 - How project affects business risk
 - FMECA and timing of projects
 - Life cycle costs
- More programmatic view of how projects interact

FMECA – Failure mode, effects and criticality analysis

Orange County Sanitation District Pilot Asset Management Review Results

15 CIP Projects reviewed:

- 2 Met validation criteria & will proceed as is
- 2 Are unlikely to proceed at all
- 3 Will be reduced in scope (redundancy)
- 3 Will be deferred over 10 years
- 5 Likely to result in reduced life cycle cost

(Note: Similar to Australian experience for businesses at same stage as OCSD)

Potential Future Savings 2004 – 2008

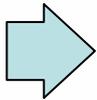
Conclusions

Based on the findings from the initial Confidence Level Ratings and these initial project element reviews, it is believed that there is potential to save between :

- \$130M to \$260M in capital deferred or eliminated
- \$160M to \$320M in “bottom-line” life cycle costs

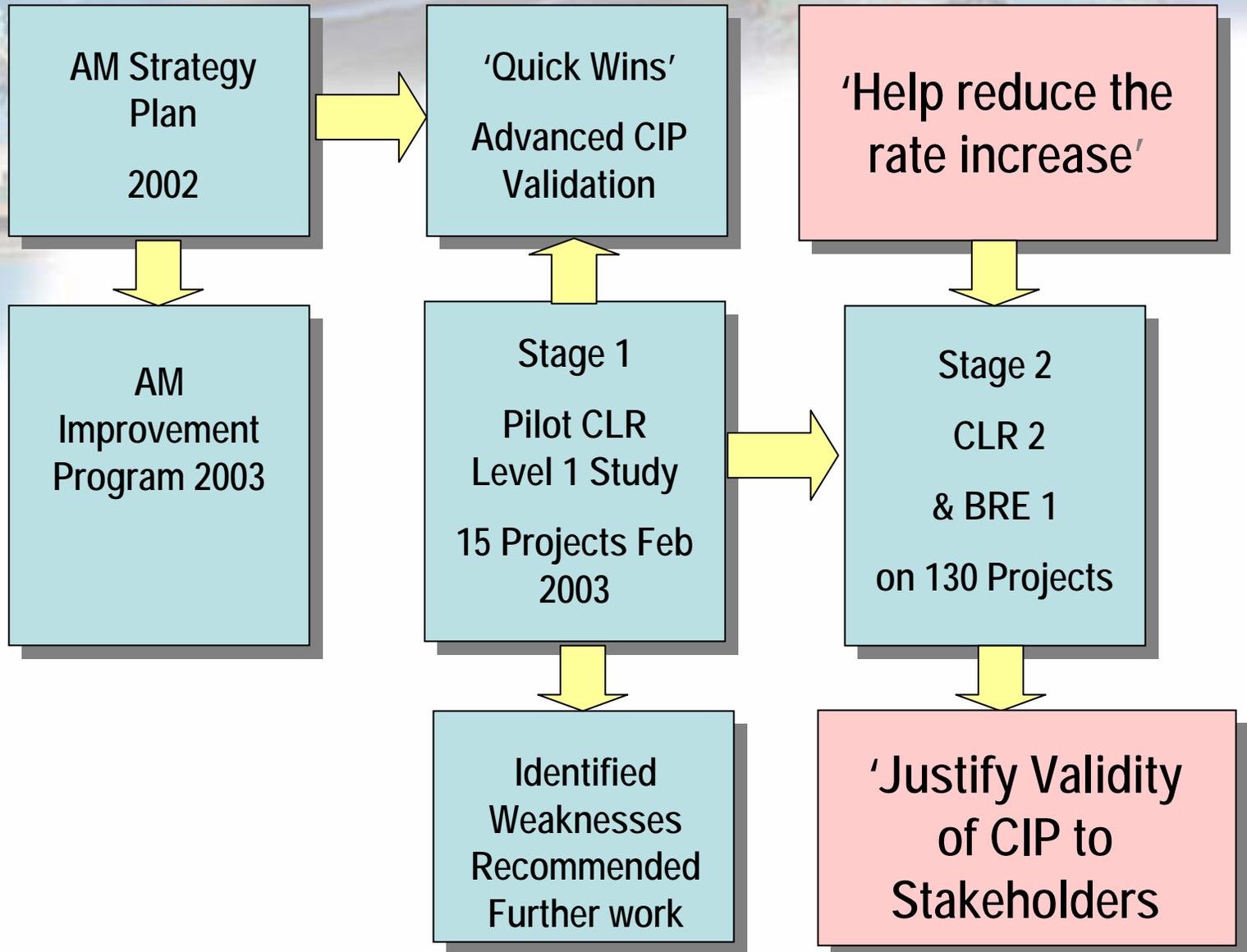
Savings Identified from Work to Date

| Project Element Name | Project Value \$ M | Capital Deferred \$ M | Period Deferred Yrs. | LCC Savings NPV \$ M |
|-----------------------------|-----------------------|--------------------------|-------------------------|-------------------------|
| Mixers Complete | 3.0 | 3.0 | 5 to 10 | 5.0 – 6.5 |
| Concrete Rehabilitation | 4.0 | 2.4 | 10 to 30 | 2.5 – 7.5 |
| Interconnecting Pipe work | 0.3 | 0.3 | 15 to 30 | 0.25 to 0.30 |
| RAS Pipe work & PS | 0.6 | 0.3 | 10 to 20 | 0.23 to 0.53 |
| Totals (Savings Identified) | (7.9) | 6.0 | 10 to 22.5 | 7.9 to 14.8 |



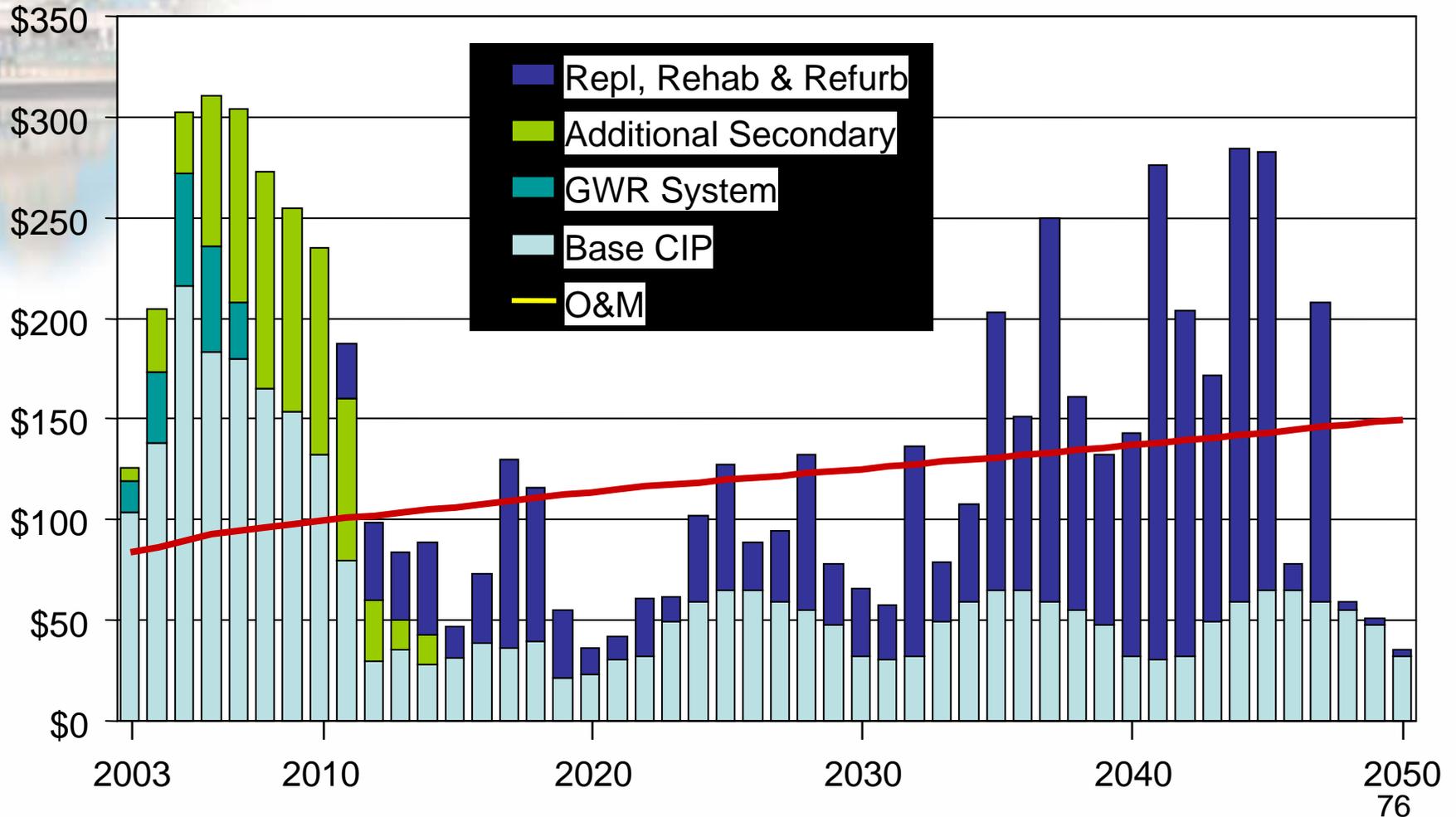
Total Initial Project Budget - \$40 million
Total Project Portion Reviewed - \$8.0

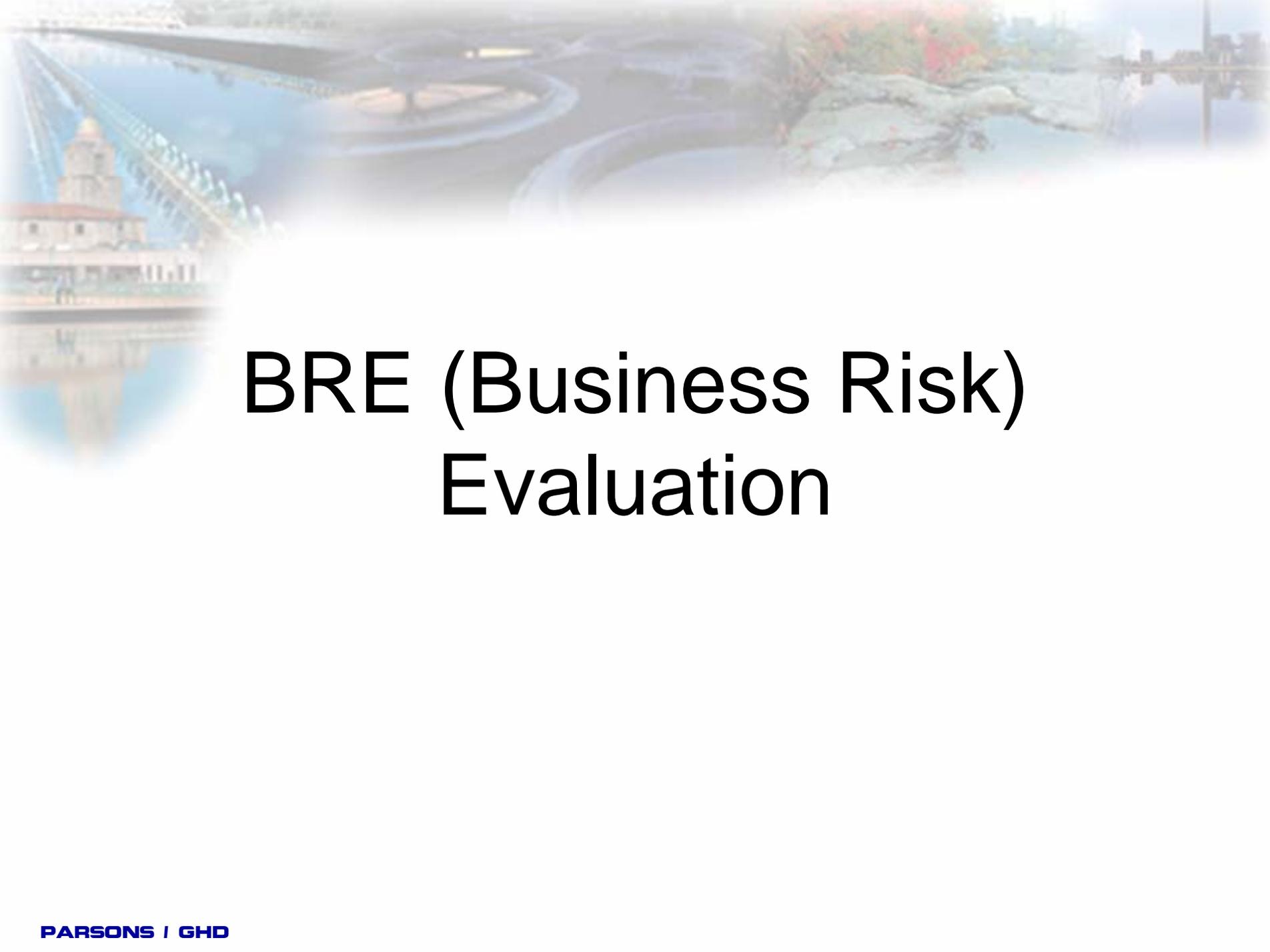
The work to date – Objectives



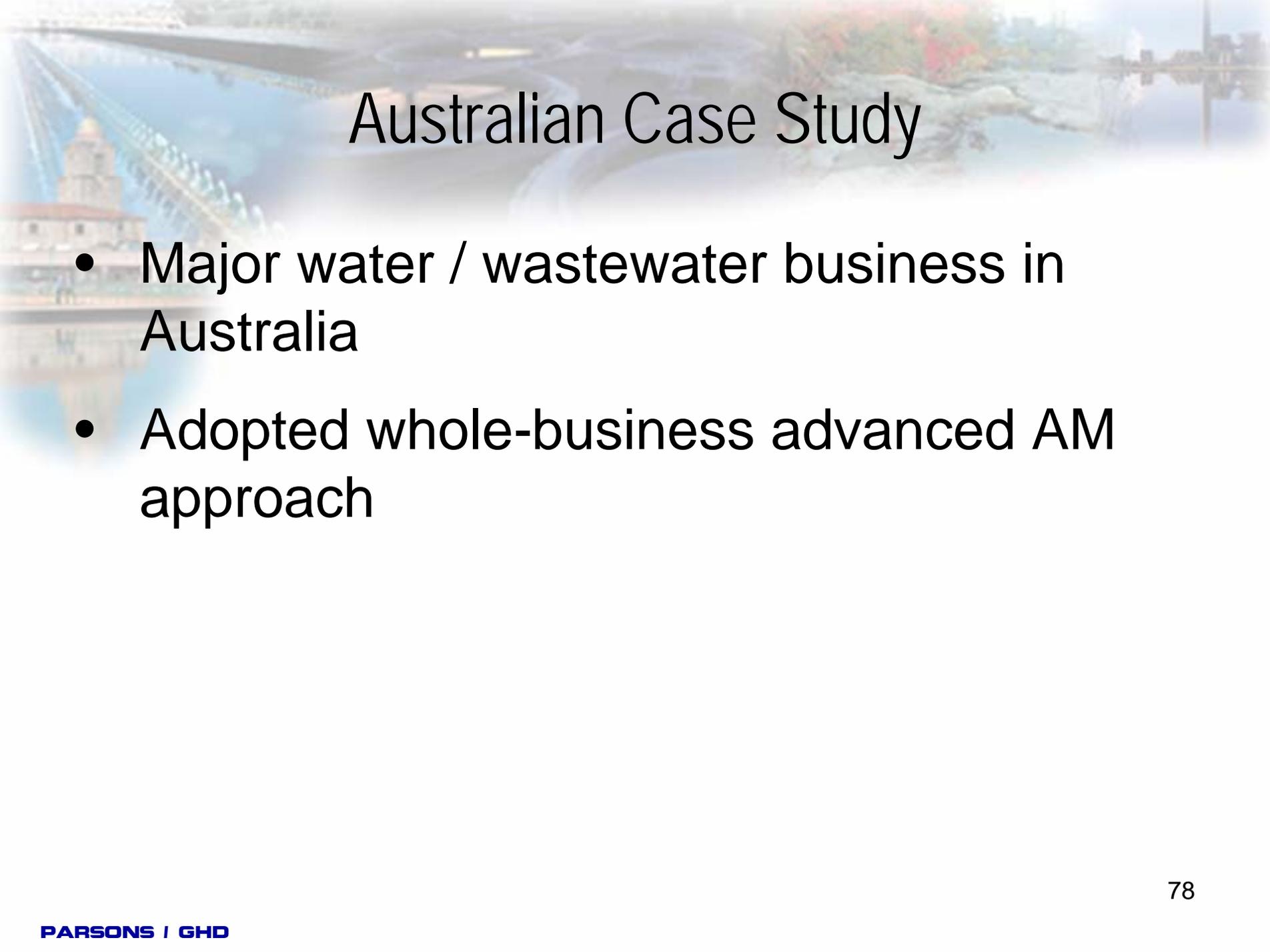
Asset Management Affects on Capital Improvement Program

\$ Millions
(current dollars)



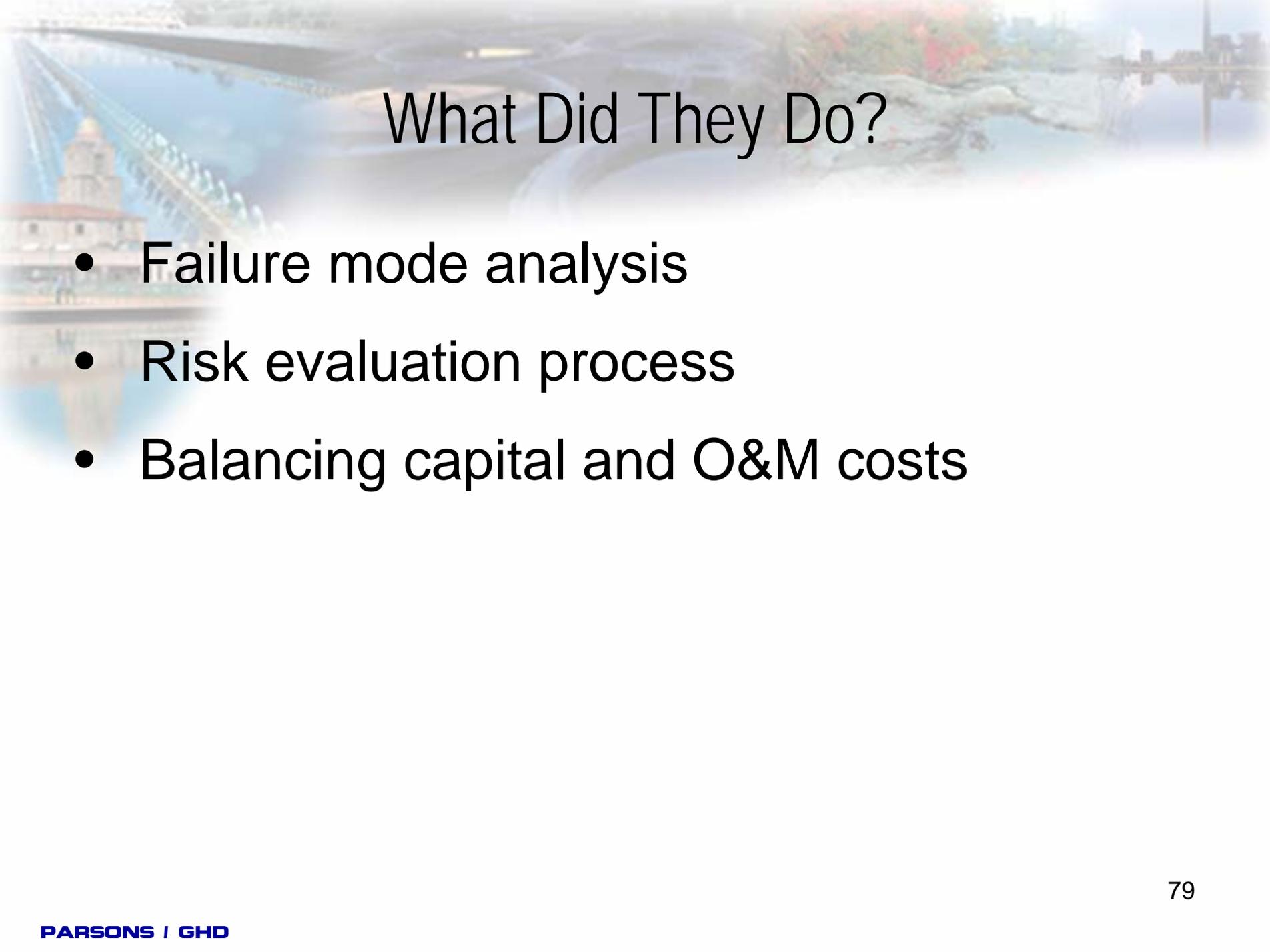
The background of the slide is a composite image. On the left, there is a view of a suspension bridge with a large stone building at its base, reflected in water. On the right, there is a park area with a large, ornate fountain and a body of water reflecting the surrounding greenery and buildings.

BRE (Business Risk) Evaluation

The background of the slide features a blurred image of a large bridge with a prominent tower, likely the Sydney Harbour Bridge, and a building with a dome, possibly a government or institutional building, situated near a body of water.

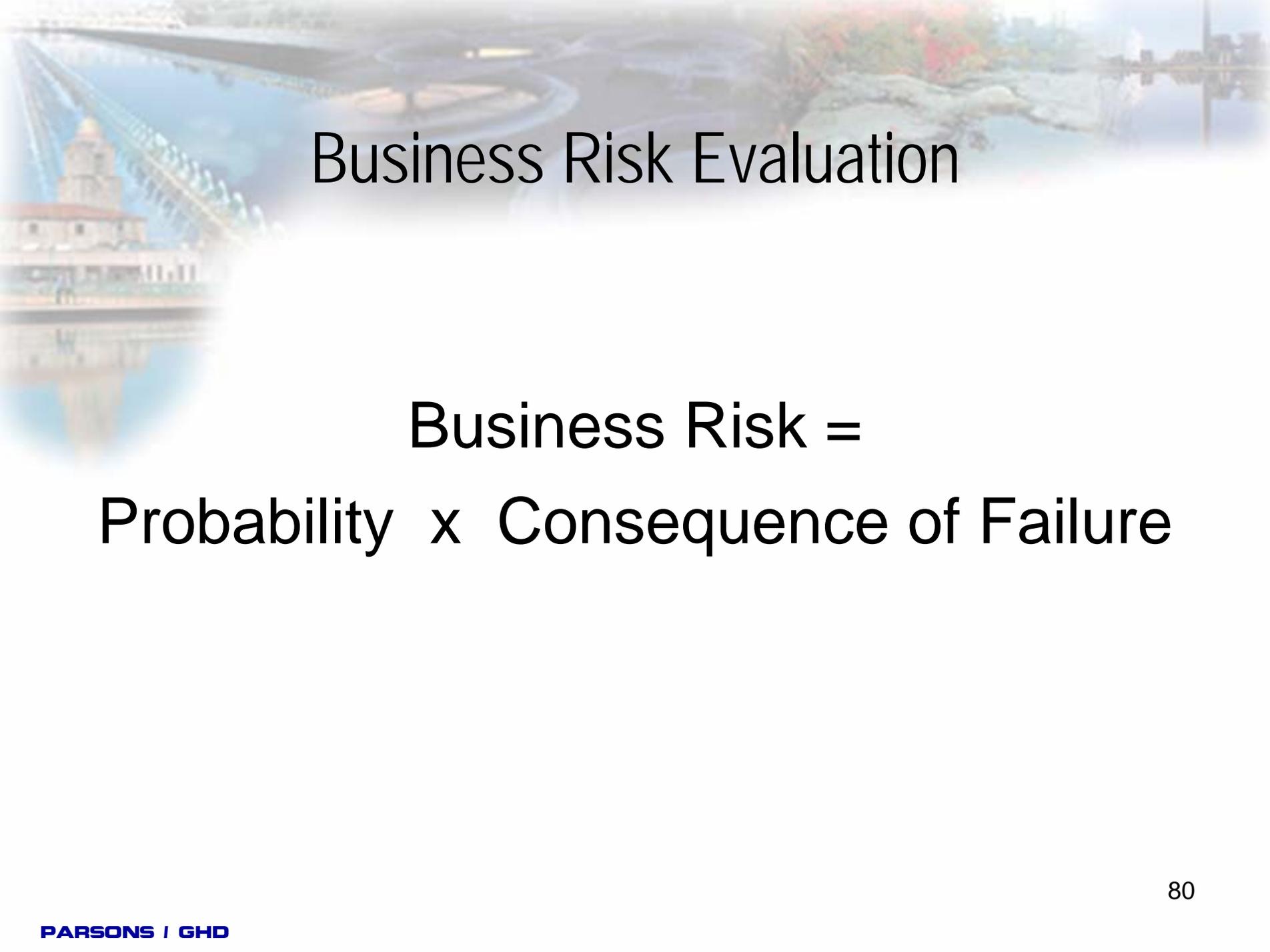
Australian Case Study

- Major water / wastewater business in Australia
- Adopted whole-business advanced AM approach



What Did They Do?

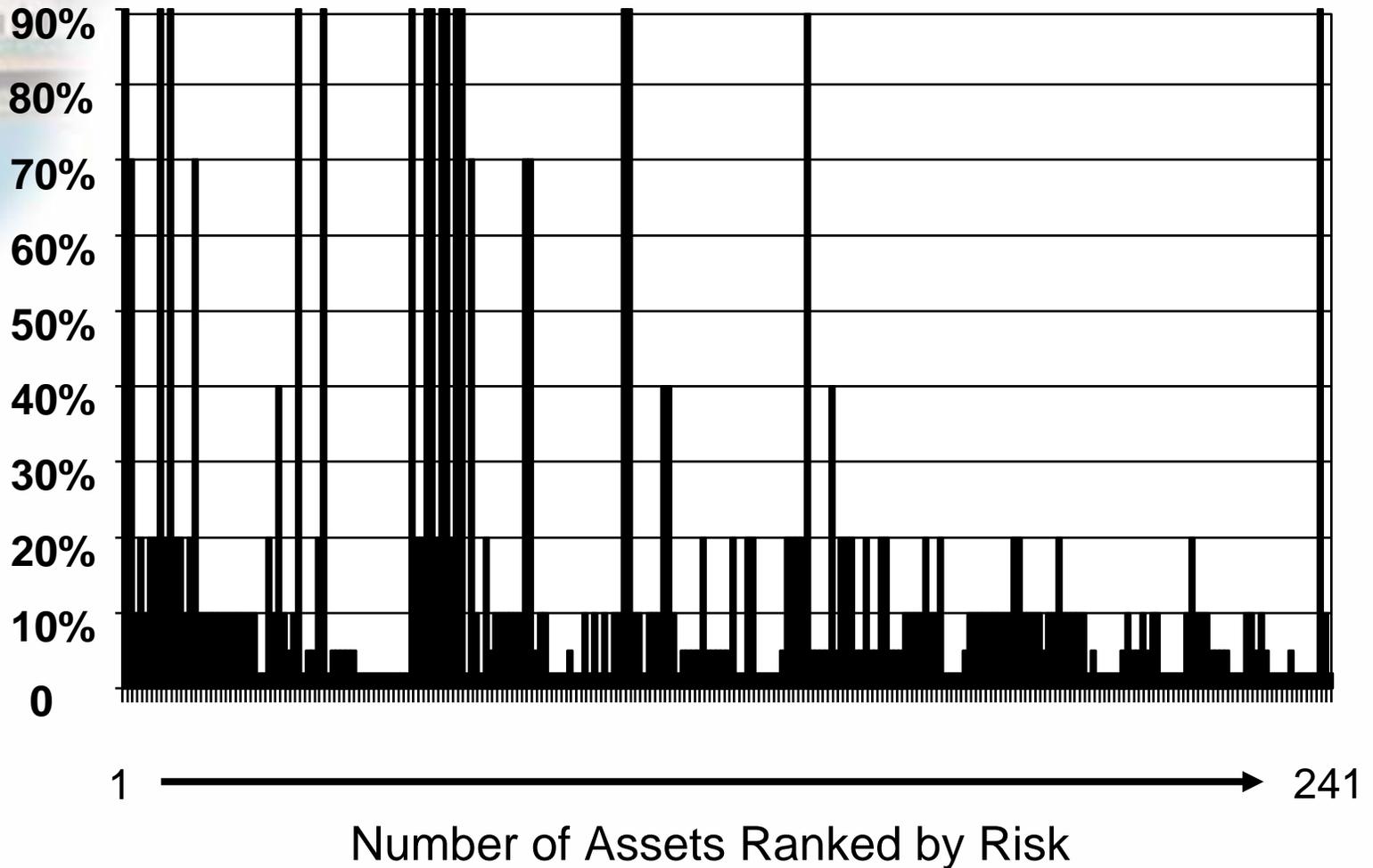
- Failure mode analysis
- Risk evaluation process
- Balancing capital and O&M costs



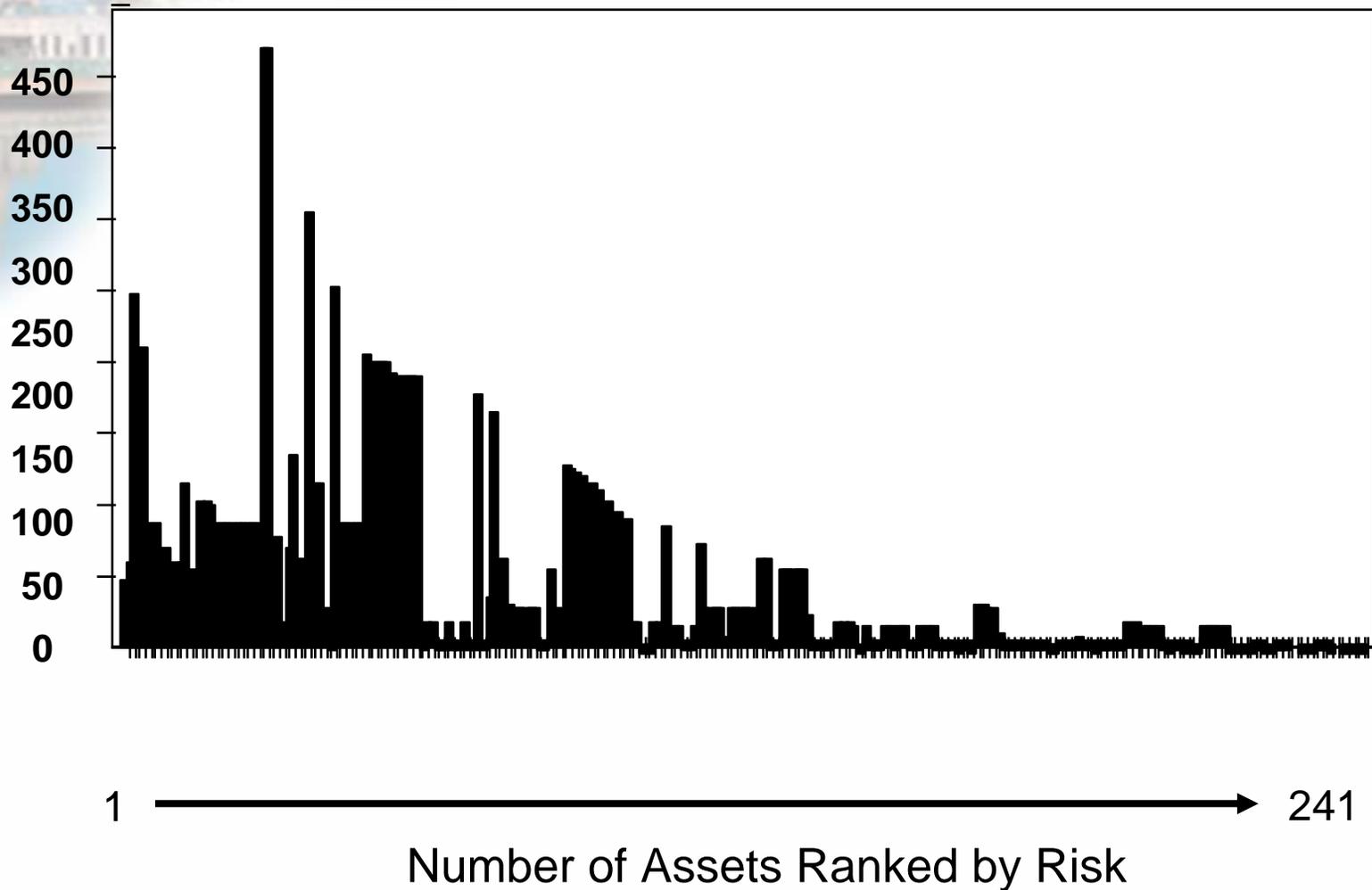
Business Risk Evaluation

**Business Risk =
Probability x Consequence of Failure**

Probability Of Failure



Consequence of Failure

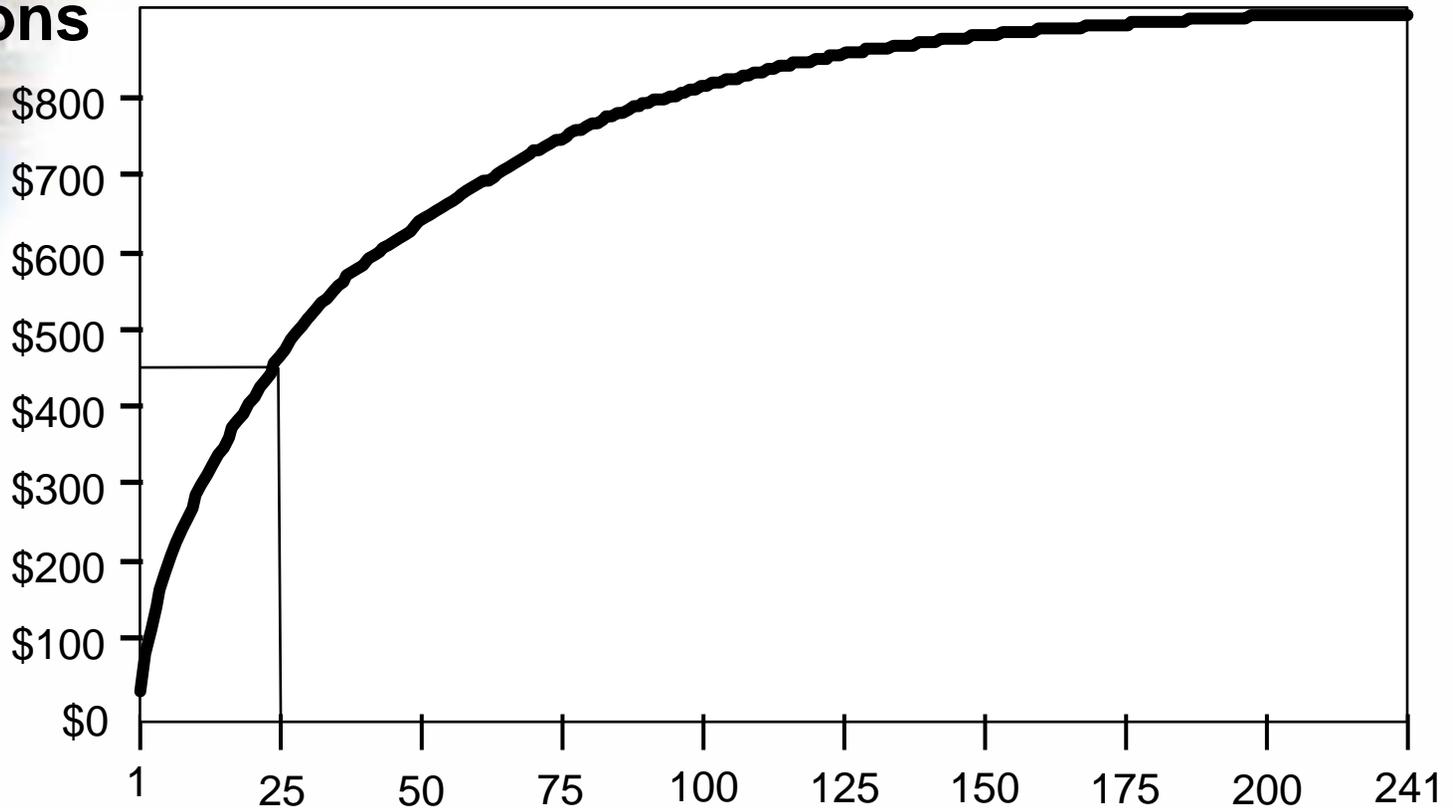


Consequences of Failure Assessed

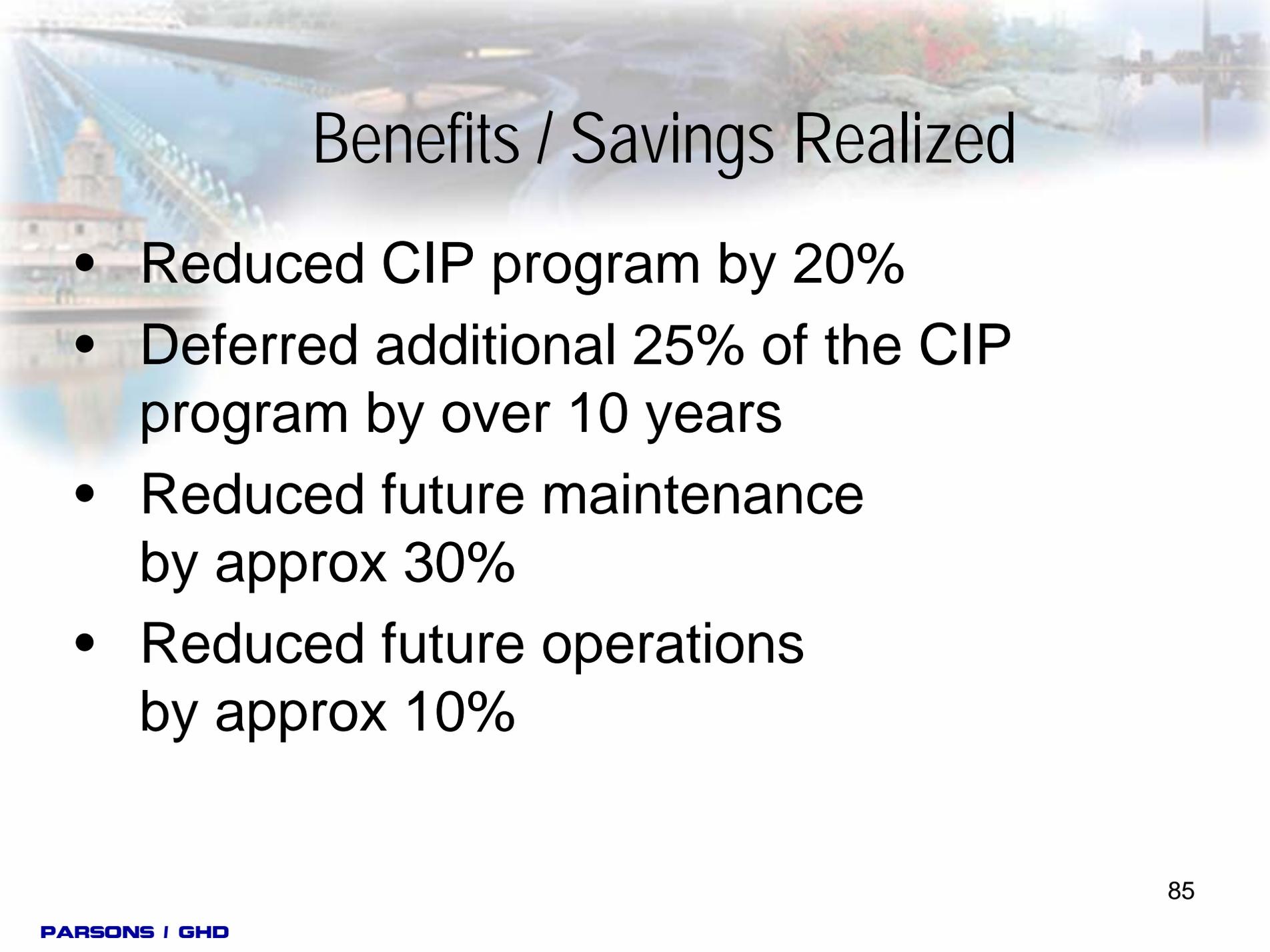
1. Environmental damage impacts
2. Repair costs (over planned renewal)
3. Loss of service
4. Outage / time off supply
5. Number of customers affected
6. Public image
7. Other property damage
8. Secondary impacts (disturbance)
9. Loss of income / product produced
10. Injury or fatality

Cumulative Risk Cost

\$ Millions



Number of Assets Ranked by Risk

The background of the slide features a blurred image of a large suspension bridge with a prominent tower on the left side, set against a cityscape and a body of water. The text is overlaid on this image.

Benefits / Savings Realized

- Reduced CIP program by 20%
- Deferred additional 25% of the CIP program by over 10 years
- Reduced future maintenance by approx 30%
- Reduced future operations by approx 10%

Savings Realized

- Capital Savings \$ 560 M
- Life Cycle Cost Savings \$ 392 M

Savings shown = NPV over 25 years

Key Lessons Learned

- ⇒ Complete a similar process for all your assets.
- ⇒ Do it with the best data you have.
- ⇒ Construct your first AM plan following this process.
- ⇒ Build the Capital Improvement Plan.
- ⇒ Add allowances for O&M.
- ⇒ Build your initial funding plan.
- ⇒ Understand its impact on your rates.
- ⇒ Decide on a strategy to sell / market the needs.

Take Home Messages

- Start your asset management plans as soon as possible...
- Don't wait .. Get started now ..
- Don't worry about quality (confidence level) but just keep going
- Understand the biggest weaknesses
- Improve those next year ..
- Follow the continuous improvement proposition..

AGENDA

Day 2

- *Summary of Day 1; Outline of Day 2*
- *Core Question 4: What Are My Minimum “Life-cycle-cost” CIP and O&M Strategies? (Continued from Day 1)*
- *Core Question 5: Given The Above, What Is My Best Long-term Funding Strategy?*

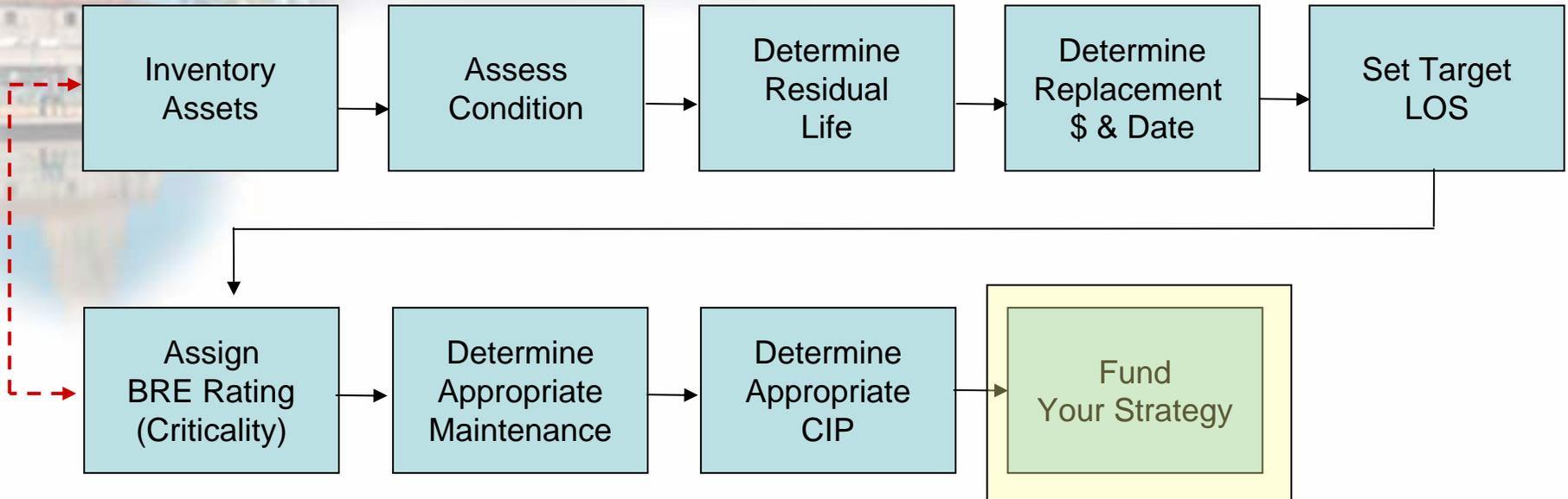
- *Lunch*

- *Case Study 1: Deploying An AAM Program*
- *Case Study 2: Meeting The IT Challenge – Toward An Enterprise Asset Management System (EAMS)*
- *Summary, Addressing Your Questions, Comments, Self-audit*



Q5: Given the above, what are my best long-term funding strategies?

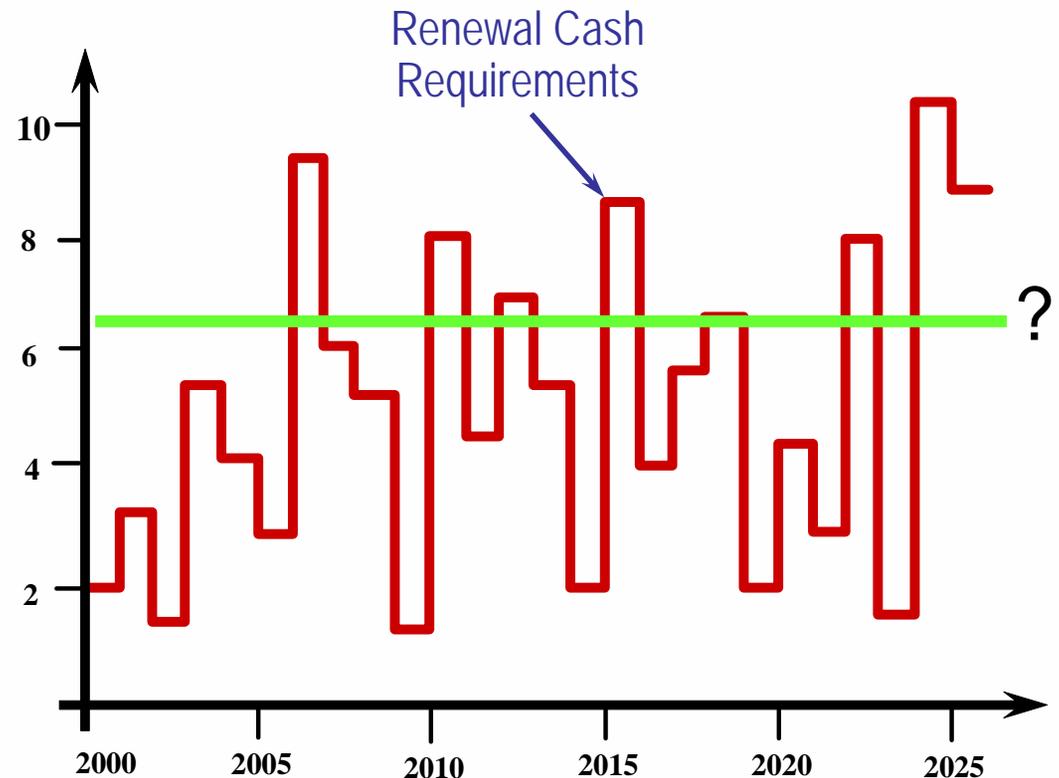
AAM Program Process



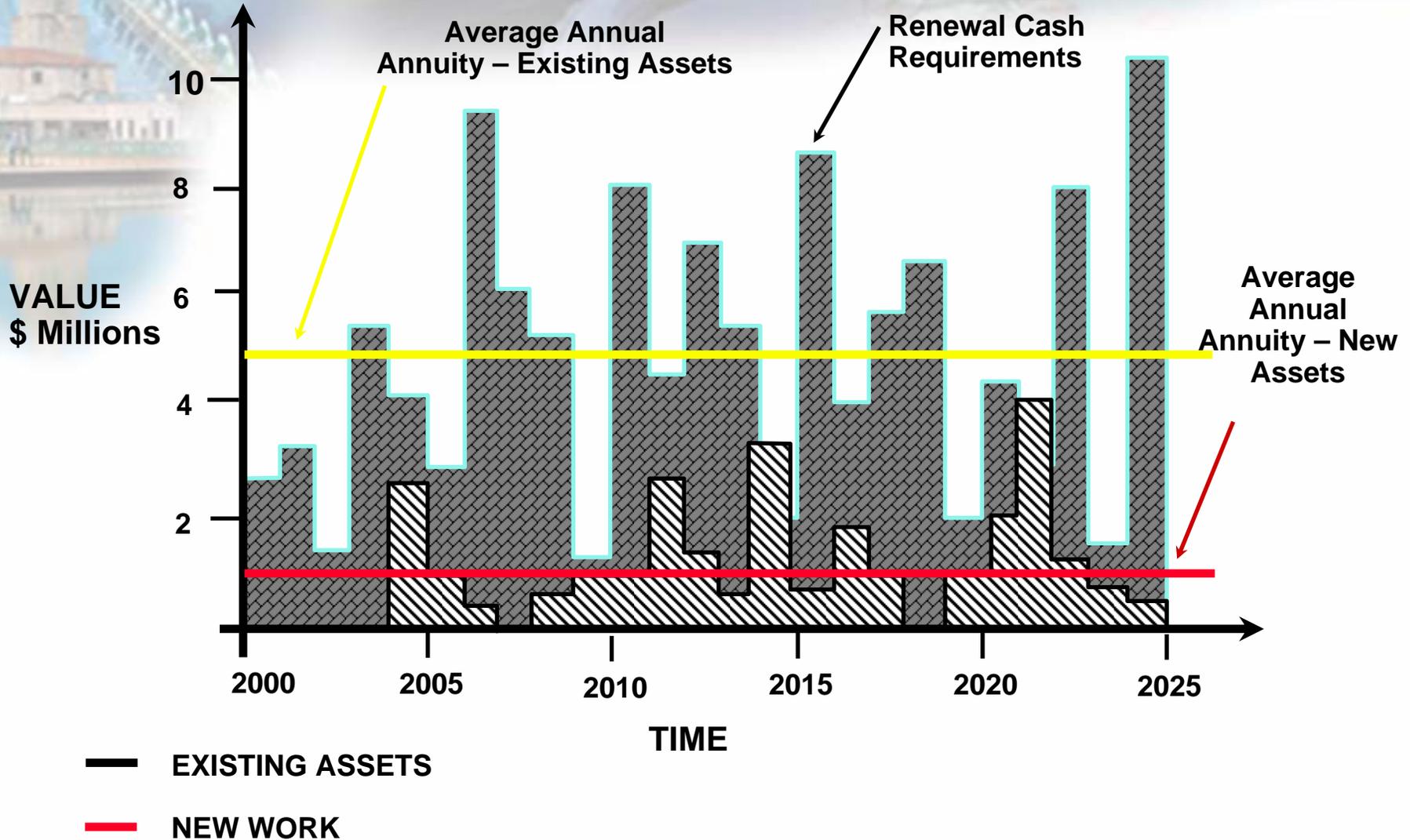
Are We Fully Funding Our Sustainable Future ?

- Have we defined a sustainable future?
- Have we assigned value to the costs associated?
- Have we determined a funding level?

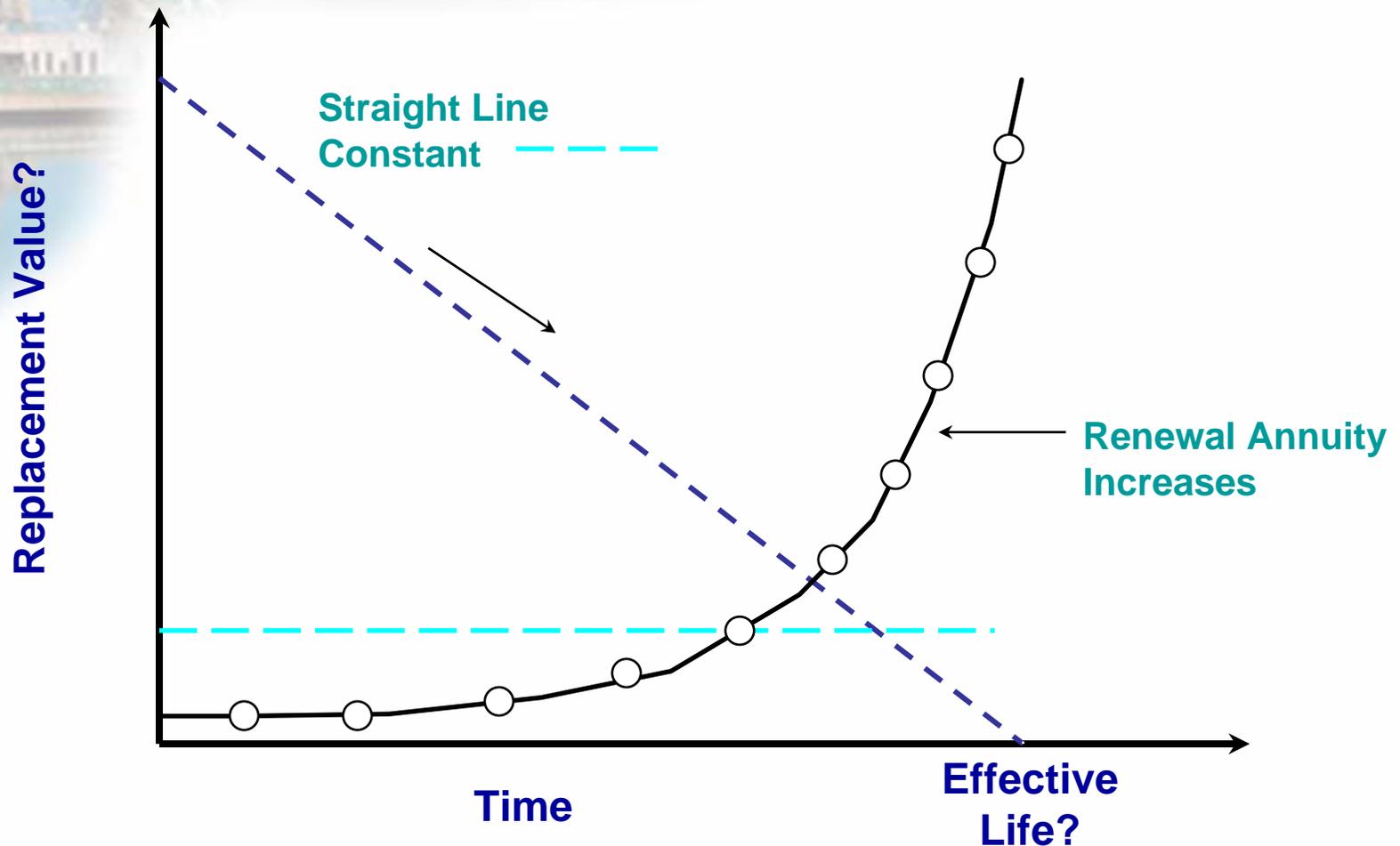
Value
\$ Millions



Renewal Programs

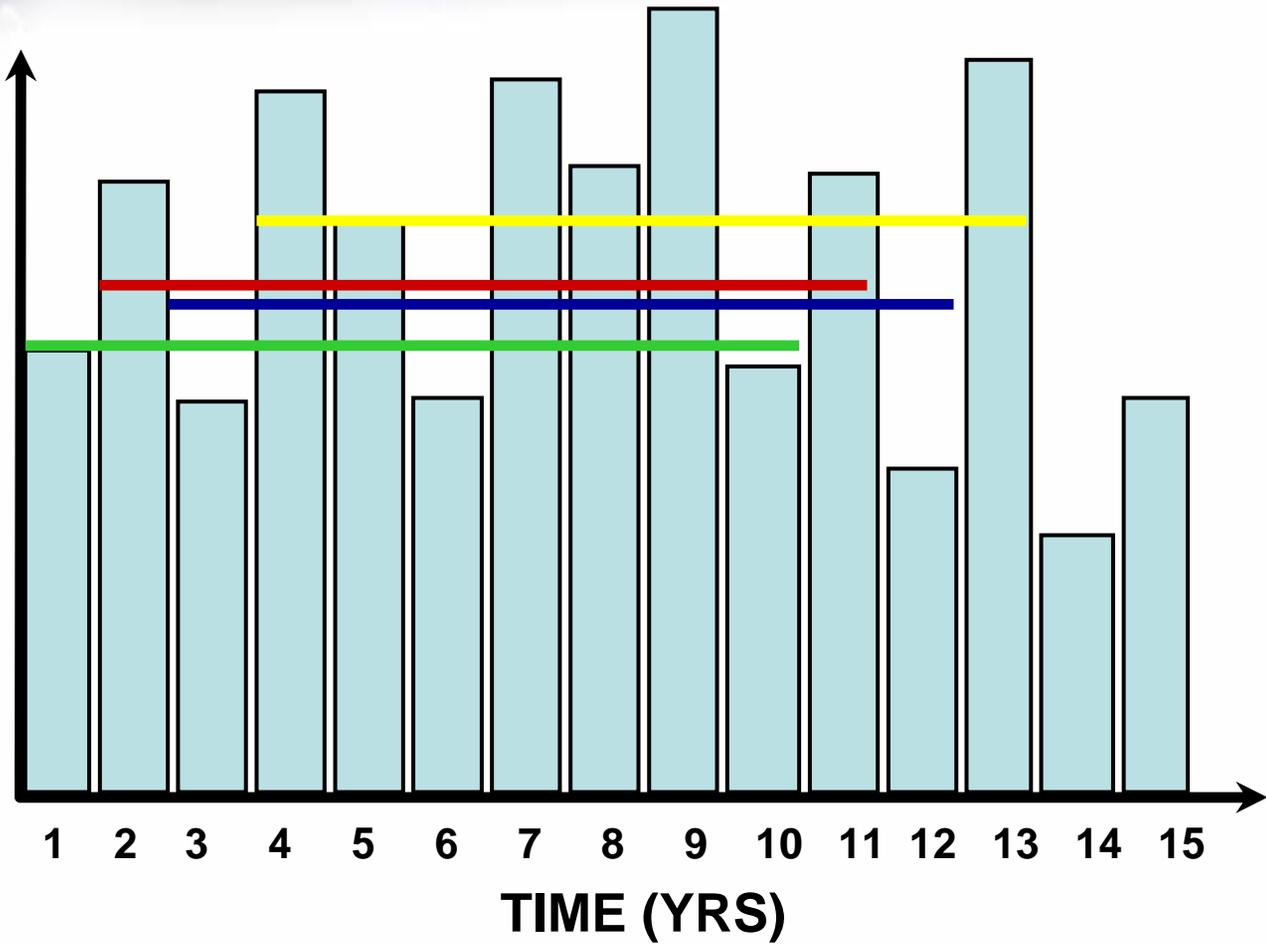


Annuity Requirement Increases as Funding is Deferred

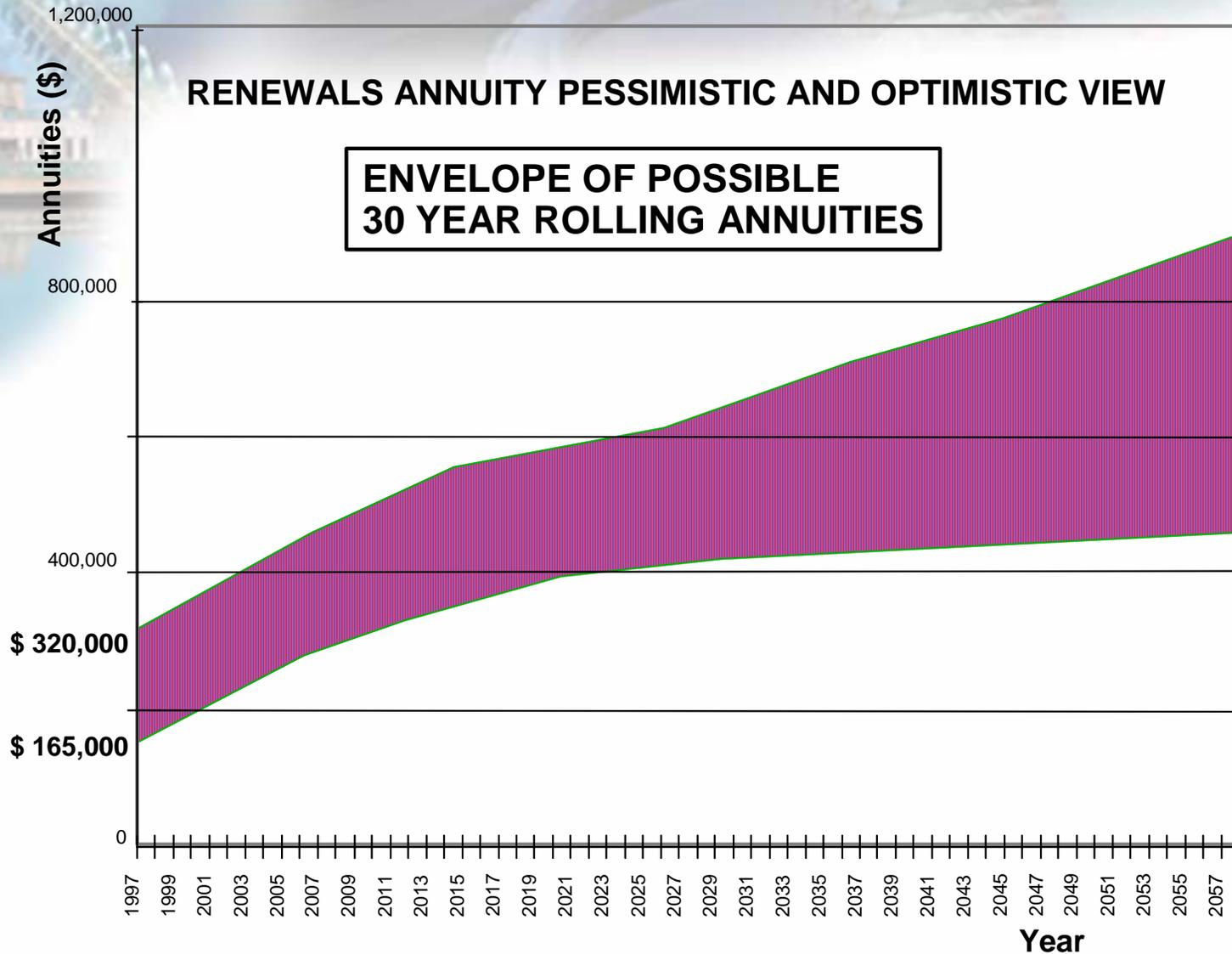


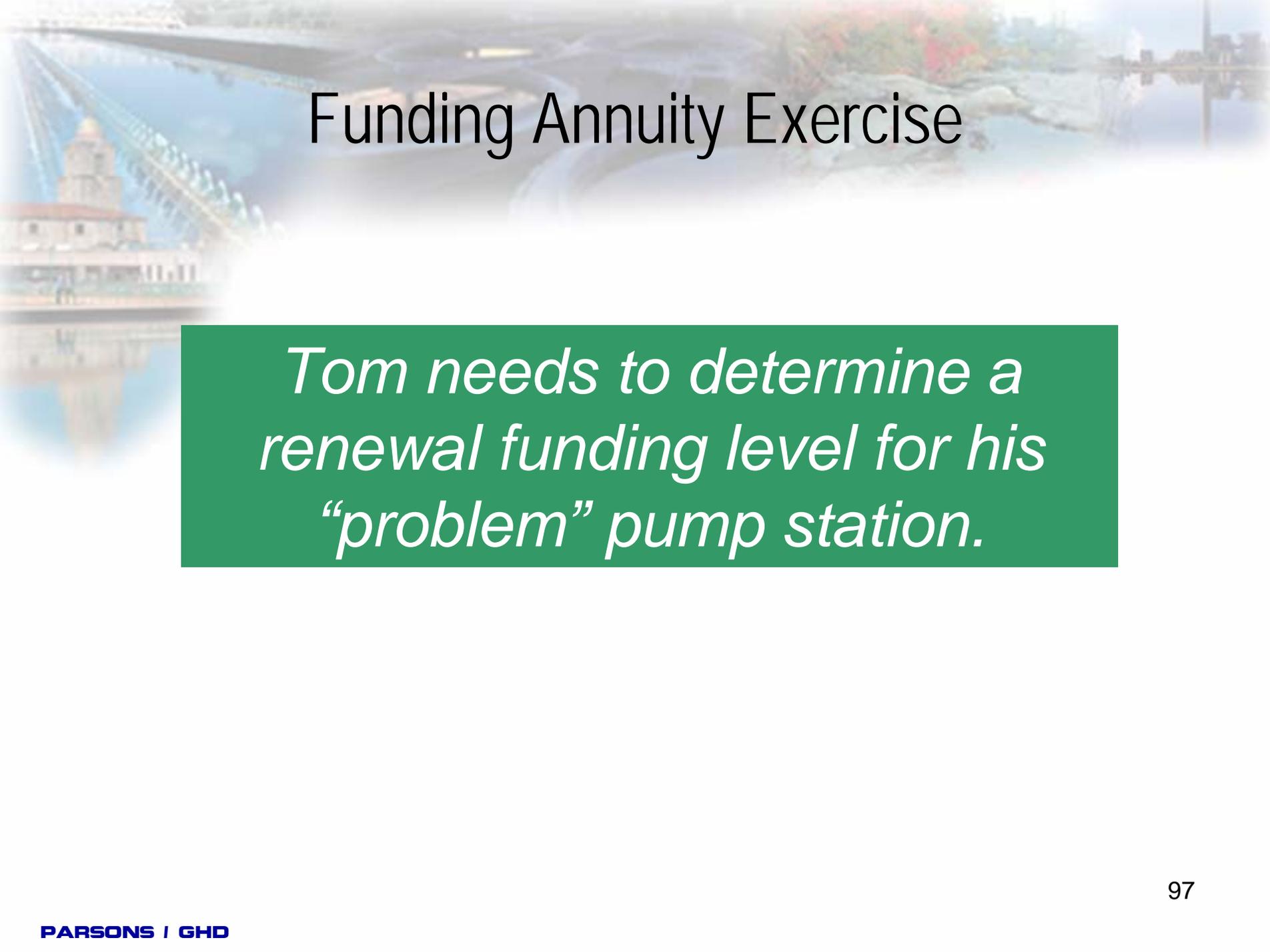
Rolling Annuities

RENEWAL
VALUE \$



Understanding Asset Renewals





Funding Annuity Exercise

Tom needs to determine a renewal funding level for his “problem” pump station.

The Valuation Results.

| Type of Cost | Cost (\$K) | Book Value (\$K) | Annual Deprec (\$ p.yr) | Accumul Deprec. (\$K) |
|--------------|------------|------------------|-------------------------|-----------------------|
| Historic | 130 | 31 | 2,708 | 99 |
| Replacement | 440 | 104 | 9,160 | NA |
| Renewal | 644 | NA | 10,000 | NA |

Valuation Accuracy V. Hierarchical Level.

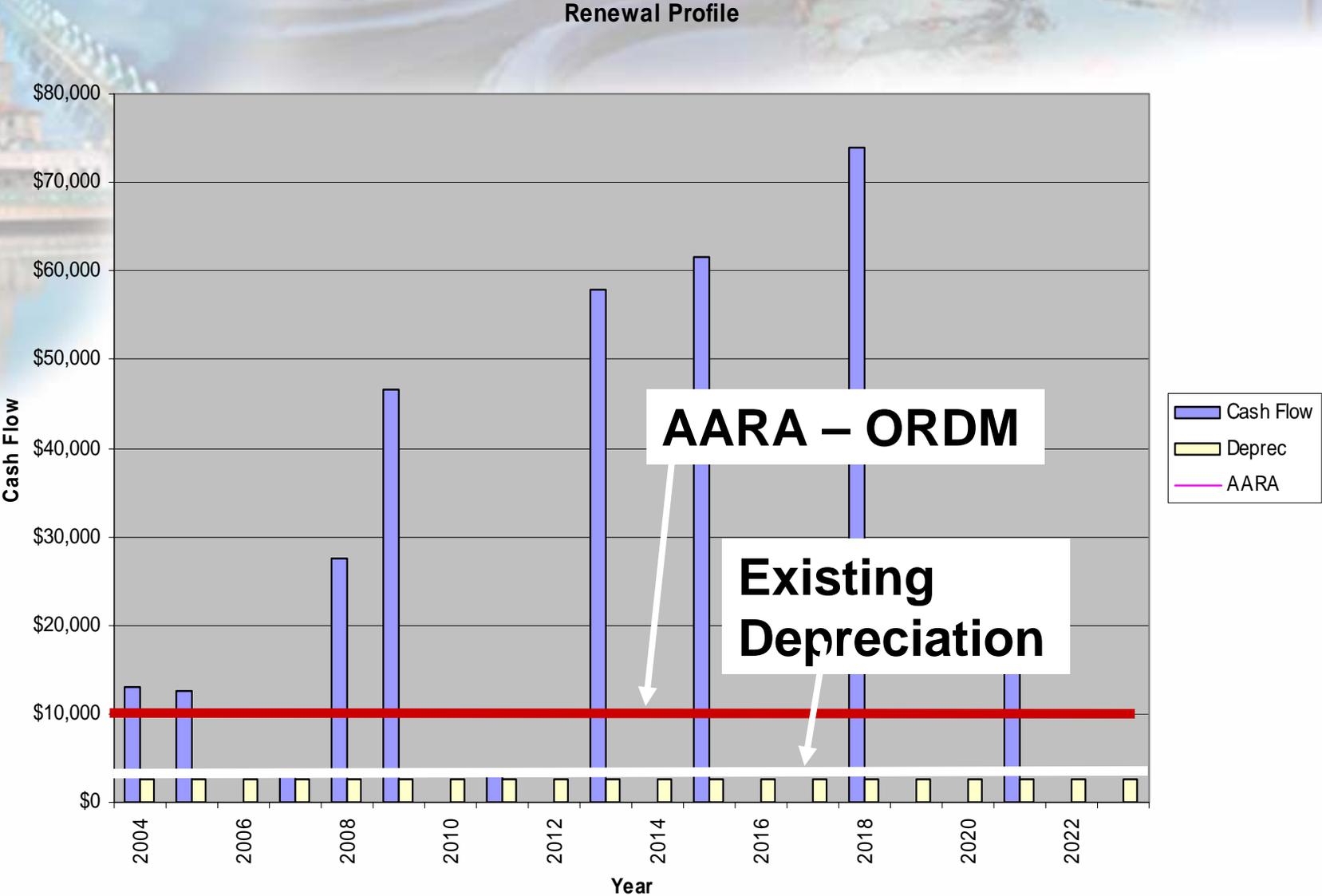
| Level of Valuation | Value (\$K) | Effect. Life (yr) | Annual Deprec (\$ p.yr) | CLR |
|---------------------|-----------------|-------------------|-------------------------|-----|
| Level 1 (3) | 130 | 70 | 1,860 | 45% |
| Level 2 (4) | 440 | 48 (wt) | 9,160 | 55% |
| Level 3 (5) AARA | 644 (198)npv | As Is | 10,000 | 70% |

Philosophy of Confidence Levels



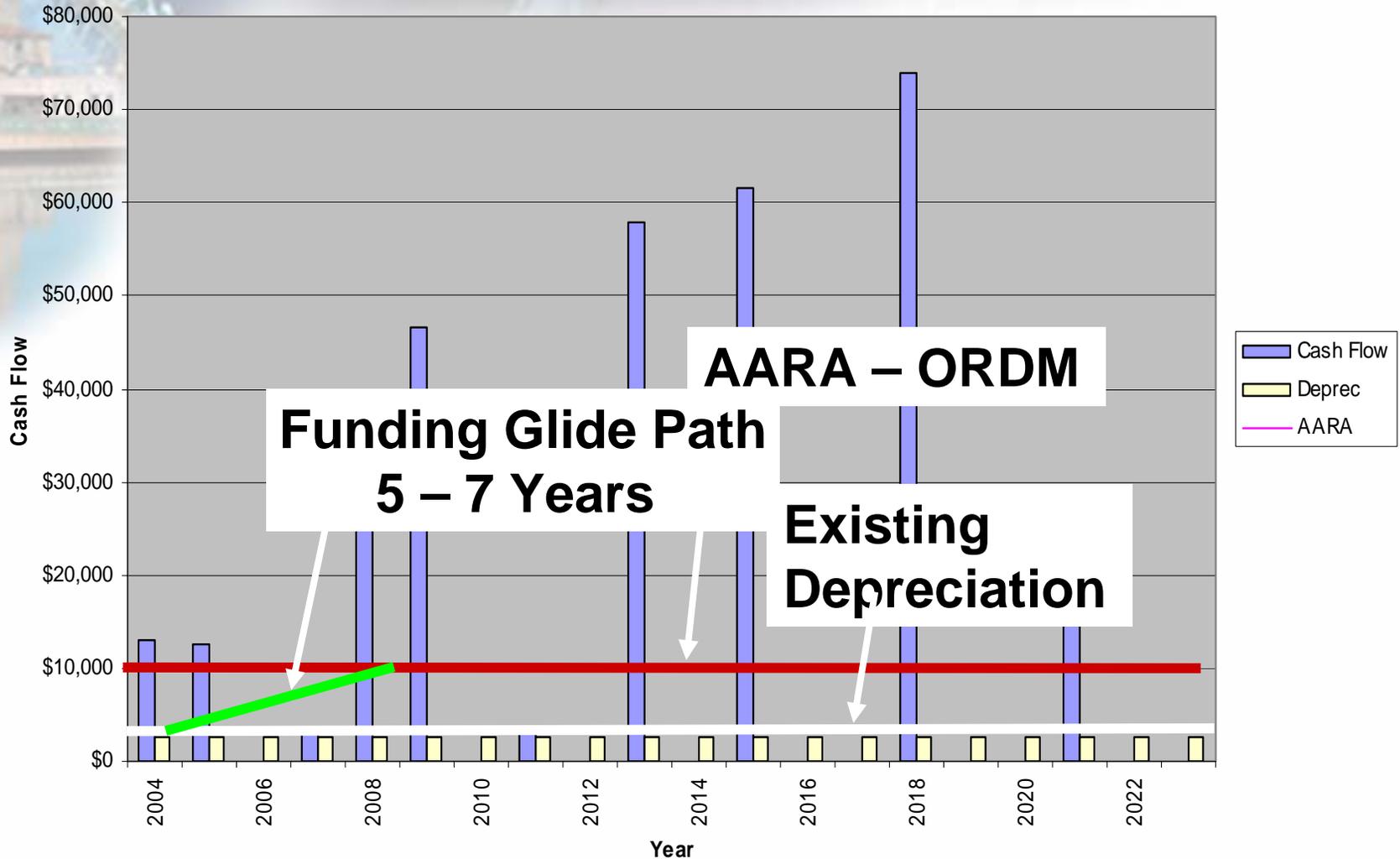
- * Note :**
- 1. Best Appropriate Practice varies from Basic AM to Sophisticated AM**
 - 2. The numbers are averaged**

How Much Money Does Tom Need ?



How Much Money Does Tom Need ?

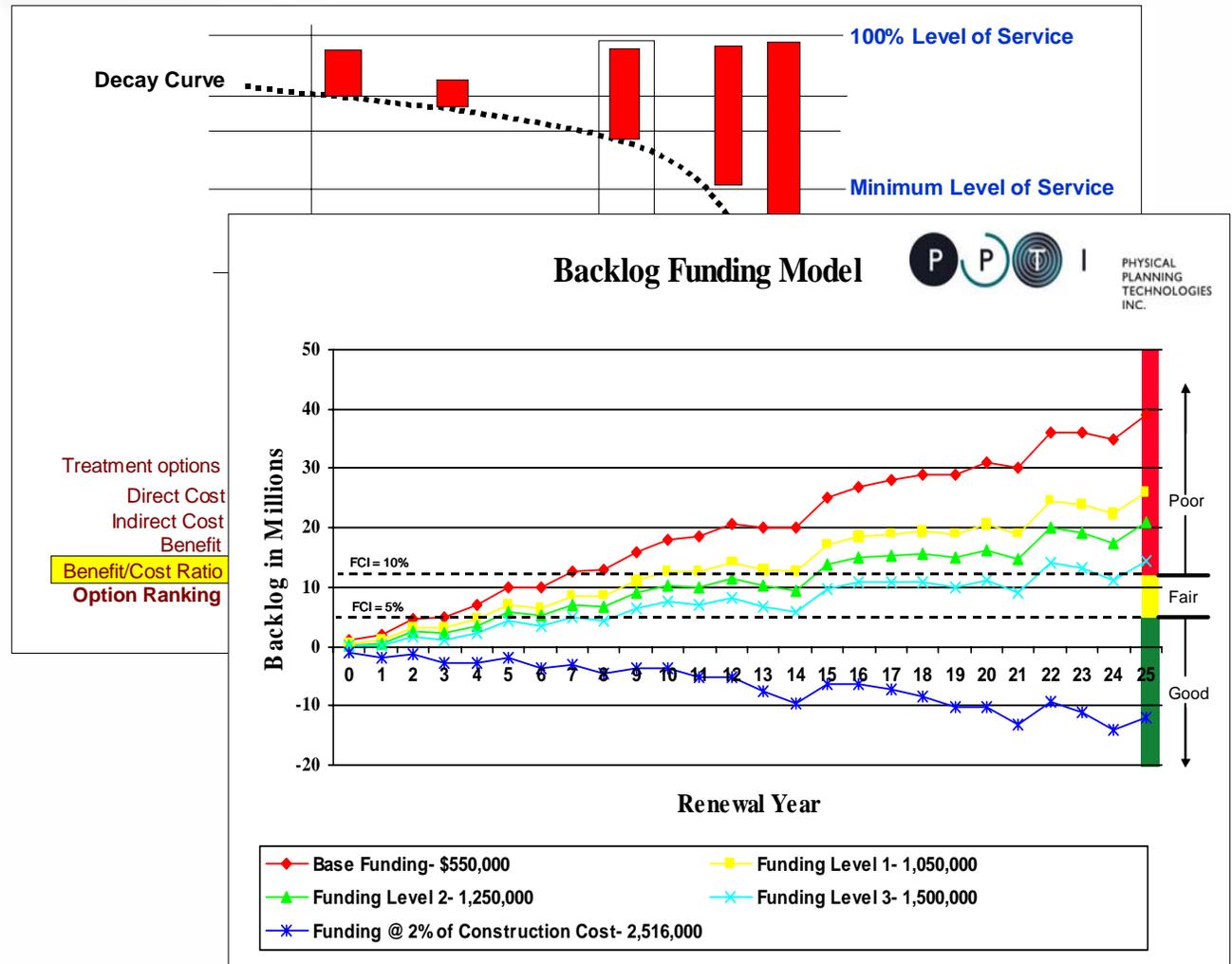
Renewal Profile



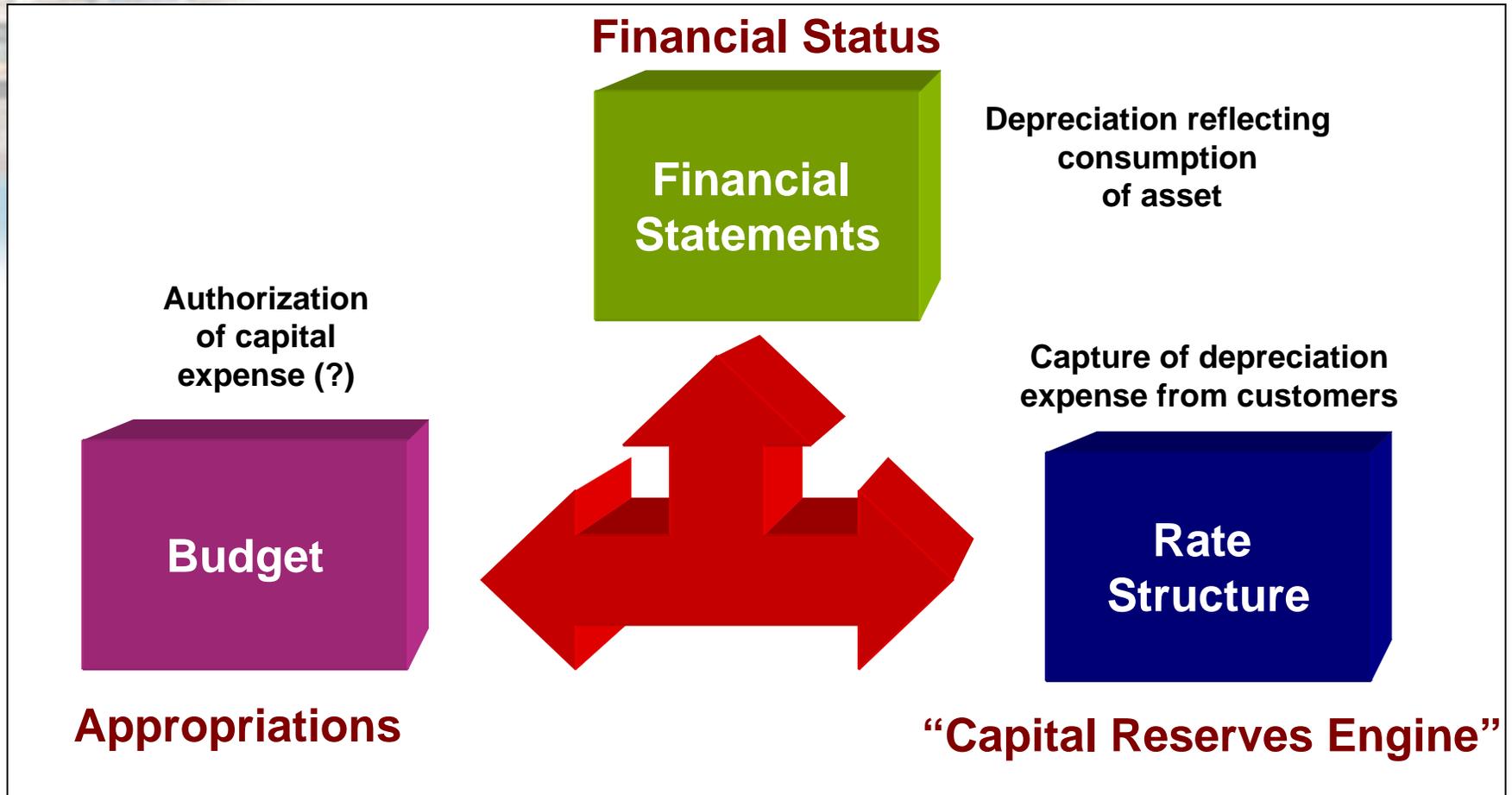
Telling the Renewal Story

Confidence
in decision
making

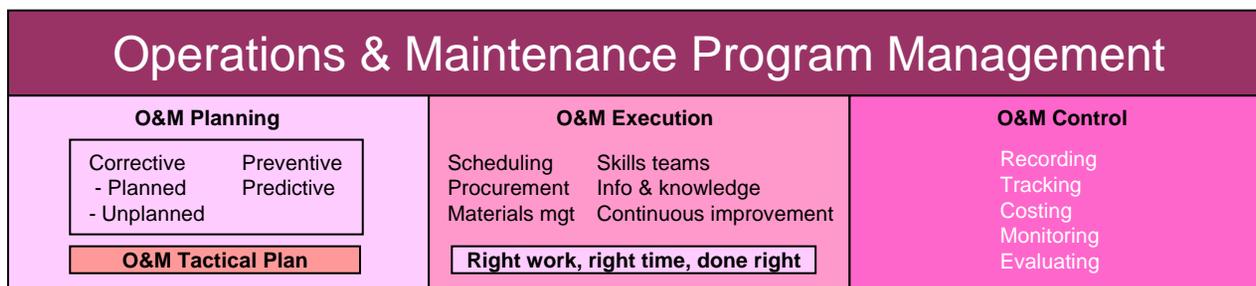
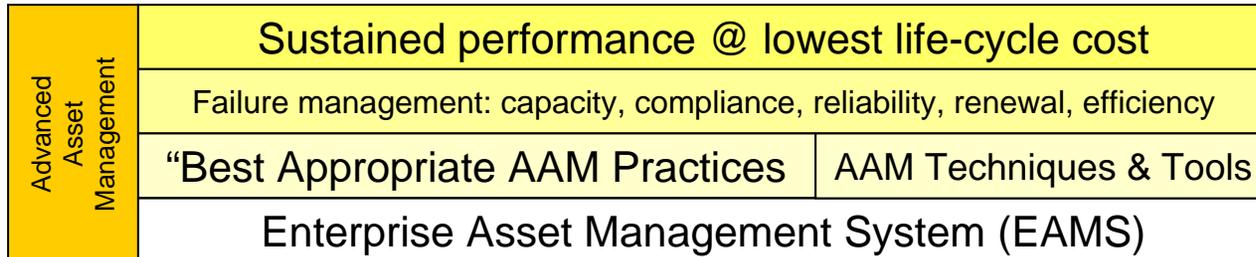
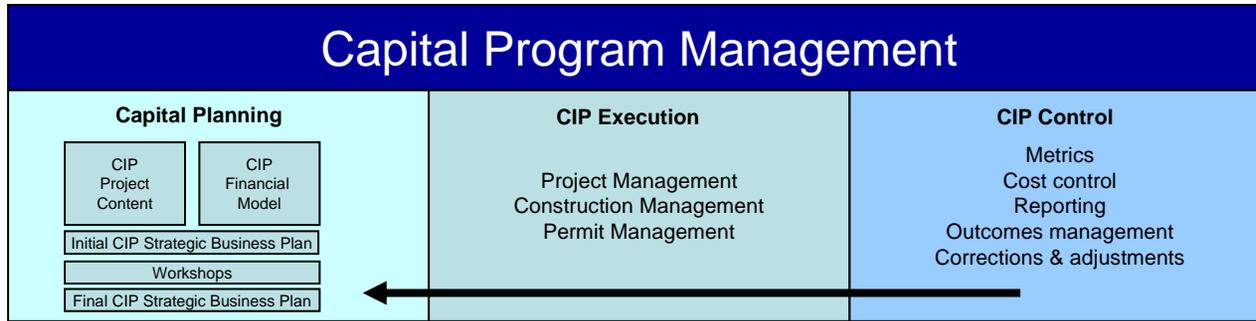
Effective
presentation



It Ain't "Renewals Funding" If It Is Appropriated For Something Else



Parsons/GHD AAM Model



Continuous Learning/Knowledge Management
"AAM University"

The Five Core AM Questions

Core Questions

1. What is the current state of my assets?

- What do I own?
- Where is it?
- What condition is it in?
- What is its remaining useful life?
- What is its economic value?

2. What is my required sustained Level Of Service?

3. Given my system, which assets are critical to sustained performance?

- How does it fail? How can it fail?
- What is the likelihood of failure?
- What does it cost to repair?
- What are the consequences of failure?

4. What are my best “minimum life-cycle-cost CIP and O&M strategies?

- What alternative treatment options exist?
- Which are most feasible?

5. Given the above, what is my best long-term funding strategy?

Steps In Total Asset Management Planning

1

Identify Current Levels of Service

2

Assess Existing Assets:

- *Physical Details*
- *Condition/Remaining Life*
- *Performance*
- *Capacity (Current / Ultimate)*

3

Predict Demand:

- *Capacity / Demands*
- *Levels of Service*
- *Performance / Risk*

4

Predict Mode of Failure

- *Capacity (Due to Growth)*
- *Performance / Reliability*
- *Condition (Age) Integrity*
- *Cost of Service*

5

Examine All Feasible Treatment Alternatives:
New Assets / Renewal / Growth / Efficiency
Improved levels of service
Determine all Technical / Financial Options

Steps In Total Asset Management Planning (Cont'd)

6

Assess Impact On Cost Of Service For All Options

7

Ask: Are Customers
Willing to Pay?

No

9

Yes

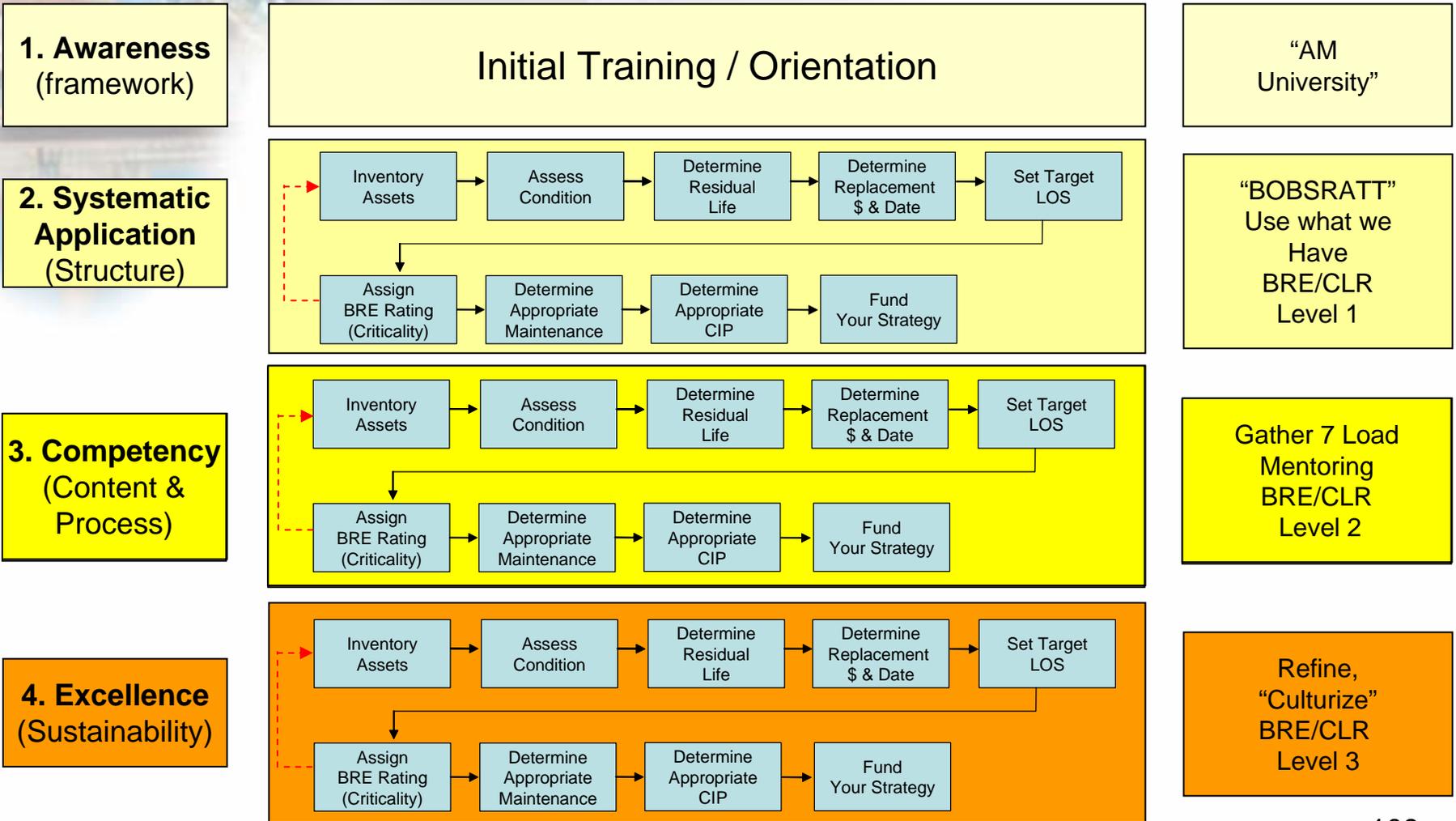
8

Execute

Review program options (reduce cost)

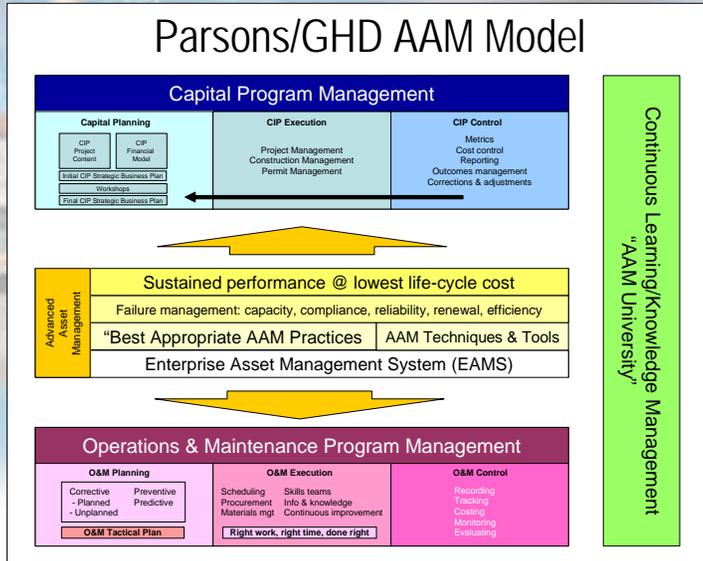
- *Reduce levels of service*
- *Dispose of under-utilized and under-performing assets*
- *Manage demand for service (pricing, regulation)*
- *Alter maintenance or operations*
- *Increase other income sources (grant funds, etc)*
- *Accept higher residual risk*
- *Rationalize project work in order of risk*

Four Major Stages of AAM Program Deployment



Fitting It All Together

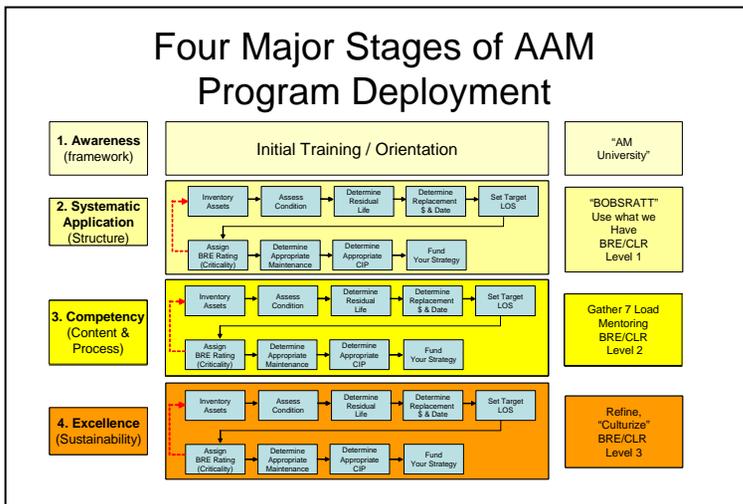
Parsons/GHD AAM Model



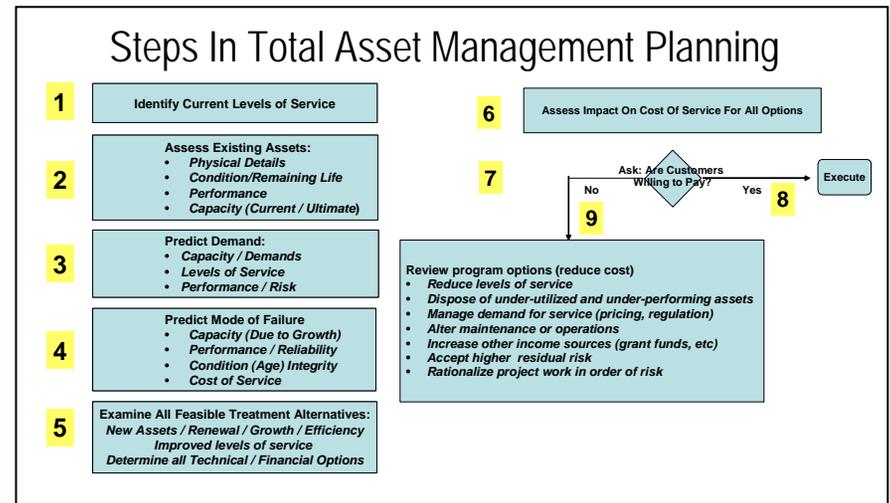
Core Questions

- 1. What is the current state of my assets?**
 - What do I own?
 - Where is it?
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 - What is its remaining useful life?
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- 2. What is my required sustained Level Of Service?**
- 3. Given my system, which assets are critical to sustained performance?**
 - How does it fail? How can it fail?
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 - What are the consequences of failure?
- 4. What are my best "minimum life-cycle-cost CIP and O&M strategies?"**
 - What alternative treatment options exist?
 - Which are most feasible?
- 5. Given the above, what is my best long-term funding strategy?**

Four Major Stages of AAM Program Deployment



Steps In Total Asset Management Planning



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Case Study in Developing and Deploying an AAM Program for a Large Utility

Orange County
Sanitation District,
Orange County,
California



Issues in Effective Deployment

- **Framework** – Creating a common conceptual framework (paradigm)
- **Structure** – The Asset Management Steering Team
- **Workplan** – Who does what for whom by when?
- **Culture** – Transitioning from “short-term operations centric” to “long-term asset centric”
- **Politics** – Winning commitment from the top shop
- **Cost** – Funding the first steps; making the business case

AGENDA

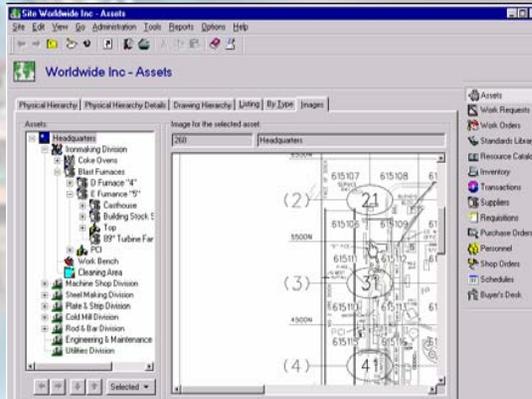
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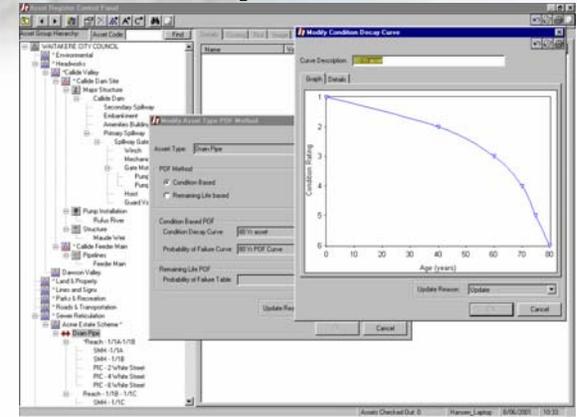
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IT Systems – 4 Core EAMS Components



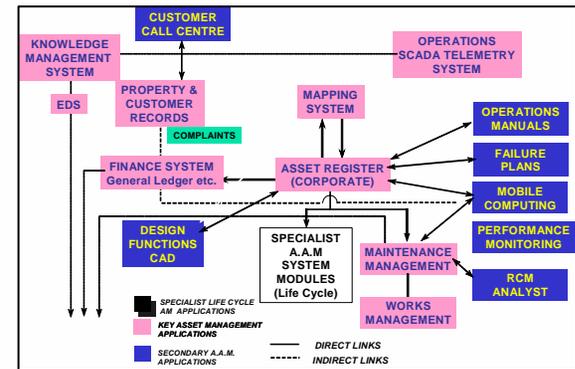
1. Data Standards/Asset Hierarchy



2. Work Processes/"Best Practices"



4. Knowledge Management



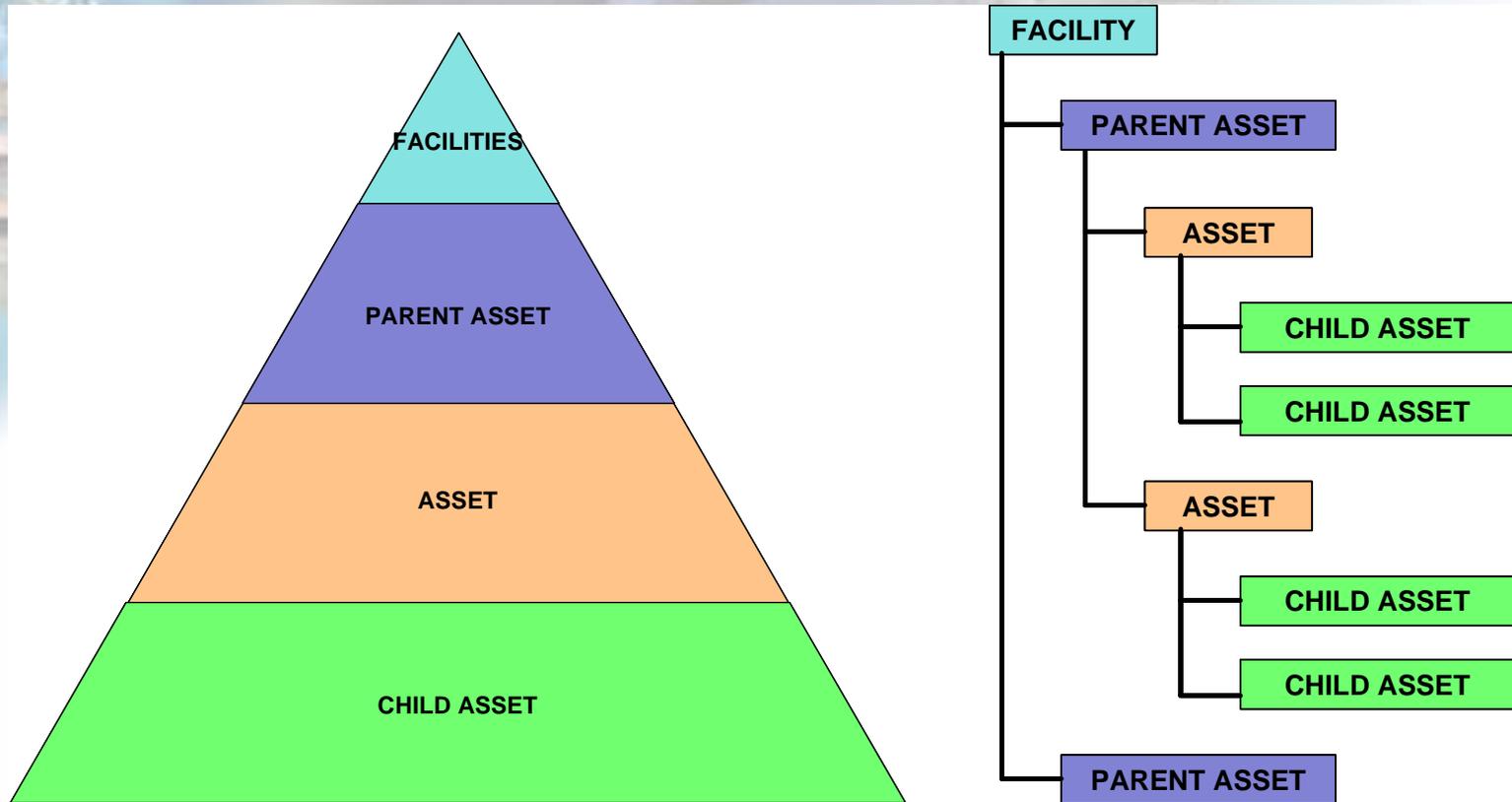
3. Architecture/Integration of Tools

**Robust Enterprise Asset Management System
 – Enterprise-Wide EAM Functionality**

A Vision of IT Best Practice – The Starting Point

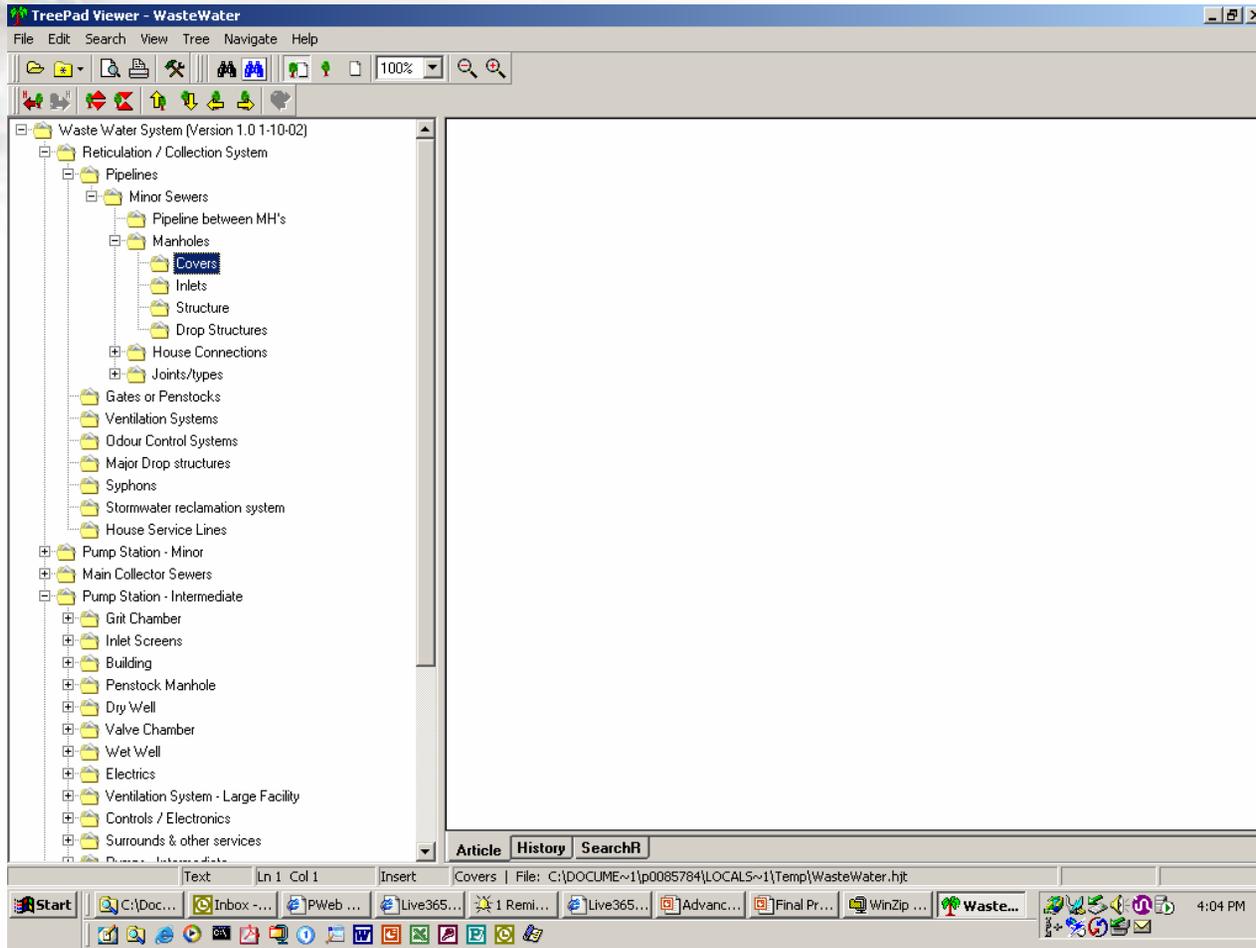
- “We monitor the condition, performance, utilization, and costs of assets down to the Managed Maintenance Item component level (as justified) and aggregate this data up to give outputs of cost and performance at:
 - asset
 - facility
 - sub system or
 - full system / program level”

1. Data Standards and Asset Hierarchy



An agency's data standards are the backbone of its management capabilities:
if we don't know what we have, where it is, and what condition it is in,
we can't really be managing it.

1. Data Standards and Asset Hierarchy



1. Data Standards and Asset Hierarchy

Storm - Structure Inventory

Structure # 5847S-001 Basin STM005 Sewer Connection

Facility 1 Happyville Status 1 Operational

Address 339 S BLECKLEY ST Lot Location SE

Gen. Location Bridge Southeast of the Intersection of Kellogg St

General | Inspections | User Defined | Comments

Owner 0 N/A Street Slope 0 N/A

Structure Type 7 Bridge Rim Elevation GPS Flag

Location 14 Streamway Rim Status 5 Field Survey

Surface Type 2 Concrete Struct Depth (ft) Inside Length (in) 360.00

Outlet To 5846S-099 Inside Width (in) 60.00 Wall Thick (in) 12.00

Cover Type 0 None # of In Conduits 3

Wall Material 4 Poured # of Out Conduits 3

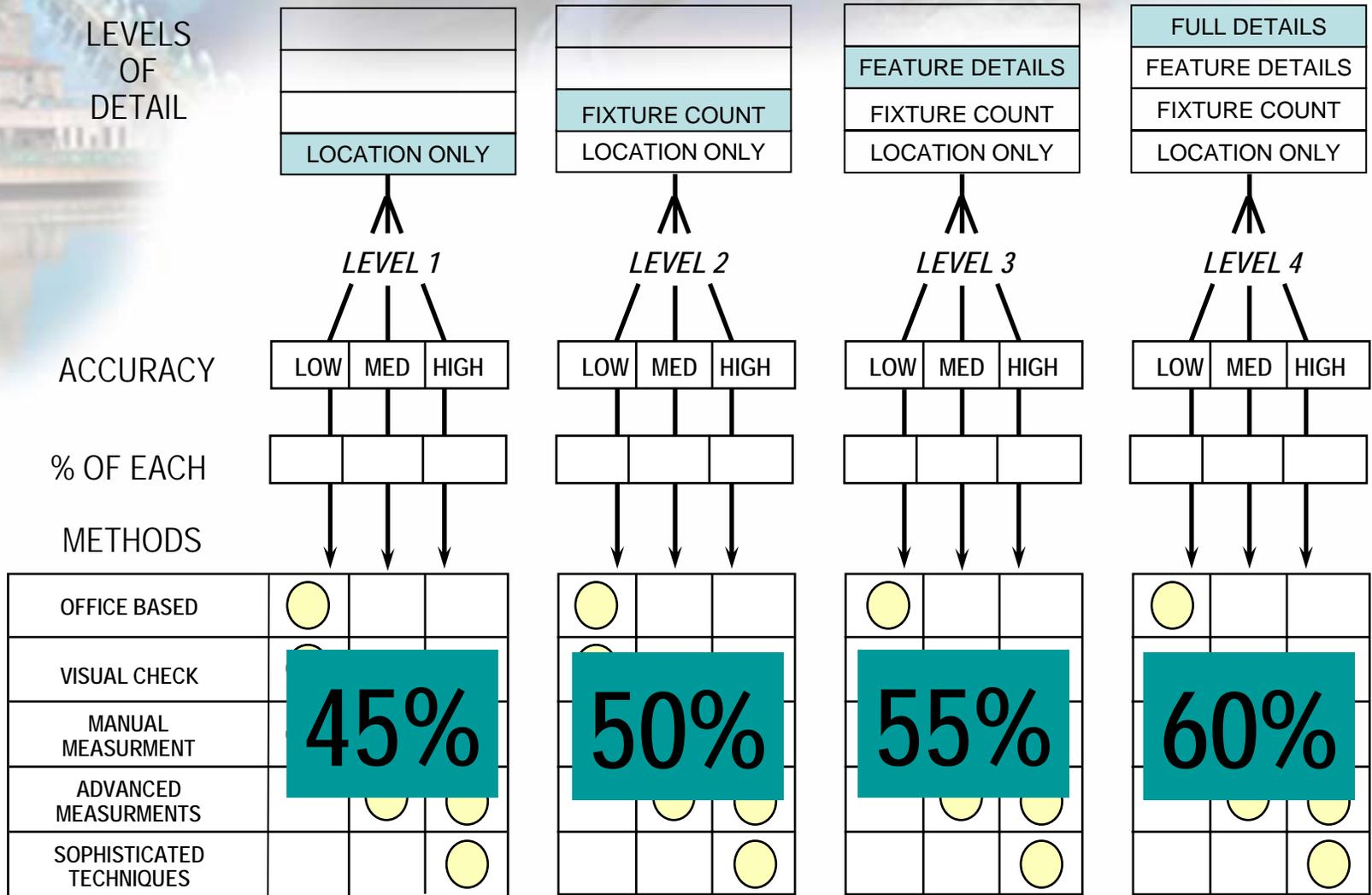
Inlet Information

Capacity 2.56 Inlet Area 250.00 % Impervious 75.00

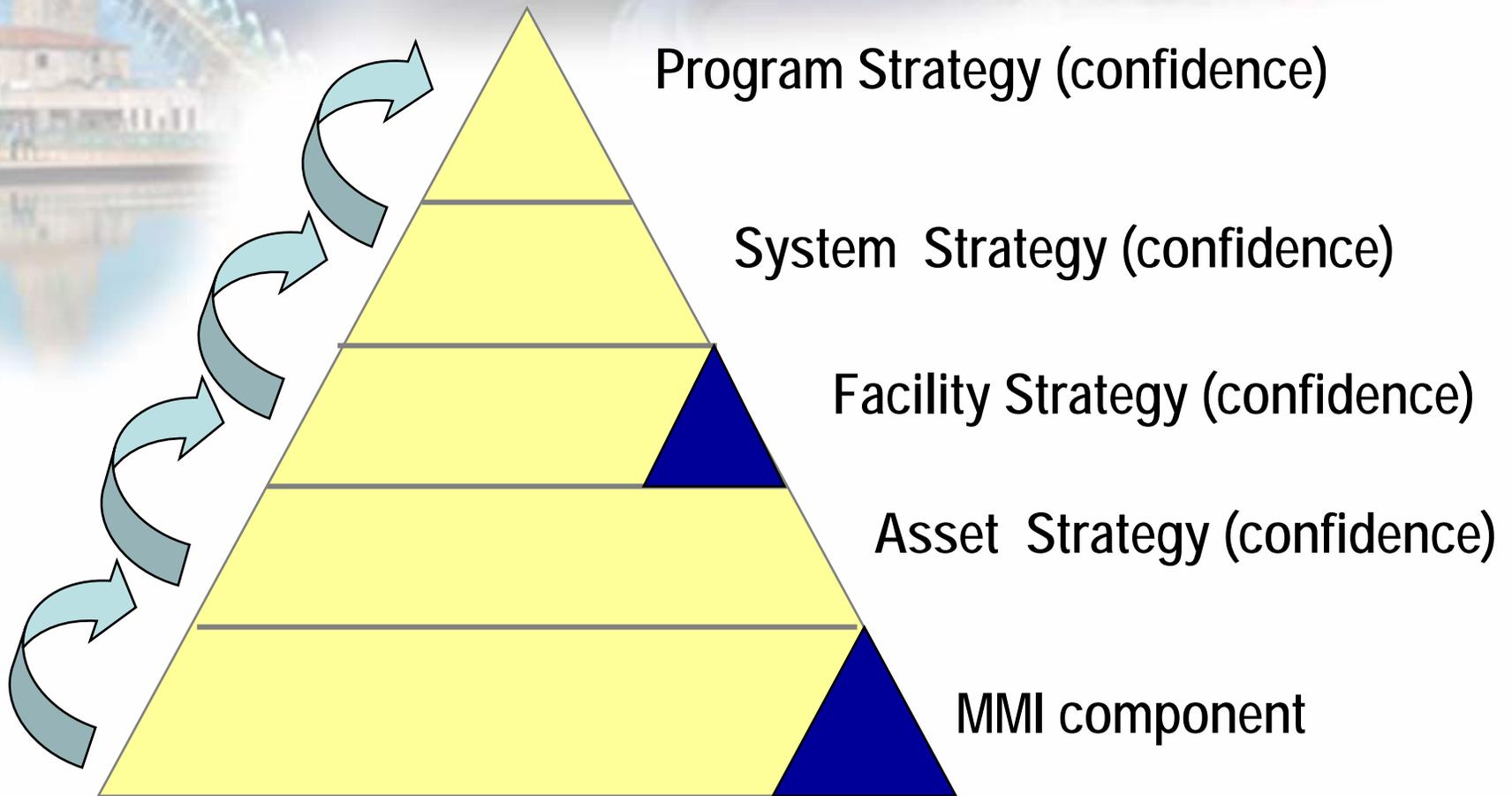
| Inlet Number | Facing Code | Inlet Width | Inlet Length | Catchment Area | C Coefficient | % Impervious | Average Slope | It |
|--------------|-------------|-------------|--------------|----------------|---------------|--------------|---------------|----|
| 1 | North | 8.00 | 24.00 | 100 | 0.90 | 75.00 | 1.00 | 3 |
| 2 | South | 8.00 | 24.00 | 150 | 0.91 | 70.00 | 1.25 | 2 |

Record 1 of 166 View Mode Ready...

Data Collection – Levels of Detail



Rolling up Confidence

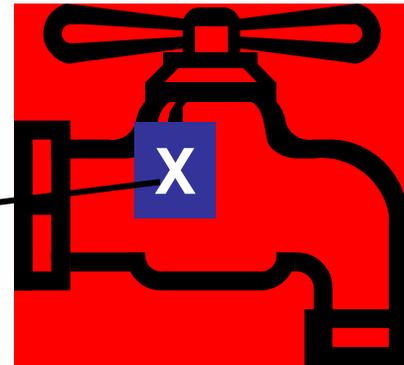
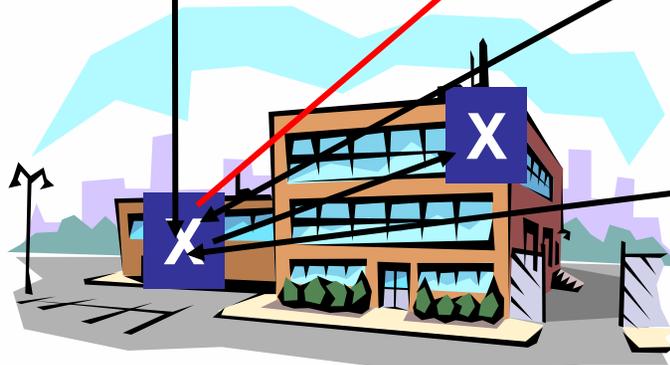
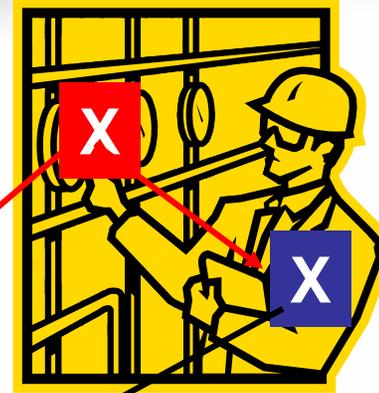
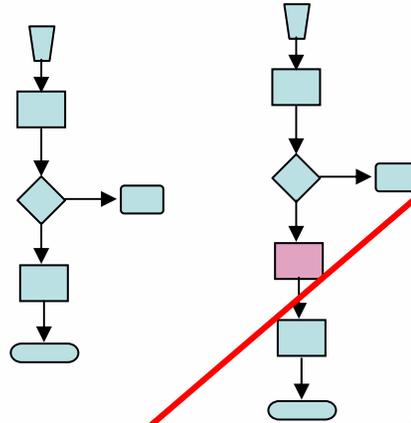


Confidence at higher system levels is determined by MMI component accuracy.

2. Work Processes + "Best Practices"

Collection/Conveyance

Treatment



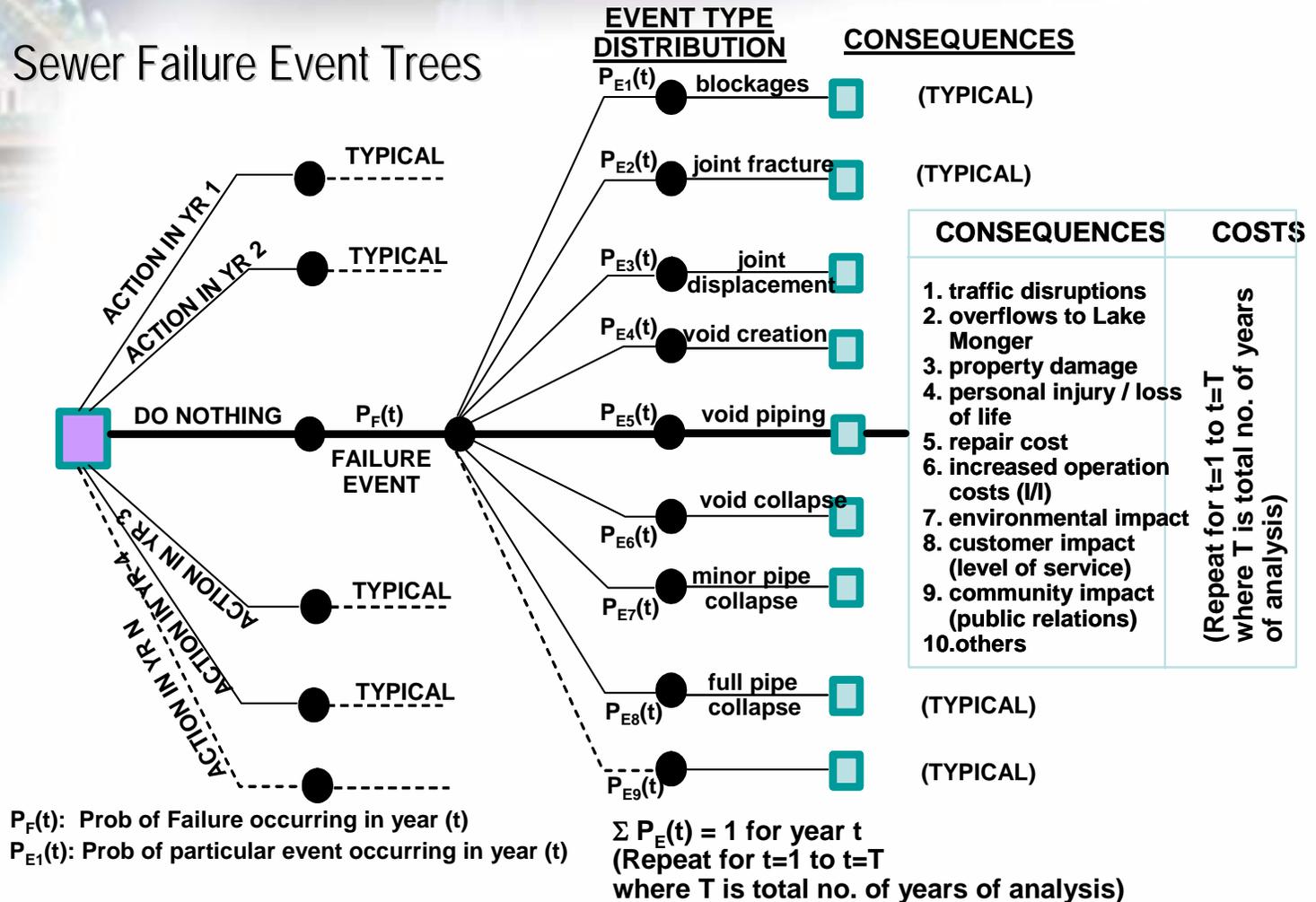
Office

Distribution

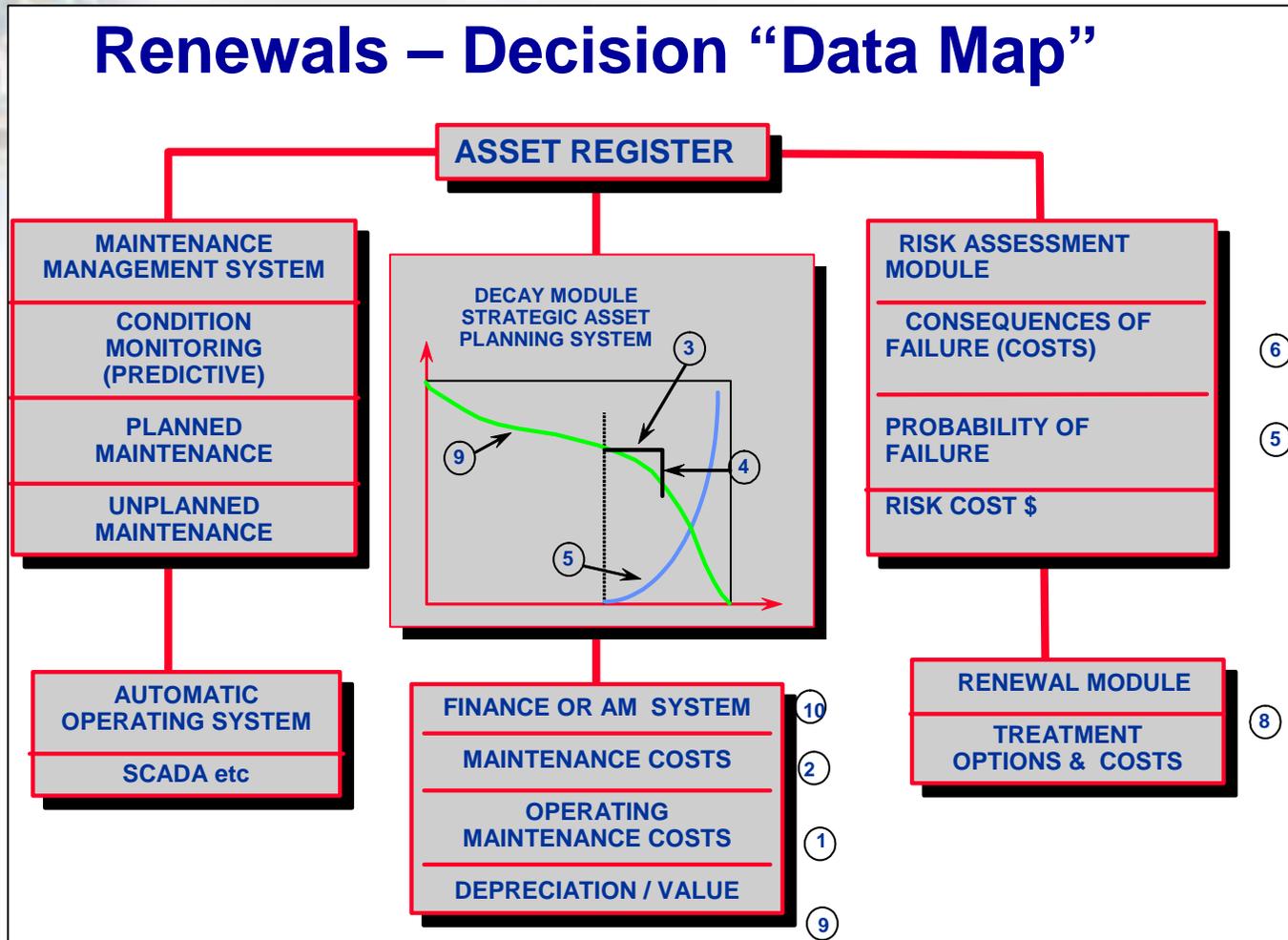
Who?
What?
When?
"Best Practice"
work
processes
should
drive
system
functionality

2. Work Processes + "Best Practices"

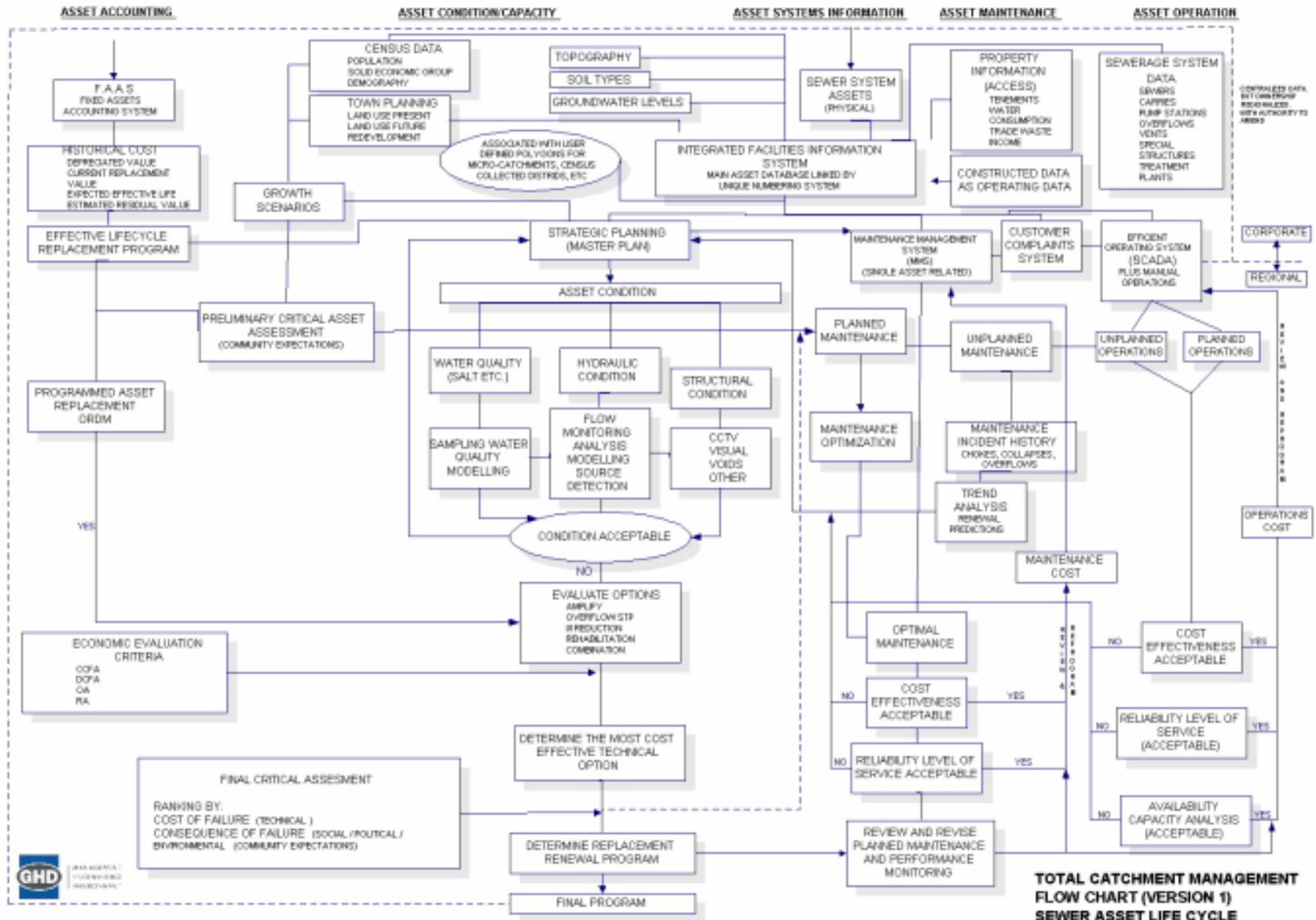
Sewer Failure Event Trees



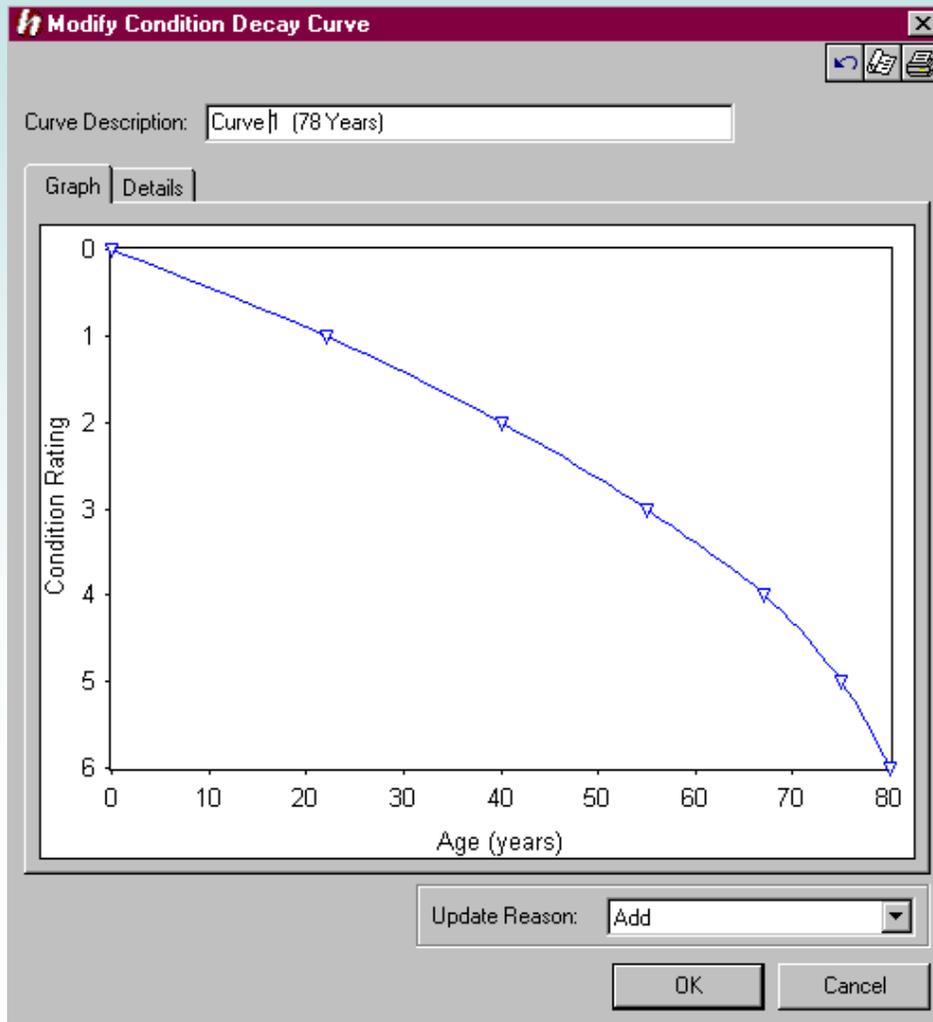
2. Work Processes + "Best Practices"



Mapping the Work Process



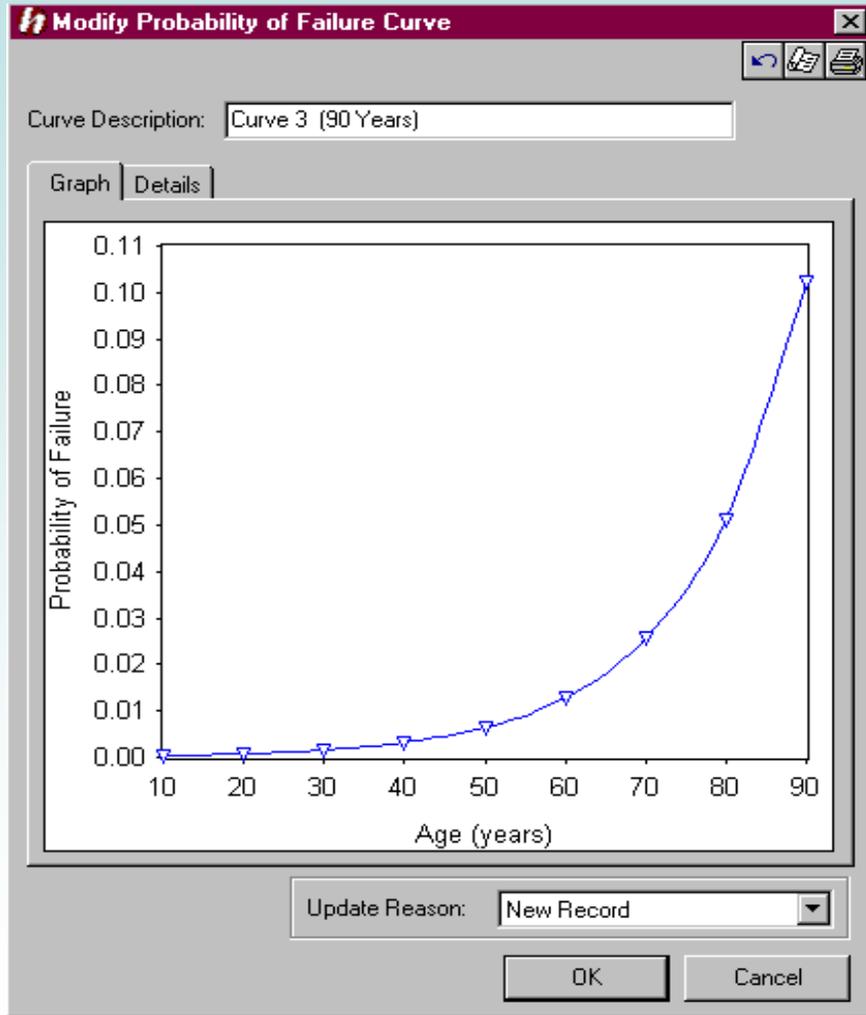
AssetLife



Risk
Management -
Definable Decay
Curves



AssetLife



Risk Management -
Definable
Probability of
Failure Curves



AssetLife

Risk Management - Multi-Trial Risk Analysis

Risk Analysis - SS000004 Reach - 1/1A-1/1B *

Highest Risk Failure Mode: **Remaining Life**

Date of Analysis: 07/08/2000

Cause of Failure:

Remaining Life: 25

Use Remaining Life from Costing

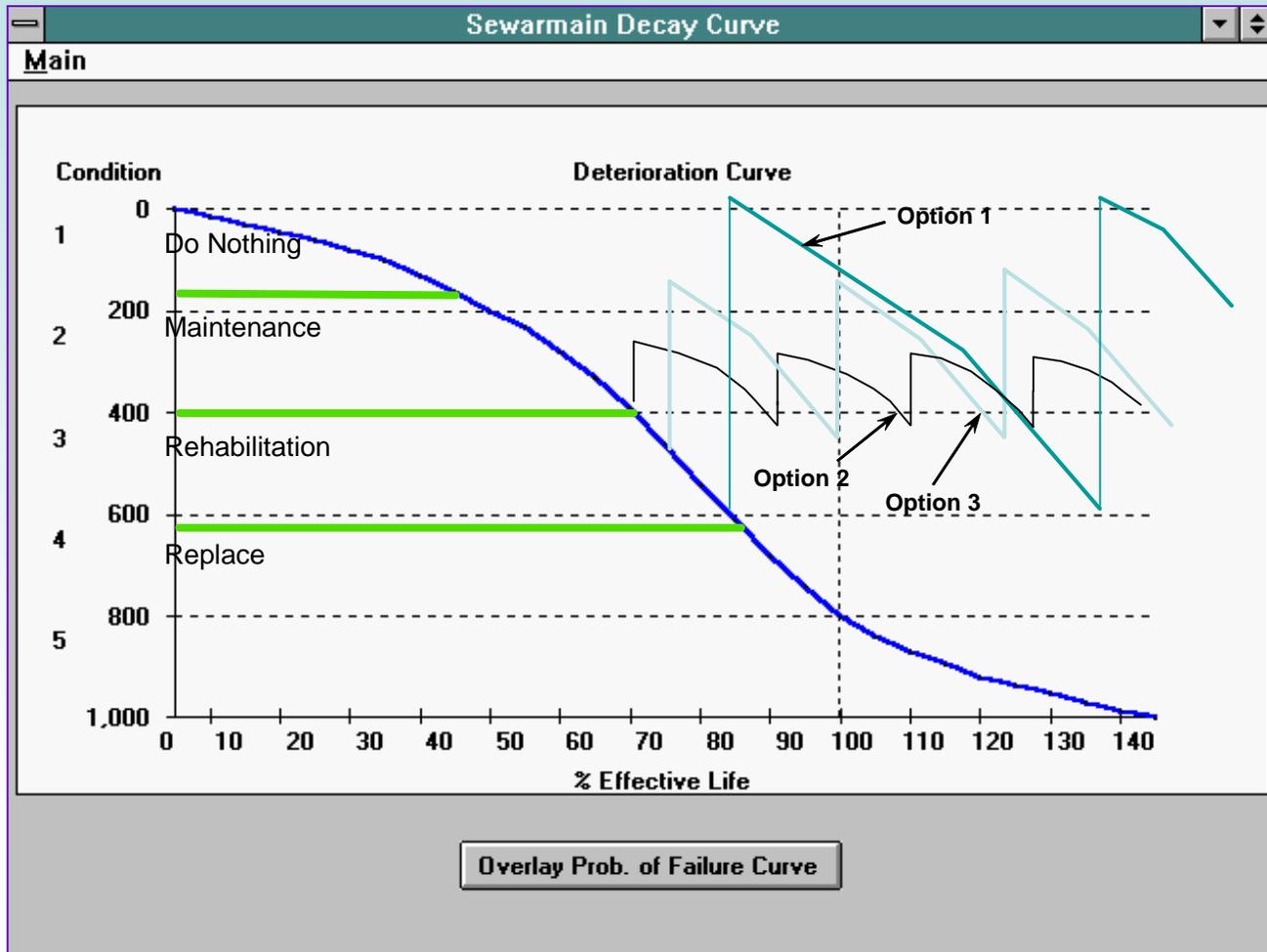
| Failure Mode | Weight | Area | Trial 1 | Trial 2 | |
|-------------------------------|--------|------|----------------------------------|---------------------------------|-----|
| | | | Remaining Life | Root Penetration | Str |
| Cost of Repairs | 30.00 | 1.00 | 2 - Costs less than \$10,000 | 2 - Costs less than \$10,000 | |
| Damage to 3rd Party | 20.00 | 1.00 | 2 - Liability less than \$10,000 | 6 - Liability between \$500,00 | |
| Environmental Damage | 10.00 | 1.00 | 0 - None | 0 - None | |
| Loss of Life | 40.00 | 1.00 | 20 - Loss of 1-2 lives | 200 - Loss of more than 10 live | |
| Total C.o.F. | | | 900.0000 | 8180.0000 | |
| Unit Cost Multiplier | | | 1.00 | 1.00 | |
| Calc. Probability of Failure | | | 0.0200 | 0.3000 | |
| No. of Redundancies | | | 1 | 1 | |
| Redundancy Factor | | | 1.0000 | 0.5000 | |
| Actual Probability of Failure | | | 0.0200 | 0.1500 | |
| Risk | | | 18.0000 | 1227.0000 | |

Buttons: Add Trial, Delete Trial, Delete, OK, Cancel



AssetLife

Risk Management - Multi-Trial Risk Analysis



NOI/Cash Generation Projections

Microsoft Excel - 2003 CIP Cash-NOI Projections-Bill.xls

File Edit View Insert Format Tools Data Window Help

Type a question for help

48%

Arial 14

161

| | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Water and Sewer CIP-based NOI Projections | | | | | | | | | |
| Fund 201 revenues | | | | | | | | | |
| <i>Fund 201 subtotal</i> | \$88,482,397 | \$95,049,926 | \$95,662,617 | \$99,584,413 | \$103,666,988 | \$107,916,933 | \$112,341,109 | \$125,125,161 | \$130,254,841 |
| Fund 203 revenues | | | | | | | | | |
| <i>subtotal 203 revenues</i> | \$7,538,877 | \$5,674,403 | \$6,429,081 | \$7,856,104 | \$7,391,148 | \$8,131,593 | \$8,277,656 | \$8,429,561 | \$8,387,543 |
| subtotal interest income | \$9,822,418 | \$6,056,800 | \$3,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 |
| Total 201 and 203 revenues | \$105,843,692 | \$106,780,929 | \$105,091,698 | \$109,440,517 | \$113,658,136 | \$118,048,526 | \$122,618,765 | \$135,554,722 | \$140,642,384 |
| <LESS> TOTAL PROJECTED EXPENSES | \$74,802,839 | \$77,319,840 | \$82,626,226 | \$90,619,705 | \$95,605,227 | \$97,771,069 | \$100,319,584 | \$114,059,922 | \$116,468,325 |
| <LESS> MANDATORY BOND COVERAGE RESE | \$2,445,205 | \$2,445,205 | \$2,445,300 | \$2,445,300 | \$2,445,500 | \$2,445,500 | \$2,445,500 | \$2,445,500 | \$2,445,400 |
| <LESS> Contingency | | | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 |
| <i>Revenue Coverage / Shortfall</i> | <i>33,486,888</i> | <i>27,015,854</i> | <i>18,020,172</i> | <i>14,375,513</i> | <i>13,667,465</i> | <i>15,832,957</i> | <i>17,853,581</i> | <i>17,045,866</i> | <i>15,728,658</i> |
| New Debt Service Impact - Scenario 1 - NRI | | | | | | | | | |
| Additional Debt Service | | | | \$15,376,425 | \$15,376,425 | \$15,376,425 | \$15,376,425 | \$15,376,425 | \$15,376,425 |
| Additional Bond Coverage Reserve Requirement | | | | \$1,537,643 | \$1,537,643 | \$1,537,643 | \$1,537,643 | \$1,537,643 | \$1,537,643 |
| <ADD> Total New (additional) Disbursements | | | | \$16,914,068 | \$16,914,068 | \$16,914,068 | \$16,914,068 | \$16,914,068 | \$16,914,068 |
| <i>Revised Coverage/Shortfall (reserve drawdown)</i> | <i>33,486,888</i> | <i>27,015,854</i> | <i>18,020,172</i> | <i>\$2,538,585</i> | <i>\$3,366,658</i> | <i>\$1,681,111</i> | <i>\$938,514</i> | <i>\$138,733</i> | <i>\$2,814,551</i> |
| New Debt Service Impact - Scenario 2 - ALL CIP | | | | | | | | | |
| Additional Debt Service | | | | \$47,800,000 | \$47,800,000 | \$47,800,000 | \$47,800,000 | \$47,800,000 | \$47,800,000 |
| Additional Bond Coverage Reserve Requirement | | | | \$4,780,000 | \$4,780,000 | \$4,780,000 | \$4,780,000 | \$4,780,000 | \$4,780,000 |
| <ADD> Total New (additional) Disbursements | | | | \$52,580,000 | \$52,580,000 | \$52,580,000 | \$52,580,000 | \$52,580,000 | \$52,580,000 |
| <i>Revised Coverage/Shortfall (reserve drawdown)</i> | <i>33,486,888</i> | <i>27,015,854</i> | <i>18,020,172</i> | <i>\$38,264,487</i> | <i>\$38,572,551</i> | <i>\$36,747,643</i> | <i>\$34,726,018</i> | <i>\$35,536,266</i> | <i>\$32,651,342</i> |
| New Debt Service Impact - Scenario 3 - Staged DS | | | | | | | | | |
| Additional Debt Service | | | | \$9,375,000 | \$9,375,000 | \$9,375,000 | \$17,879,564 | \$17,879,564 | \$17,879,564 |
| Additional Bond Coverage Reserve Requirement | | | | \$937,500 | \$937,500 | \$937,500 | \$1,787,956 | \$1,787,956 | \$1,787,956 |
| <ADD> Total New (additional) Disbursements | | | | \$10,312,500 | \$10,312,500 | \$10,312,500 | \$19,667,520 | \$19,667,520 | \$19,667,520 |
| <i>Revised Coverage/Shortfall (reserve drawdown)</i> | <i>33,486,888</i> | <i>27,015,854</i> | <i>18,020,172</i> | <i>\$4,063,013</i> | <i>\$3,284,565</i> | <i>\$5,526,457</i> | <i>\$1,813,533</i> | <i>\$2,617,726</i> | <i>\$61,138</i> |
| Parameters: | | | | | | | | | |
| Growth in customer-base | | | | | | | | | |
| Sewer | | 2.5% | 3.0% | 4.1% | 4.1% | 4.1% | 4.1% | 4.1% | 4.1% |
| Water | | 4.0% | 4.5% | 4.1% | 4.1% | 4.1% | 4.1% | 4.1% | 4.1% |
| Connection fee rate increase | | | 100.0% | 4.0% | 4.0% | 4.0% | 4.0% | 4.0% | 4.0% |
| Rate Increase Assumptions | | | | | | | | | |
| Sewer | | | | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Water | | | | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| South Fulton water Purchase in 2008 | | | | | | | | 125% | |
| ## Cauley creek Reuse revenue is based on Cont | | | | | | | | | |

Charts W-WW Revs & Totals Debt Service Calculator W-WW Expenses Cash Flow

Ready

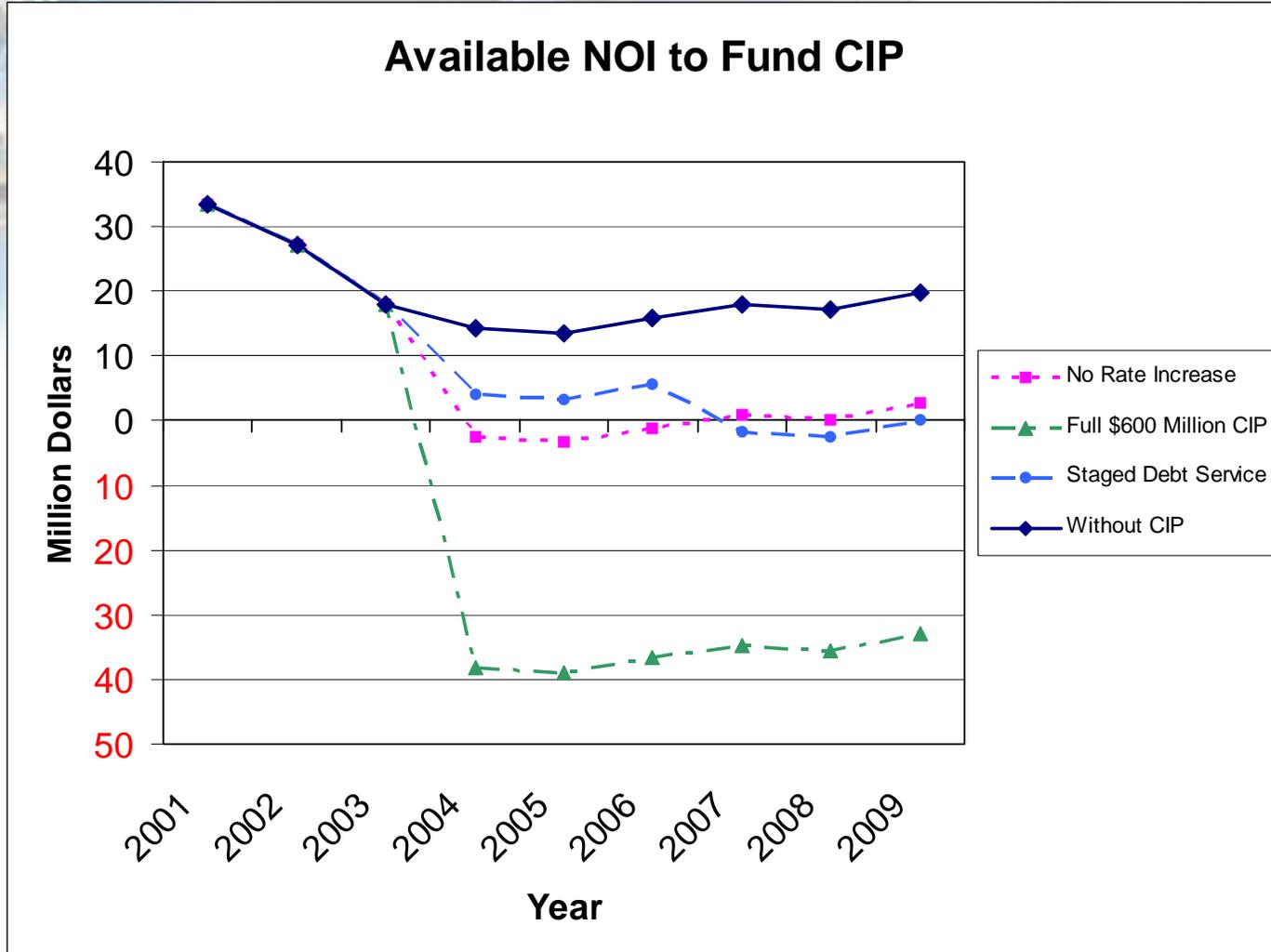
Start C:\Docume... Inbox - Mic... Music Sojou... Live365 - Pl... Microsoft P... Microsoft ... SpecificPOP... 8:24 AM

Alternative Funding Scenarios

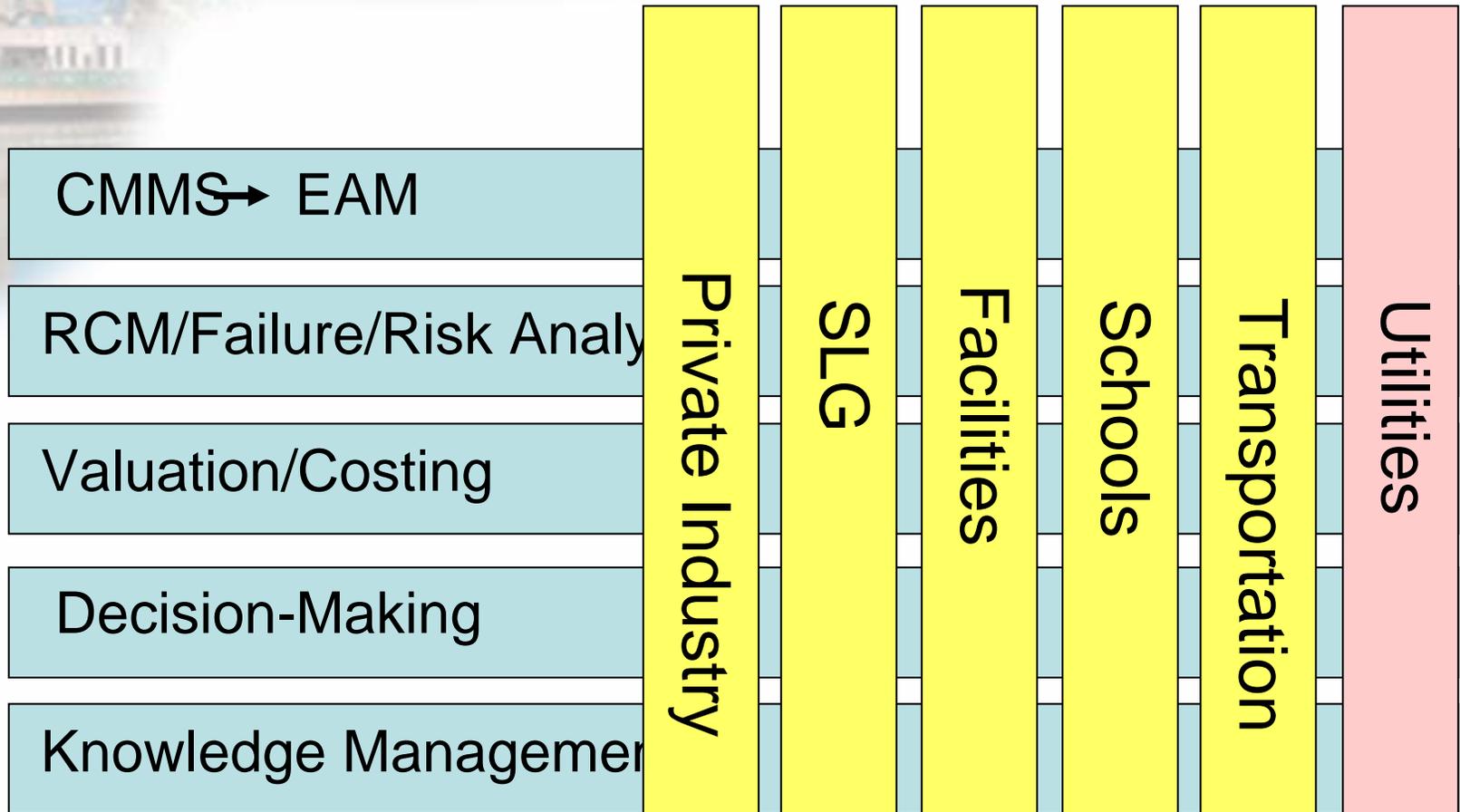
| Scenario | Gross Bond Amount (millions) | Net Bond Proceeds (millions) | Annual Debt Service (millions) | Notes |
|---|------------------------------|------------------------------|--------------------------------|--|
| 1. No rate increase | \$215.0 | \$193.5 | \$15.4 | Current 201/203 available cash balances pay for current 203 projects for all scenarios |
| 2. Fund all \$600 million initially | \$668.4 | \$601.5 | \$47.8 | 30 to 35% immediate rate increase |
| 3. Staged Debt Service | \$250.0 | \$225.0 | \$9.4 \$17.9 | 3 years of interest only |
| 4. "Just in time" capacity, obligations | \$230.0 | \$207.0 | \$8.6 \$16.5 | 3 years of interest only; meets "bottom line" capacity requirements and commitments |

Bond assumptions: 20 year term, semi-annual payments, 3.75% rate, 10% cost-to-issue, initial payment in June 2004

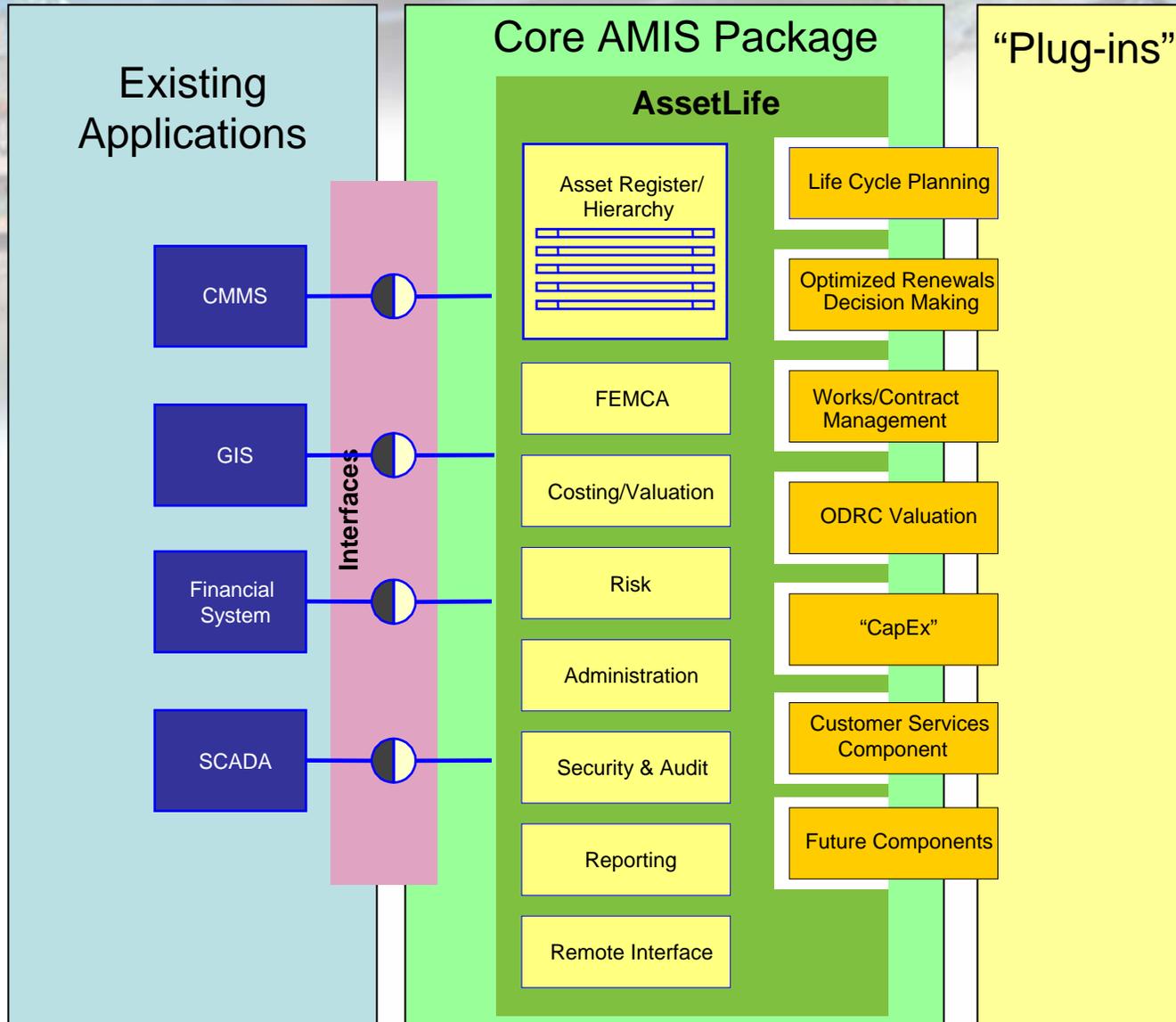
Cash Impact By Scenario



3. Architecture/Integration of Tools



3. Architecture/Integration of Tools



Most agencies find it much more cost-effective to build on existing platforms, step-by-step.

“ERP” Versus “Integrated Suite”

Integrated Suite

1. Deploy

| Integrated Suite Applications | | | | | | | |
|-------------------------------|-----------|-------|---------------|--------------------------|------------------|-------------------|---------------|
| CMMS | Valuation | SCADA | Materials Mgt | Environmental Management | Decision Support | Environmental Mgt | Interface Mgt |

2. Modify Work Processes to fit those embedded in Suite

- Hansen USA
- DataStream
- MRO Maximo
- Synergen
- GBA Master Series

“ERP”

1. Refine work processes

- Determine “As Is”
- Identify “To be”

2. Program “business logic” using programming tools built into the ERP package

3. Deploy

- SAP
- Oracle
- PeopleSoft
- JD Edwards

"Best of Breed"

CMMS/ EAMS

CMMS – Driven:

DataStream
MRO Maximo
Synergen
Hansen
GBA MasterSeries
IVARA

GIS – Driven:

City Works
ESRI ARCFM

AAM

AssetLife
HRA Nessie Model
CAPFinance
KANEW
AWWA Infrastructure Manager

Plug-In Applications May Be Relatively Inexpensive – AWWA's "Plant Manager"

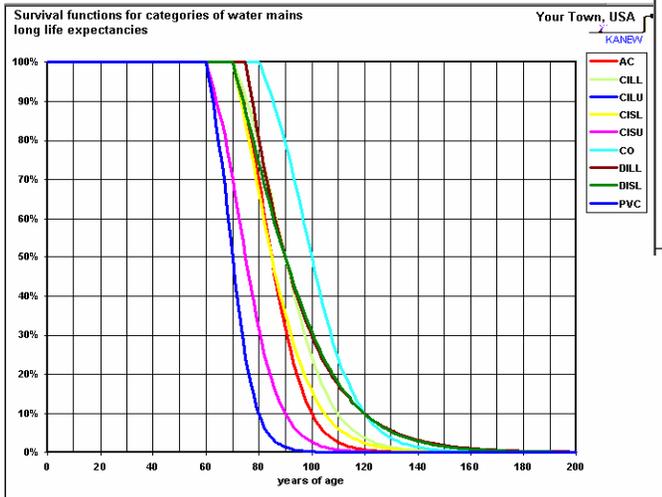
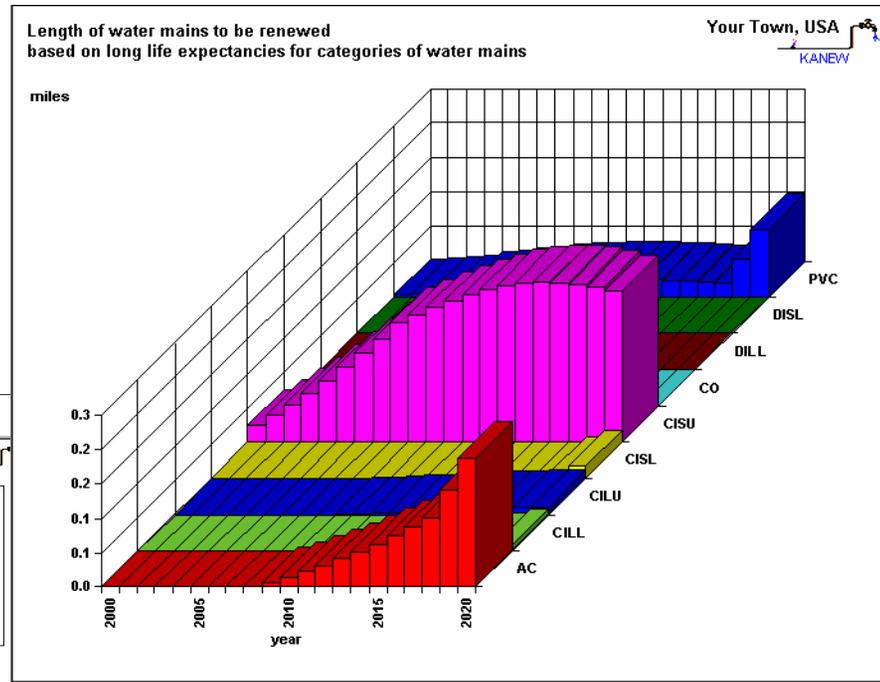
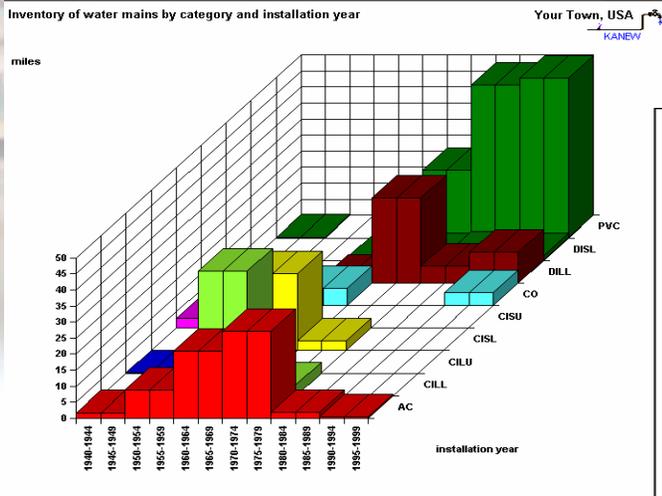
AWWA Research Foundation Water Treatment Plant Infrastructure Assessment Manager

Facility **Water Treatment Facility** **Score: 0**

| Systems in this Facility | Weight Percent | Individual System Score | Weighted System Score |
|--------------------------------|----------------|-------------------------|-----------------------|
| Raw Water System | 0 | 0.00 | 0.00 |
| Water Treatment System | 0 | 0.00 | 0.00 |
| Chemical Systems (excl. ozone) | 0 | 0.00 | 0.00 |
| Ozonation System | 0 | 0.00 | 0.00 |
| Finished Water System | 0 | 0.00 | 0.00 |
| Buildings | 0 | 0.00 | 0.00 |
| Support Systems | 0 | 0.00 | 0.00 |
| Civil / Sitework System | 0 | 0.00 | 0.00 |

Total Weight Percent: 0

Plug-In Applications May Be Relatively Inexpensive – AWWA's "Kanew"



Plug-In Applications May Be Relatively Inexpensive: USEPA's Environmental Finance Center (Boise State) "CAP Finance"

Gravity Collection Sewer
Data Set: Example

Use the 'Tab' key to move from field to field.

| System Account Group Identifier | Year of Installation | Inflation Rate Over Useful Life (%) | Estimation of Useful Life (yrs) | * Installation Cost in Install Year Dollars | * Installation Cost in Current Year Dollars | Accumulated Reserves for Replacement Funding | Interest Rate on Replacement Debt (%) | Amo Pe Rep |
|---------------------------------|----------------------|-------------------------------------|---------------------------------|---|---|--|---------------------------------------|------------|
| East Side | 1995 | 1.00% | 30 | \$85,000 | \$ | \$ | 3.00% | |
| Foothills East | 1997 | 2.60% | 30 | \$100,000 | \$ | \$ | 2.50% | |
| South Side | 1990 | 1.20% | 25 | \$88,755 | \$100,000 | \$25,000 | 3.00% | |

* If Installation Cost is entered in Current Year Dollars CAPFinance will calculate the cost in Installation Year Dollars.

Account Summary-WasteWater

Account: Gravity Collection Sewer 2003 Asset Group Replacement Cost \$312,395.55

East Side
Installation Year: 1995 Estimated Useful Life (in years): 30 Reserve Funding Goal: 75%
Future Debt Amortization Period: 20 Future Debt Interest Rate: 3%

| | |
|--|------------|
| Future replacement cost in 2025 | \$ 114,367 |
| Renewal and replacement reserve withdrawal in 2025 | \$ 85,923 |
| Annual replacement reserve from 2003 to 2025 | \$ 3,311 |
| Future annual debt payments from 2025 to 2045 | \$ 1,925 |
| Future annual reserve from 2025 to 2055 | \$ 2,864 |

Foothills East
Installation Year: 1997 Estimated Useful Life (in years): 30 Reserve Funding Goal: 65%
Future Debt Amortization Period: 20 Future Debt Interest Rate: 3%

| | |
|--|------------|
| Future replacement cost in 2027 | \$ 215,984 |
| Renewal and replacement reserve withdrawal in 2027 | \$ 140,339 |
| Annual replacement reserve from 2003 to 2027 | \$ 4,236 |
| Future annual debt payments from 2027 to 2047 | \$ 4,849 |
| Future annual reserve from 2027 to 2057 | \$ 4,630 |

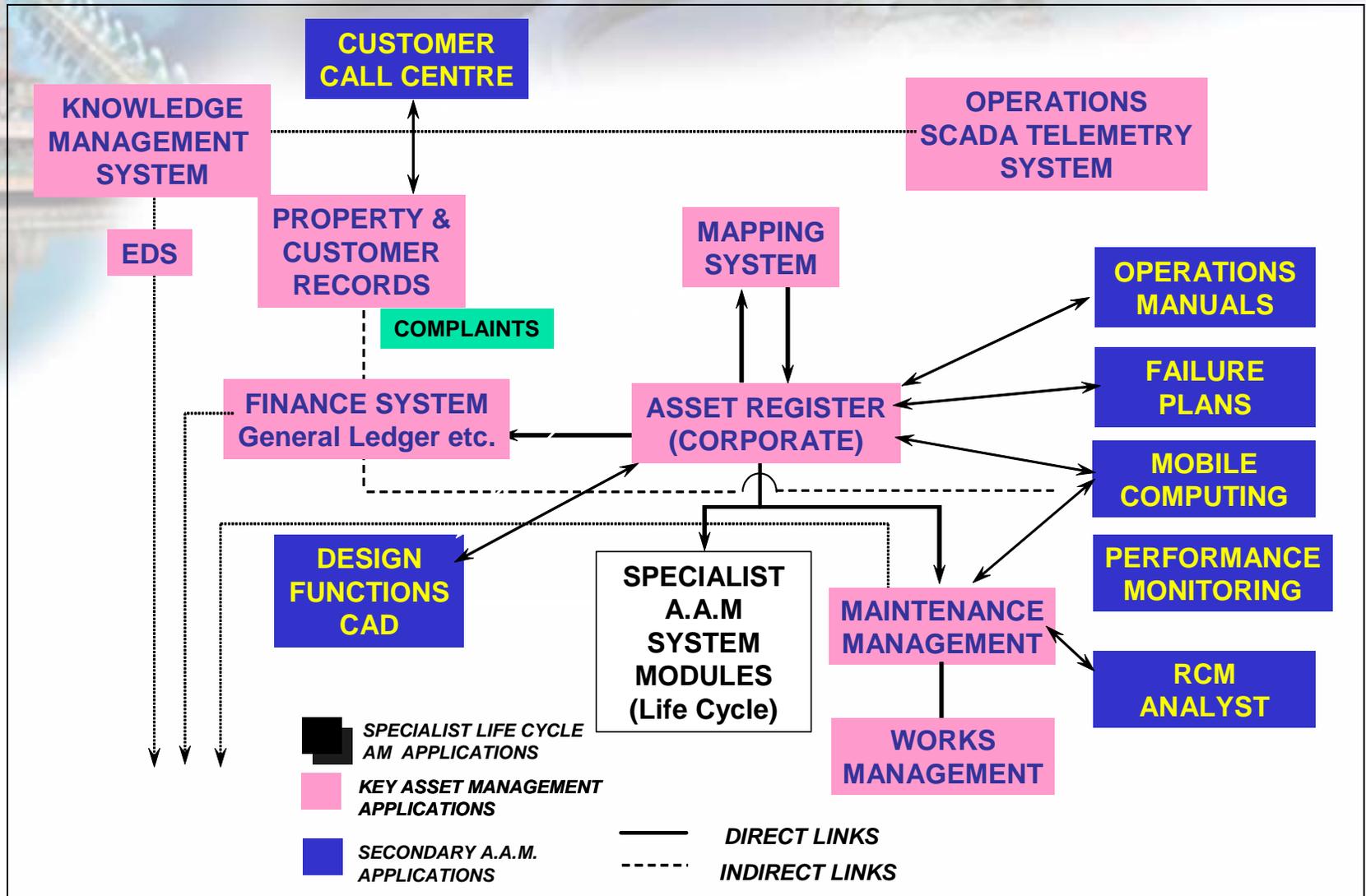
South Side
Installation Year: 1990 Estimated Useful Life (in years): 25 Reserve Funding Goal: 90%
Future Debt Amortization Period: 20 Future Debt Interest Rate: 3%

| | |
|--|------------|
| Future replacement cost in 2015 | \$ 119,393 |
| Renewal and replacement reserve withdrawal in 2015 | \$ 99,796 |
| Annual replacement reserve from 2003 to 2015 | \$ 6,912 |
| Future annual debt payments from 2015 to 2035 | \$ 4,019 |
| Future annual reserve from 2015 to 2040 | \$ 2,392 |

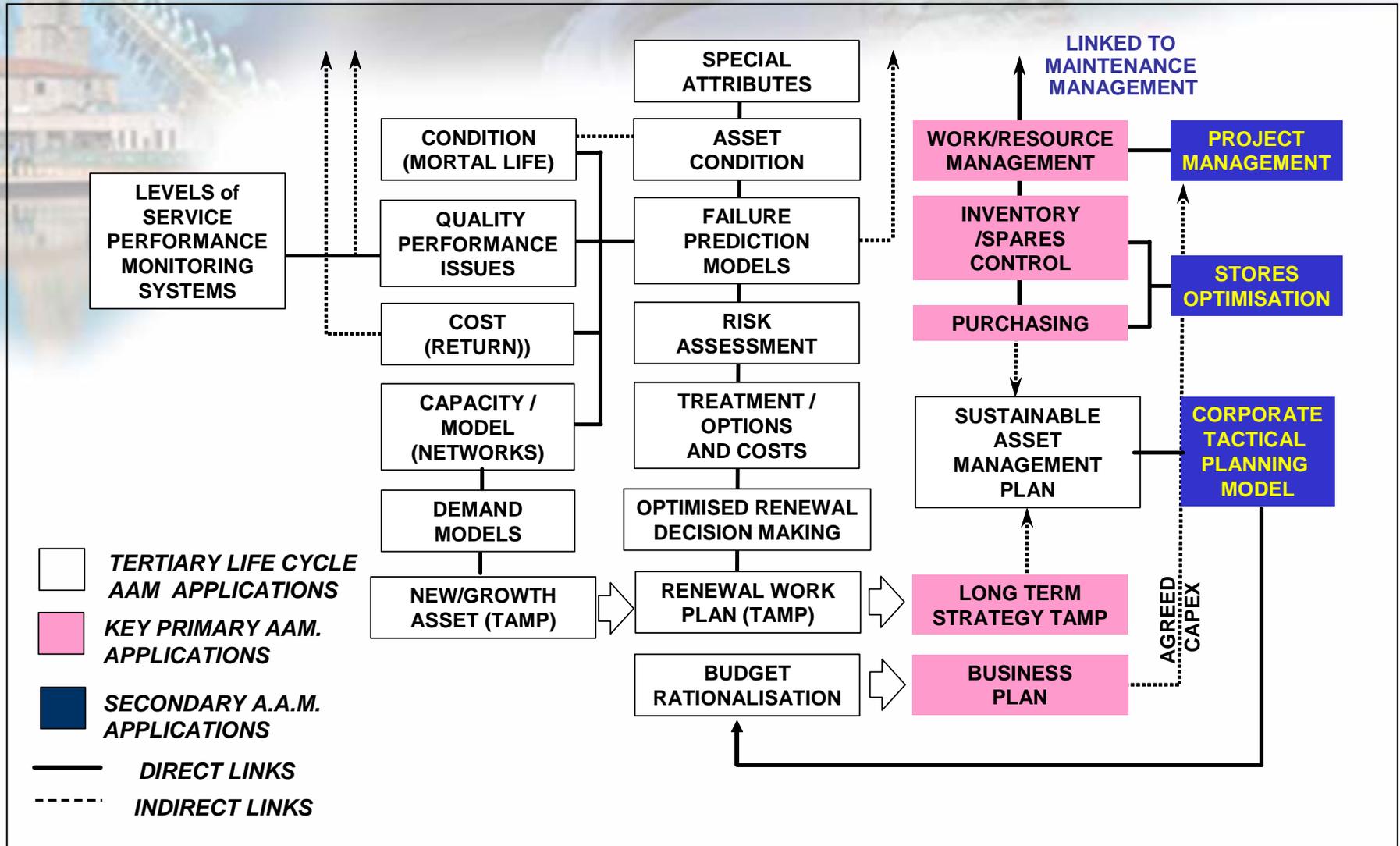
Selected Data set: Example Page 1 of 2 11/21/2003

Please Click On An Account →

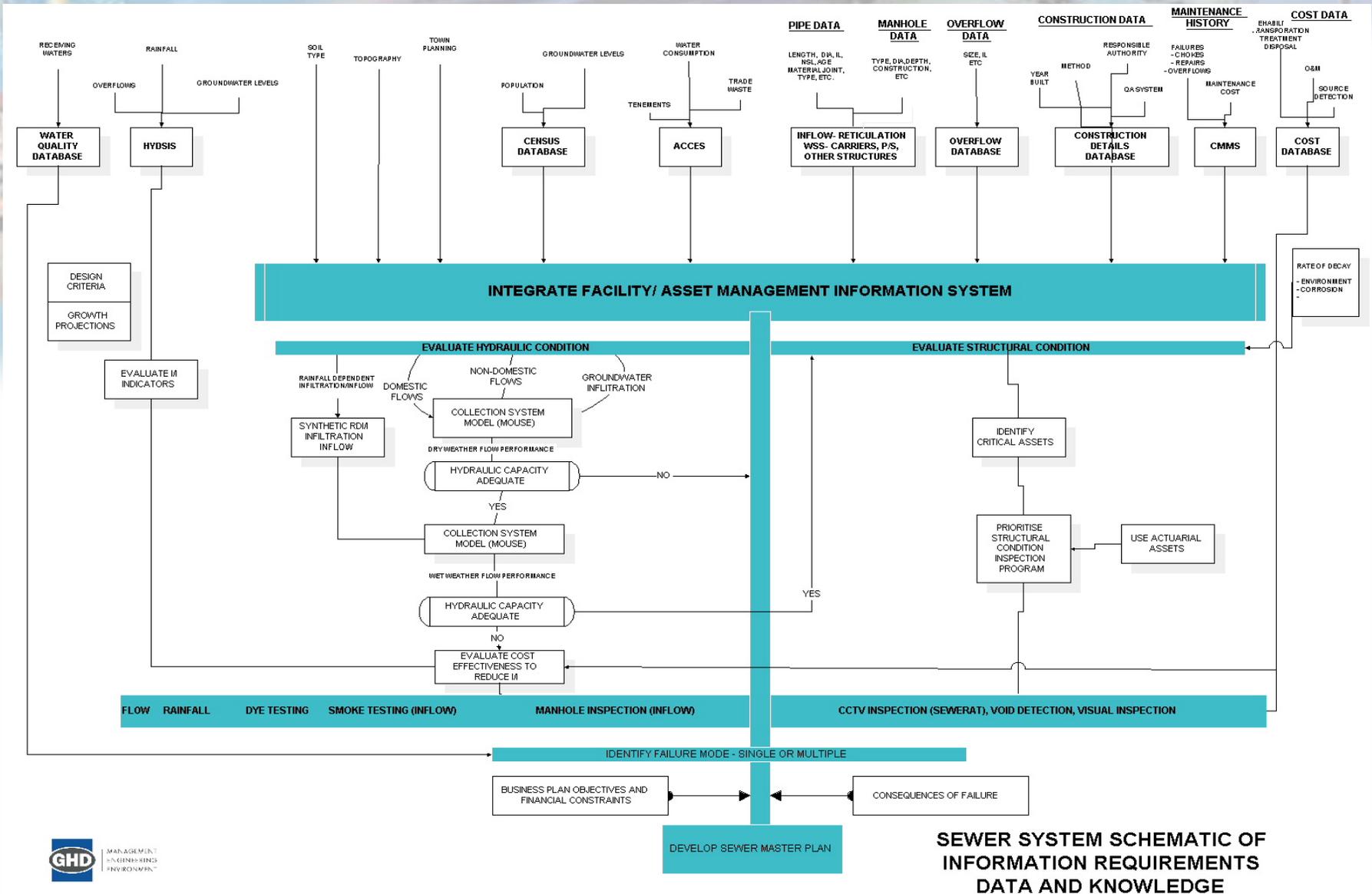
Idealized Model of Integrated Functionality



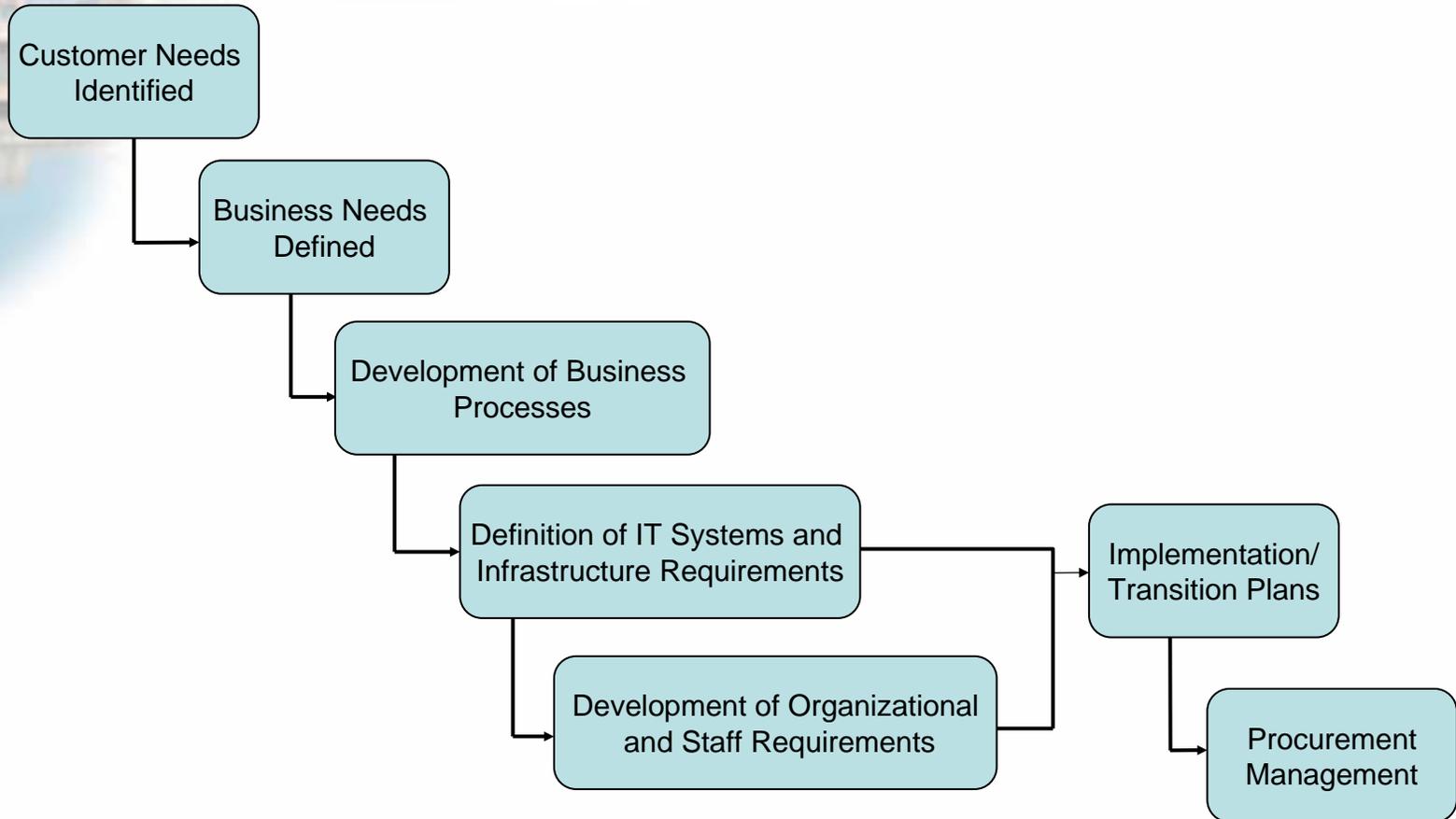
Idealized Model of Integrated Functionality



Dataflow Diagrams – Work Process + Data



The System Design/Integration Process

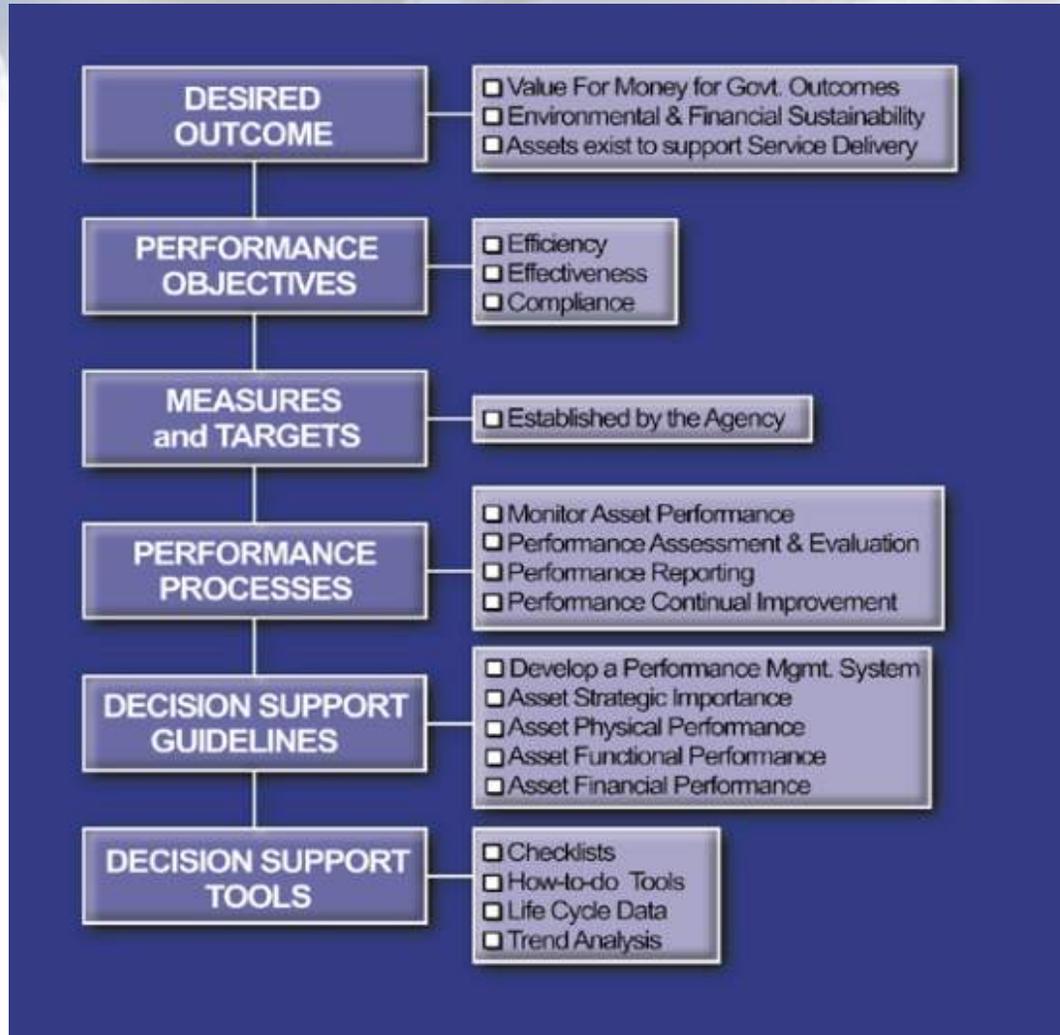


4. Knowledge Management

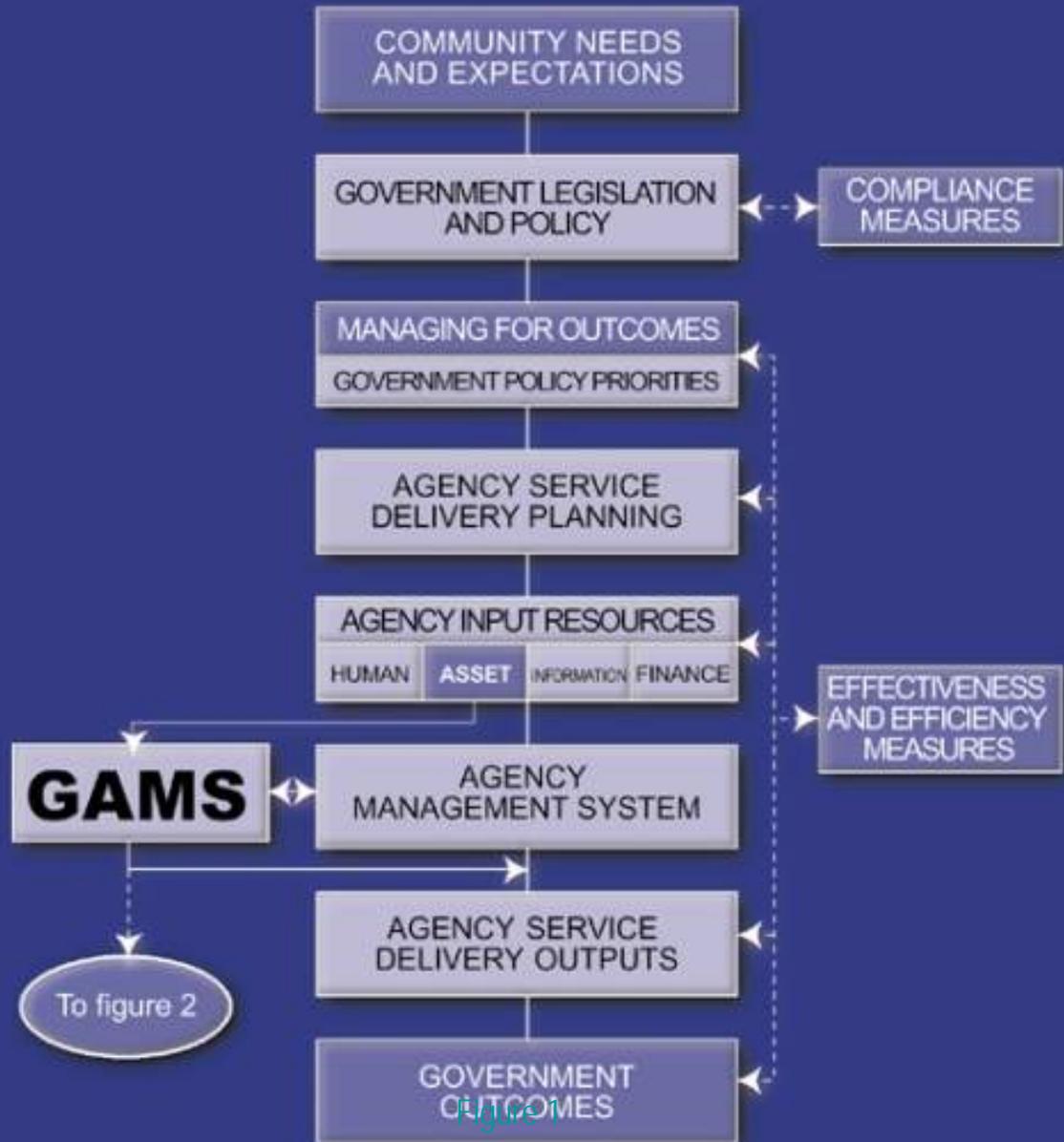
The screenshot shows the GAMS website interface in Microsoft Internet Explorer. The main content area displays a process flow diagram under the heading 'Major Processes'. The first major process is 'ASSIGN ROLES AND FUNCTIONS', which includes the role of 'ASSET MANAGER'. This process leads to 'EVALUATE CURRENT PLANS AND POLICIES', which then leads to 'REVIEW THE ASSET PROFILE'. To the right of each major process is a 'Sub-Process Steps' box. For 'ASSIGN ROLES AND FUNCTIONS', the steps include Roles, Responsibilities, and Competencies. For 'EVALUATE CURRENT PLANS AND POLICIES', the steps include Getting Started and Review agency policies and procedures. For 'REVIEW THE ASSET PROFILE', the steps include Strategic profile, Physical profile, Functional profile, Financial profile, and Maintenance Information System. A left-hand navigation menu lists various categories like Plan, Invest, Operate, and Maintain, with sub-items under 'Asset Maintenance - Process'.

Bedding down EAM work processes in the organization is critical to sustaining long term improvements

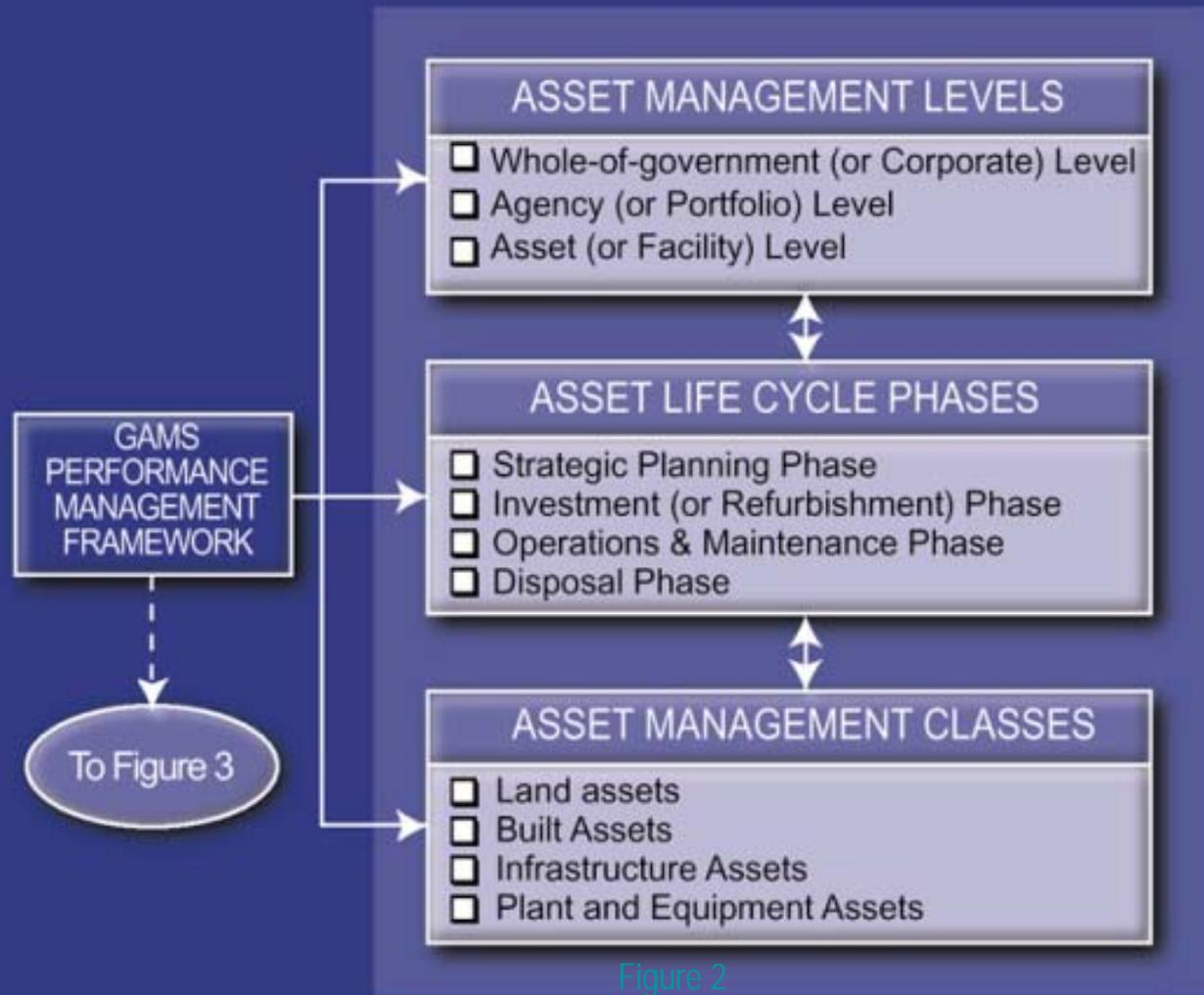
4. Knowledge Management



GAMS IN A "MANAGING FOR OUTCOMES" ENVIRONMENT



THE GAMS ASSET MANAGEMENT FRAMEWORK



GAMS PERFORMANCE MANAGEMENT FRAMEWORK

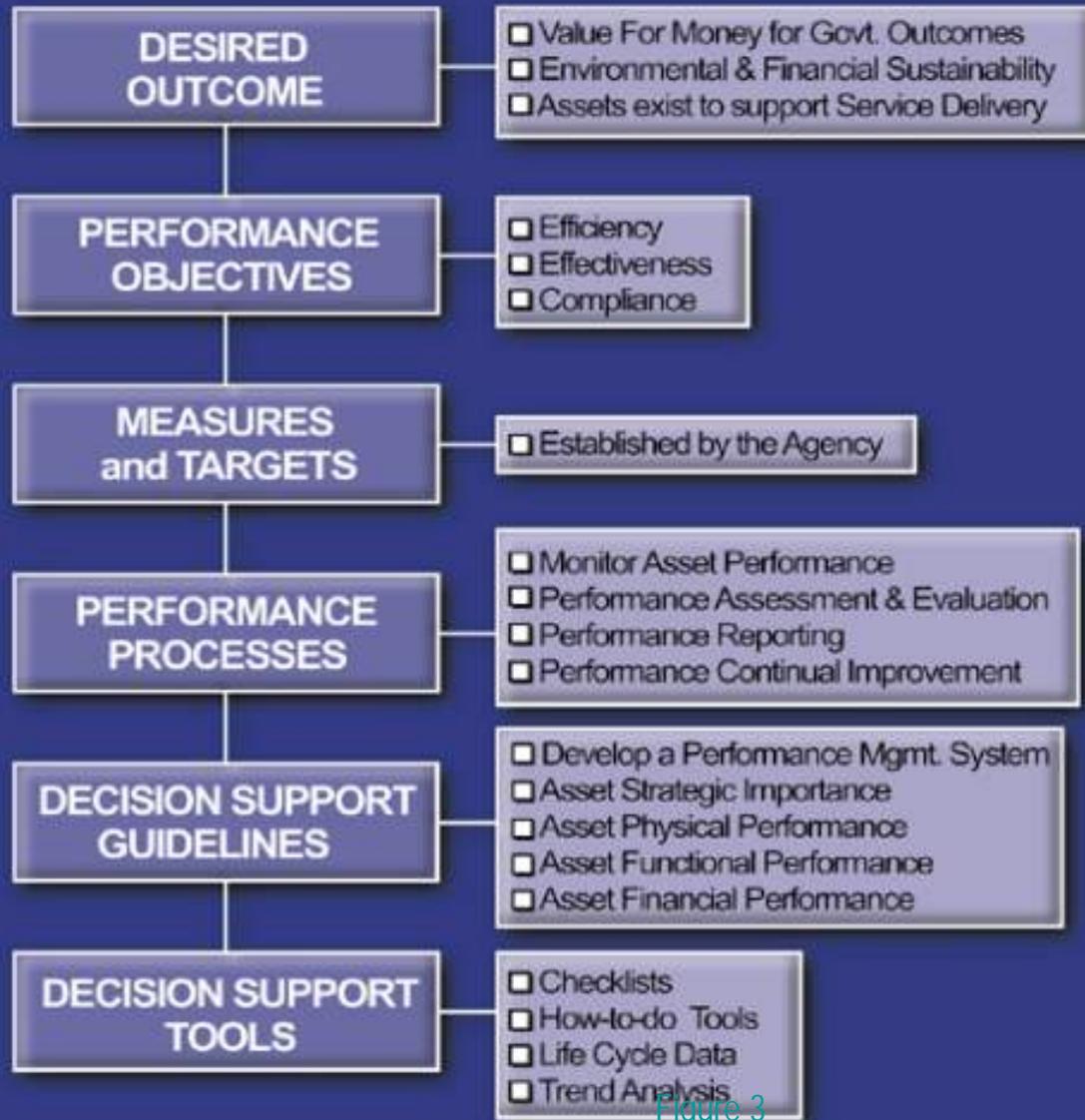


Figure 3

4. Knowledge Management

GUIDELINES
FEEDBACK
CONTACT

- Overview
- Planning
- Investment
- MAINTENANCE**
- Management
- Disposal
- Tools

MAINTENANCE PLANNING

- Flow Diagram
- Definition
- Objective
- Benefits
- Risks
- Process
- Framework
- Strategic Plan
- Performance
- Reference Material

Maintenance Management

Maintenance Management Framework - Flow Diagram

```
graph TD; A[Whole-of-Government Reporting (QBIS)] --> B[Maintenance Policy, Standards & Strategy]; B --> C[Maintenance Strategic Planning]; C --> D[Maintenance Implementation]; D --> E[Condition Assessment]; D --> F[Maintenance Planning]; D --> G[Budget Allocation]; D --> H[Maintenance Service Procurement]; E --> I[Maintenance Works Program]; F --> I; G --> I; H --> I; I --> J[Maintenance Information]; J --> K[Maintenance Performance]; K --> L[Maintenance Reporting]; L --> A;
```

Definition

Maintenance Strategic Planning is the process that provides a strategic link between an agency's maintenance program and its corporate directions and core business. Maintenance Strategic Planning allows an agency to plan and implement a maintenance program in alignment with its capital investment, operational and disposal plans.

The process of maintaining physical assets covers all actions necessary for:

- retaining an asset in a specified condition
- restoring an asset to a specified condition

The Role of the "Data View"

Storm - Structure Inventory

Structure # 5847S-001 Basin STM005 Sewer Connection

Facility 1 Happyville **Asset Record View** Operational

Address 339 S BLECKLE Lot Location SE

Gen. Location Bridge Southeast of the Intersection of Kellogg St

General | Inspections | User Defined | Comments

Owner 0 N/A Street Slope 0 N/A

Structure Type 7 Bridge Rim Elevation GPS Flag

Location 14 Streamway Rim Status 5 Field Survey

Surface Type 2 Concrete Struct Depth (ft) Inside Length (in) 360.00

Outlet To 5846S-099 Inside Width (in) 60.00 Wall Thick (in) 12.00

Cover Type 0 None # of In Conduits 3

Wall Material 4 Poured # of Out Conduits 3

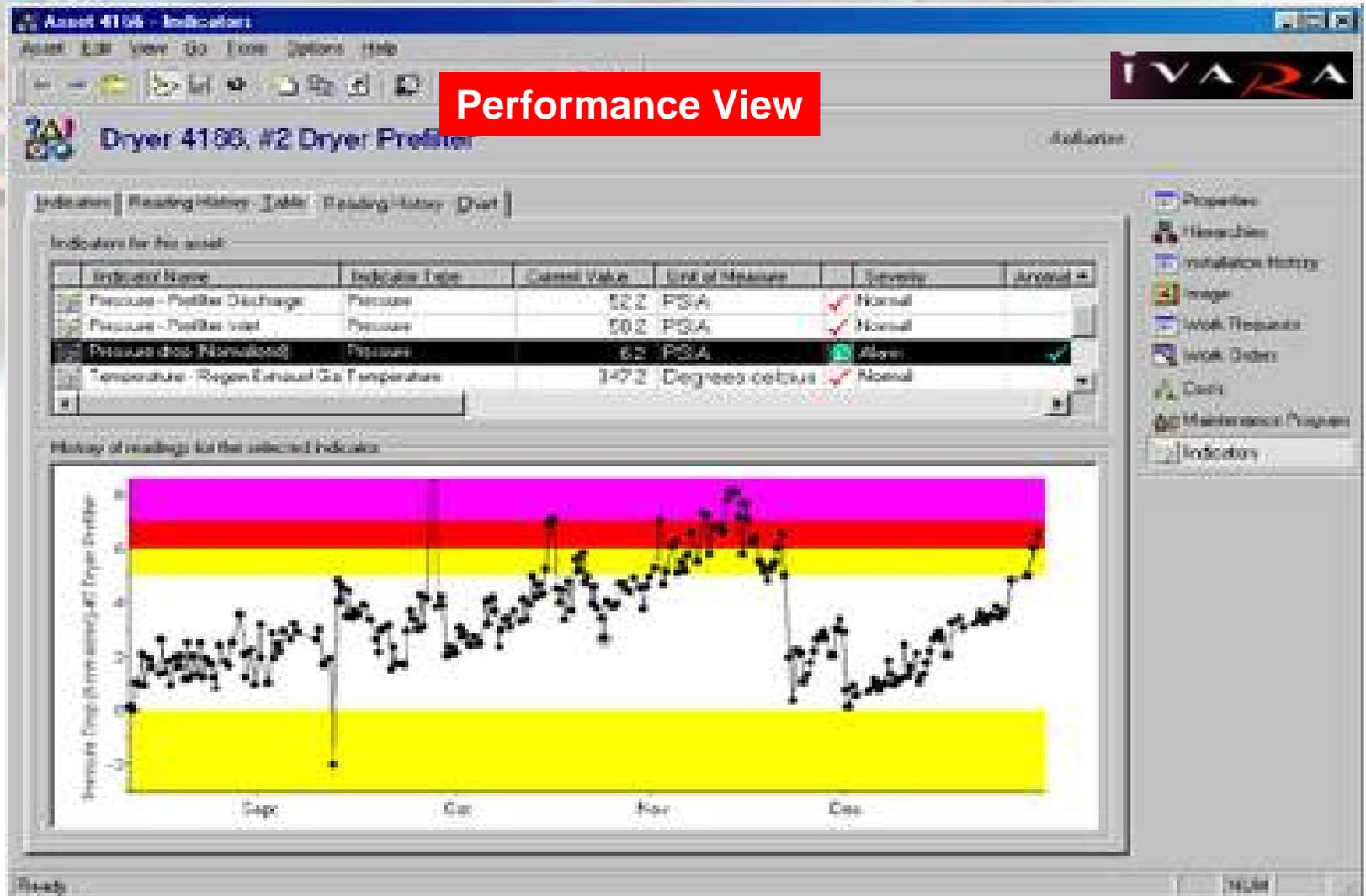
Inlet Information

Capacity 2.56 Inlet Area 250.00 % Impervious 75.00

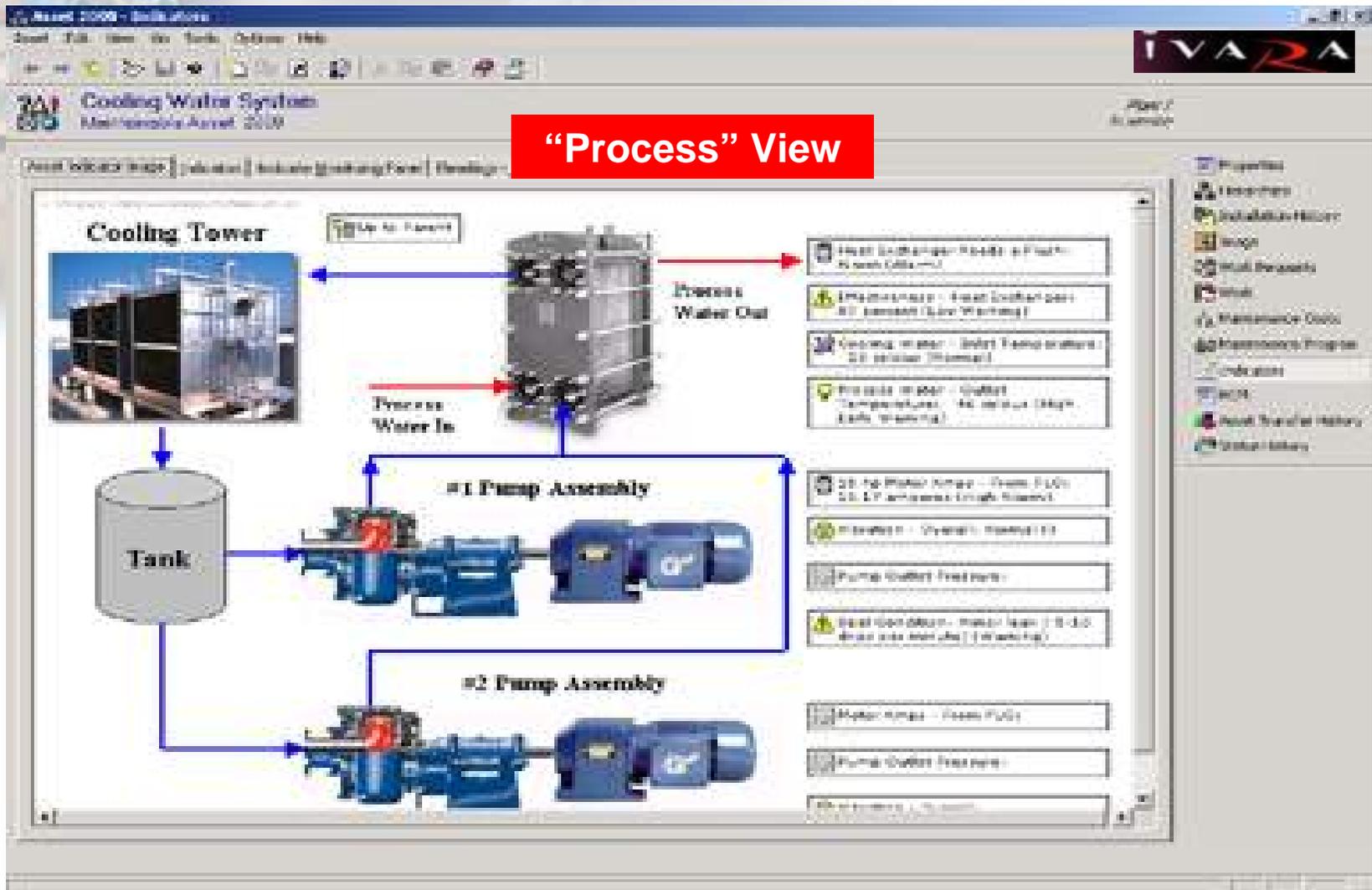
| Inlet Number | Facing Code | Inlet Width | Inlet Length | Catchment Area | C Coefficient | % Impervious | Average Slope | Ir |
|--------------|-------------|-------------|--------------|----------------|---------------|--------------|---------------|----|
| 1 | North | 8.00 | 24.00 | 100 | 0.90 | 75.00 | 1.00 | 3 |
| 2 | South | 8.00 | 24.00 | 150 | 0.91 | 70.00 | 1.25 | 2 |

Record 1 of 166 View Mode Ready...

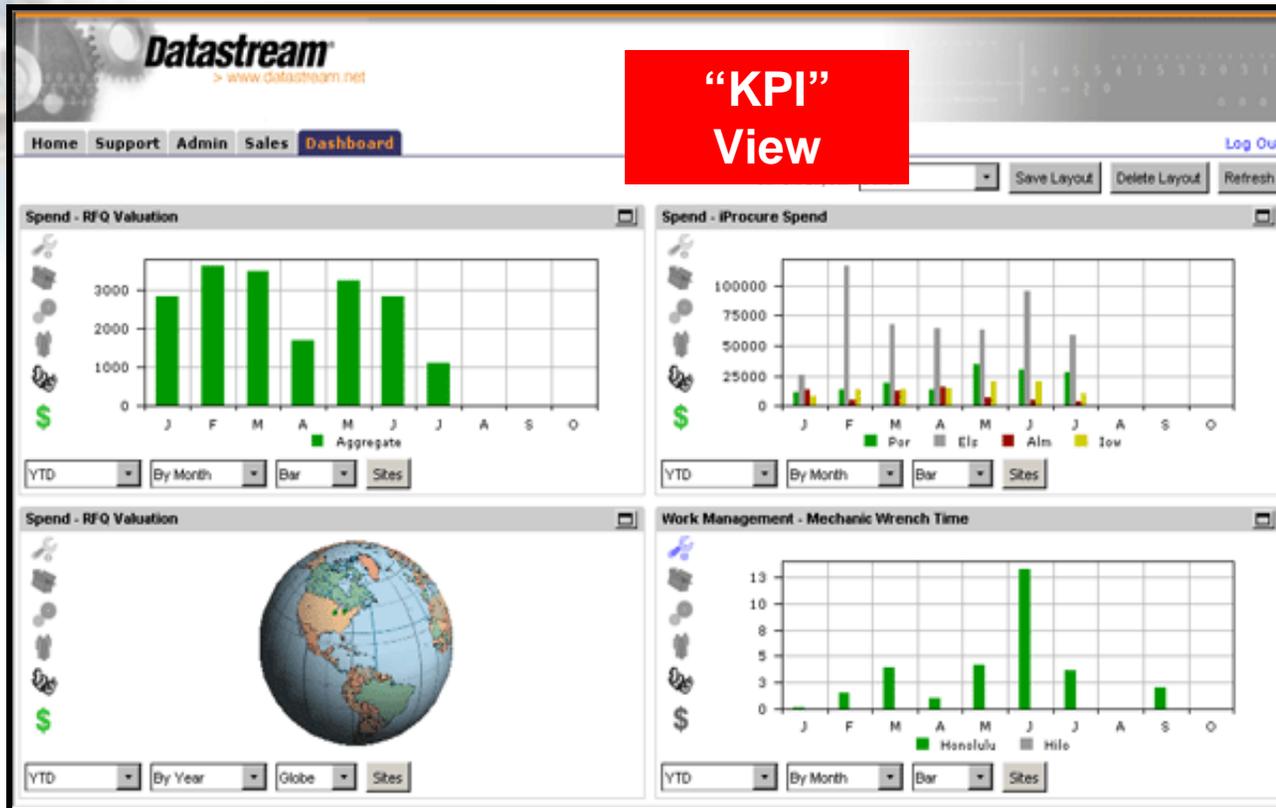
The Role of the "Data View"

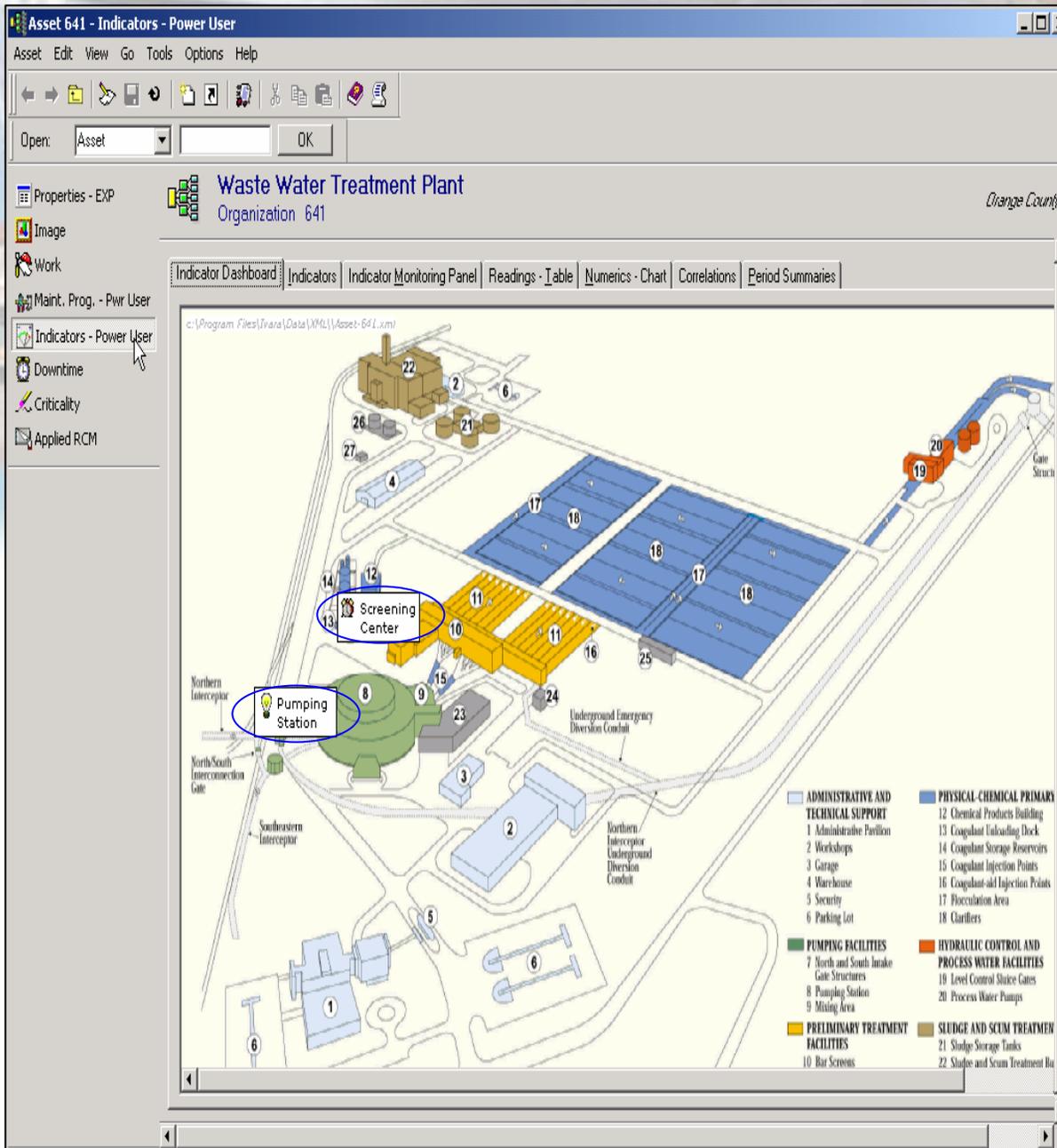


The Role of the "Data View"



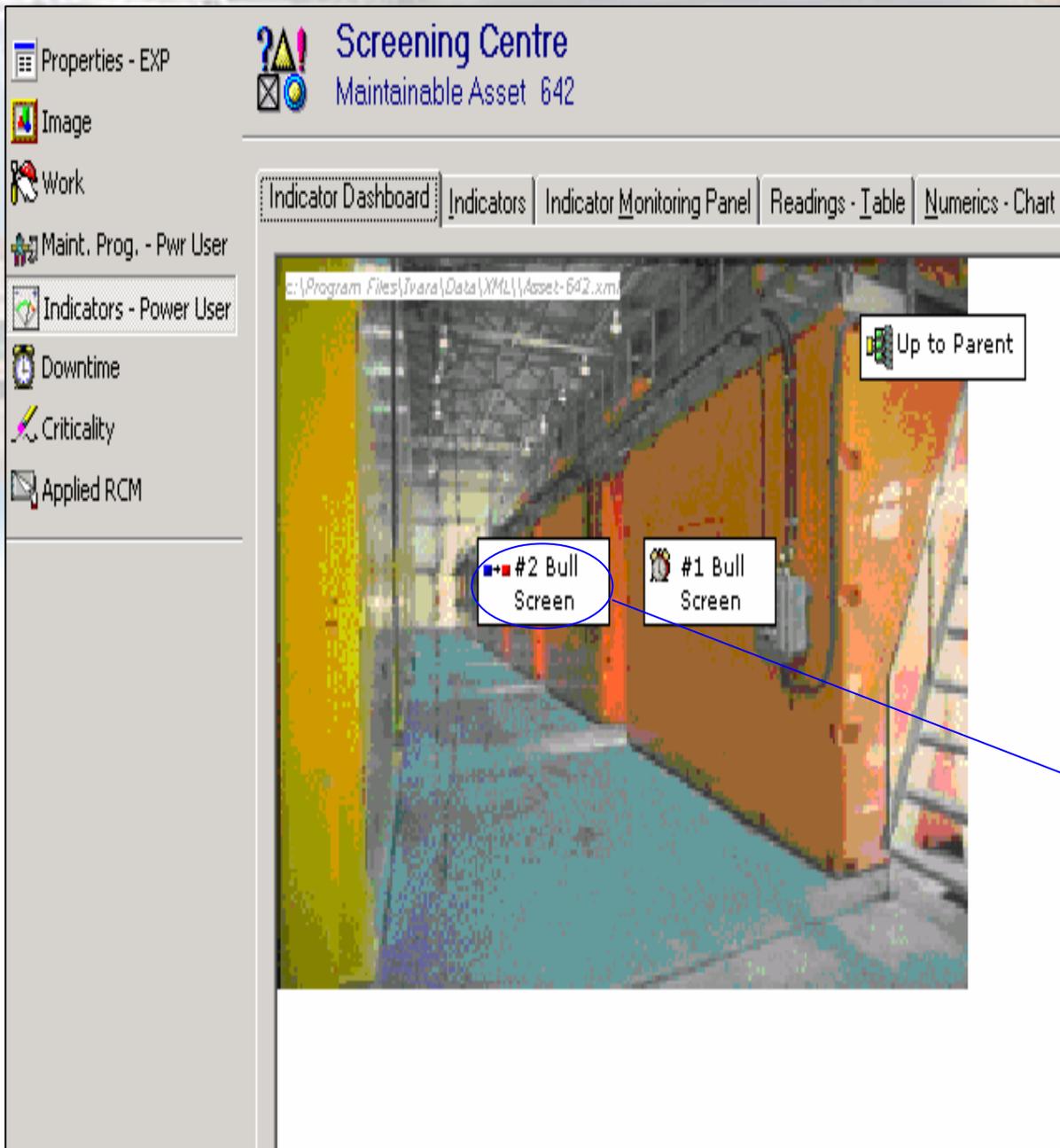
The Role of the "Data View"





Navigation by Images

- Click on the hotlinks to drill in.
- Icons (blinking) show highest alarm on each hotlinked asset
- Easy to use/understand



Navigation by Images

- Down one level at the Screening Center
- More hotlinks to child assets
- Blinking icons for assets in alarm condition

Properties - EXP
 Image
 Work
 Maint. Prog. - Pwr User
 Indicators - Power User
 Downtime
 Criticality
 Applied RCM

Bull Screen, #1 Bull Screen System, Screening Centre
 Maintainable Asset 645

Orange C
 RL

Indicator Dashboard | Indicators | Indicator Monitoring Panel | Readings - Table | Numerics - Chart | Correlations | Period Summaries

c:\Program Files\Inara\Data\XML\Asset-645.xml

Up to Parent

- Condition of Shovel Control Cable: Worn Strands (Early warning)
- Condition of Shovel Lift Control Cable:
- Condition of Shovel Lift Wench Drum:
- Motor Amps (from PLC): 16.000 amperes (High Urgent)
- Oil - Iron Content:
- Tank Oil Level:
- Coupling Condition:
- Vibration Overall:
- Oil - Water Content:
- Panel Infrared Scan:
- Condition of Guide Structure:

VUE D'ENSEMBLE DU DÉGRILLEUR MIO-011

Navigation by Images

- One more level down
- Number of levels not restricted
- Key indicator dashboard on critical assets
- Blinking icons show severity, words show condition
- Interactive links (right mouse click)

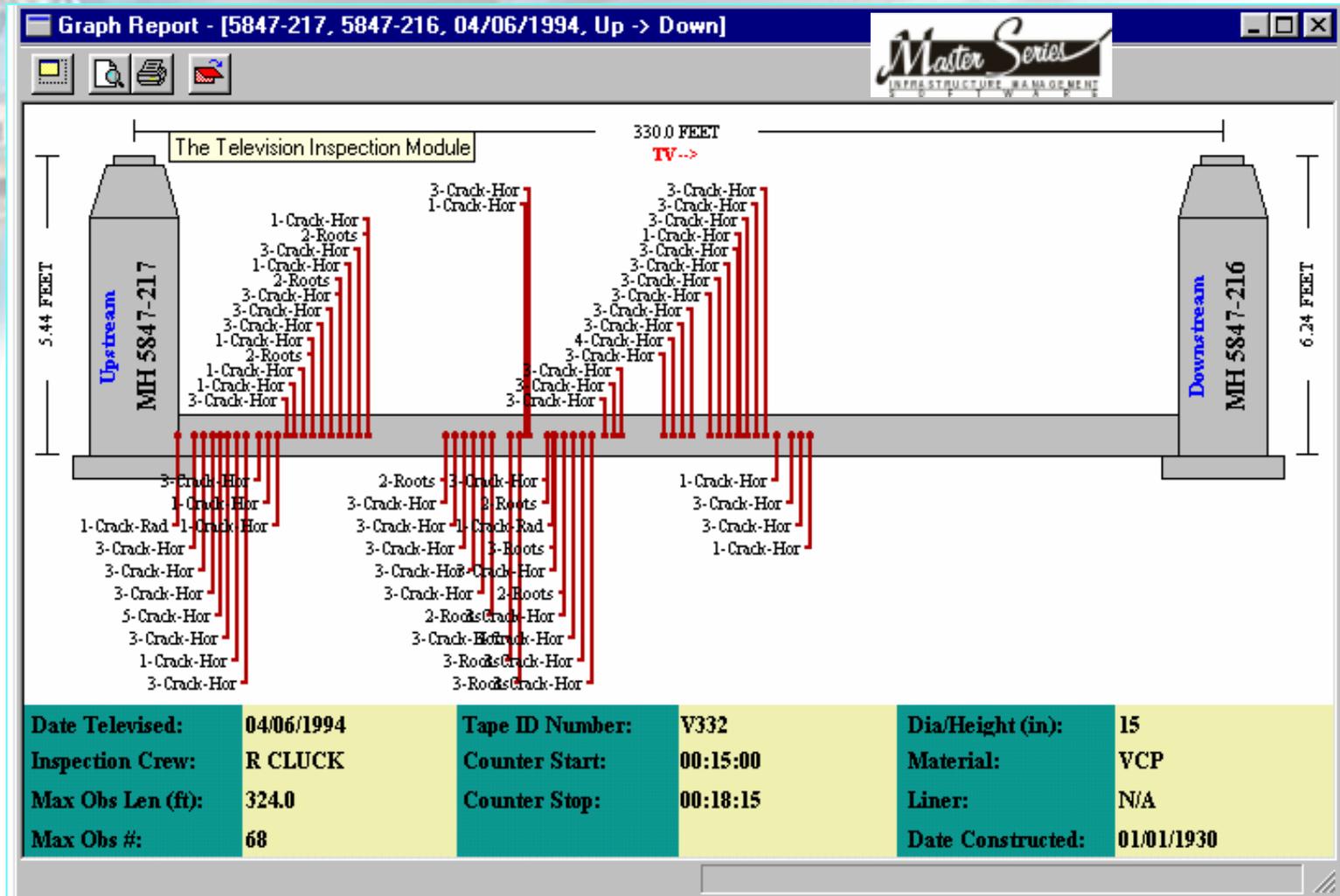
Friendly Work Process Interface

The screenshot displays the 'GBA Work Schedule' application window. The title bar includes a scale dropdown set to 1.0 and a toolbar with various navigation and editing icons. The main content area shows a calendar for October 1998, with the week of October 5 selected. The calendar grid has columns for days of the week and rows for dates. Work orders are represented by colored bars and icons (like a sewer pipe or a sign) with arrows indicating their duration across days. The work orders include:

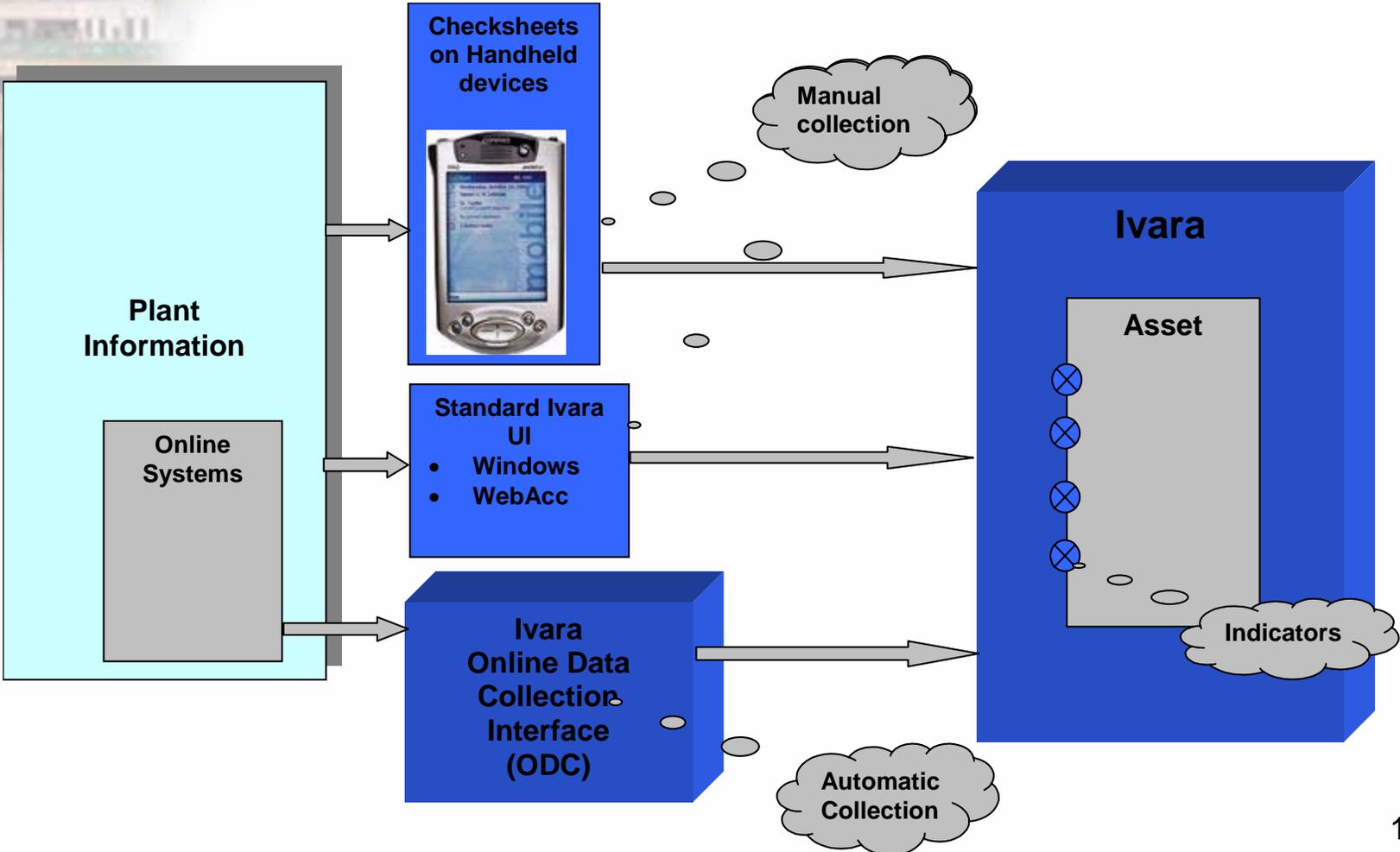
- Monday, Oct 5: 98-000019 - Check for Sewer Odor; 98-000020 - Repair Signs; 98-000021 - Flush Sewer.
- Tuesday, Oct 6: 98-000022 - Inspection.
- Wednesday, Oct 7: Inspection -
- Thursday, Oct 8: Inspection -
- Friday, Oct 9: Inspection -

At the bottom right of the interface, there is a tooltip that reads 'The Work Order Schedule Module'. The status bar at the bottom shows 'Record 1 of', 'View Mode', and 'Ready...'.

Friendly Work Process Interface



Asset Data Collection Interfaces

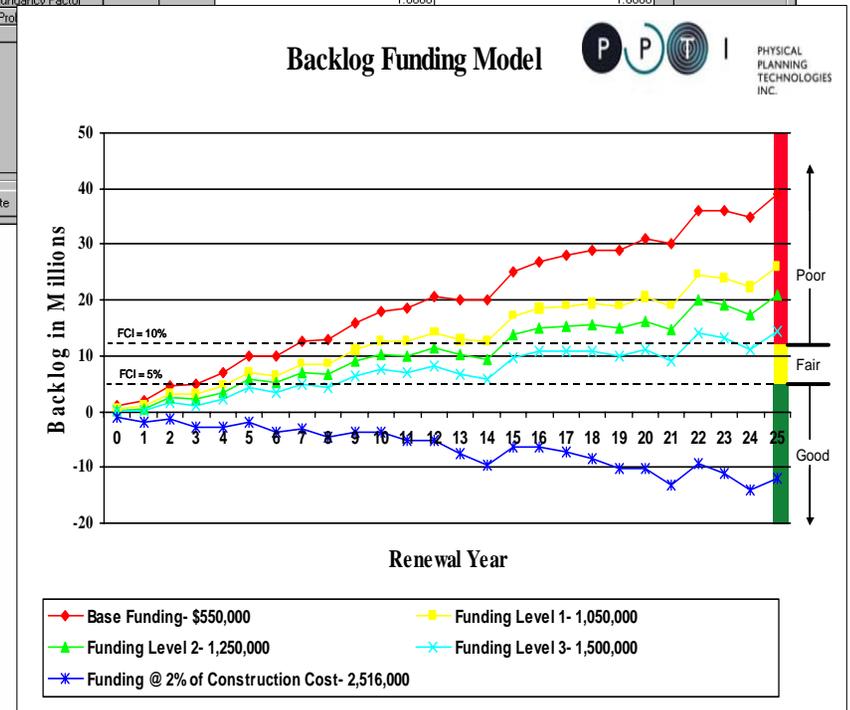
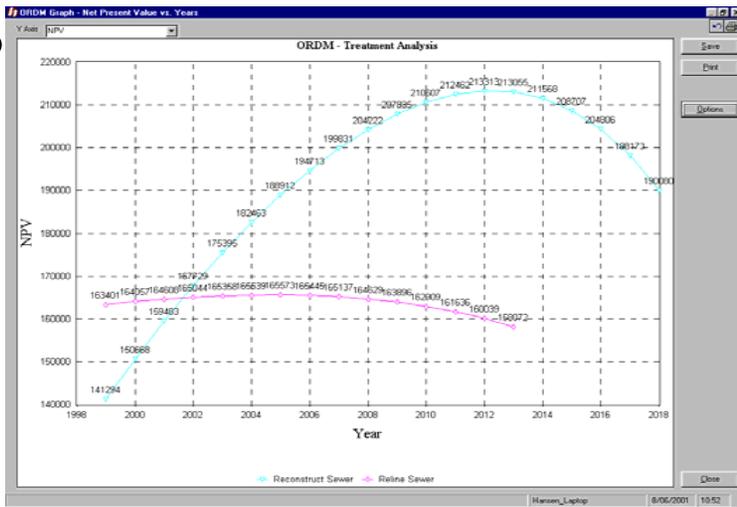
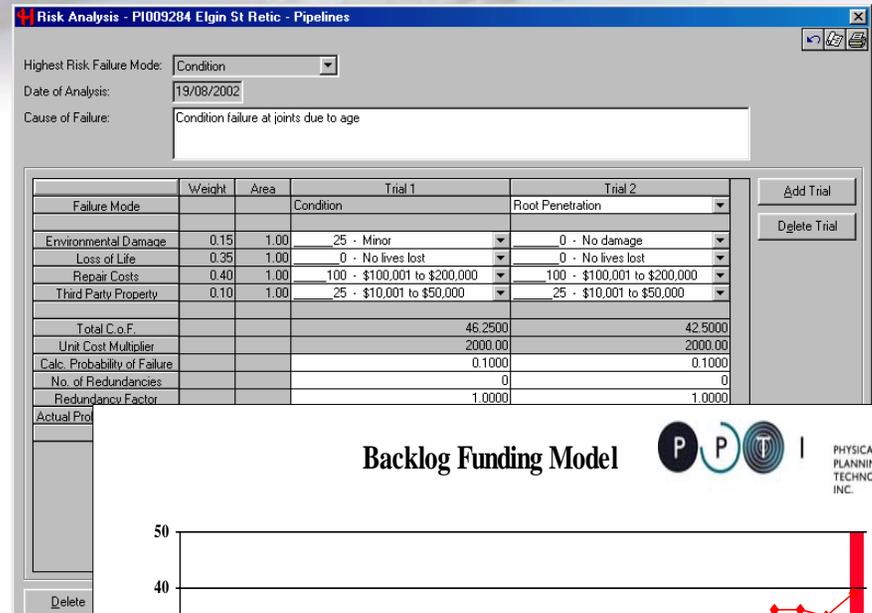


An AAM Program Is All About Knowledge Management

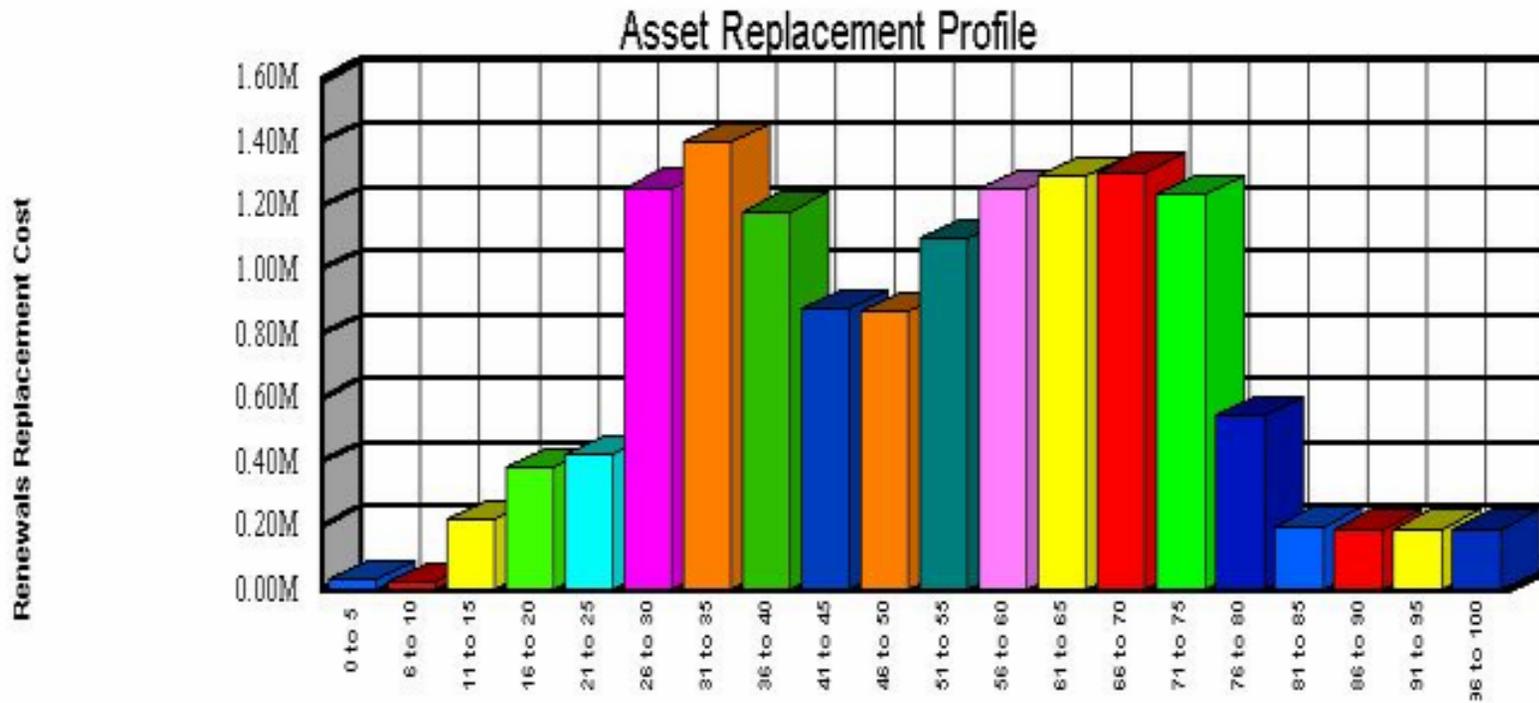


It's All About Better Decision Making

- Decision points
 - “Opex” & “Capex”
 - Optimal Renewal
 - Annuity renewal funding



Effective Presentation is Key to Good Decision Making



Displays asset replacement profile and related annuity (reserve) values for selected asset groups

5 Phases of AM IT Improvement

PHASES

DELIVERABLES

PHASE 1: Describe Current System Architecture and Structural Limits

Ø Description

PHASE 2: Determine Functionality "Gaps"

- Ø "Model" AMIS structure
- Ø System functionality assessment
- Ø Functionality gaps identified
- Ø Functionality specifications

PHASE 3: Identify "Gap Elimination Strategies"

Ø Development/deployment strategies

PHASE 4: Execute the Identified "Gap Elimination Strategies"

- Ø Selection process
- Ø Systems development work plan
- Ø Systems integration work plan

PHASE 5: Train Personnel/Teams and Institutionalize

- Ø Training program structure
- Ø Training program content
- Ø Training oversight

Skills Transfer Techniques



- “AM University”
 - Collaborative workshops
 - Classroom training
 - Side-by-side mentoring / “skills impact teams”
 - Brown bag training
- Peer-to-peer interviews
- Knowledge Management System

Lessons Learned...

- Keep it simple – it's more common sense than rocket science
- Keep it organized and focused
 - Core questions/"storyline"
 - Gap Analysis and Quarterly Work Plans
 - AAM Charter
- Focus on the relevant decision process – who should be asking what questions and what is needed to give credible answers
- Implement in this order:
 1. Concepts and framework
 2. Work processes
 3. Data acquisition and IT development/integration
- Use prototype projects, Skills Teams
- Focus where best gains can be made first
- It's ultimately all about **knowledge management**

AGENDA

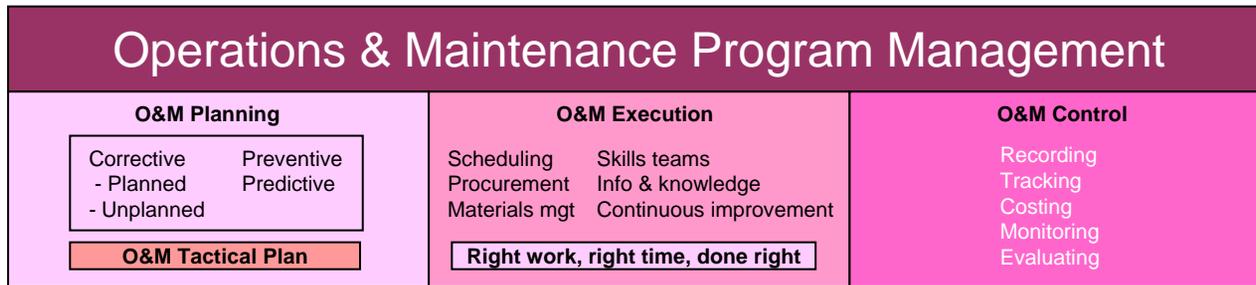
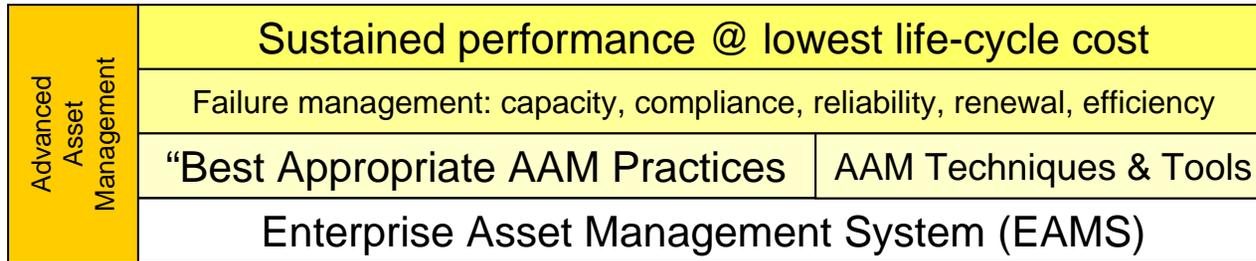
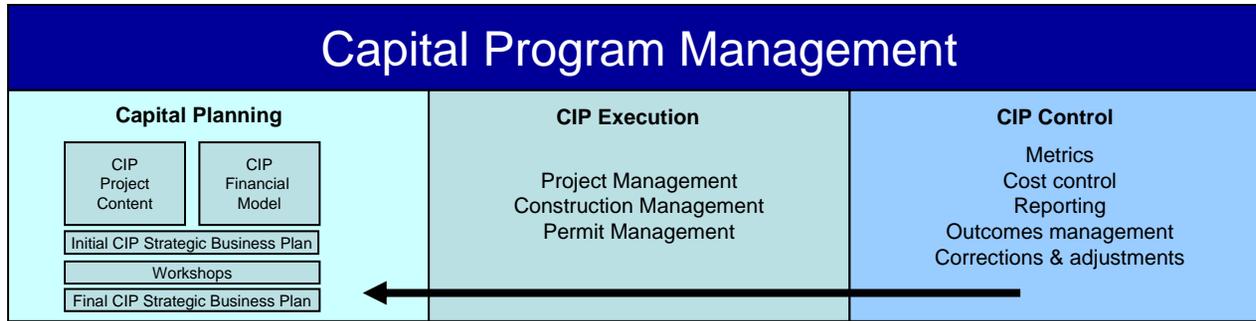
Day 2

- *Summary of Day 1; Outline of Day 2*
- *Core Question 4: What Are My Minimum “Life-cycle-cost” CIP and O&M Strategies? (Continued from Day 1)*
- *Core Question 5: Given The Above, What Is My Best Long-term Funding Strategy?*

- *Lunch*

- *Case Study 1: Deploying An AAM Program*
- *Case Study 2: Meeting The IT Challenge – Toward An Enterprise Asset Management System (EAMS)*
- *Summary, Addressing Your Questions, Comments, Self-audit*

Parsons/GHD AAM Model



Continuous Learning/Knowledge Management
"AAM University"

The Five Core AM Questions

Core Questions

1. What is the current state of my assets?

- What do I own?
- Where is it?
- What condition is it in?
- What is its remaining useful life?
- What is its economic value?

2. What is my required sustained Level Of Service?

3. Given my system, which assets are critical to sustained performance?

- How does it fail? How can it fail?
- What is the likelihood of failure?
- What does it cost to repair?
- What are the consequences of failure?

4. What are my best “minimum life-cycle-cost CIP and O&M strategies?

- What alternative treatment options exist?
- Which are most feasible?

5. Given the above, what is my best long-term funding strategy?

Steps In Total Asset Management Planning

1

Identify Current Levels of Service

2

Assess Existing Assets:

- *Physical Details*
- *Condition/Remaining Life*
- *Performance*
- *Capacity (Current / Ultimate)*

3

Predict Demand:

- *Capacity / Demands*
- *Levels of Service*
- *Performance / Risk*

4

Predict Mode of Failure

- *Capacity (Due to Growth)*
- *Performance / Reliability*
- *Condition (Age) Integrity*
- *Cost of Service*

5

Examine All Feasible Treatment Alternatives:
New Assets / Renewal / Growth / Efficiency
Improved levels of service
Determine all Technical / Financial Options

Steps In Total Asset Management Planning (Cont'd)

6

Assess Impact On Cost Of Service For All Options

7

Ask: Are Customers
Willing to Pay?

No

9

Yes

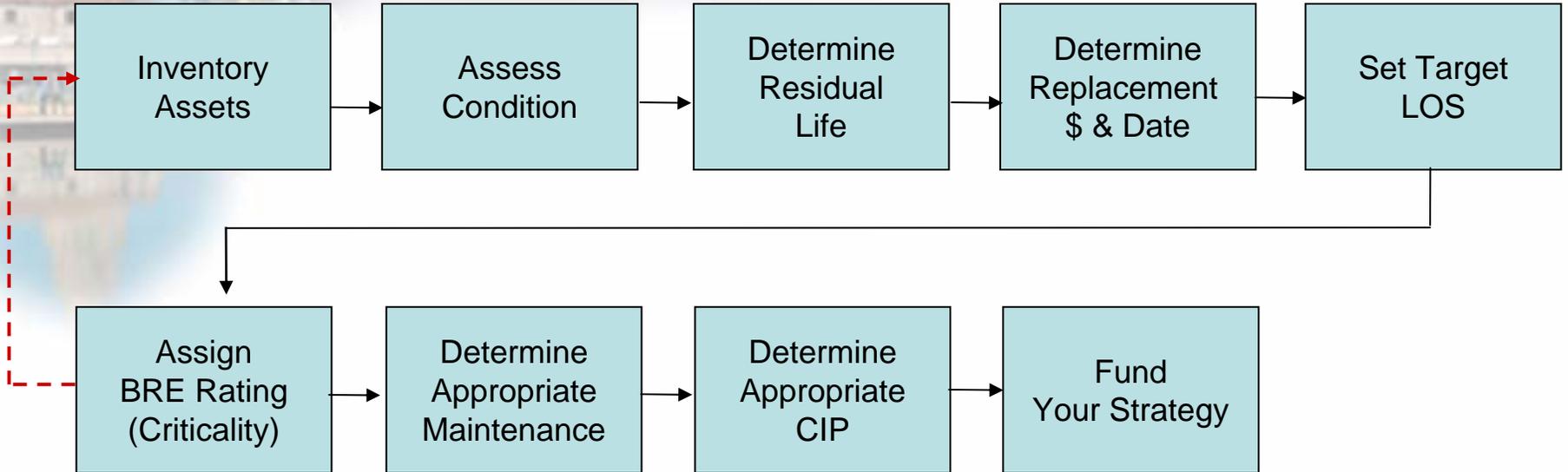
8

Execute

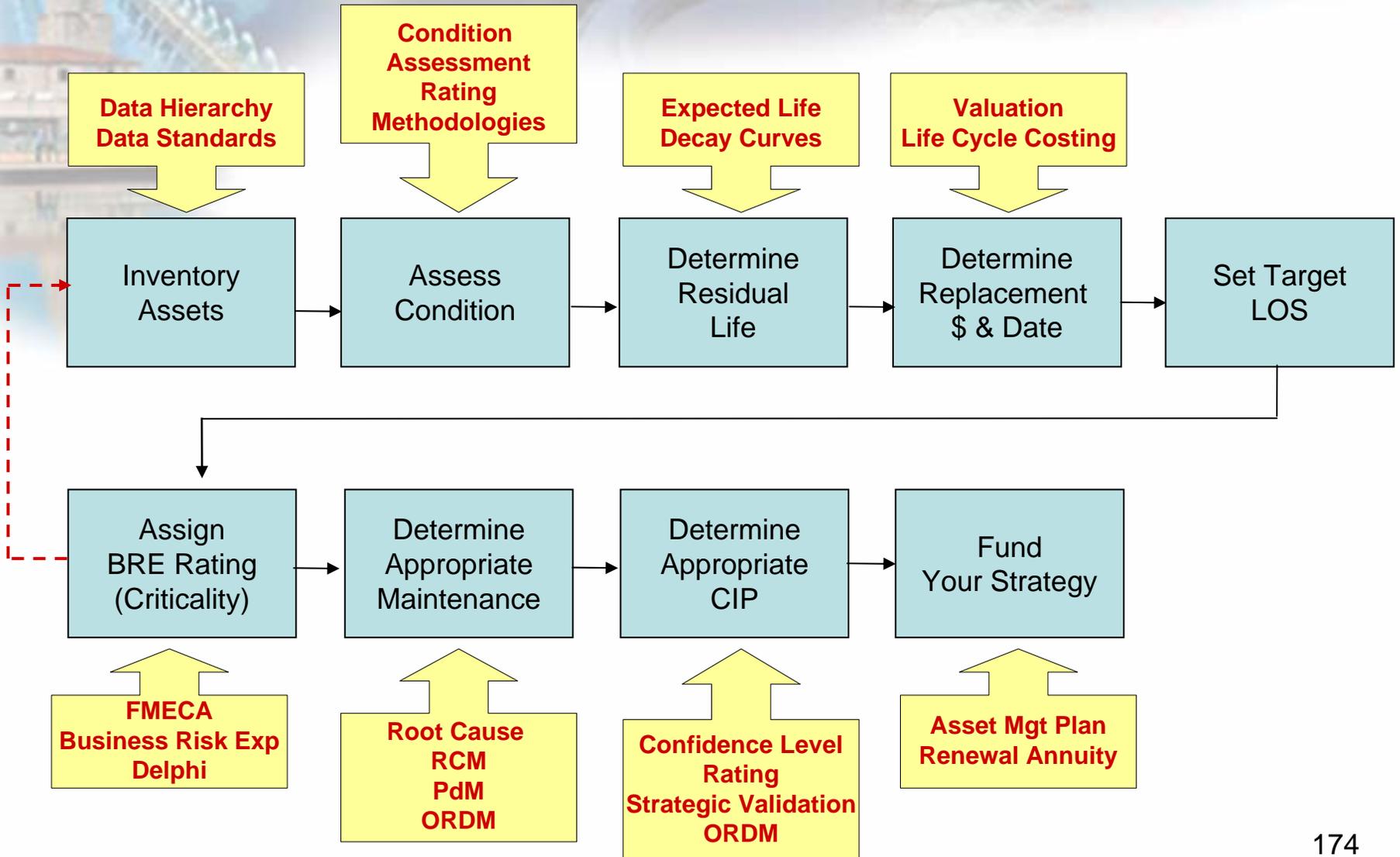
Review program options (reduce cost)

- *Reduce levels of service*
- *Dispose of under-utilized and under-performing assets*
- *Manage demand for service (pricing, regulation)*
- *Alter maintenance or operations*
- *Increase other income sources (grant funds, etc)*
- *Accept higher residual risk*
- *Rationalize project work in order of risk*

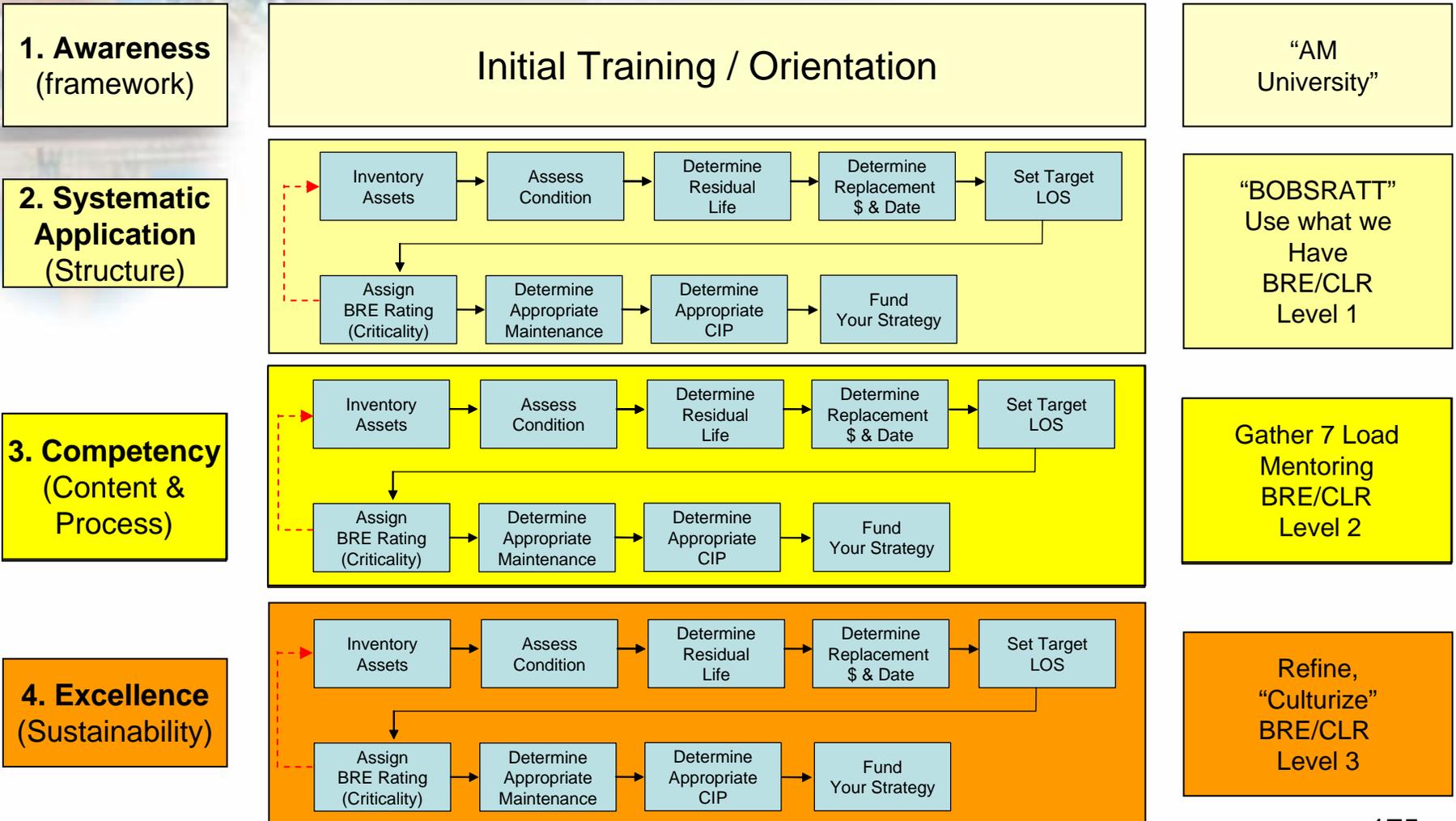
The AAM Program Process



Core AAM Program Process Tools

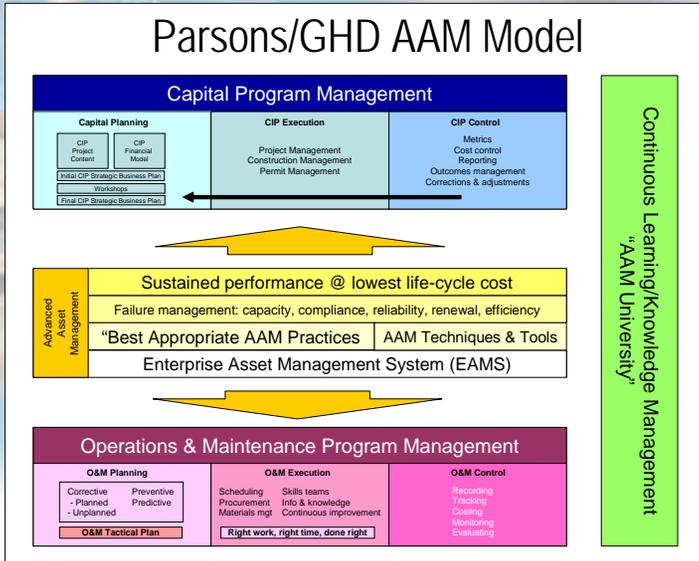


Four Major Stages of AAM Program Deployment



Fitting It All Together

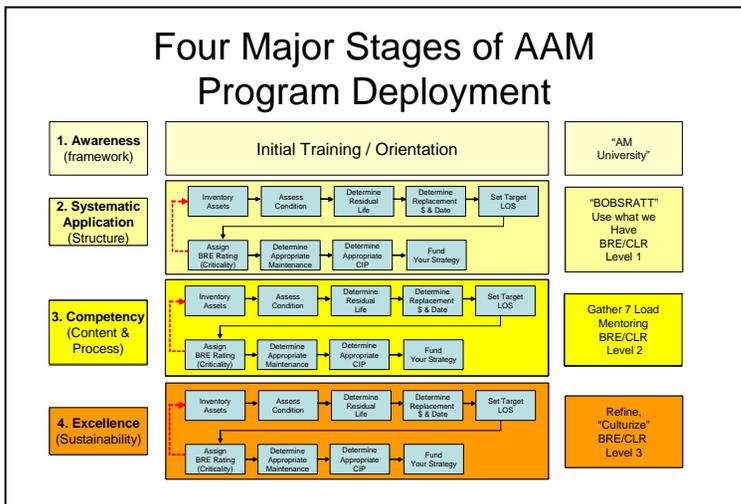
Parsons/GHD AAM Model



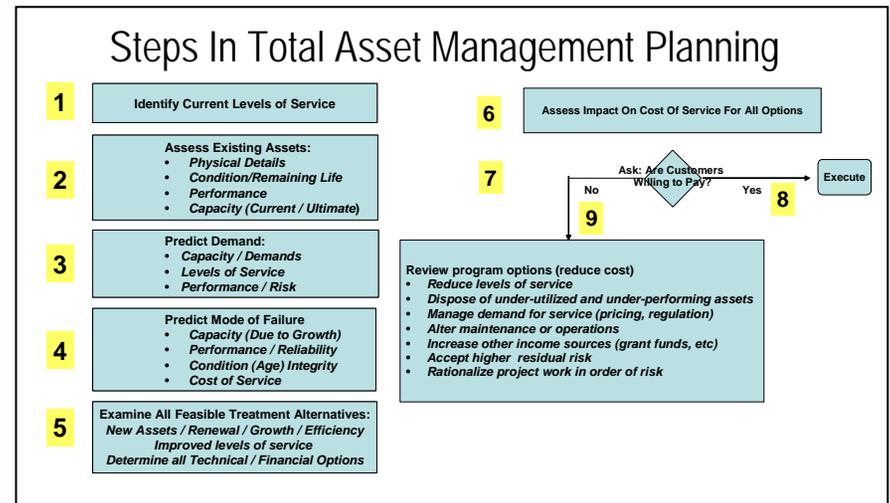
Core Questions

- 1. What is the current state of my assets?**
 - What do I own?
 - Where is it?
 - What condition is it in?
 - What is its remaining useful life?
 - What is its economic value?
- 2. What is my required sustained Level Of Service?**
- 3. Given my system, which assets are critical to sustained performance?**
 - How does it fail? How can it fail?
 - What is the likelihood of failure?
 - What does it cost to repair?
 - What are the consequences of failure?
- 4. What are my best "minimum life-cycle-cost CIP and O&M strategies?"**
 - What alternative treatment options exist?
 - Which are most feasible?
- 5. Given the above, what is my best long-term funding strategy?**

Four Major Stages of AAM Program Deployment



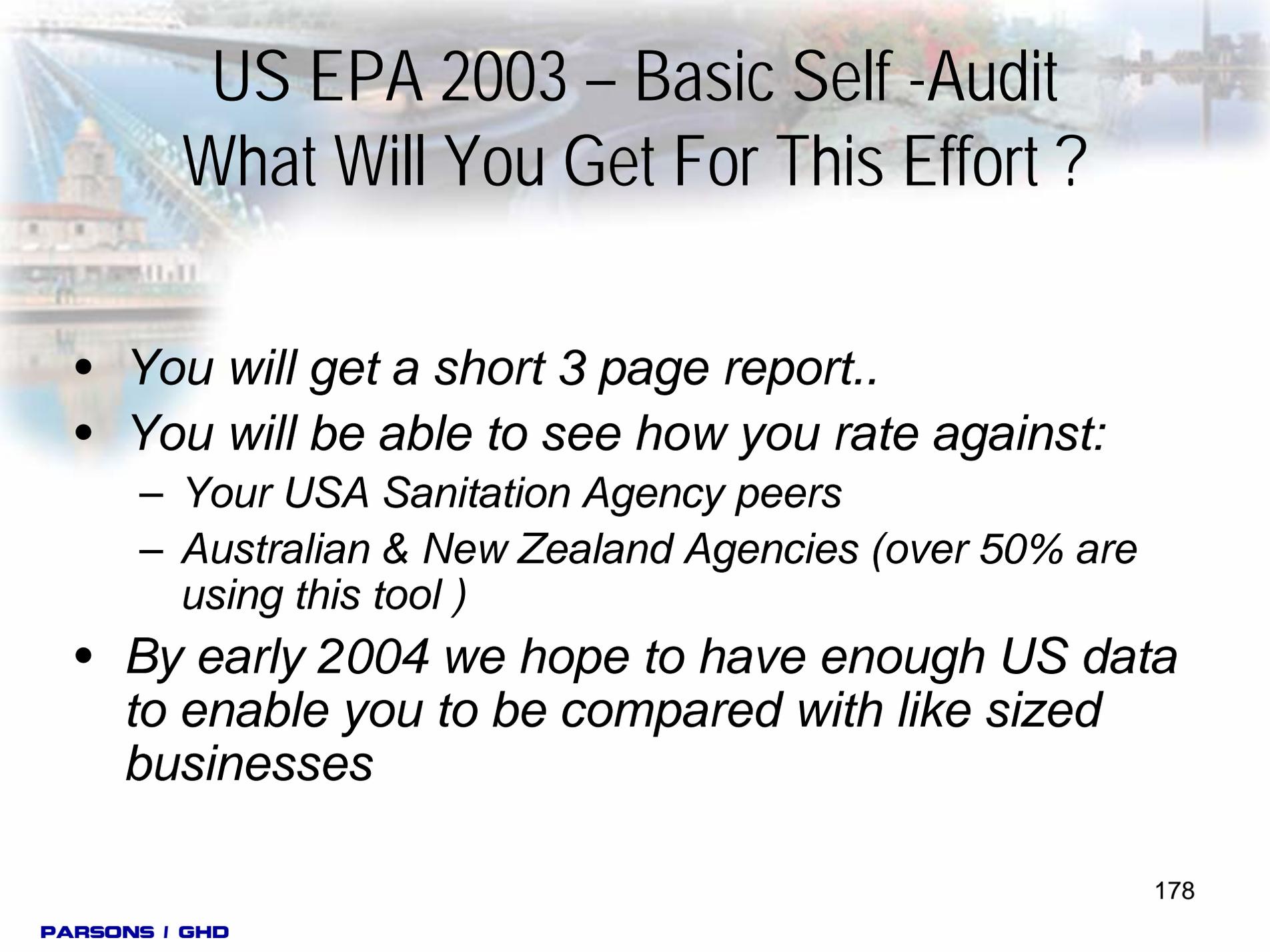
Steps In Total Asset Management Planning



US EPA 2004 – Basic Audit Self Assessment Tool ..

Helping you & your Agency to better understand the strengths and weaknesses of your current asset management activities...

- *You will be e-mailed a self-assessment file ..*
- *You need to complete the survey ..*
- *We will then aggregate the data and provide you with feedback...*
- *It will show you ...*

The background of the slide features a blurred image of a suspension bridge, likely the Golden Gate Bridge, and a building with a dome, possibly a government or institutional building, under a clear sky.

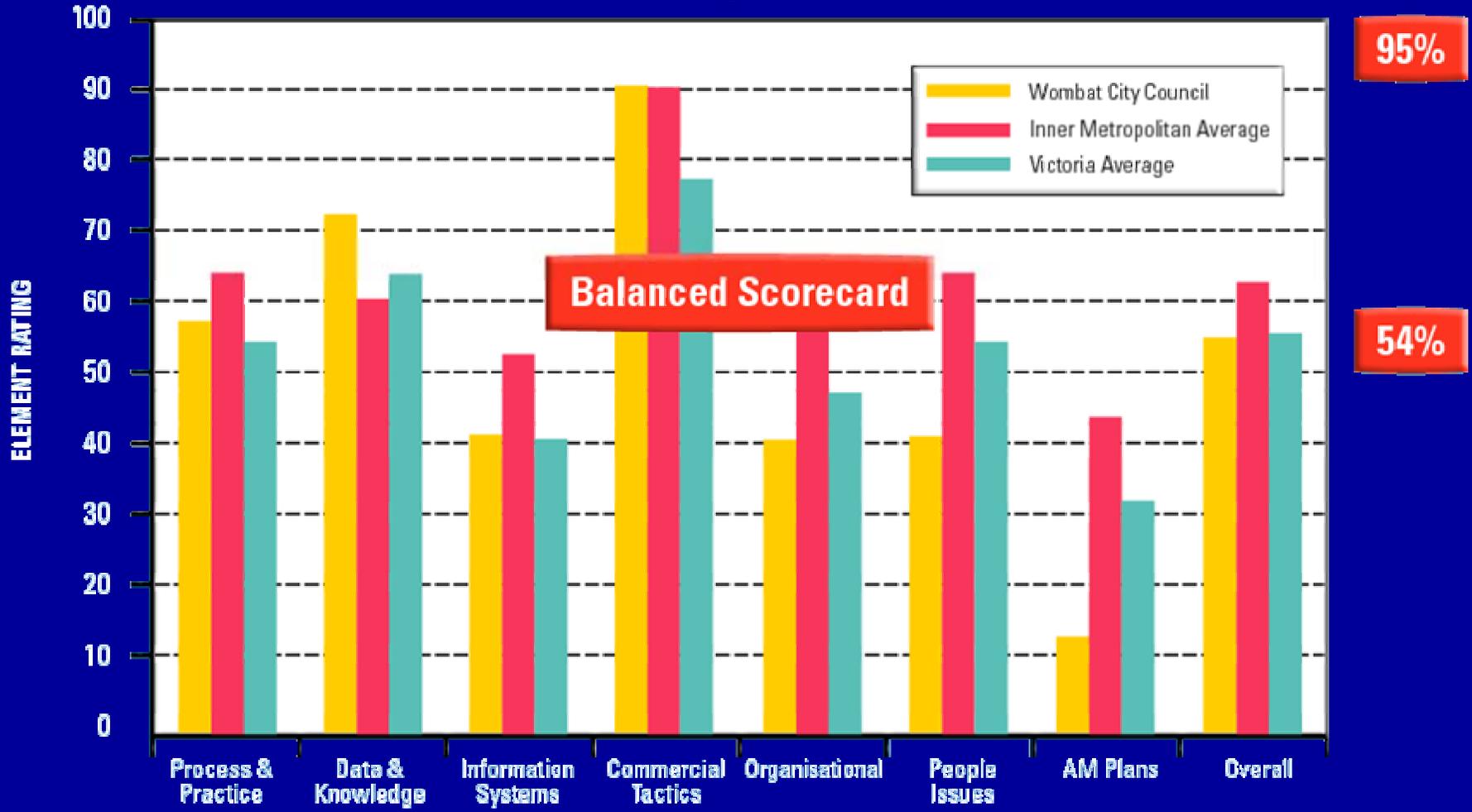
US EPA 2003 – Basic Self -Audit

What Will You Get For This Effort ?

- *You will get a short 3 page report..*
- *You will be able to see how you rate against:*
 - *Your USA Sanitation Agency peers*
 - *Australian & New Zealand Agencies (over 50% are using this tool)*
- *By early 2004 we hope to have enough US data to enable you to be compared with like sized businesses*

Typical Business Unit TEAMQF Report

Overall Element Rating - Wombat City Council

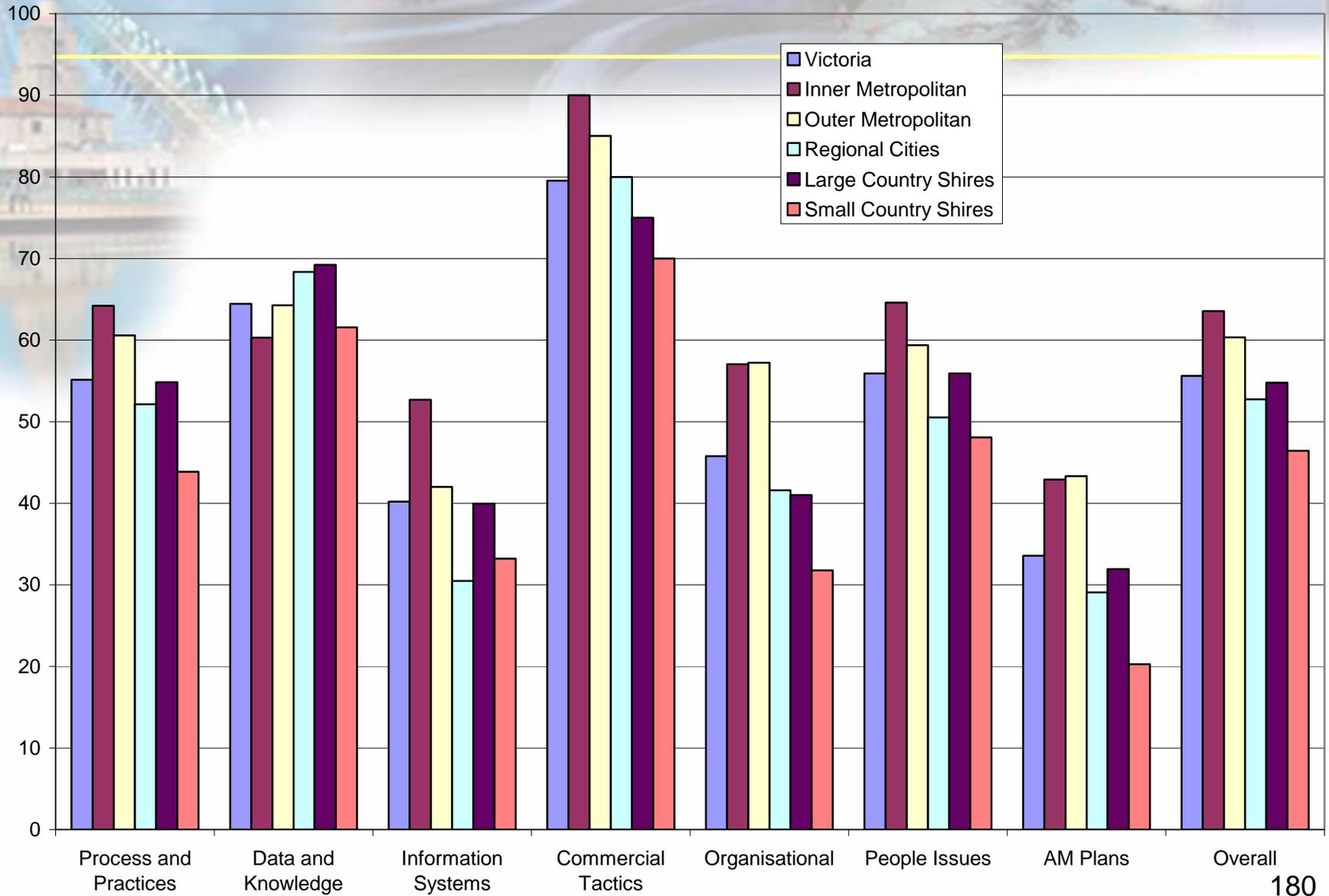


95%

54%

Balanced Scorecard

Example AM Benchmarking Study



Typical Individual Agency Report ..

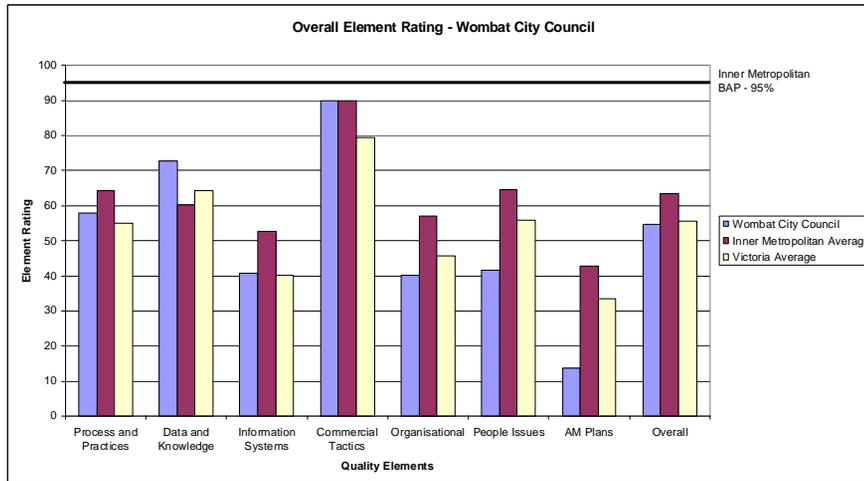
| Quality Elements | Weighted Gap | Rank |
|---------------------|--------------|------|
| Process & Practices | 741 | 3 |
| Data & Knowledge | 334 | 5 |
| Information Systems | 814 | 2 |
| Commercial Tactics | 100 | 7 |
| Organisational | 274 | 6 |
| People Issues | 533 | 4 |
| AM Plans | 1219 | 1 |

MAV ASSET MANAGEMENT BENCHMARKING STUDY

WOMBAT CITY COUNCIL

Confidential Results for Wombat City Council only

OVERALL BENCHMARK



GAP ANALYSIS

| Quality Elements | Weighted Gap | Rank |
|-----------------------|--------------|------|
| Process and Practices | 741 | 3 |
| Data and Knowledge | 334 | 5 |
| Information Systems | 814 | 2 |
| Commercial Tactics | 100 | 7 |
| Organisational | 274 | 6 |
| People Issues | 533 | 4 |
| AM Plans | 1219 | 1 |

IMPROVEMENT PRIORITIES

Based on this gap analysis, Wombat City Council is 19.6% behind the top ten percentile of the Council's in the Inner Metropolitan category and 40.2% behind the best appropriate practice target level as deemed appropriate for a Council of this size and nature. Wombat City Council has over \$605M worth of infrastructure assets, the management of which is crucial to Council's performance in terms of both cost and levels of service.

This form of the benchmarking does not allow a detailed analysis, however, based on GHD's weighted gap shown above, the following items are likely areas where improvement should be considered in more detail.

For the purposes of this study we have restricted this to the top 4 quality elements in order of importance.

You Will Get A Brief Report

Asset Management Plans

The organisation should develop asset management plans for all infrastructure and physical assets involved in service programs. These plans should follow the format outlined in the International Infrastructure Management Manual (IIMM).

The organisation has significant amounts of data, however, more use could be made of this data in terms of analysis in production of asset management plans. It is vital that the organisation considers these aspects.

Information Systems

Information systems become a critical element of sound asset management by replicating the best appropriate processes and providing a location to store the relevant data and knowledge.

The organisation should undertake and validate the information systems and develop appropriate improvement strategies in issues such as:

- Implementing a maintenance management system
- Implementing a works management system
- Implementing life cycle asset management systems for the following asset groups:
 - Parks and gardens assets
 - Solid waste assets
 - Fleet assets
 - Recreational assets
- These systems need to be interfaced to the corporate asset register

Processes and Practices

The key improvements in this area include:

- The development of specific asset management policies covering issues such as:
 - Only improving new capital works on a life cycle cost basis, including full recurrent expenditures.
 - That asset renewal expenditures will be approved before new services or improved levels of service are considered.
- Asset handover procedures need to be developed to ensure that new and rehabilitated assets are included onto the asset register immediately in the most cost effective manner.
- Processes that outline the way in which the organisation will produce asset management plans on a regular basis including the clearly defined outputs such as:
 - Capital works in the following categories:
 - Sustaining existing service levels
 - Improving service levels
 - New assets or services
 - New works related to growth
 - Works related to new regulations
 - Asset sales
 - Operations
 - Maintenance
 - Depreciation
 - Administration
- Develop process to assist staff to complete better life extension or renewal decision making.

Showing Your Key Areas For Improvement

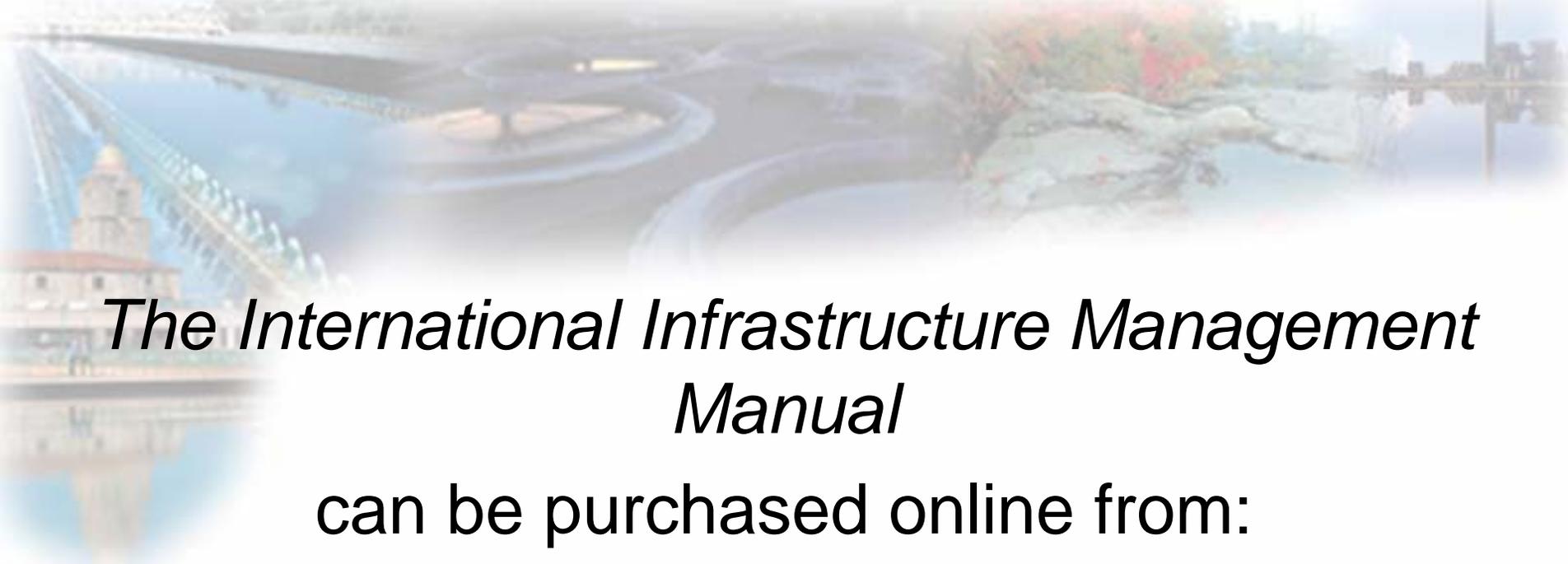


Testimonial...

“The basic audit results proved extremely useful to me and my City.

By understanding how we rated against our peers I was able to win our management’s attention to the situation and it allowed us to commence AM improvement in earnest...”

Cheryl Kidston *Strategic Planner City Services – City of Melbourne.*

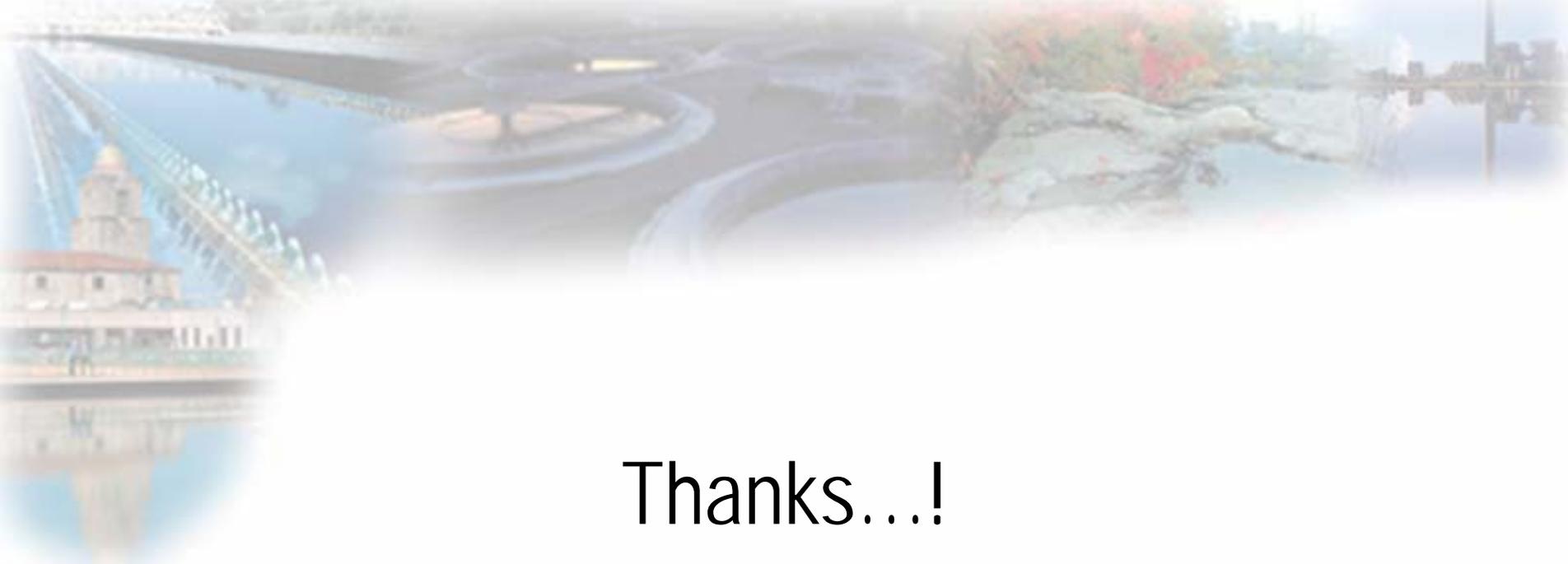


*The International Infrastructure Management
Manual*

can be purchased online from:

www.ipwea.org.au

for approximately \$220 US



Thanks...!