The Fundamentals of Asset Management

Executive Overview

A Hands-On Approach

Emerging utility business conditions

- Increasing demand for utility services
- Diminishing resources
- Leveling of production efficiencies
- Increasing restrictions on output
- Aging infrastructure

Result: *increasingly expensive treatment options*

Emerging utility business conditions

- Aging customer base
- Diminishing technical labor pool
- Larger and more sophisticated facilities
- Loss of knowledge with personnel retirements
- Public resistance to rate increases

Result: *increasingly complex management environment*

Changing utility business environment

- Demand to do more with existing resources
- Need to make every dollar work – to better use capital and operating budgets
- Move from *reactive* to *proactive* work environment

A paradigm shift…

- Transition from *building and operating* to *managing* assets
  - Extending asset life
  - Optimizing maintenance and renewal
  - Developing accurate long-term funding strategies
  - *Sustain long term performance!*

Infrastructure is the foundation to sustained quality of life

Consequences of asset failure can be severe

Asset management improves…

Decision making throughout the life cycle of the asset

- Acquisition
- Operations
- Maintenance
- Renewal

Resulting in *lowest total cost of ownership*

This training describes…

- *What* is asset management?
- *Why* do it?
- What *deliverables* do I get from it?
- What are the *steps*?
- *How* do I move my organization forward?

Views on asset management

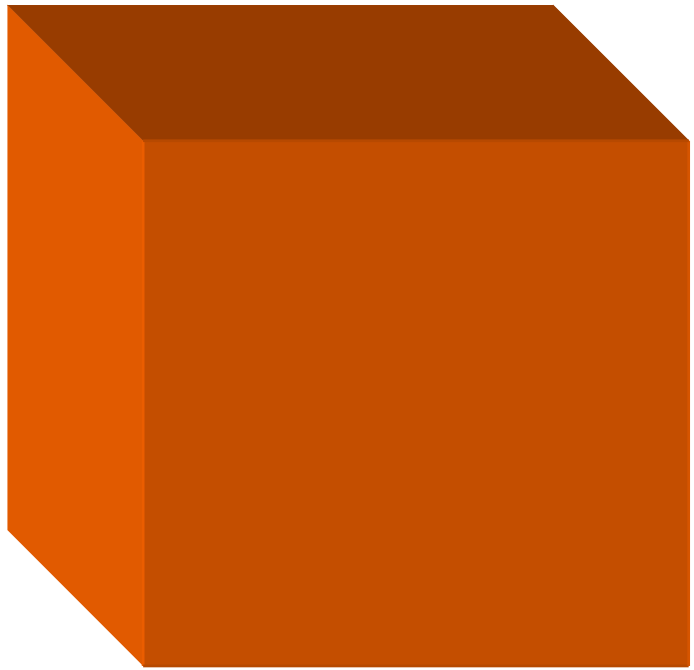
- Life cycle
- Conceptual framework
- Charter principles
- Asset management plan

What is asset management (AM)?

- Systematic integration of advanced and sustainable management techniques into a management paradigm or *way of thinking*, with
- Primary focus on the *long-term life cycle* of the asset and its sustained performance, rather than on short-term, day-to-day aspects of the asset

Views on asset management – a framework

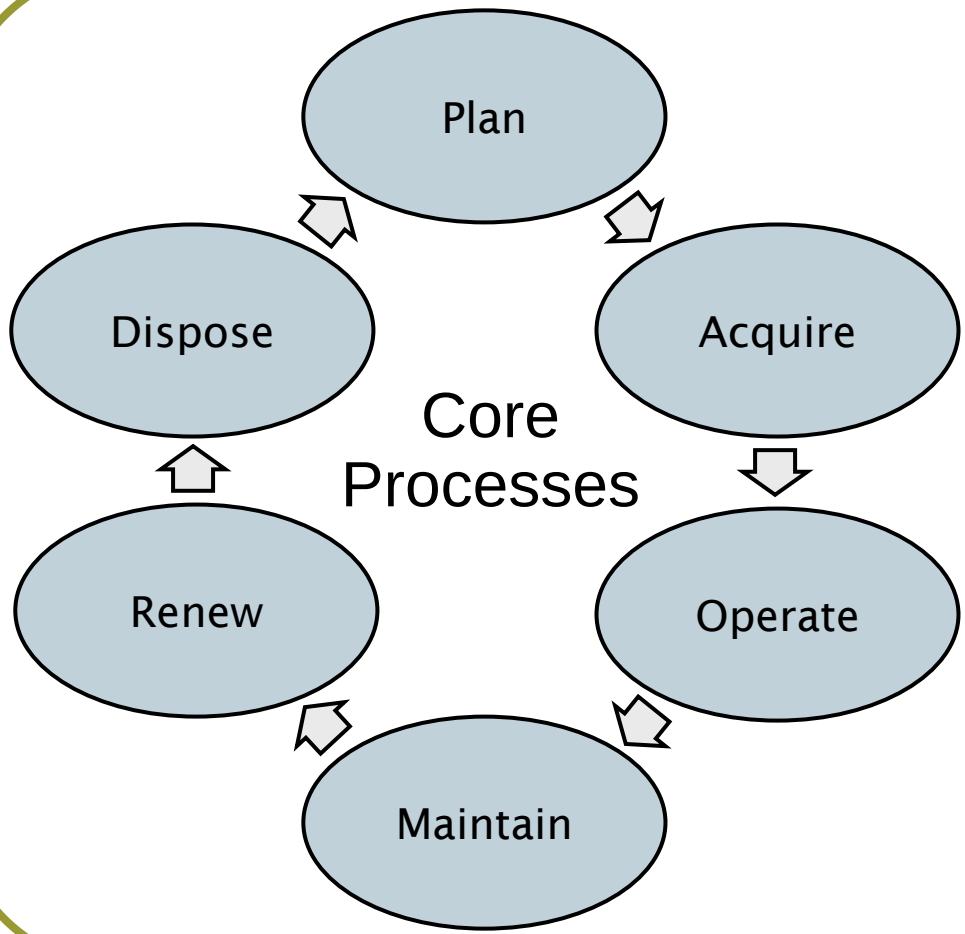
- Asset management can be thought of as an object - a box or framework
- Following is a brief characterization of *8 different views* on asset management
- These views make up the framework



View 1: Definition - asset management

- *Management paradigm* and *body of management practices*
- Applied to the *entire portfolio* of infrastructure assets at all levels of the organization
- Seeking to *minimize total costs* of acquiring, operating, maintaining, and renewing assets…
- Within an environment of *limited resources*
- While *continuously delivering the service levels* customers desire and regulators require
- At an acceptable level of *risk* to the organization

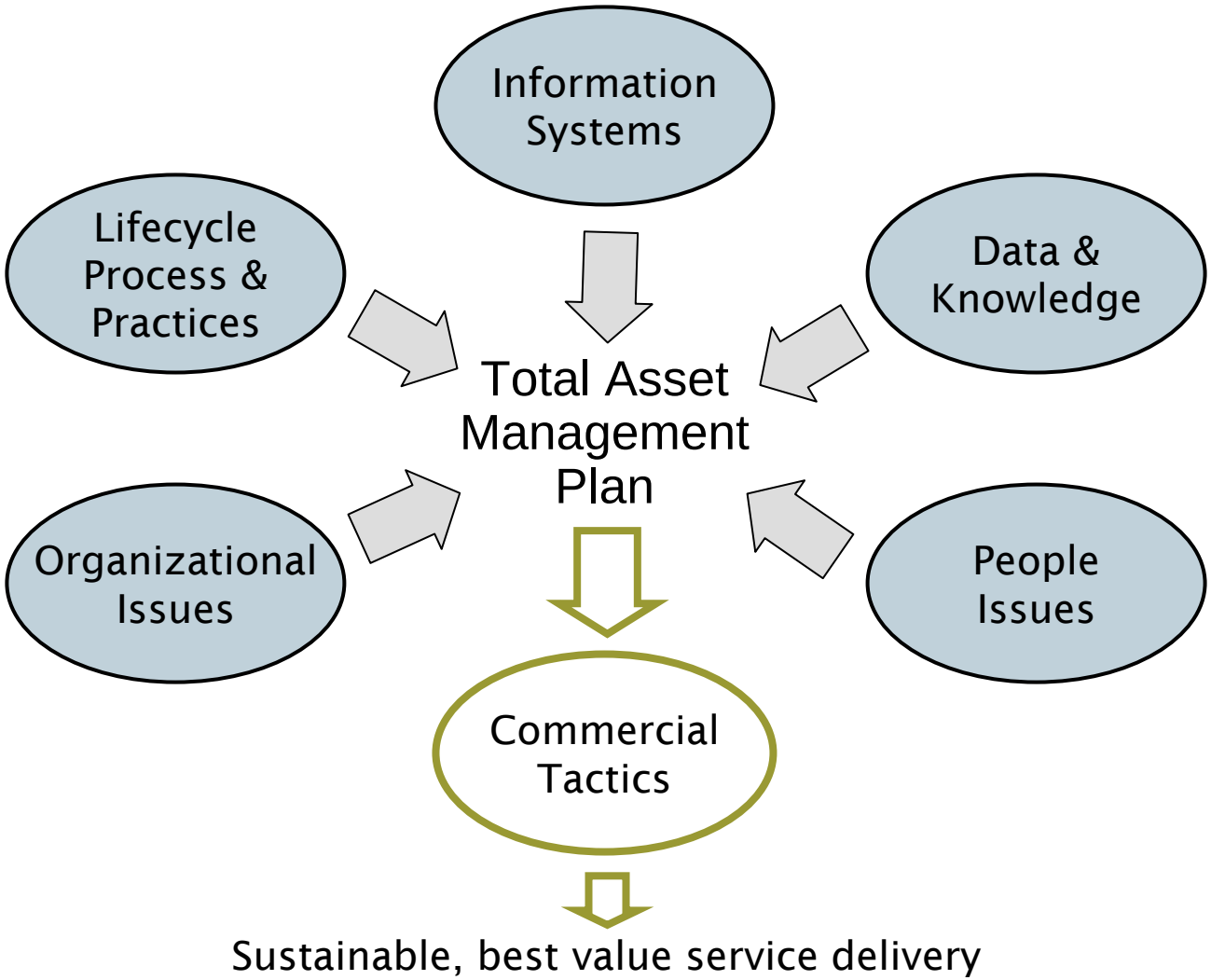
View 2: Life cycle business processes



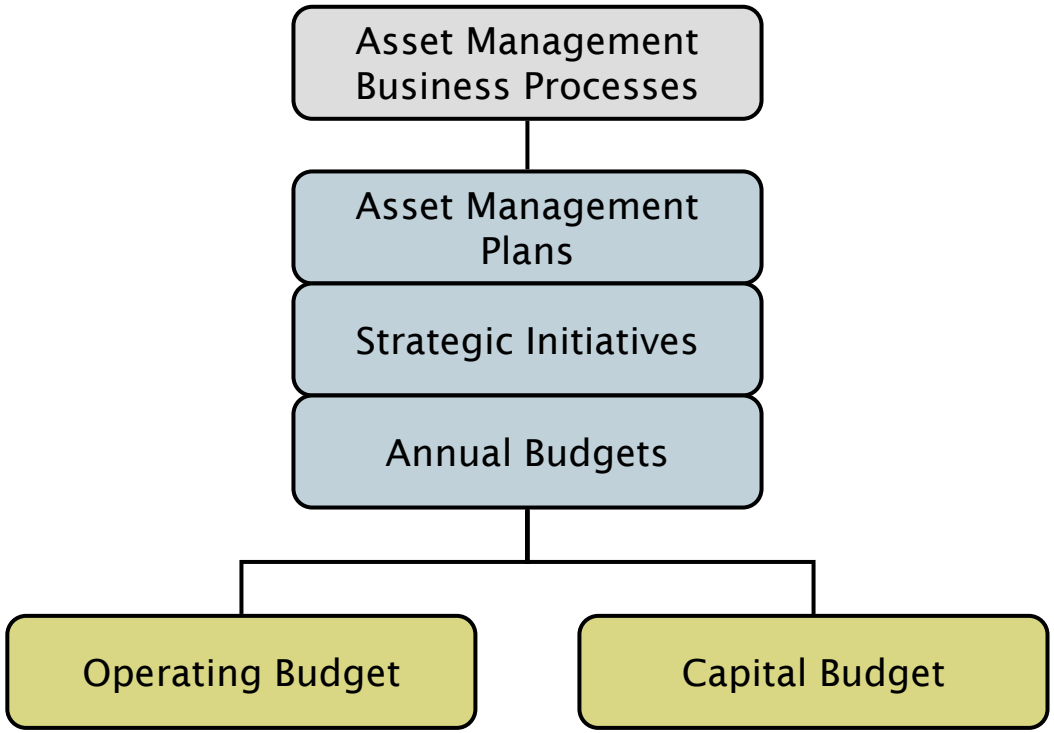
Support processes

- Demand management
- Knowledge of assets
- CIP validation
- Accounting & economics
- Condition & performance monitoring
- Business risk exposure
- Works resource management
- Review & continuous improvement

View 3: Core AM program elements



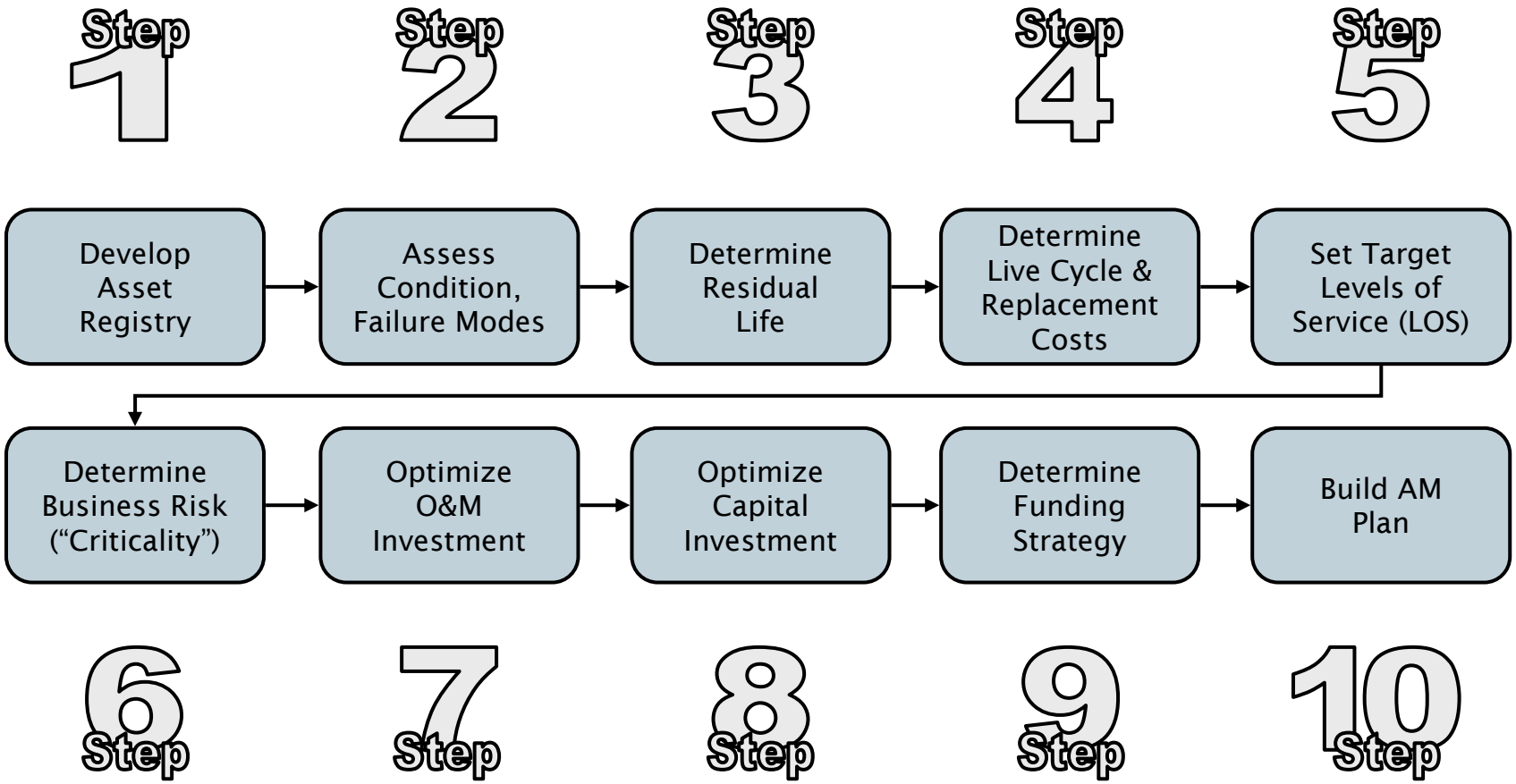
View 4: Management framework



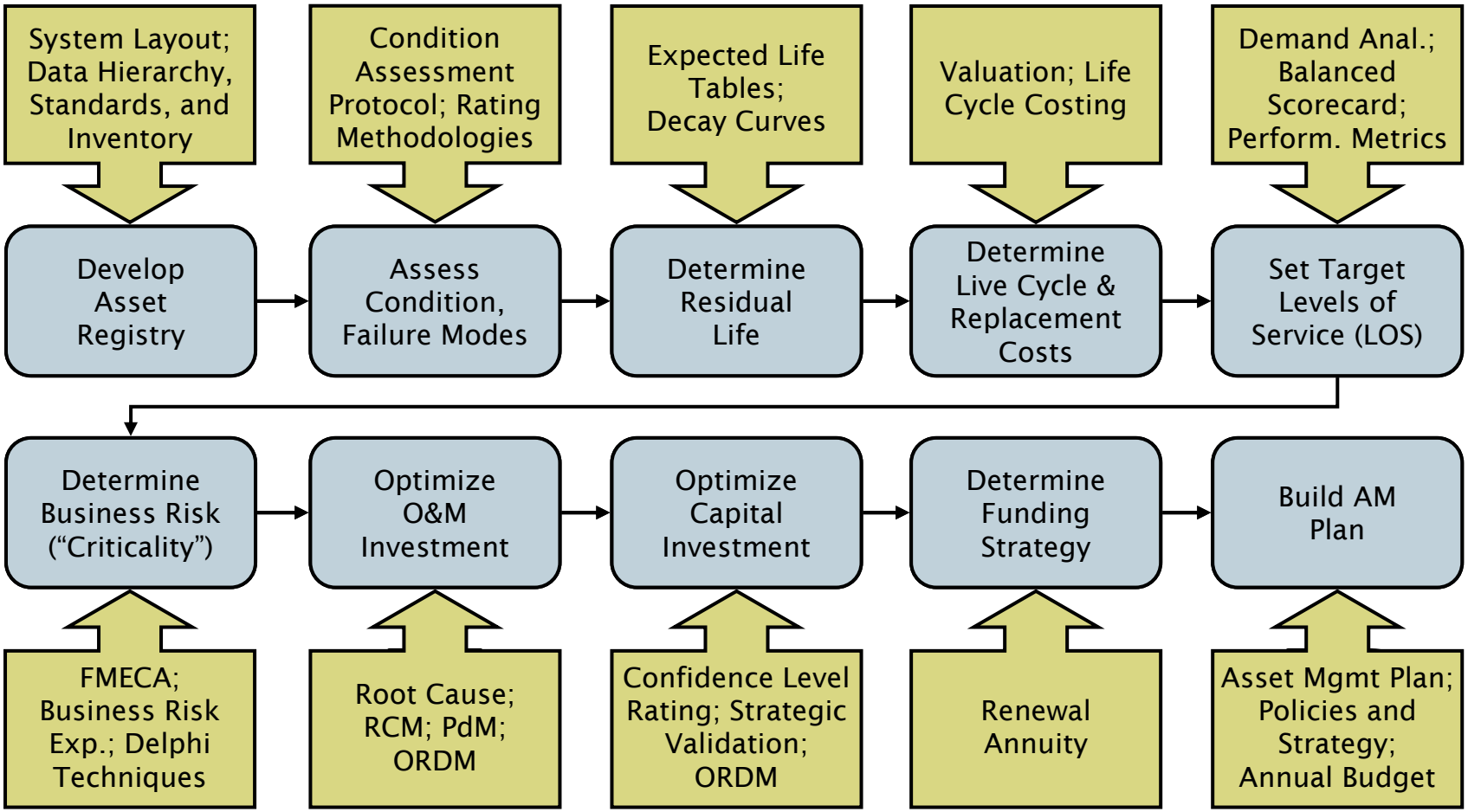
View 5: Five core questions

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 remaining economic value?
2. What is my required level of service (LOS)?
   - What is the demand for my services by my stakeholders?
   - What do regulators require?
   - What is my actual performance?
3. 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 O&M and CIP investment strategies?
   - What alternative management options exist?
   - Which are the most feasible for my organization?
5. What is my best long-term funding strategy?

View 6: AM plan 10-step process



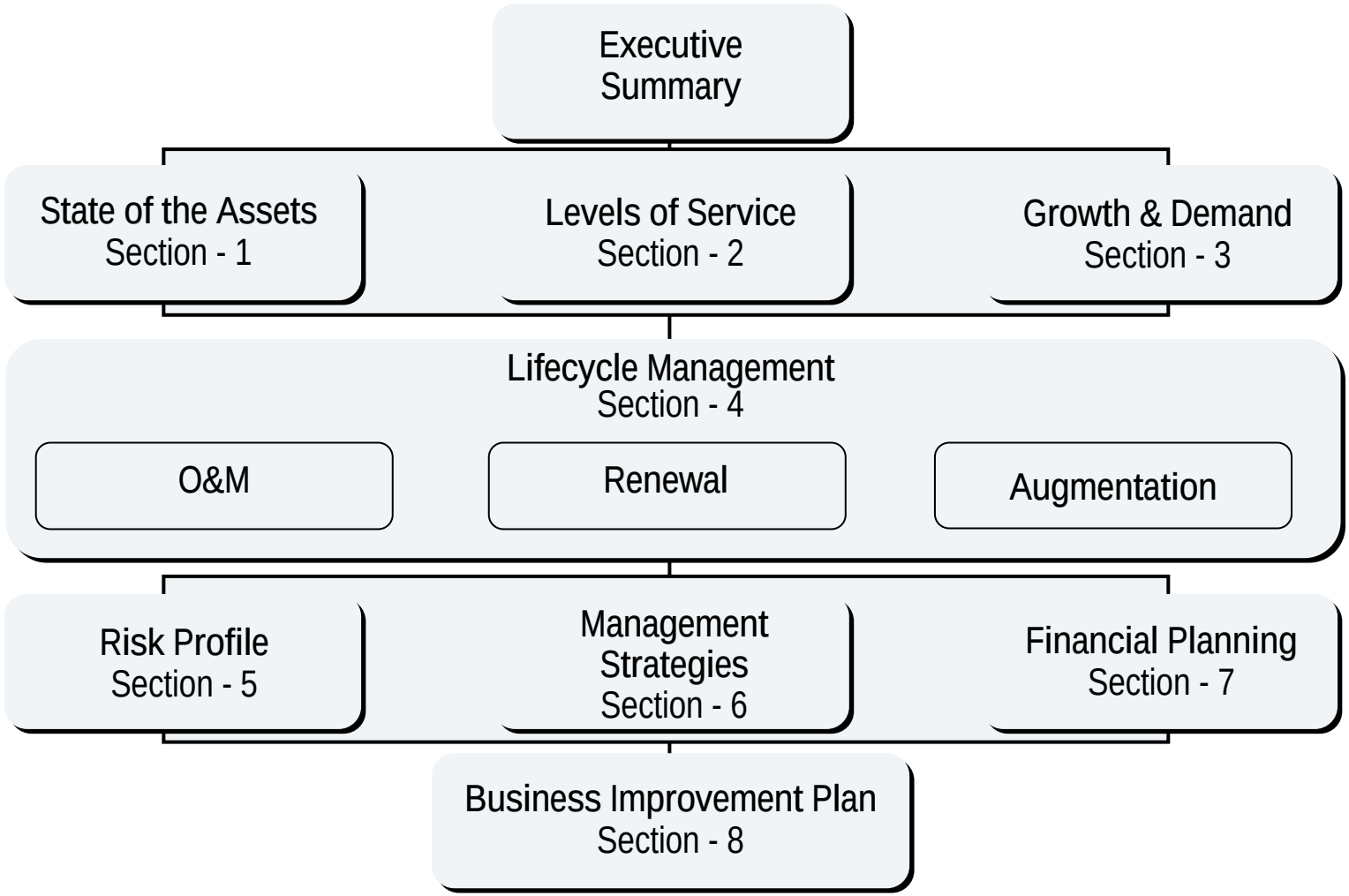
View 6: AM plan 10-step process



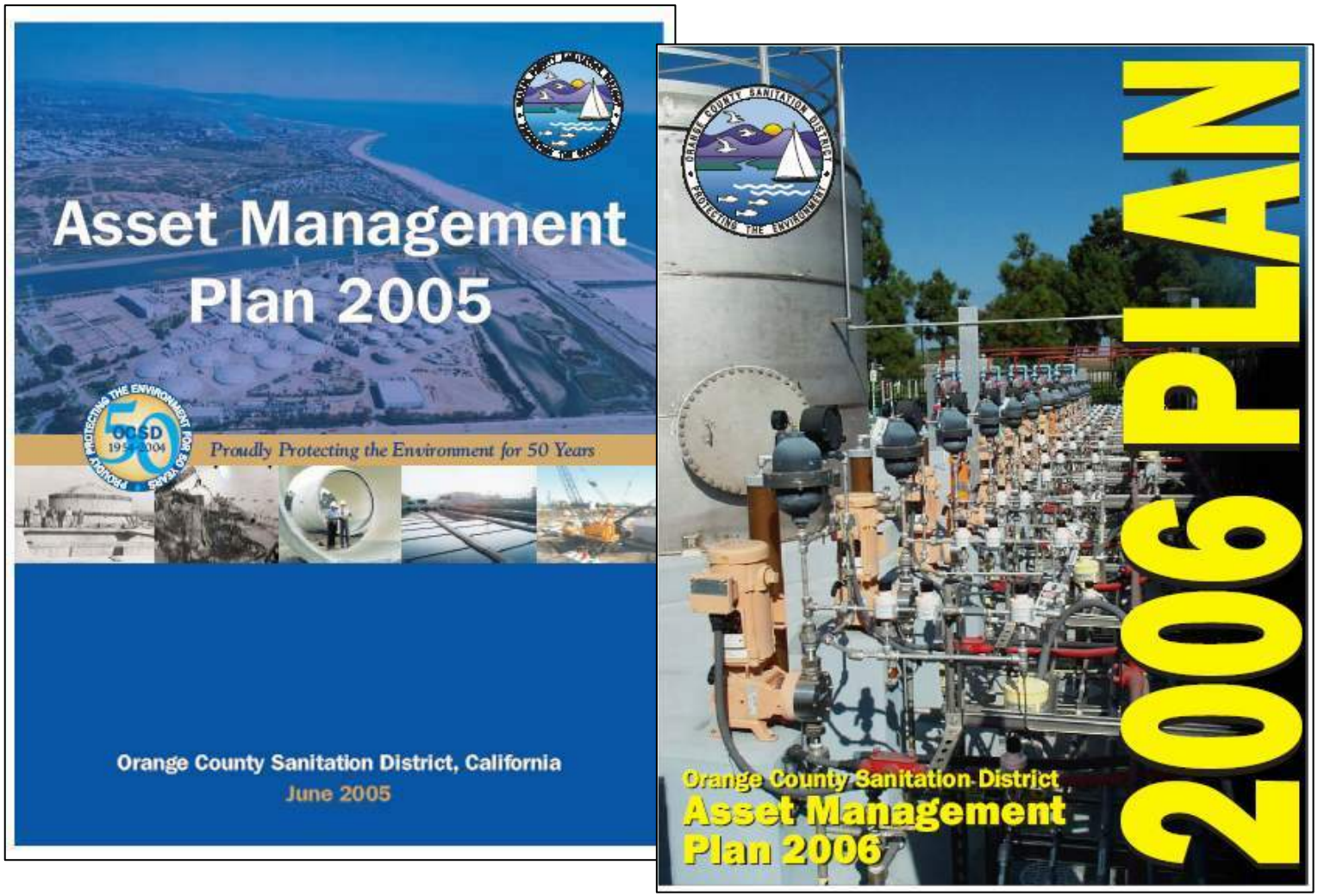
View 7: Seven principles of asset management

1. The “Value Added/Level of Service” Principle—assets exist to deliver services and goods that are valued by the customer-stakeholder; for each consumer-stakeholder there is a minimum level of service below which a given service is not perceived as adding value.
2. The “Life Cycle” Principle—all assets pass through a discernable life cycle, the understanding of which enhances appropriate management.
3. The “Failure” Principle—usage and the operating environment work to break-down all assets; failure occurs when an asset can not do what is required by the user in its operating environment.
4. The “Failure Modes” Principle—not all assets fail in the same way.
5. The “Probability” Principle—not all assets fail at the same time.
6. The “Consequence” Principle—not all failures have the same consequences.
7. The “Total Cost of Ownership” Principle—there exists a minimum optimal investment over the life cycle of an asset that best balances performance and cost given a target level of service and a designated level of risk.

View 8: Enterprise asset management plan



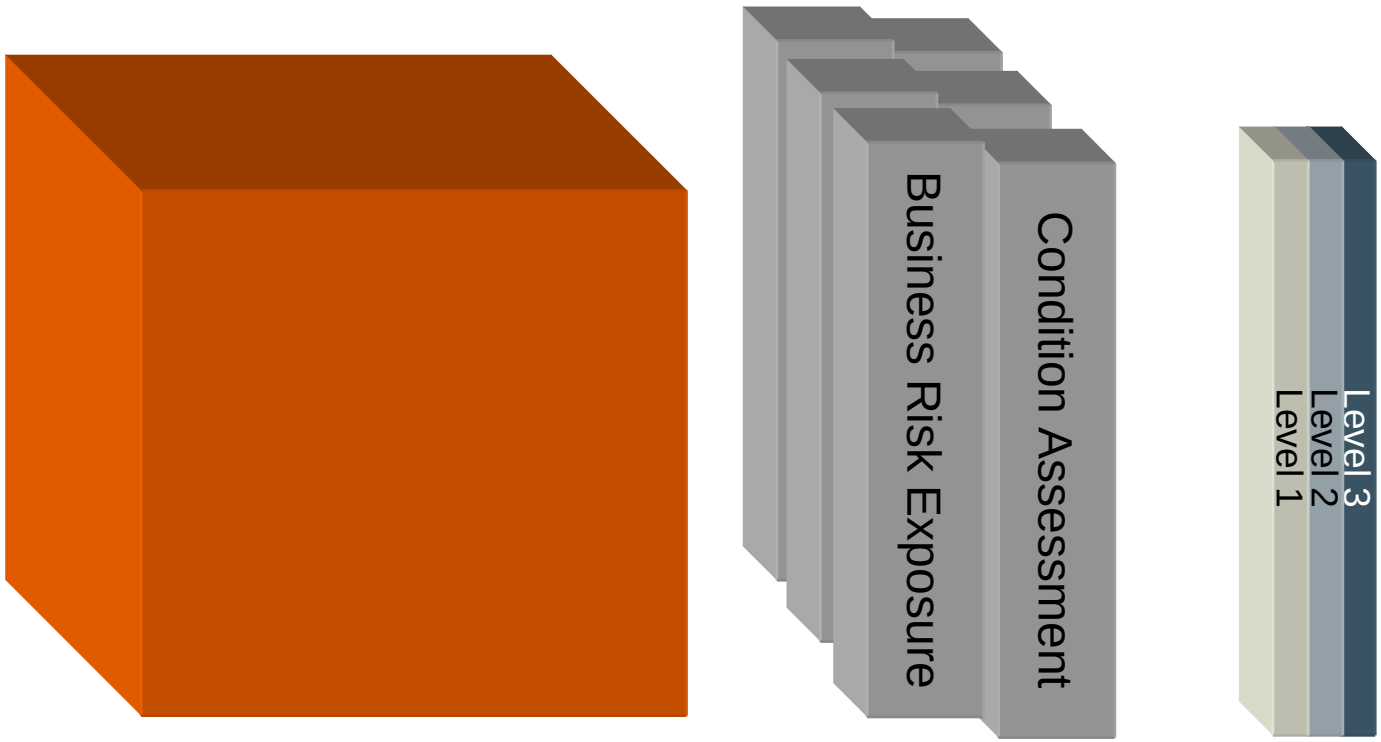
The enterprise asset management plan



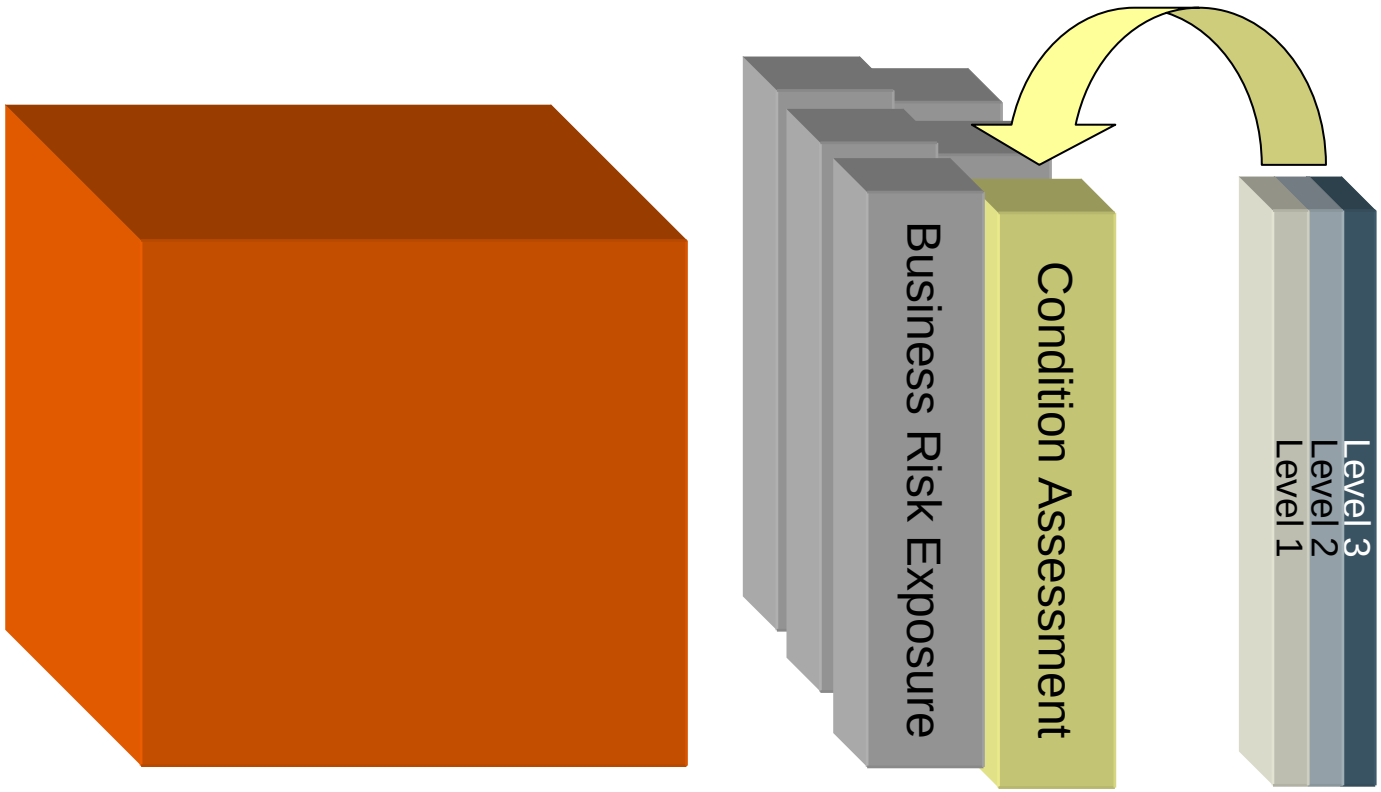
Example of organizational AM strategies

Strategy	Objective/ Description	Related Service Standard
Strategic Planning		
M.1 Organisational Structure	**Manage the wastewater system through a structure that maintains a separation between asset management and service delivery to promote accountability, transparency and efficiency** Asset management staff will be responsible for ensuring the Council achieves its objectives for wastewater services through setting, implementing, and monitoring of strategy and process. The actual delivery of wastewater services will be contracted, through competitive market mechanisms, to various service providers, who are concerned with the way the assets are operated and maintained in order to meet defined service standards.	Value for money Financial management Maintain service potential of assets
M.2 Human Resources	**Develop the professional skills of the staff through adequate training and experience.** Training needs will be agreed with staff each year at performance reviews and a register maintained to record training history. Staff are encouraged to belong to appropriate professional bodies and to attend appropriate conferences, seminars and training courses	Value for money
M.3 AM Plan Updates	**The Asset Management Plans remain strategic 'living' documents and will be reviewed on a regular basis.** The scope of the review will be influenced by changes in service standards, improved knowledge of assets, introduction of AM improvements and corporate strategy/ policy and process. The Wastewater Asset Manager, Policy Advisor and other senior management members will be involved in the plan review process.	Legislative standards
M.4 Risk Management	**Manage risk exposure by completing an annual risk assessment to update the Wastewater Risk Management Plan and implement risk mitigation measures to maintain risk exposure at a level compatible with the Corporate risk policy.**	Service continuity Service standards Financial standards

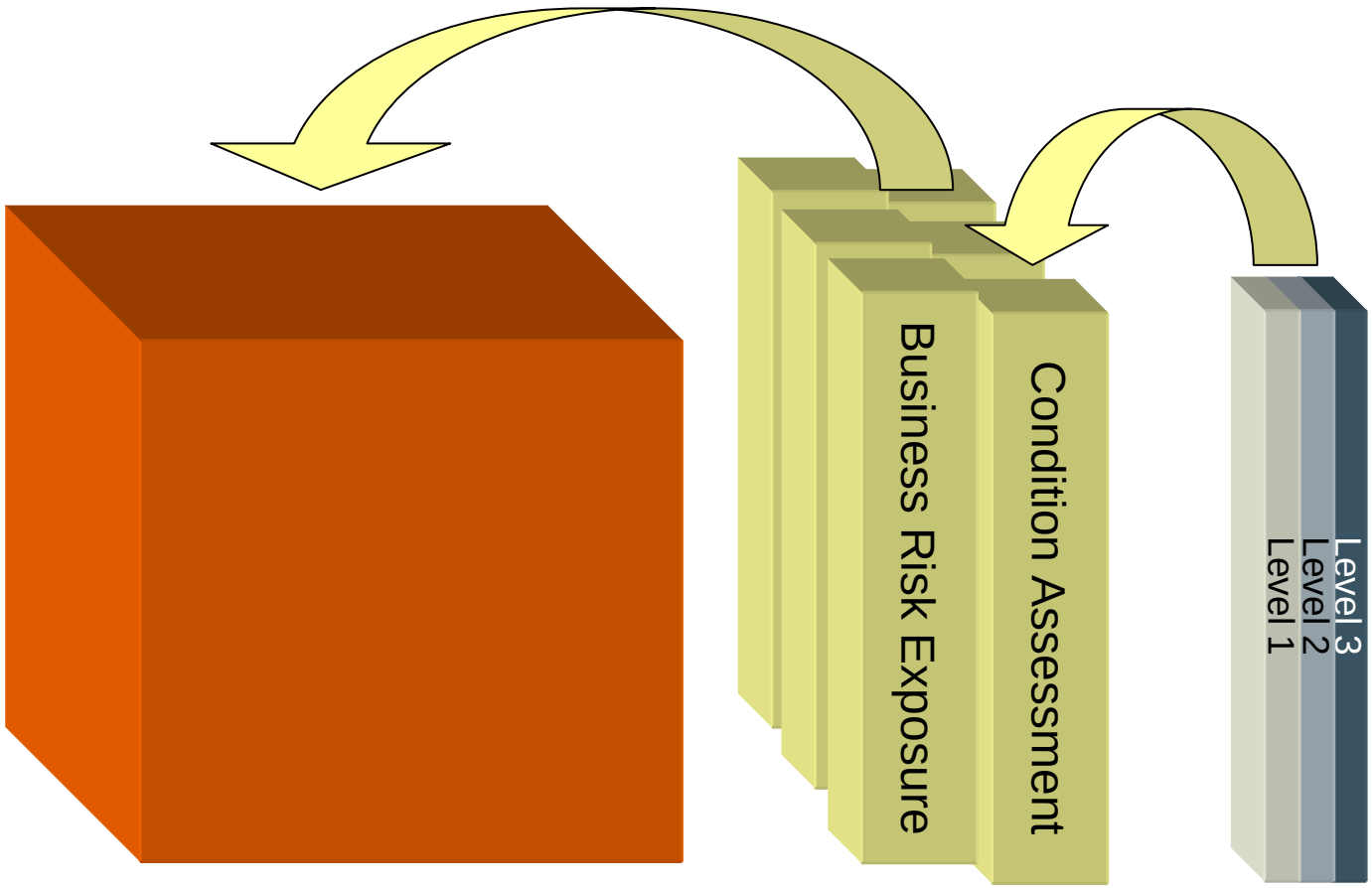
Inside the AM framework



Inside the AM framework



Inside the AM framework



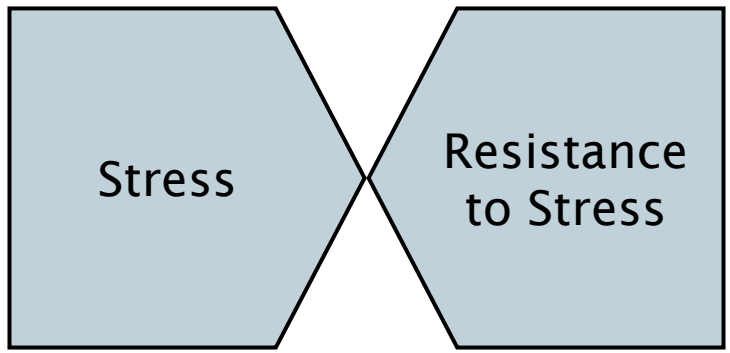
Three fundamental management decisions

1. What are my work crews doing, where are they doing it—*and why*?
2. What CIP projects should be done—*and when*?
3. When should I *repair*, when should I *rehabilitate*, and when should I *replace*?

These decisions typically account for *over 80%* of a utility's annual expenditures

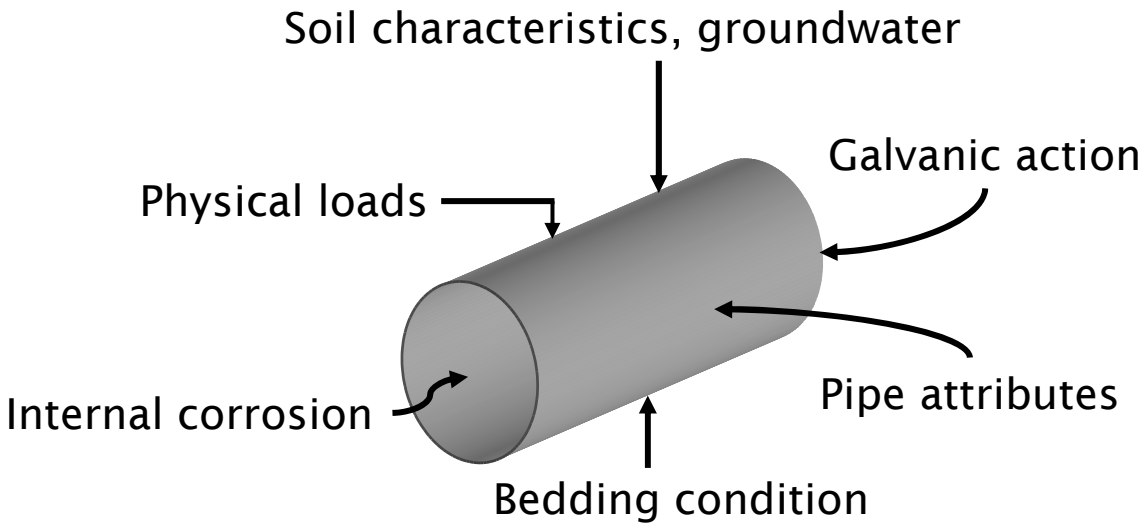
Understanding how our assets fail

Yin-yang of asset failure



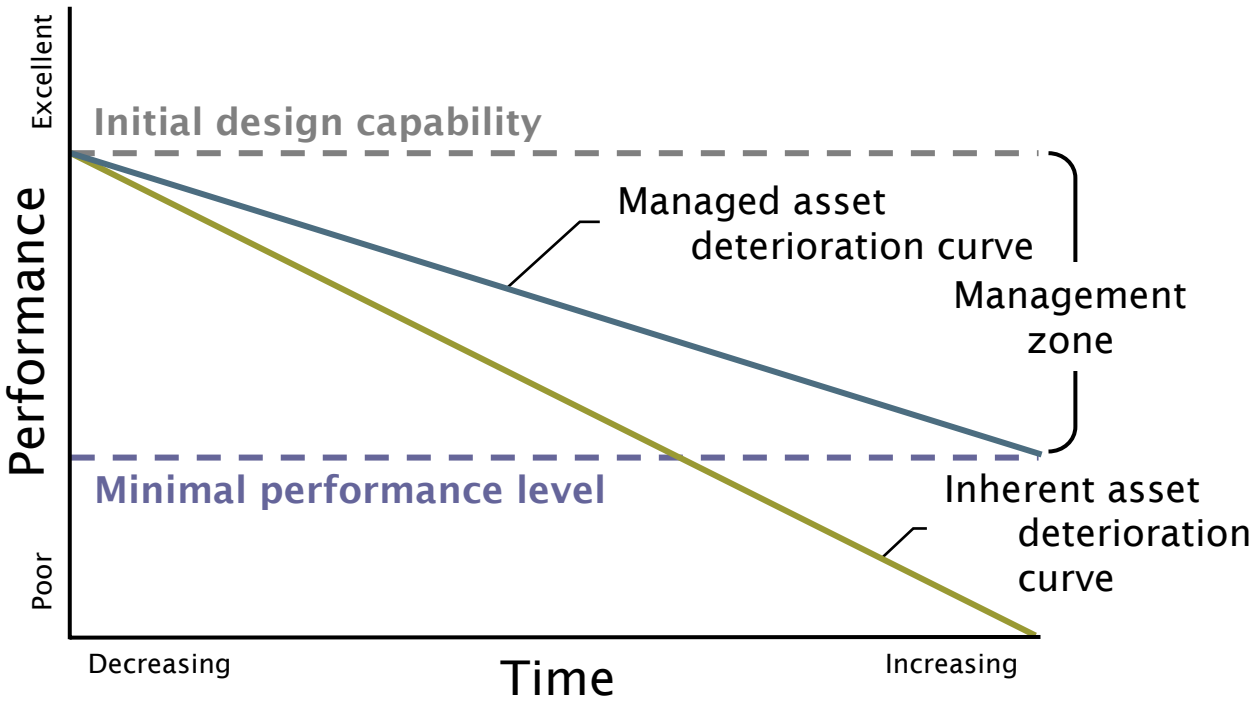
Understanding how our assets fail

Pipe failure



Understanding how our assets fail

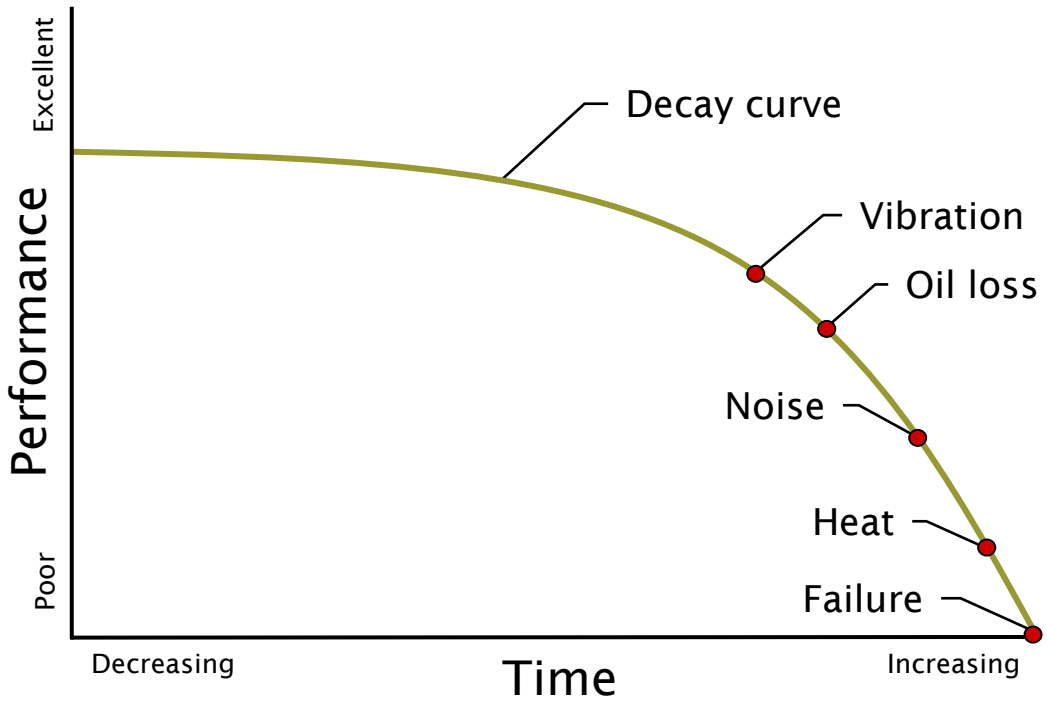
Managing asset deterioration



"Failure is…the inability of any asset to do what users want it do to."
John Moubray

Understanding how our assets fail

Monitoring performance is a key to reliability



Understanding how our assets fail

Experience indicates…

- Failure can be subjected to systematic study – a science
- *30-70%* of equipment maintenance activity is typically *misdirected – it is not cost effectively deterring failure*

Understanding how our assets fail

From the science of failure - tools for *proactive* management

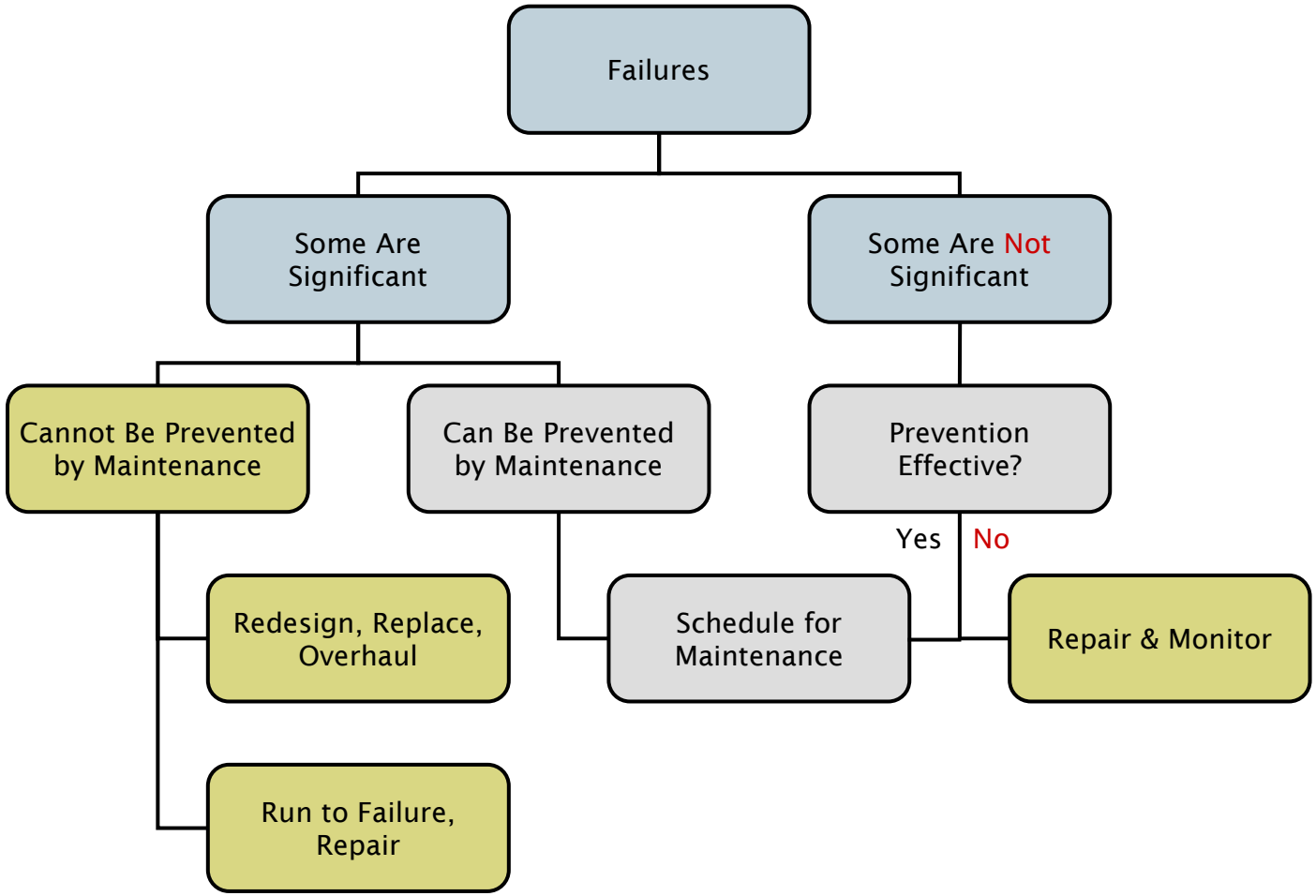
- Root cause analysis
- Failure mode, effects, and criticality analysis (FMECA)
- Condition-based monitoring, failure/survival curves
- Predictive maintenance (PdM)
- Proactive maintenance (zero breakdown, reliability centered maintenance, total productive maintenance)
- Reliability centered management (design, O&M)

AM is all about *managing the potential to fail*

Our investment *toolkit*

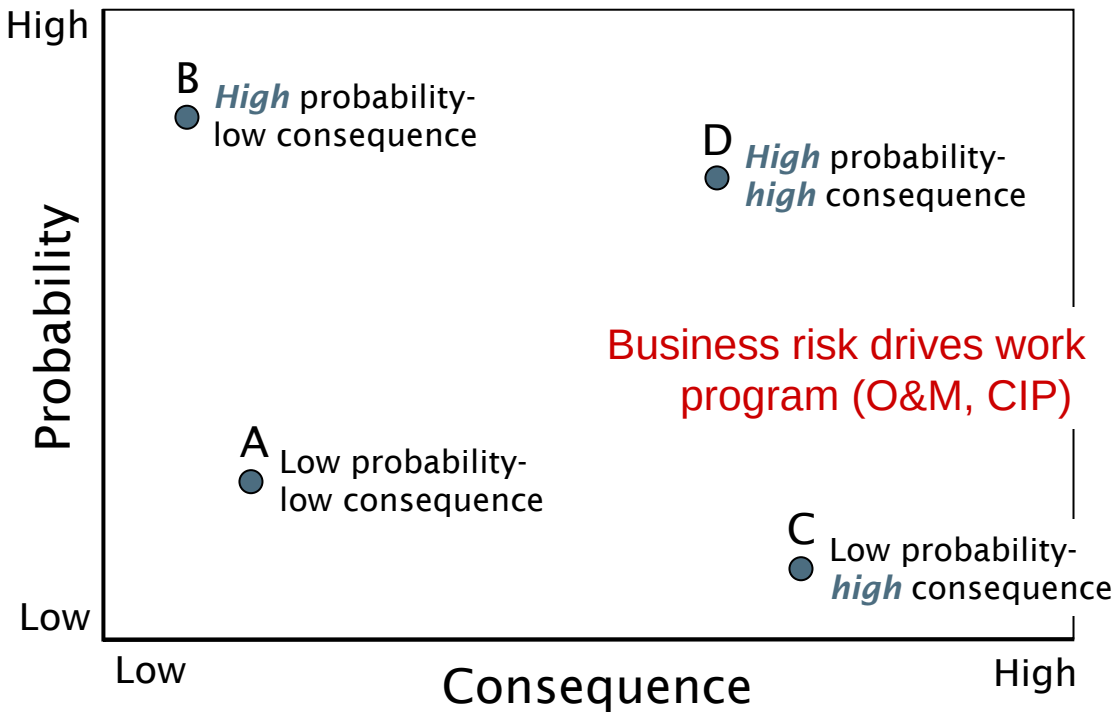
- Maintenance
- Renewal:
  - Repair – repair beyond normal periodic maintenance, relatively minor in nature, anticipated in the long-term operation of the asset; no enhancement of capabilities; typically funded by operating budget
  - Refurbish/Rehabilitate– replacement of a component part or parts or equivalent intervention sufficient to return the asset to level of performance above minimum acceptable level; may include minor enhancement of capabilities; typically funded out of capital budgets
  - Replace
    - Without enhancement – substitution of an entire asset with a new or equivalent asset without enhancement of capabilities
    - With enhancement - substitution of an entire asset with a new or equivalent asset with enhanced capabilities
- "Augmentation"

Failure mode-based management logic

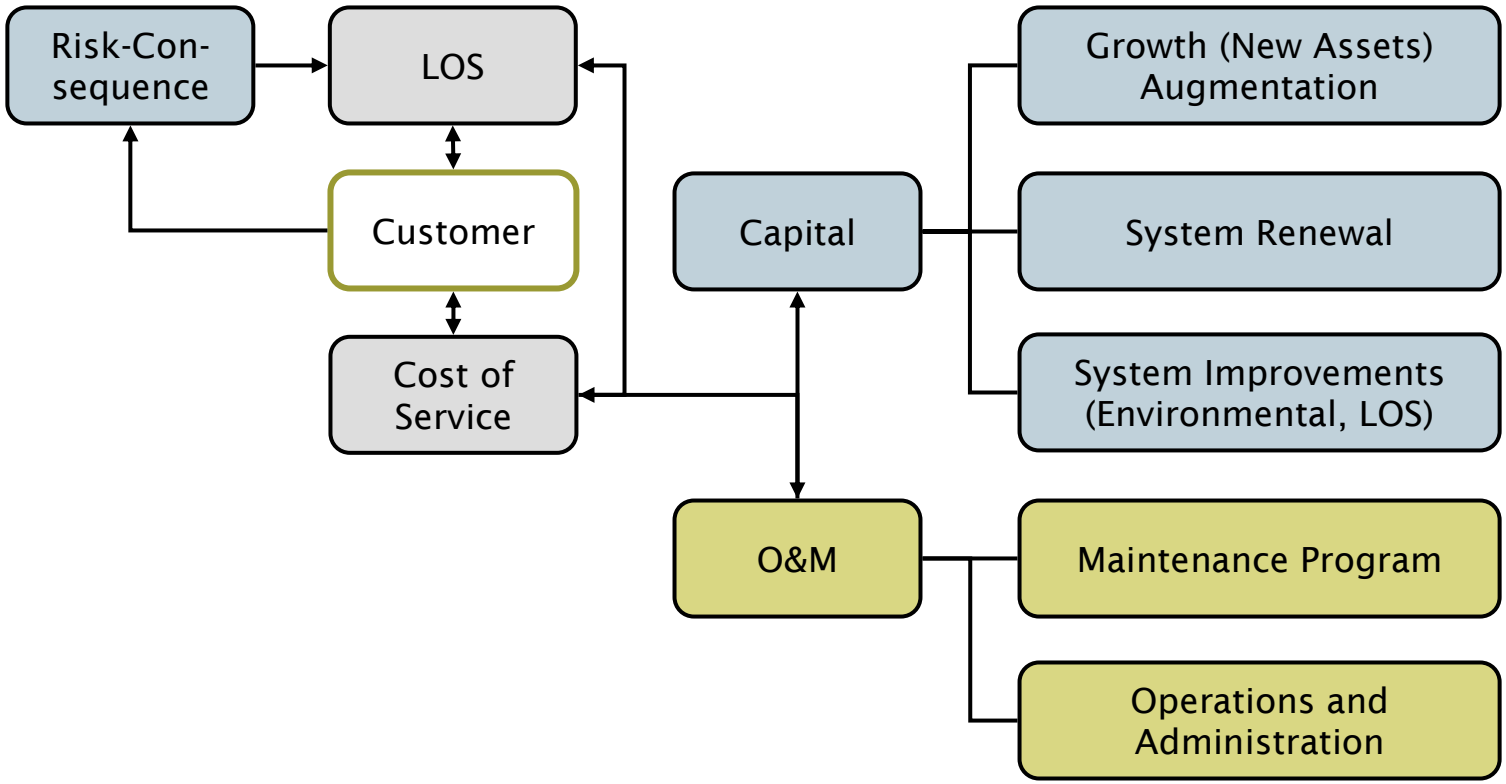


Determining significant failures

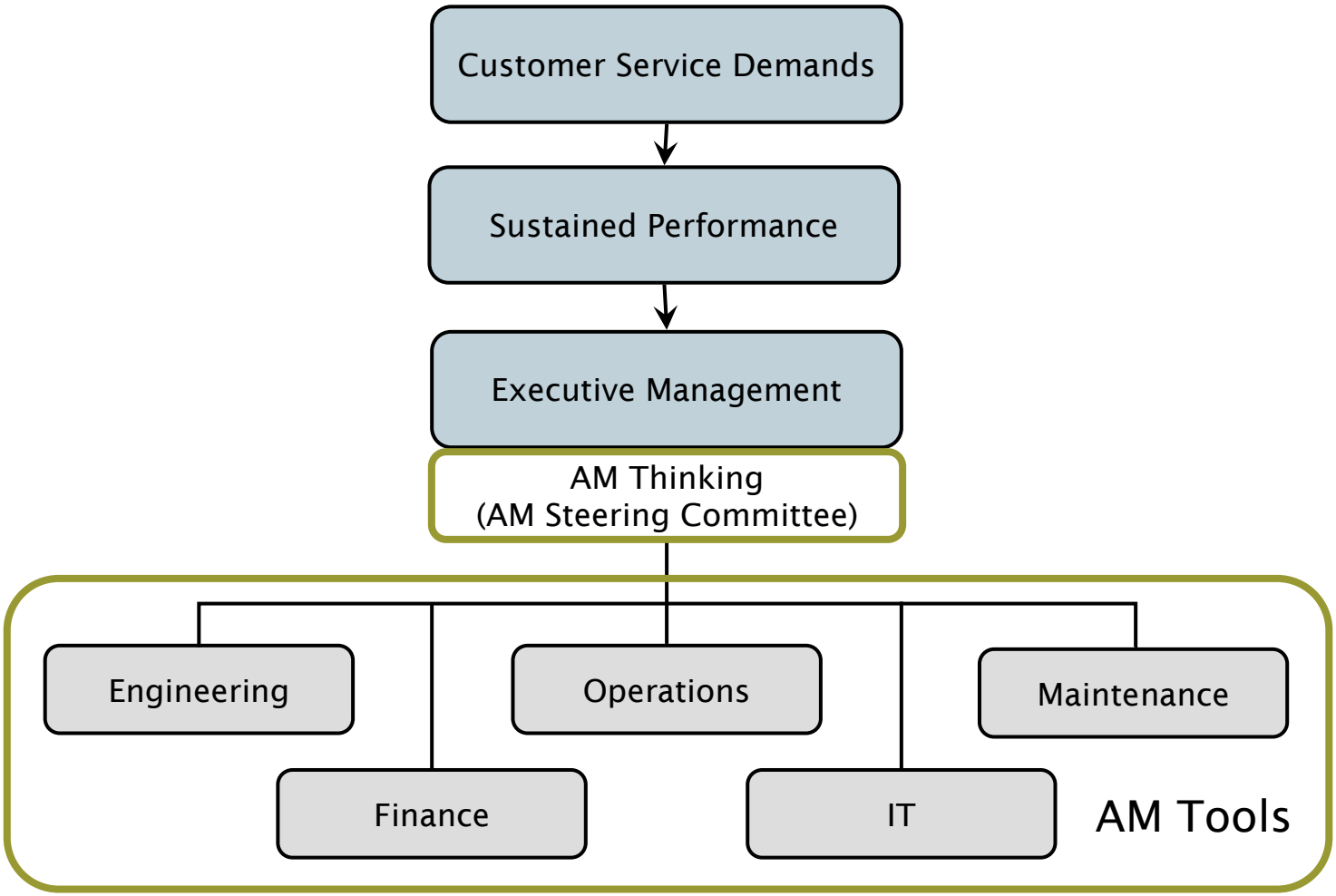
What is probability of failure? What is consequence of failure?



The big picture



AM-oriented structure



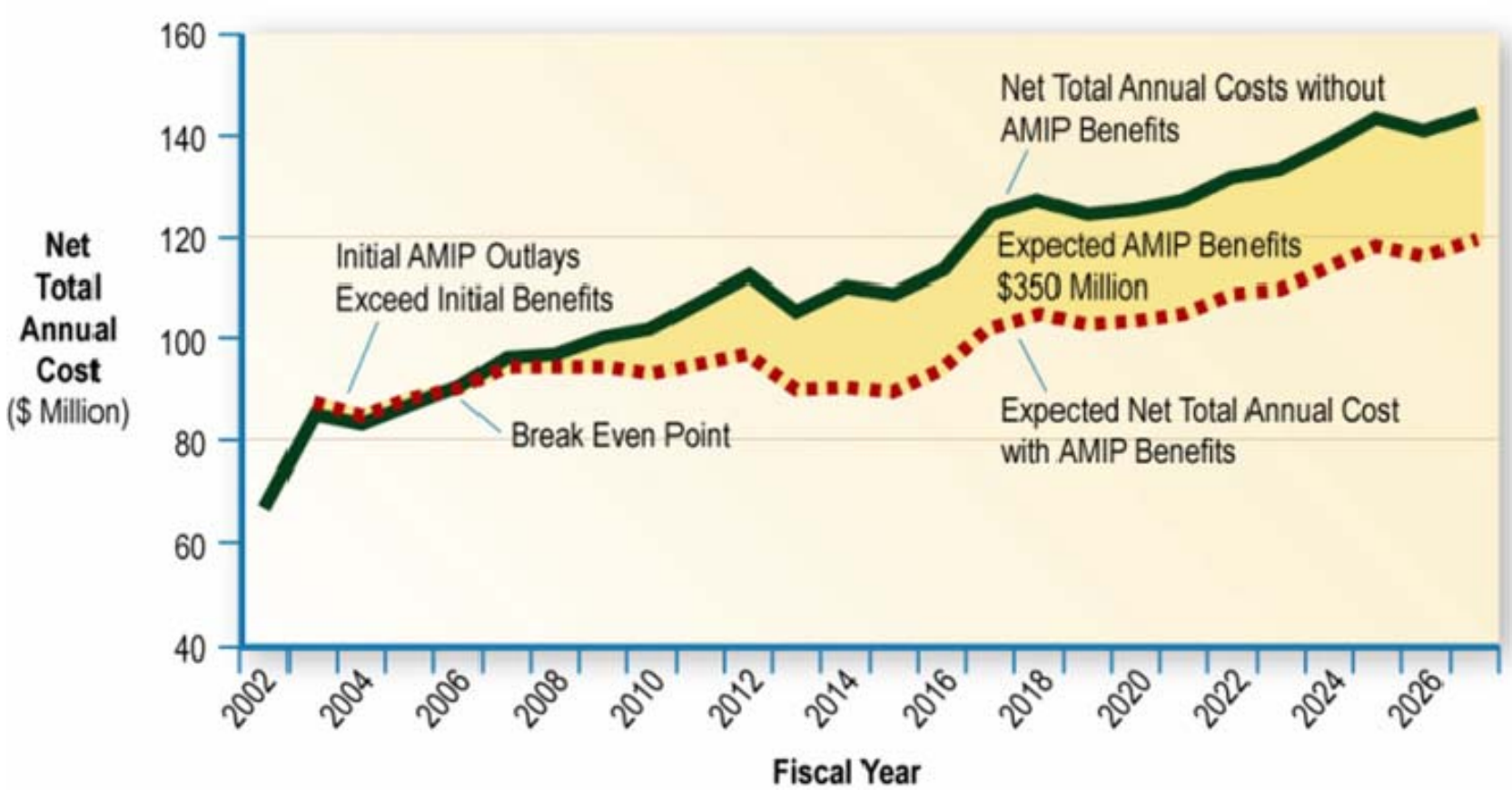
AM-based decisions produce real *savings*

From assessment of Australia's advanced management practices, *20-30%* future life cycle cost *savings* typically is achievable for US water and wastewater utilities

Where savings develop from…

- Efficiency gains
- Cost avoidance (defer, eliminate, reduce)
- Cost effectiveness and redirection

Making business case for AM

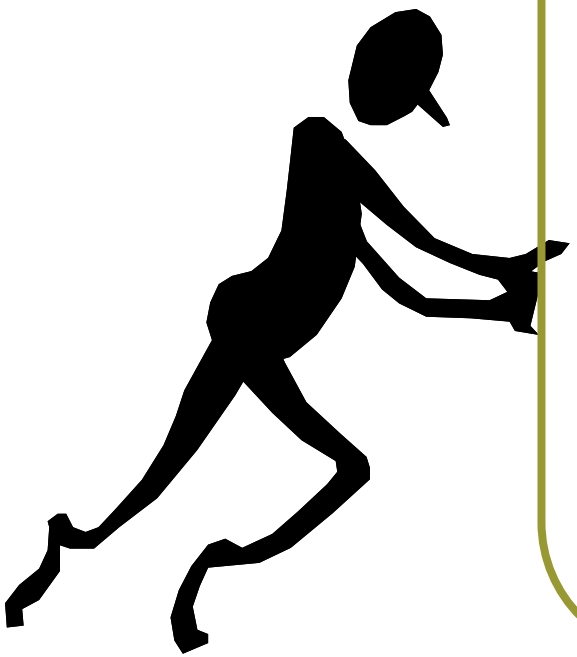


AM payoffs

- Reduced life cycle costs from better-focused (redirected) resource use
- Better value-per-dollar spending
- Confidence in decision-making

The right work,
the right investment,
at the right time,
for the right
reasons.

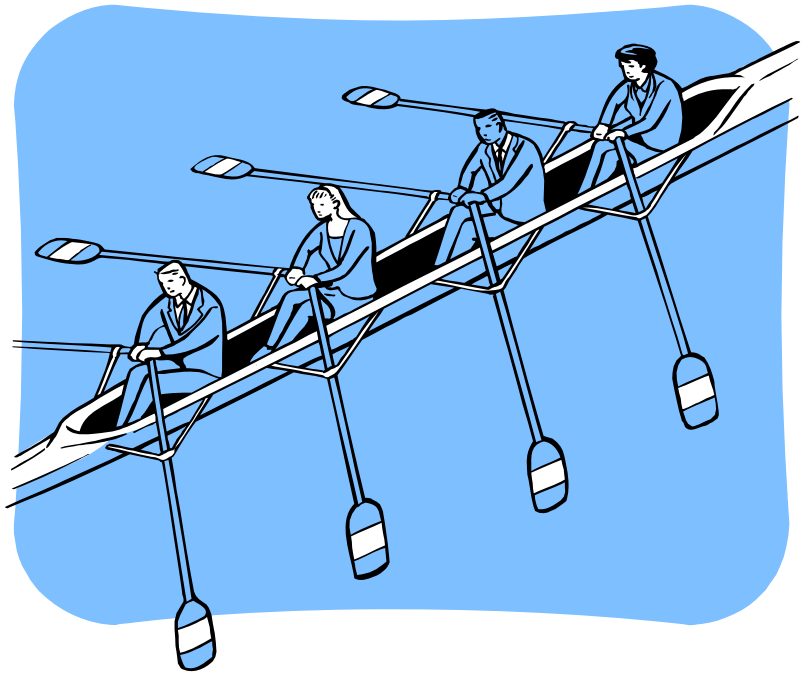
Realistic expectations for AM



- Takes several years of detailed, *nitty-gritty work* to fully deploy
- Requires eventual *buy-in* commitment of the whole organization
- Needs *upfront* investment to get started, with *hidden* returns for initial years

AM is a business model…

- *What* we do
- *Why* we do it
- *How* we do it
- *Where* we invest
- What our *costs* are
- What our *return* is



Tom’s bad day…

Tom's spreadsheet

Storyline:

A Step-By-St
Asset Man

Prologue

It's twilight. Night is co
the 40's. Tom is standi
Street lift station. Raw
street. An old pick-up t
and has hit the power
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pump station's motor
they wait, they would
force main to divert the
can not be found an
warehouse. June, the
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river is the sole water
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up-stream local indust
wastewater backups.

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problem in a control p
another. The third fa
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significant wastewater
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Tom has been a Cit
Supervisor, was prom

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	A	B	C	D	E	F	G	H	I	J	S	T	U	V	W	X	Y
6	Asset Register and Hierarchy					What is the State of My Assets?							Required LOS?		Which Are Most "Critical"?		
7						Installed Date	Asset Class	Original Cost	Estimated Effective Life	Condition Rating	Annual Dep	Accum Dep	Current LOS?	Minimum Condition	Backup Reduction (Redundancy)	Probability of Failure	Consequence of Failure
8	Curre	2006				Year		$	Years	1 to 10	$	$			%	Rating	1 to 10
9	Level 1	Level 2	Level 3	Level 4	Level 5	Act or Est	Tab A	Act or Est	Calculated	Tab A	Calculated	Calculated		Tab A	Tab D	Calculated	Tab C
10	Sanitation System																
11		Disposal System															
12		Treatment Plants															
13		Collection Systems															
14			Sewer Mains														
15			Pump Station														
16				Incoming Sewer									Avg 1500 cfm; peak 2100cfm				
17					Pipes	1963	3	$ 1,725	100	6	$ 17	$ 742		2	0%	4	5
18					Manhole	1963	3	$ 340	100	5	$ 3	$ 146		2	0%	4	5
19					Influent Gate Valve	1986	5	$ 442	30	8	$ 15	$ 295		2	0%	7	5
20				Incoming Power									20 kw peak				
21					Pole & Transformer	2006	4	$ -	40	1	$ -	$ -		2	0%	0	5
22					Connection	2006	7	$ -	35	1	$ -	$ -		2	0%	0	5
23				Control system													
24					Incoming Telephone	1985	8	$ 85	25	7	$ 3	$ 71		2	0%	8	2
25					PLC	1983	8	$ 8,600	25	8	$ 344	$ 7,912		2	0%	9	2
26					Manual controls	1978	8	$ 425	25	7	$ 17	$ 476		2	50%	5	2
27				Land & Improvemnts.													
28					Land	1950	10	$ 630	300	1	$ 2	$ 118		4	0%	2	1
29					Access Road	1963	1	$ 12,500	75	5	$ 167	$ 7,167		4	0%	6	1
30					Landscaping	2000	1	$ 595	75	6	$ 8	$ 48		3	0%	1	1
31					Security fence	1963	1	$ 1,360	75	7	$ 18	$ 780		2	0%	6	3
32				Sub Structure													
33					Cassion Outer	1963	1	$ 30,600	75	6	$ 408	$ 17,544		3	0%	6	4
34					Upper Floor	1963	1	$ 4,250	75	6	$ 57	$ 2,437		3	0%	6	4
35					Dry well	1963	1	$ 6,800	75	6	$ 91	$ 3,899		3	0%	6	4
36					Landings and Stairs	1963	9	$ 4,250	60	7	$ 71	$ 3,046		2	0%	7	4
37					Wet Well	1963	1	$ 5,100	75	6	$ 68	$ 2,924		3	0%	6	4
38					Shaped floor	1963	1	$ 850	75	6	$ 11	$ 487		3	0%	6	3
39					Sump pump	1963	4	$ 595	40	6	$ 15	$ 640		2	0%	10	4
40				Pumps									peak 2100cfm				
41					Drive shafts	2006	6	$ 12,560	35	1	$ 359	$ -		2	TBD	10	TBD
42					Pumps	2006	4	$ 29,750	40	1	$ 744	$ -		2	TBD	10	TBD

E - Renewal S

Ready

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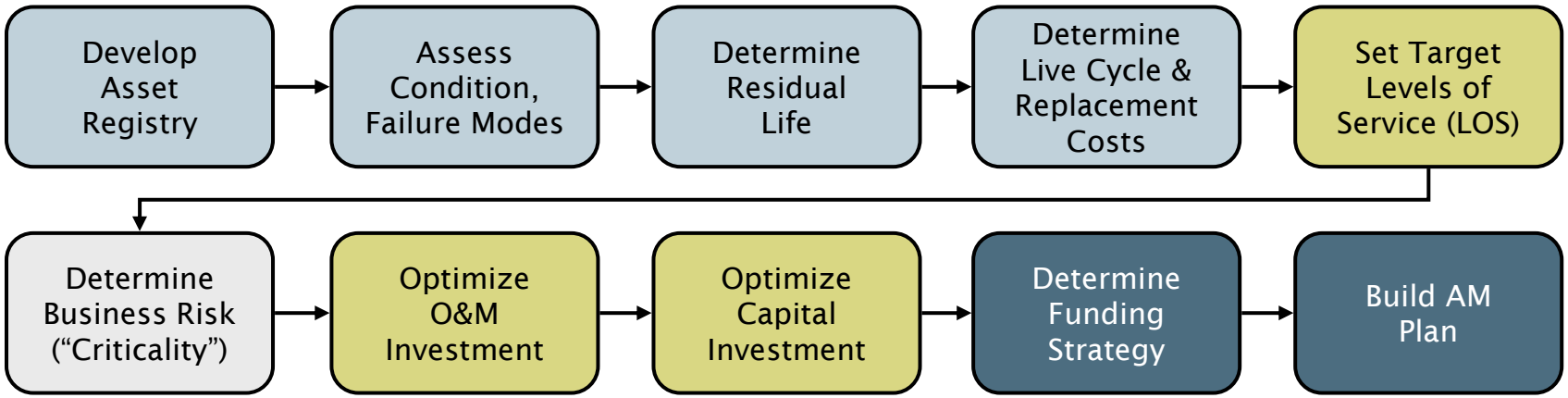
Integration of 5 core questions with 10-step process

1. What is the current state of my assets?

2. What is my required level of service?



3. Which assets are critical to sustained performance?

4. What are my best O&M and CIP investment strategies?

5. What is my best long-term funding strategy?

The Bear and the Butterfly