Asset Management

THE "CENTRAL" APPROACH

D. HEATH CLARK, P.E.
CENTRAL UTAH WATER CONSERVANCY DISTRICT

Who are We

Central Utah Water Conservancy District

- Cover 7 counties
- Federal and District facilities
- Over 200 miles of pipe
- 3 Water Treatment plants
- M&I and Agricultural supply
- 263,900 ac-ft/yr (full demand)

Outline

- Asset Management 101
- Implementation
  - Knowledge Transfer
  - Rehabilitation / Replacement Budget Planning
- Q&A

Outline

- Asset Management 101
- Implementation
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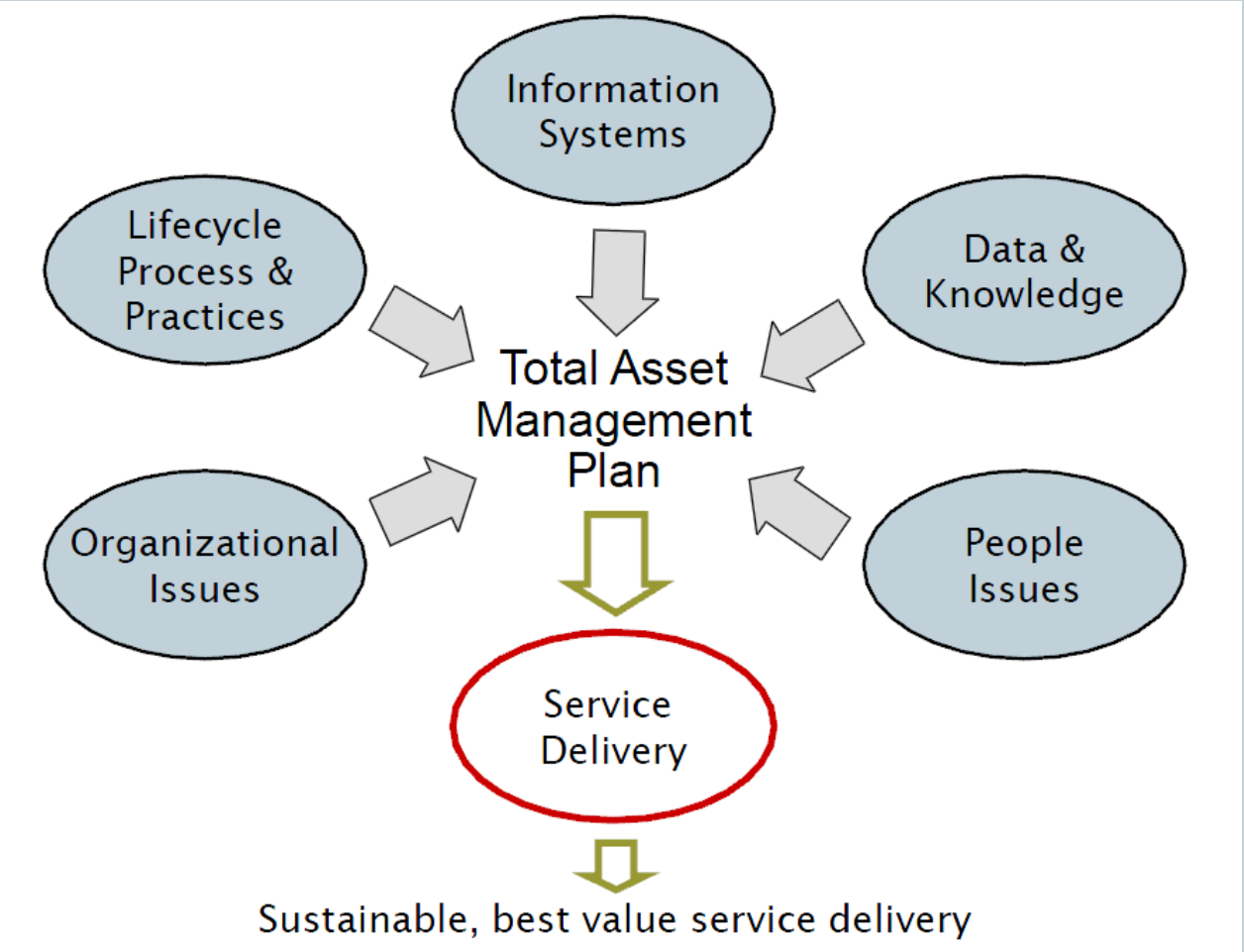
Asset Management 101

- 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!*

Asset Management 101

- 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*

Asset Management 101



Asset Management 101

- 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?

Asset Management 101

- What is the current state of my assets?
  - What do I own?
  - Where is it?
  - What condition is it in? How is its performing?
  - What is its remaining useful life?
  - What is its remaining economic value?

Asset Management 101

- 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?

Asset Management 101

- Asset Management 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

Outline

- Asset Management 101
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  - Knowledge Transfer
  - Rehabilitation / Replacement Budget Planning
- Q&A

Implementation

Implementation

- IBM'r
  - Control knowledge
  - Departmentalized – "SILO"
- Supervised your Supervisors
  - Methodology / Ideology / Culture
- Succession Planning
  - Knowledge transfer

Implementation

Asset Data & Knowledge

… combination of experience, values, information in context … forecasts of future behaviour require ***good knowledge not just good data****.*

- Knowledge Transfer
  - Not just a good idea, but a requirement
  - Trained ideology creates suspicion, apprehension
  - Does not make you less valuable to organization
  - Management has to create environment where it can happen

Implementation

Asset Data & Knowledge

… combination of experience, values, information in context … forecasts of future behaviour require good knowledge not just good data.

- Knowledge Transfer Documents (KTD)
  - Record of what is done with the how/why
  - Intended for the next generation of workforce

- Anatomy of a KTD
  - Combination of “instructions”, warnings/safety items, tips/tricks, and photos documentation

Implementation

KTD Process

- Weekly safety meetings and schedule coordination in O&M department
- Calendar items created in common calendar
  - repairs, inspections, etc.
- Coordinate and prioritize schedule for “job shadow”
- Operator’s are questioned in the field during work
  - how, why, what…

Implementation

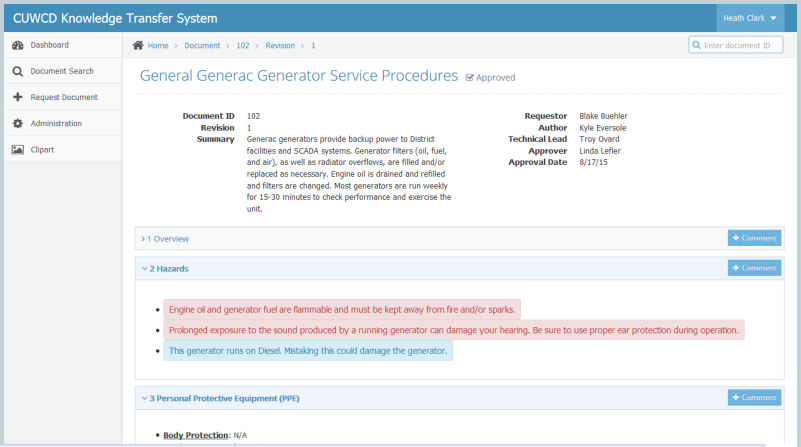
KTD Process

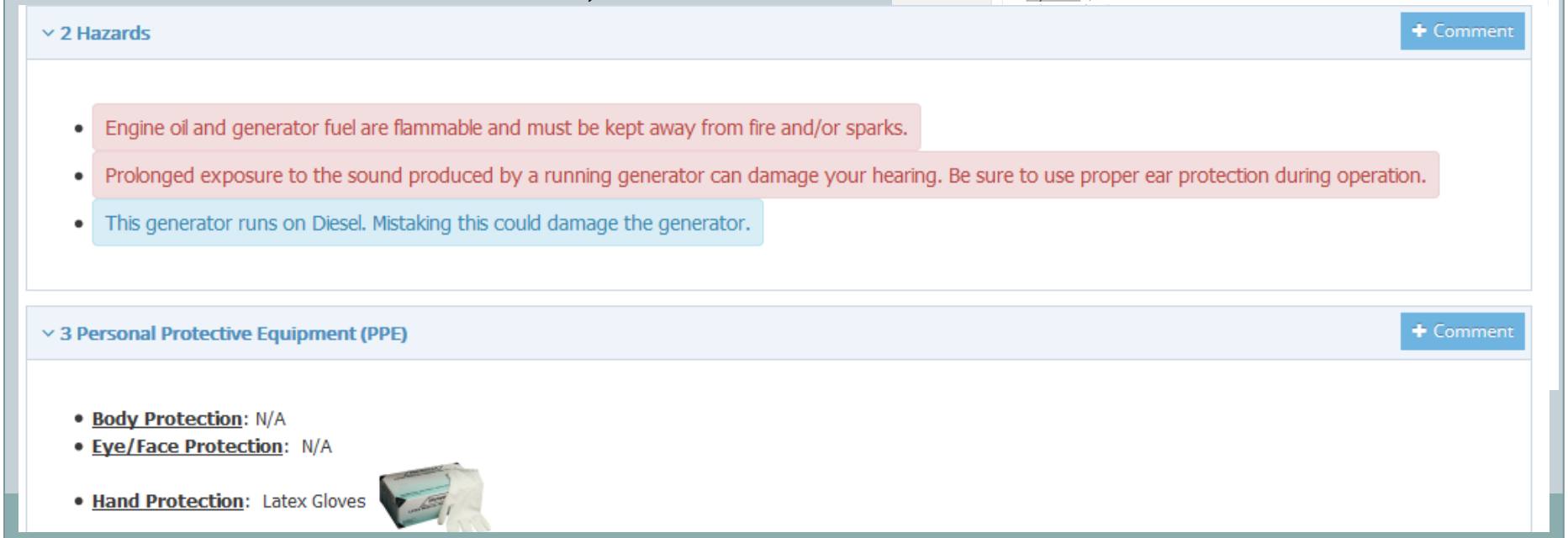
- Media record is taken in field (photo, video, audio)
- Documentation is prepared in language understood by operators
- Approach is it's their knowledge/experience we need to make sure things keep running into the future
- They are integral to process and take ownership
- Ultimately reviewed by operator, approved by manager

Implementation

Anatomy of a KTD

- Managed in a database
- Dynamic rendering as web pages
- Links to District media system
  - Not embedded in document, allows for





Implementation

Lessons Learned

- Managers discover both good and bad procedures
  - Years of doing something wrong does not make it right
  - Efficiencies discovered that can be applied across the District
- Balance personal preference by general processes
- Including everyone yields more useful data

Implementation

Lessons Learned

- A picture is worth….

Challenges

- Hours in a day
- Staffing
- Full adoption

Outline

- Asset Management 101
- Implementation
  - Knowledge Transfer
  - Rehabilitation / Replacement Budget Planning
- Q&A

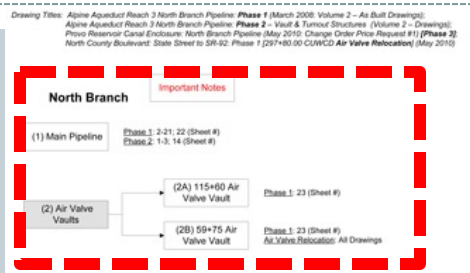
Rehabilitation/Replacement Budget Planning

Asset Information Strategy

… taking into account the costs providing asset information & the value of the information

- Asset Management Units (AMU)
  - Logical "container"
  - Used for initial budgeting, performance/condition assessments
  - Every Asset is linked to one AMU (thru parent-child chain)
  - Low enough to provide value, high enough to actually get something done
  - Work order logging / maintenance records / documentation
    - North Branch Pipeline (Highland / Cedar Hills)
      - 28 AMU's
      - 589 Assets

Rehabilitation/Replacement Budget Planning



North Branch

Important Notes

(1) Main Pipeline

Phase 1: 2-21; 22 (Sheet #)
Phase 2: 1-3; 14 (Sheet #)

(2) Air Valve Vaults

- (2A) 115+60 Air Valve Vault — Phase 1: 23 (Sheet #)
- (2B) 59+75 Air Valve Vault — Phase 1: 23 (Sheet #); Air Valve Relocation: All Drawings

Rehabilitation/Replacement Budget Planning

North Branch			February 2013	
CUWCD Asset Management Unit to focus on OM&R and long term expense forecasting for the District.				
AMU #	**Title**	**AMU Level**	**Replacement Cost**	**Lifespan (yrs)**
1	Main Pipeline	1	$5,468,000	75.00
2	Air Valve Vaults	1		
2A	115+60 Air Valve Vault	2	$67,000	75.00
2B	59+75 Air Valve Vault	2	$66,000	75.00
3	68+32 Blow-off Vault	1	$161,000	75.00
5B3	Highland	3		
5B3a	Pipe	4	$124,000	75.00
5B3b	Valves	4	$39,000	25.00
5B3c	SCADA / Electrical	4	$51,000	10.00
6	138+00 Bypass Vault	1		
6A	Pipe	2	$174,000	75.00
6B	Valves	2	$106,000	25.00
6C	Structure	2	$221,000	75.00
6D	SCADA / Electrical	2	$52,000	30.00
7	Parallel Pipe	1		
7A	Pipe	2	$1,119,000	75.00
7B	102+25 Air Valve Vault	2	$57,000	75.00
7C	127+55 Blow-off Vault	2	$42,000	75.00
Total - North Branch			$8,758,000	

AMU #	Title	AMU Level	Replacement Cost	Lifespan (yrs)
1	Main Pipeline	1	$5,468,000	75.00
2	Air Valve Vaults	1		
2A	115+60 Air Valve Vault	2	$67,000	75.00
2B	59+75 Air Valve Vault	2	$66,000	75.00

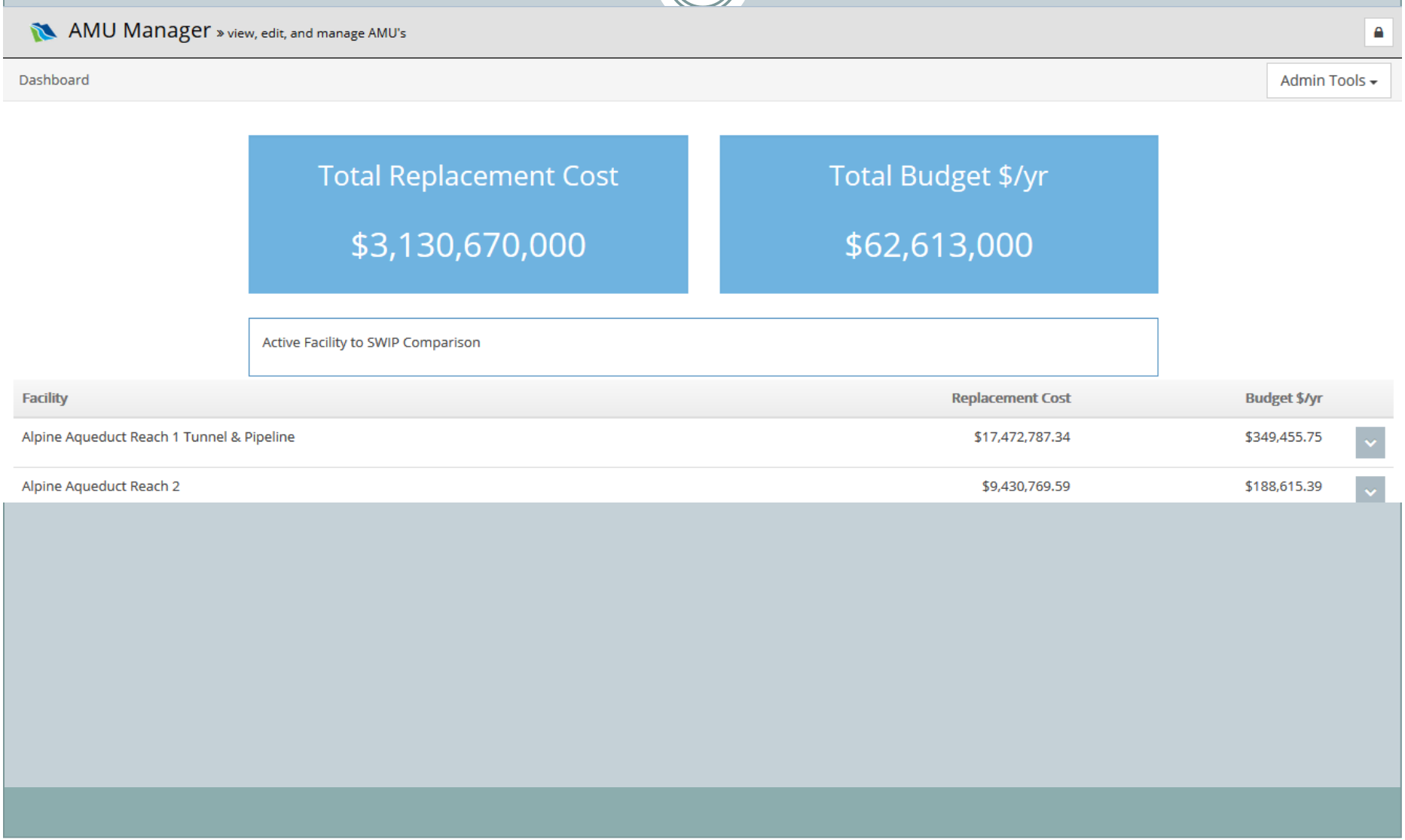
Rehabilitation/Replacement Budget Planning

2A - VENT/MANWAY STA 115+60 — February 2013

CUWCD Asset Management Unit to focus on OM&R and long term expense forecasting for the District.	Model NO.	Each	Length FT	Width FT	Thickness or Depth FT	Diameter	Quantity		Unit Cost (Labor & Materials) $	Total Cost $	Replacement Average Years	Replacement CUWCD Years
Thermal & Moisture Protection												
2" Rigid Insulation Wall		4.00	6.00	5.00			120.00	SF	1.65	$198	15	15
2" Rigid Insulation Ceiling		1.00	6.00	6.00			36.00	SF	1.65	$59	15	15
Finishes												
Painting		1.00	0.00	0.00	0.00		0.00	LS	400.00	$400	10	10

CUWCD Asset Management Unit to focus on OM&R and long term expense forecasting for the District.	Model NO.	Each	Length FT	Width FT	Thickness or Depth FT	Diameter	Quantity		Unit Cost (Labor & Materials) $	Total Cost $	Replacement Average Years	Replacement CUWCD Years
Stainless Steel Ladder		1.00		5.00			5.00	LF	300.00	$1,500	75	75
Thermal & Moisture Protection												
2" Rigid Insulation Wall		4.00	6.00	5.00			120.00	SF	1.65	$198	15	15
2" Rigid Insulation Ceiling		1.00	6.00	6.00			36.00	SF	1.65	$59	15	15
Finishes												
Painting		1.00	0.00	0.00	0.00		0.00	LS	400.00	$400	10	10
Mechanical												
Vent Pipe						4"	12.00	LF	85.00	$1,020	75	75
Vent Pipe						6"	14.00	LF	128.00	$1,792	75	75
Flanged Manway		1.00	0.00	0.00	0.00	24"	0.00	EA	7,500.00	$7,500	75	75
APCO Combination Air/Vac Valve	149C					4"	1.00	EA	1,712.00	$1,712	25	25
Gate Valve						4"	1.00	EA	1,021.00	$1,021	25	25
Garlock Style 206 EZ Flow Coupling						4"	1.00	EA	755.00	$755	5	5
Pipe Supports & Miscellaneous		1.00	0.00	0.00	0.00		0.00	LS	1,380.00	$1,380	75	75
Contingency							1.00	LS	25%	$13,242		
Engineering Design Fee							0.00	LS	25%	$0		
CUWCD Project Administration Fee During Design and Construction							0.00	LS	25%	$0		
Total - 2A - Vent/Manway Sta 115+60										$66,211		
									Use	$67,000		

Rehabilitation/Replacement Budget Planning



Rehabilitation/Replacement Budget Planning

					Lifespan (years)				
...	QTY	Units	Unit Cost	Total Cost	Industry	District	Site Specific	$/yr Total	
General Requirements			10.0%	$654.72					
Site Restoration			10.0%	$595.20					
Demolition			20.0%	$992.00					
This is a test									
002-2	1.0000	cu.yd	$1,200.00	$1,200.00	20	10	--	$217.80	
002-2	1.0000	cu.yd	$1,200.00	$1,200.00	20	10	--	$217.80	
00Test	1.0000	cfs	$2,560.00	$2,560.00	15	15	--	$309.76	
Contingency			25.00%	$1,800.48					

AMU Total: $9,002.40

Total $/yr: $527.56

Consultant AMU Replacement Cost:

Summary

Since we can't "tear it all down to build it back up"

- AM is our culture from the "big" boss
- Abandon "my sandbox" ideology
- AM is support group that crosses boundaries
- Challenge / change knowledge compartmentalization
- Collect knowledge before it walks out the door
- Better understand R&R moving forward

Summary

Since we can't "tear it all down to build it back up"

- Get everyone involved –
  - Buy-In top to bottom & bottom to top
- Operators are front-line data gathers
  - Get them involved early and often
  - Build support tools / technology
- Hiring practices that support AM vision
  - May require some Org-Chart changes
- AM is "Reason" for decisions

Outline

- Asset Management 101
- Implementation
  - Knowledge Transfer
  - Rehabilitation / Replacement Budget Planning
- Q&A

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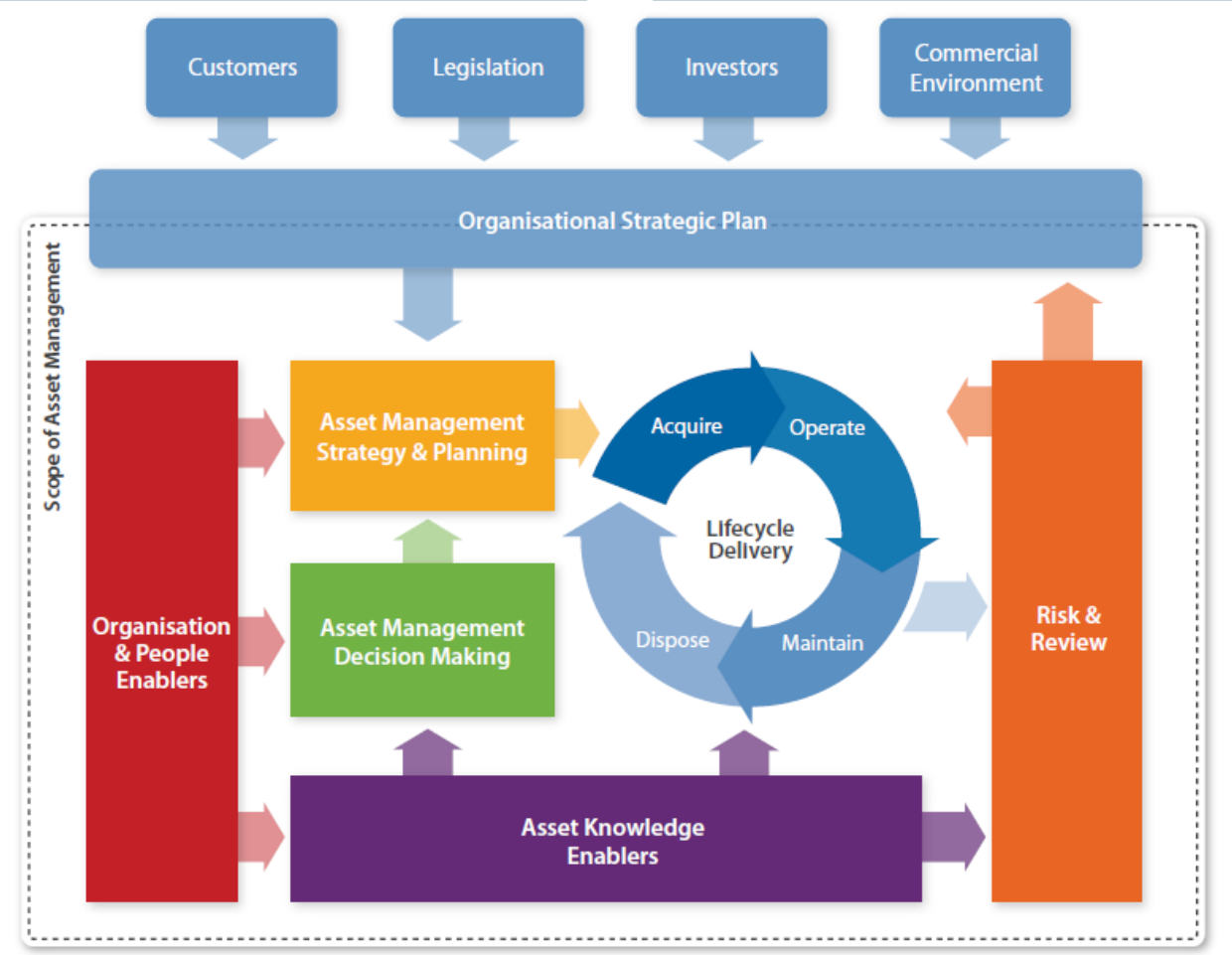
Implementation



Implementation

Asset Knowledge Enablers

- Records of the existence of a physical asset, collectively known as an asset inventory.
- Attributes about these assets e.g. make, model, serial number, age, capacity.
- Location, spatial information and connectivity information – especially in Geographical Information Systems (GIS).

Implementation

Asset Data & Knowledge

- Accuracy – the data is a true reflection of the physical entity it represents.
- Clarity – data interpretation is unambiguous
- Completeness – a complete set of data is available for each data record.

Implementation

Asset Data & Knowledge

- Consistency – data is consistent in its definition, rules, format & value.
- Correctness – all data held is verified as valid and up-to-date.
- Integrity – the structure of data and relationships is maintained consistently.
- Uniqueness – all keys should be unique with no duplication of data.

Implementation

Asset Data & Knowledge

Knowledge is derived from the combination of experience, values, information in context, and insight. The quality of this understanding will affect the reliability and quality of decision making. For example, forecasts of future behaviour require good knowledge not just good data.

Implementation

Asset Information Strategy

… taking into account the costs providing asset information & the value of the information

- What do I own/manage?
- Develop a hierarchy than can grow with asset data/knowledge acquisition
  - Minimum: Spreadsheet
  - Best: Database
  - Parent-Child relationship for data organization
  - Include spatial ties (facilities or projects)
  - Focus efforts at level for early wins

Implementation

Asset Knowledge Standards

… quality and accuracy that is appropriate for the different types of information

- Minimum
  - Name, description, asset type, installation date
- Better
  - Location (x/y/z coordinates)
  - Installation cost, lifespan
  - Details - Manufacturer, supplier, material type, size (h/w/d)…
- Best
  - Remaining life, Condition/performance
  - Link media, documents, GIS

Implementation

Asset Information Systems

Across the Asset Management lifecycle, different functions of an organisation will have an interest in the asset…

- Black & Veatch Program Review - 2009
  - 9 Key Tasks to move AM Program forward
  - Asset Hierarchy
  - CMMS (Software) Decisions
    - Internal
    - Off the shelf
  - Organizational changes

Implementation

Asset Information Systems

Across the Asset Management lifecycle, different functions of an organisation will have an interest in the asset…

- Common theme:
  - Software, Software, Software, utilities invested heavily in software
  - "I am Joe Schmo, manager of District A. We have X miles of pipe and Y pump stations. The remainder of my presentation will be given by our consultant, they will explain our system.."

Implementation

Asset Information Systems

Across the Asset Management lifecycle, different functions of an organisation will have an interest in the asset…

- Common theme:
  - *Working* with upper management and other departments…
  - Difficulties integrating with new technologies and other useful platforms

Implementation

Asset Information Systems

Across the Asset Management lifecycle, different functions of an organisation will have an interest in the asset…

- Decision time
  - Custom (internal) development
    - Get exactly what you want, dynamic
    - Requires organization-wide buy-in, staff input and time, may not be the cheapest up-front
  - Off the shelf
    - R&D paid for, “ready-to-go”, maintained by others
    - Training, training, training, on-going maintenance costs, customizations not always backwards compatible

Implementation

Asset Information Systems

… require asset information presented and manipulated in differing formats

- Custom Web-based platform accessible “anywhere”
  - Flexible design
  - Custom look/feel
  - Reporting / Dashboard concepts
  - Revisions controlled internally (cross platform and backwards compatible)
- iOS
  - Field collection, verification, interaction with system data

Implementation

Step One - Develop Asset Hierarchy

- What do I own/manage?
  - Organized in logical fashion
  - Unit
    - Facility
      - Asset Management Unit
        - Asset(s)
  - Everything belongs to a “parent” so “children” can be located

Implementation

Asset Information Strategy

Example

- Unit – Bonneville Unit
  - Area – M&I System
    - Facility – North Branch
      - AMU – Air Valve Vaults
        - Asset (Level 1) - Air Valve Vault 59+75
          - Asset (Level 2) – 24” Flanged Manway
          - Asset (Level 2) – 30”x36” Vault Access
          - …
        - Asset (Level 1) - Air Valve Vault 115+60

Implementation

- Data fields for assets
  - Minimum
    - Name, description, asset type, installation date

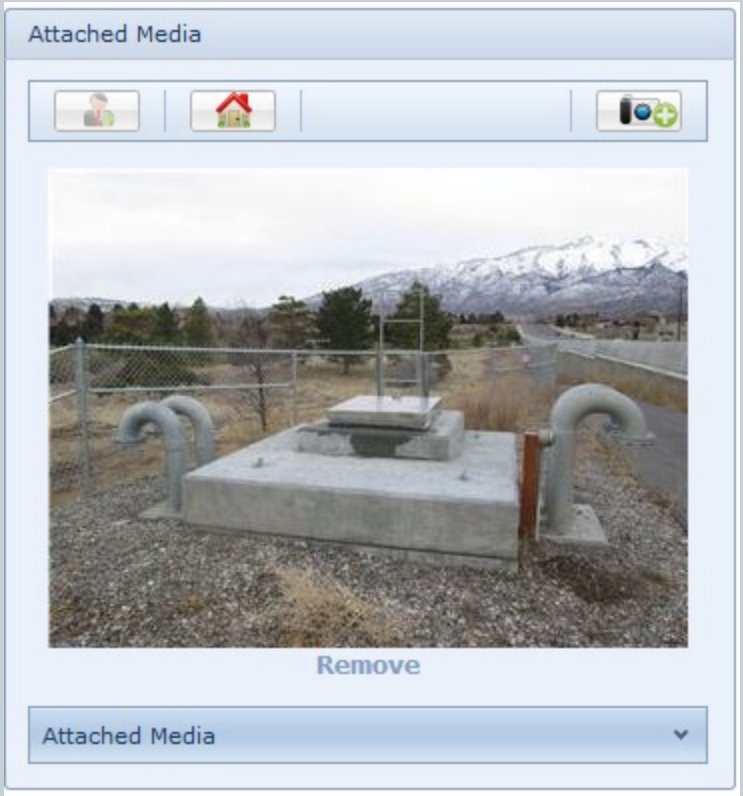
Implementation

- Data fields for assets
  - Better
    - Location (x/y/z coordinates)
    - Installation cost, lifespan
    - Details
      - Manufacturer, supplier, material type, size (h/w/d)…

Base Details	
Name:	8" Steel Gooesneck Vent
Description:	8" Steel Gooesneck Vent W/ 1/4" Welded Wire Birdscreen Drawing #66-418-8272
Type:	Vent_Piping
Installed:	10/01/1995
Cost:	$294.00
LifeSpan (yr):	75.00
LifeStatus:	Operational

Implementation

- Data fields for assets
  - Best
    - Remaining life
    - Condition/performance
    - Link media, documents, GIS



Outline

- Asset Management 101
- Implementation
- Road Map
- Live Demo
- Q&A

Implementation

- Silo effect

Engineering

Finance

WTP

Records

CUPCA

O&M

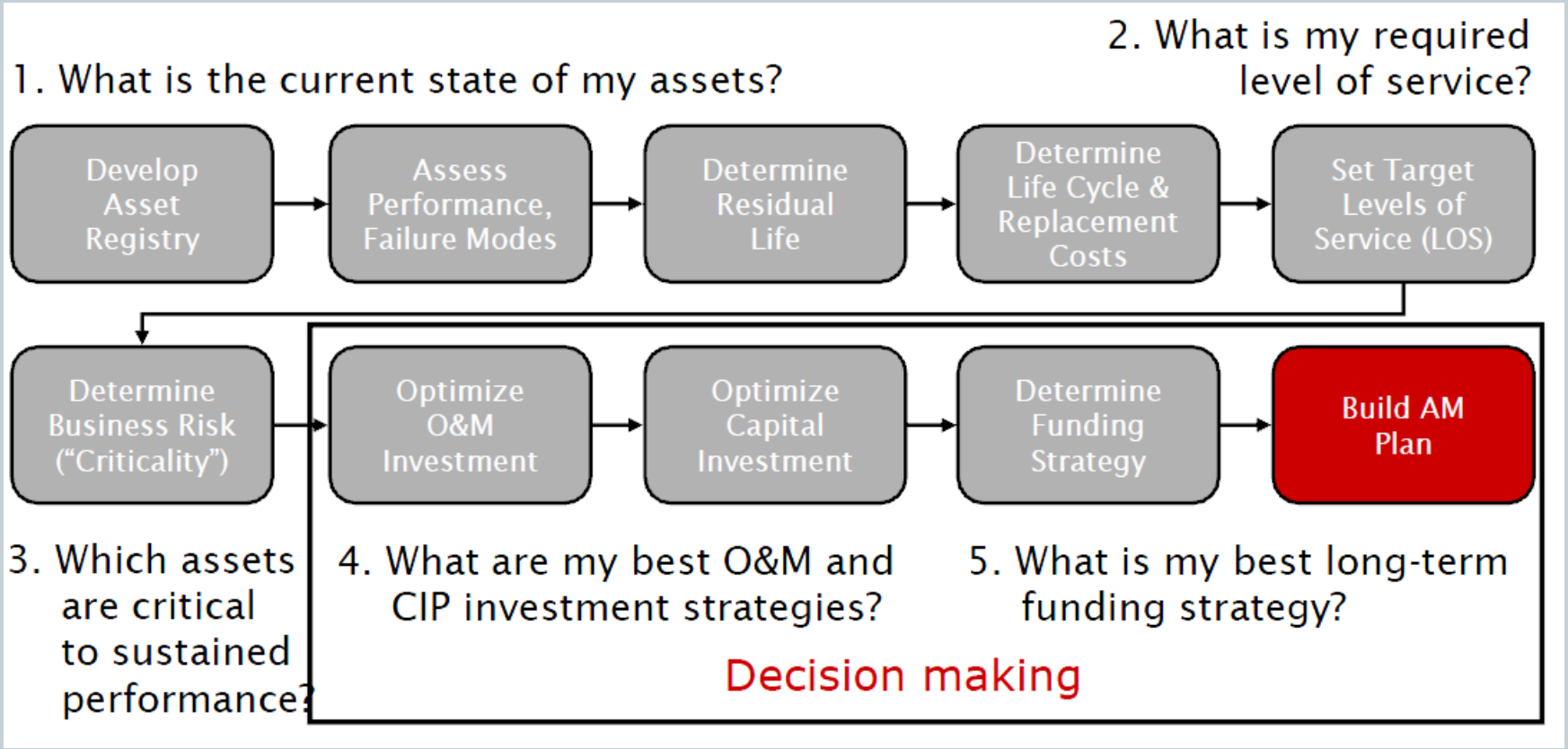
Asset Management 101

- What are my best O&M and CIP investment strategies?
  - What alternative management options exist?
  - Which are the most feasible for my organization?
  - Reinvestment Decision

Asset Management 101

- What is my best long-term funding strategy?
  - Replacement vs. Rehabilitation

Asset Management 101



Implementation

Asset Knowledge Enablers

- Subjective information about the asset, such as asset performance, condition and serviceability assessments.
- Planned short, medium and long term asset intervention activities and the history of past activities.
- Documents, CAD drawings and photographs of the asset.

Implementation

Asset Knowledge Enablers – Groups

- Asset Information Strategy
- Asset Knowledge Standards
- Asset Information Systems
- Asset Data and Knowledge

Implementation

Asset Information Strategy

- Key decisions and the information required to support these.
- The proposed approach to defining information requirements taking into account the costs providing asset information & the value of the information.
- Information flows, system interfaces & logical data model.
- Data management and governance arrangements.

Implementation

Asset Information Strategy

- The costs, benefits and timescales for delivery of improvements to asset information.
- Main system functionality required from Asset Information Systems.
- Core Asset Information *Systems* required.
- A description of how different asset information systems (both existing and proposed) will integrate.
- A strategy for migrating from existing systems to new systems.

Implementation

Asset Information Strategy

The Asset Information Strategy should take into account the lifecycle costs of the provision of asset information and the value the information adds to the organisation in terms of improved decision-making and support the day-to-day delivery of Asset Management activities.

Implementation

Asset Knowledge Standards

- Classification of assets to an agreed hierarchy in order to allow an overall asset inventory to be created and managed.
- Definition of the required attributes that should be gathered and managed for each asset type.
- Common approaches to the assessment and recording of the condition of an asset in order to support strategic Asset Management planning.

Implementation

Asset Knowledge Standards

- Common methods for categorising asset defects and failures for use in planning remedial actions to improve service and reliability.
- Defined approaches to the assessment and recording of the performance or serviceability of an asset to support long and short term planning activities.
- Agreed methods for assessing and recording the utilisation of an asset to help determine overall asset lives and intervals between intervention activities.

Implementation

Asset Knowledge Standards

Should also define the level of quality and accuracy that is appropriate for the different types of information, taking into account the criticality of the different assets and the criticality of the decisions that are made using the Asset Information.

Implementation

Asset Information Systems

- An asset register to detail the assets of interest to an organisation.
- A Geographical Information System (GIS) to record the location and spatial details of assets.
- Work management systems to plan and record work activities related to an asset.

Implementation

Asset Information Systems

- Logistics systems are required to manage the storage, issuing and use of spares.
- Possession management systems are used to plan access to assets for work activities.

Implementation

Asset Information Systems

- Demand management systems will forecast how demand on assets will change over time.
- Decision Support Tools such as investment modeling systems are used in strategic planning activities.

Implementation

Asset Information Systems

- Process, telemetry and SCADA systems provide a record of how well assets have performed and are meeting their service requirements.
- Condition monitoring systems monitor key condition indicators of assets, such as temperature and vibration, to help predict possible future failures.

Implementation

Asset Information Systems

Across the Asset Management lifecycle, different functions of an organisation will have an interest in the asset and will require asset information presented and manipulated in differing formats, therefore it is just as important to have a robust reporting system as part of the asset information systems.