WERF
Water Environment Research Foundation

Sustainable Infrastructure Management Program Learning Environment (SIMPLE) Knowledge Base

SCAP Asset Management Workshop

April 20, 2015

Walter Graf

Program Director – Infrastructure Management

SIMPLE

- Designed for the wastewater industry and modified to include drinking water utilities
- A framework for organizing and applying AM material, called Total Enterprise Asset Management Quality Framework (TEAMQF)
- Guidelines outlining Best Appropriate Practices to match the quality framework elements
- Decision analysis tools
- An implementation case study and training program organized around the 5 core question, 10 step process

SIMPLE developed in advance of the WERF Strategic Asset Management Challenge

- The research team: EMA, GHD, MWH, CSIRO, and Virginia Tech
  - Track 1 – Public Communications
  - Track 2 – Benchmarking
  - Track 3 – Decision Support Tools
  - Track 4 – Remaining Asset Life
  - Track 5 – Information Technology: SIMPLE

SIMPLE
Sustainable Infrastructure Management Program Learning Environment

Search: [ ] **Go**

Introductory Level
Free Access Enter Here

Practitioner Level
WERF & WaterRF
Members Only

WERF
WATER ENVIRONMENT RESEARCH FOUNDATION

Water Research Foundation℠

How to Subscribe
Join WERF and WaterRF

What is SIMPLE?
Read an overview.

Entry Level Scorecard
Rate your current level

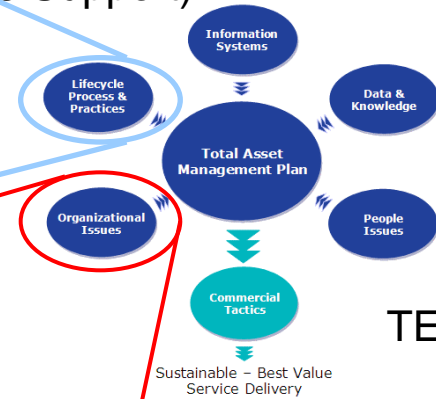**Asset Management**
Links to web sites

GHD

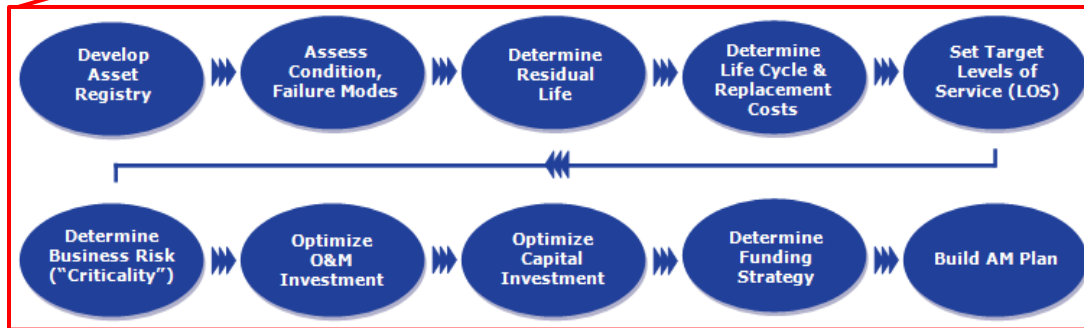# Strategic Planning Decision Framework
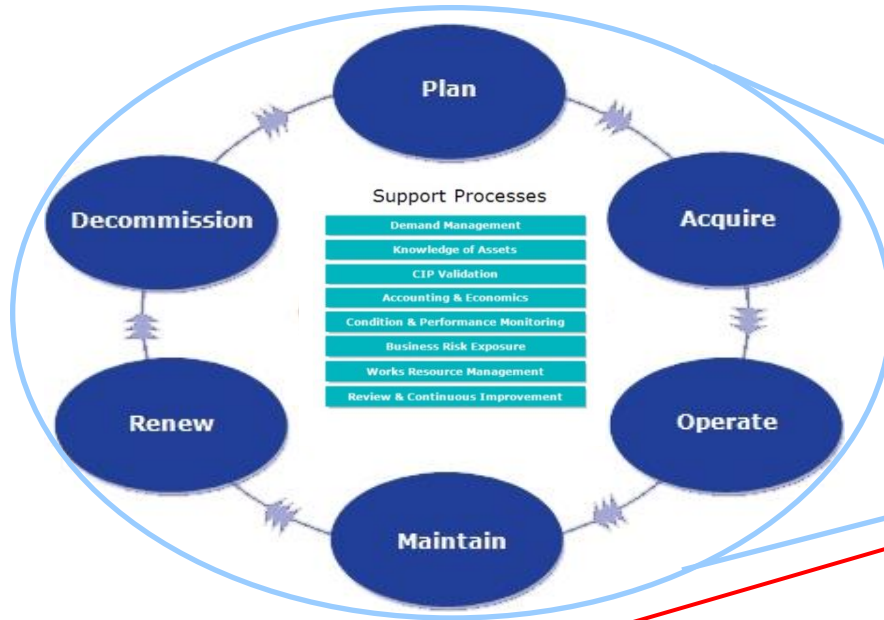
Life Cycle AM Processes & Practices
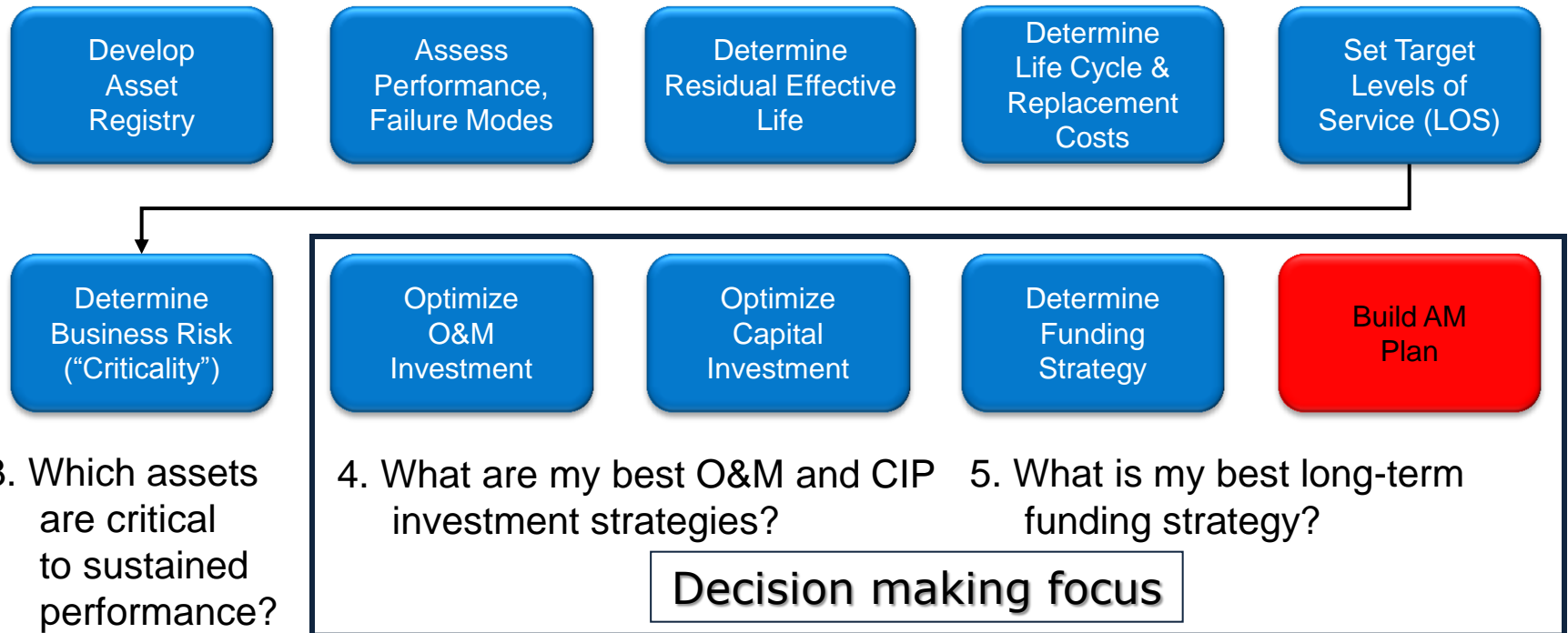
(4 Core Life Cycle &
8 Support)

TEAMQF

The 10 Steps to
Advanced Asset
Management

Core Concept Model of SIMPLE

1. What is the current state of my assets?

2. What is my required level of service?

Develop Asset Registry	Assess Performance, Failure Modes	Determine Residual Effective Life	Determine Life Cycle & Replacement Costs	Set Target Levels of Service (LOS)

Determine Business Risk ("Criticality")	Optimize O&M Investment	Optimize Capital Investment	Determine Funding Strategy	Build AM Plan

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?

Decision making focus

SIMPLE
Sustainable Infrastructure Management Program Learning Environment

Search: [   ] **Go**

Introductory Level
Free Access Enter Here

Practitioner Level
WERF & WaterRF
Members Only

WERF
WATER ENVIRONMENT RESEARCH FOUNDATION

WATER RESEARCH FOUNDATION
ADVANCING THE SCIENCE OF WATER®

How to Subscribe
Join WERF and WaterRF

What is SIMPLE?
Read an overview.

Entry Level Scorecard
Rate your current level

Asset Management
Links to web sites

GHD

A Quick Look at SIMPLE

SIMPLE
Sustainable Infrastructure Management Program Learning Environment

Home | Scorecard | Glossary | Weblinks | EPA Training | Support | Forum | SAM-Tools | SAM-GAP

Search: [____] Go

Switch Content View
Water | Waste Water | All
Content Manager

Introductory Contents
- How to Subscribe
- How Can Asset Management Help Me?
- ⊞ Project Background
- ⊞ How to use SIMPLE
- ⊞ What is SIMPLE?
- ⊞ Getting Started
- ⊞ Pathways to Asset Management
- ⊞ Effective Implementation
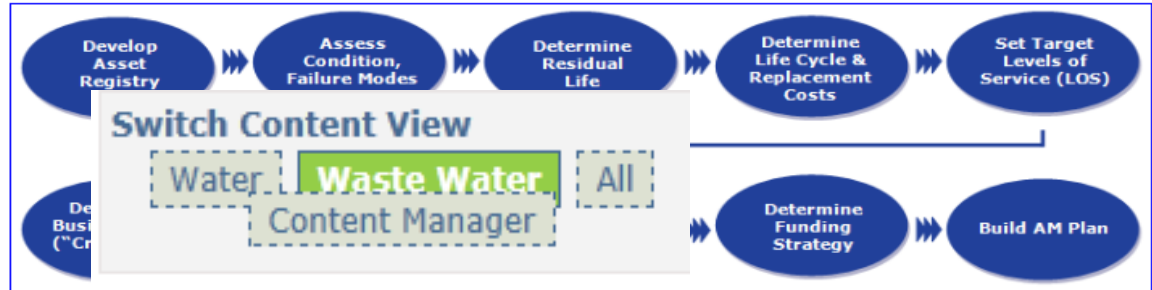- ⊞ Asset Management for Small Utilities
- ⊞ Interactive Training

Practitioner Contents
- ⊞ GASB 34
- ⊟ The 10 Steps to Asset Management
  - ⊞ Develop Asset Registry
  - ⊞ Assess Performance, Major Failure Modes
  - ⊞ Determine Residual Life
  - ⊞ Determine Life Cycle & Replacement Costs
  - ⊞ Set Target Levels of Service
  - ⊞ Determine Business Risk
  - ⊞ Optimize Operations & Maintenance Investment
  - ⊞ Optimize Capital Investment
  - ⊞ Determine Funding Strategy
  - ⊞ Build Asset Management Plan
- ⊞ Asset Management Guidelines
- ⊞ Develop an Improvement Plan
- ⊞ Reports, Case Studies
- ⊞ SAM Practitioner Tools

Contents

The 10 Steps to Asset Management
This section provides links to the tools that apply to each of these ten Asset Management steps. It also links to other useful tools, such as SAM-GAP to assess current AM practices.

Develop Asset Registry ⟫⟫ Assess Condition, Failure Modes ⟫⟫ Determine Residual Life ⟫⟫ Determine Life Cycle & Replacement Costs ⟫⟫ Set Target Levels of Service (LOS)

Determine Funding Strategy ⟫⟫ Build AM Plan

Switch Content View
Water | Waste Water | All
Content Manager

Introductory Contents
- How to Subscribe
- How Can Asset Management Help Me?
- ⊞ Project Background
- ⊞ How to use SIMPLE
- ⊞ What is SIMPLE?
- ⊞ Getting Started
- ⊞ Pathways to Asset Management
- ⊞ Effective Implementation
- ⊞ Asset Management for Small Utilities
- ⊞ Interactive Training

Tools fo

Click her

previous
GASB 3

next
Develop Asset Registry

Glossary

Switch Content View
Water | Waste Water | All
Content Manager

Introductory Contents

- How to Subscribe
- How Can Asset Management Help Me?
- Project Background
- How to use SIMPLE
- What is SIMPLE?
- Getting Started
- Pathways to Asset Management
- Effective Implementation
- Asset Management for Small Utilities
- Interactive Training

Practitioner Contents

- GASB 34
- The 10 Steps to Asset Management
- Asset Management Guidelines
- Develop an Improvement Plan
- Reports, Case Studies
- SAM Practitioner Tools

Glossary – A

a | b | c | d | e | f | g | h | j | k | l | m | n | o | p | q | r | s | t | u | v | w | x | y | z | sources | acronyms

Accountability

The requirement by which those exercising authority are answerable for the responsibilities that have been given to them.

Accrual Accounting

Recognition and recording of economic events and other transactions involving revenues, expenses, assets, liabilities and equity as they occur, rather than when a flow of cash occurs. Thus, under accrual accounting, revenues are recognized as soon as they are earned and expenses are recognized as soon as a liability is incurred, regardless of the timing of related cash inflows and outflows. Source: T3

Alternative: In accrual basis accounting, income is recorded when earned (instead of when cash is received) and expenses are recorded when incurred (instead of when cash is disbursed). Income is typically earned when the underlying goods or services have been delivered to the customer. Expense is typically incurred when the company receives the underlying goods or services purchased.

Accrual Output Budgeting

A system of budgeting that focuses on the delivery of outputs to meet the organization's priorities, within a financial framework based on full accrual accounting. Source: T3 (modified)

Accrued Expenses

An expense that is incurred, but not yet paid for, during a given accounting period such as a payroll, interest or rent payment that crosses an accounting period, a portion of which reflects an actual obligation and a portion which represents an as yet unrealized obligation. Source: T4

Acquisition

To obtain by lawful means, except by gift or inheritance. To obtain by paying money. For an asset, acquisition includes all direct and indirect costs associated with the acquiring of the asset, including planning, engineering, design, right of way/land, site preparation, construction, and commissioning costs. Source: S2

Activity

The work performed to produce outputs and describe what activities an organization does. Source: S2 (modified)

Scorecard

Want to find out *your* level? Simply answer 10 simple questions on our scorecard below and press the 'Score Me' button.

Scorecard

Question		Knowledge/Awareness					
		No/None	Little	Some	Average	Good	Excellent
1.	Have you read the International Infrastructure Management Manual?	◉	○	○	○	○	○
2.	Have you attended any formal training in asset management?	◉	○	○	○	○	○
3.	Does your agency contain an electronic asset register?	◉	○	○	○	○	○
4.	Does this register contain all assets or just some	◉	○	○	○	○	○
5.	Are you aware of Total Quality Management processes?	◉	○	○	○	○	○
6.	Have you commenced an Agency Asset Management program?	◉	○	○	○	○	○
7.	Does your agency use a computerized maintenance management system and are staff sufficiently skilled in its operation?	◉	○	○	○	○	○
8.	Have you read other available texts on Asset Management?	◉	○	○	○	○	○
9.	Is Asset Management a regular topic of discussion within your Agency?	◉	○	○	○	○	○
10.	Does your Agency have an Asset Management Steering Committee?	◉	○	○	○	○	○

Score Me   **Reset Page**

Guidelines

SIMPLE
Sustainable Infrastructure Management Program Learning Environment

Switch Content View

Water | Waste Water | All
Content Manager

Introductory Contents

- How to Subscribe
- How Can Asset Management Help Me?
- Project Background
- How to use SIMPLE
- What is SIMPLE?
- Getting Started
- Pathways to Asset Management
- Effective Implementation
- Asset Management for Small Utilities
- Interactive Training

Practitioner Contents

- GASB 34
- The 10 Steps to Asset Management
- Asset Management Guidelines
    - Quality Framework Guidelines
    - Core Life Cycle Business Processes
        - Strategic Planning
        - Acquire
        - Operate
        - Maintain
        - Renew, Repair, Rehabilitate (ORDM)
            - Overview
            - **An Example of the ORDM Process**
            - Advanced Asset Management - Key Principles
            - Repair Replace Rehabilitate Options
            - Benefits & Costs
            - Renewal Decision Analysis
            - Computerized Support Systems
        - Implementation

Contents » Asset Management Guidelines » Core Life Cycle Business Processes » Renew, Repair, Rehabilitate (ORDM)

An Example of the ORDM Process

One problem faced by many authorities is the prediction of failures as compared with the actual failures that may occur.

As assets age and their condition deteriorates, the number of failures varies significantly due to many variables such as:
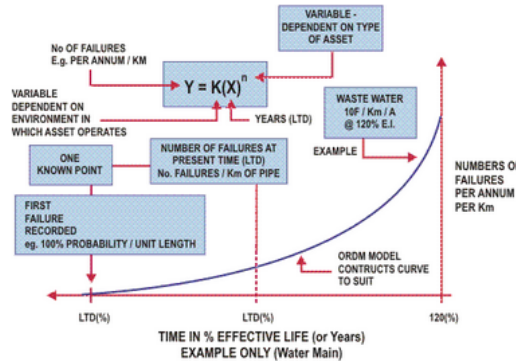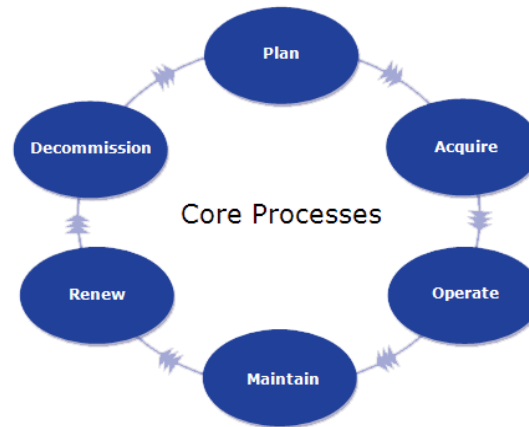
- Original construction quality
- Variable decay rates
- Material weaknesses and rate of decay
- Environmental factors
- Operational factors
- External loadings and stresses.

In general the numbers of failures will vary significantly from year to year and as such we often find it difficult to determine the accurate long-term trends for these failures.

This is shown below:
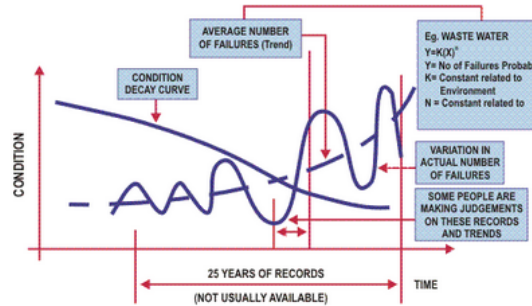
The overall trends of failures, disregarding those failures that are not associated with the age of the asset equates to the formula shown in the following diagram.

Life Cycle View

Step-by-Step Approach to Building an AM Plan

SAM GAP

SIMPLE
Sustainable Infrastructure Management Program Learning Environment

Search: [____] Go

Switch Content View

Water | Waste Water | All
Content Manager

Introductory Contents

· How to Subscribe
· How Can Asset Management Help Me?
⊞ Project Background
⊞ How to use SIMPLE
⊞ What is SIMPLE?
⊞ Getting Started
⊞ Pathways to Asset Management
⊞ Effective Implementation
⊞ Asset Management for Small Utilities
⊞ Interactive Training

Practitioner Contents

⊞ GASB 34
⊞ The 10 Steps to Asset Management
⊞ Asset Management Guidelines
⊞ Develop an Improvement Plan
⊞ Reports, Case Studies
⊞ SAM Practitioner Tools

SAM-GAP

Key to any strategic planning process is a gap analysis. It quantifies the effectiveness of an organization's management practices by identifying the distance between the current state of play - the 'as is' - and the desired state - the 'to be' - for future sustainable business operations.

SAM-GAP is a web-enabled gap analysis tool that facilitates clear identification of the organization's asset management capabilities relative to:

- The best run organizations in the world (Top 10 percentile)
- A set of comparable companies or agencies
- What is reasonable and relevant for the particular organization.(Best appropriate practice)

Defining a reasonable and relevant standard is particularly important - not all "world class best practices" are affordable or even applicable for every entity.

SAM-GAP has identified Best Appropriate Practices that fit the organization's needs. By following the program prompts you will be guided through an extensive on-line questionnaire, which will provide the input for the gap assessment & report that contains a comprehensive graphical representation and list of tasks in priority order for the implementation of a justified improvement program.

When you are satisfied that the questions answered are a true reflection of the organization's current capability in asset management, you will be prompted to generate a report to indicate what tasks are needed in priority order to develop your improvement program.

Click here to open the SAM-GAP website in a new window.

A report presenting an overview of the development and structure of the SAM GAP tool is available, please click here. Further it summarizes 37 utility self assessments using the SAM GAP tool in a benchmark research project.

GHD

Example of Question

SAM GAP Report

SAM2R06COa

ASSESSING UTILITY PRACTICES WITH THE
STRATEGIC ASSET MANAGEMENT
GAP ANALYSIS TOOL (SAM GAP)

WATER RESEARCH FOUNDATION PROJECT #4013

by:

Walter Graf
Water Environment Research Foundation

2010

WERF

WATER
RESEARCH
FOUNDATION
ADVANCING THE SCIENCE OF WATER

Assessment Report

WERF and AwwaRF
SAM-GAP
ASSET MANAGEMENT GAP ANALYSIS AND BENCHMARKING
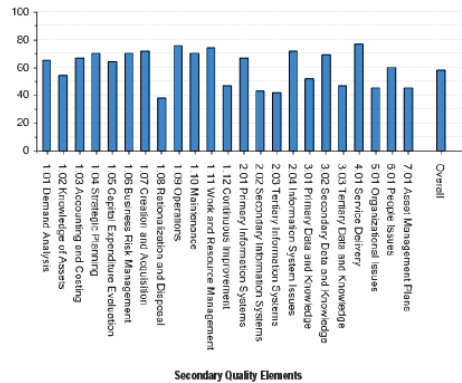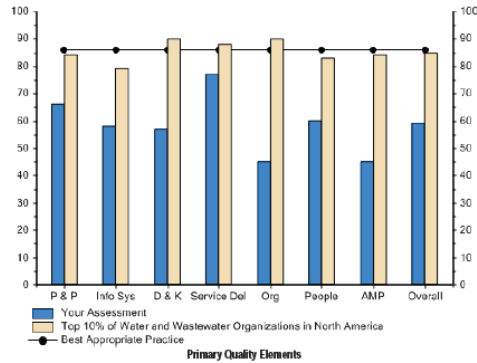Confidential Results for GHD only

About This Report

- This report presents the results of your self assessment of your agency's asset management AM practices – your SAM-GAP "gap analysis". A "Gap Analysis" is a systematic process to characterize or "profile" an organization's current asset management business practices. *A gap analysis measures where an organization is in its AM practices relative to where it wants to be within a specified period of time.* The gap, as one might expect, is the distance between the "as is" of the current environment and the top 10% scores of US and Canadian utilities held in the database.
- SAM-GAP facilitates clear identification of a utility's AM practices relative to the top 10% highest scoring water and wastewater utilities in the US and Canada, most importantly, what is reasonable and relevant for your utility. Recognize that it is a place to begin planning for each utility based on unique needs and drivers as some gaps are more important than others.
- The gap analysis serves two fundamental functions - it guides future action toward a measurable "state of practice" for your utility and it benchmarks progress along the way toward that goal. Both functions are important if your utility is to achieve a long-lived transition to a management paradigm and culture that is centered on an asset management perspective.
- Asset management can be seen as an interaction of seven core organizational "quality elements". Quality elements are fundamental components of an organization's business model that drive the sustained success of the organization. Over the past twenty years, seven core elements around which the practice of asset management is effectively organized have been identified worldwide and include: 1) life cycle processes and practices, 2) information systems, 3) data and knowledge, 4) service delivery, 5) people issues, 6) organizational issues and 7) asset management strategies and planning.
- This report is comprised of two elements:
  1. A bar graph profile of the level of practice as recorded in your organization that is benchmarked against the 10% highest performing, utilities in the US and Canada who have assessed themselves, and
  2. A bullet-formatted listing of suggested task elements (organized around the seven elements listed above) for your consideration for strengthening your asset management practices derived from the profile. These task elements are intended to serve as a starting point for developing an asset management improvement roadmap for your organization.

Developing an asset management improvement program roadmap using SAM-GAP

- Not all "world class best practices" are affordable by or even applicable to every local government or agency. The important thing is to identify "best appropriate practices" - those world-class practices *that fit your organization's unique needs - and to customize a work plan and measure progress against that benchmark.*
- The seven elements have proven particularly effective in assisting utilities to organize a simple work plan to strengthen asset management practices. Keep in mind that all seven elements are interrelated - a basic balance among the elements is necessary if cost effective improvement is to be achieved. We suggest that the same review team that scored current practices review the profile and begin to identify those areas of most need – and greatest return in terms of lifting asset management practice.
- Note that just because a score is relatively low does not necessarily mean that that area is the best candidate for strengthening. Look instead for those areas that most directly and immediately impact current investment decision-making processes (investment here includes operations and maintenance

Report Output

Your Assessment
Top 10% of Water and Wastewater Organizations in North America
Best Appropriate Practice

Primary Quality Elements

Secondary Quality Elements

Gap Analysis

Quality Elements	Weighted Gap	Rank
Process and Practices (P&P)	20.0	5
Information Systems (Info Sys)	28.0	3
Data and Knowledge (D&K)	29.0	2
Service Delivery (Service Del)	9.0	6
Organizational Issues (Org)	41.0	1
People Issues (People)	26.0	4
AM Plans (AMP)	41.0	1

Processes and Practices

Processes and practices form the basis for all asset management activities within an organization. Therefore, without clearly defined and documented procedures, the ability for your organization to conduct consistent practices are greatly reduced. These processes should cover the entire life cycle of the asset and the individual practices that will be required for different asset types. For example, condition assessment is a common process for all assets, but the actual applied practice will differ for each asset type. Improvements within this area are listed below.

Demand Analysis

The key improvements in this area include:

- Review, document, and implement processes for managing records of historic demands, including how the organization determines what data to collect and how is it maintained through assigning roles and responsibilities.
- Review, document, and implement processes for breaking up demand into key drivers and understanding their influences on demand, including how the organization monitors the impacts of growth, changes in key stakeholders, and demographic changes.
- Review, document, and implement processes for undertaking, analyzing, and responding to customer and stakeholder surveys.
- Review, document, and implement processes for defining and maintaining levels of service, including how the organization determines levels of service through customer consultation.
- Review, document, and implement processes for predicting future trends in demand for services based on historic records, future predictions, and external influences.

Knowledge of Assets

The key improvements in this area include:

- Review, document, and implement processes for defining the level of detail of asset information that is collected and managed. For example, should it be down to the maintenance managed item (MMI).
- Review, document, and implement processes defining the collection and management of asset attribute information as part of a data standard, including the assigning of roles and responsibilities.
- Review, document, and implement processes for determining which assets should have data about their condition collected and for undertaking the assessments, including the creation of a data standard.
- Review, document, and implement processes for determining which assets should have data about their performance collected and for undertaking the collection. This should include the creation of a written data standard for condition assessments.
- Review, document, and implement processes for determining which assets should have data about their utilization collected and for undertaking the collection. This should include the creation of a data standard.

Accounting and Costing

The key improvements in this area include:

Training Modules in SIMPLE

- An implementation case study and training program based on the US EPA training program "Tom's Bad Day."

- Uses the 5 core question / 10 steps of asset management approach

- Tied directly to the structure of SIMPLE

- Modular, "on demand"

- Flash video and pdf slides

Asset Management Training

Opening Screen

SIMPLE
Sustainable Infrastructure Management Program Learning Environment

Switch Content View

Water | Waste Water | All
Content Manager

Introductory Contents

- How to Subscribe
- How Can Asset Management Help Me?
- ⊞ Project Background
- ⊞ How to use SIMPLE
- ⊞ What is SIMPLE?
- ⊞ Getting Started
- ⊞ Pathways to Asset Management
- ⊞ Effective Implementation
- ⊞ Asset Management for Small Utilities
- ⊟ Interactive Training
  - **EPA Asset Management Training Material**
  - SIMPLE Webcasts

Practitioner Contents

- ⊞ GASB 34
- ⊞ The 10 Steps to Asset Management
- ⊞ Asset Management Guidelines
- ⊞ Develop an Improvement Plan
- ⊞ Reports, Case Studies
- ⊞ SAM Practitioner Tools

Contents » Interactive Training

EPA Asset Training Management Material

Introduction and Welcome (USEPA, Steve Allbee)		PDF (85Mb) includes embedded video
National context of Asset Management (USEPA, Steve Allbee)		Flash Video (96min)

Fundamentals of Asset Management

Executive Overview	PDF	Flash Video (39min)
Introduction of Storyline: Tom's Bad Day		Flash Video (20min)
Step 1. Develop Asset Registry	PDF	Flash Video (40min)
Step 2. Assess Performance, Failure Modes	PDF	Flash Video (48min)
Step 3. Determine Residual Life	PDF	Flash Video (30min)
Step 4. Determine Life Cycle & Replacement Costs	PDF	Flash Video (43min)
Step 5. Site Target Level of Service	PDF	Flash Video (21min)
Step 6a. Determine Business Risk ("Criticality")	PDF	Flash Video (58min)
Step 6b. Optimized Investment Decision Making (OIDM)	PDF	Flash Video (43min)
Step 7. Optimize Operations & Maintenance (O&M) Investment	PDF	Flash Video (61min)
Step 8. Optmize Capital Investment	PDF	Flash Video (51min)
Step 9. Determine Funding Strategy	PDF	Flash Video (24min)
Step 10. Build Asset Management Plan	PDF	Flash Video (20min)

Supporting Materials

Storyline Text	PDF
Pump Station Drawings	PDF
Management Worksheets	MS Excel
Support Tables	PDF
Acknowledgements	PDF

previous	home	next
Interactive Training		SIMPLE Webcasts

Slides with narration

The Fundamentals of Asset Management

Executive Overview
A Hands-On Approach

Tom's bad day…

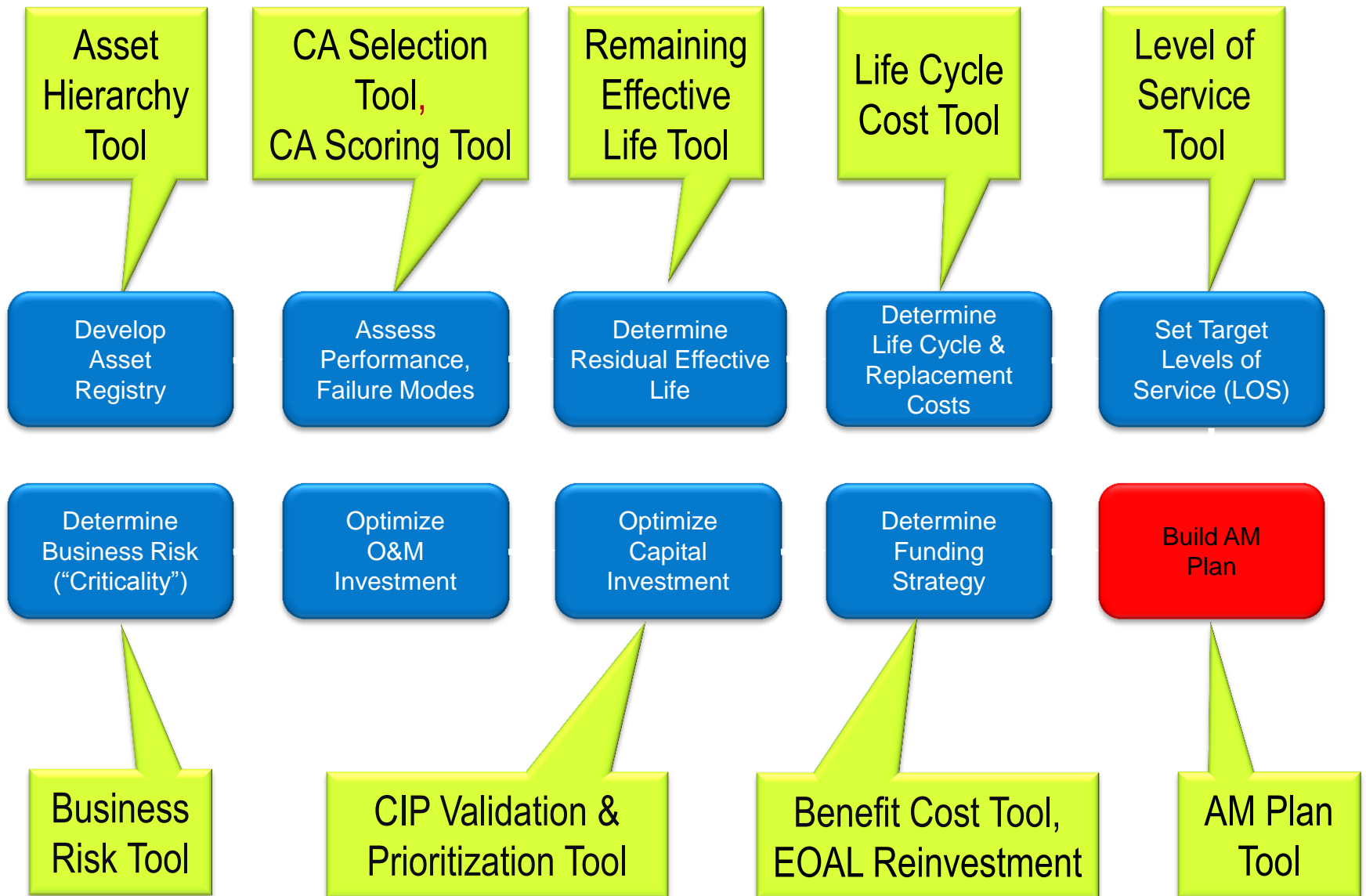Tom's spreadsheet

How the SAM Tools Relate

Asset Hierarchy Tool	CA Selection Tool, CA Scoring Tool	Remaining Effective Life Tool	Life Cycle Cost Tool	Level of Service Tool
Develop Asset Registry	Assess Performance, Failure Modes	Determine Residual Effective Life	Determine Life Cycle & Replacement Costs	Set Target Levels of Service (LOS)
Determine Business Risk ("Criticality")	Optimize O&M Investment	Optimize Capital Investment	Determine Funding Strategy	Build AM Plan
Business Risk Tool		CIP Validation & Prioritization Tool	Benefit Cost Tool, EOAL Reinvestment	AM Plan Tool

Accessing Tools in SIMPLE

Accessing Tools in SIMPLE

CIP Validation/Prioritization Tool

Step 3: Strengthen project content until confidence level is acceptable

Capital Investment Validation and Prioritization Tool
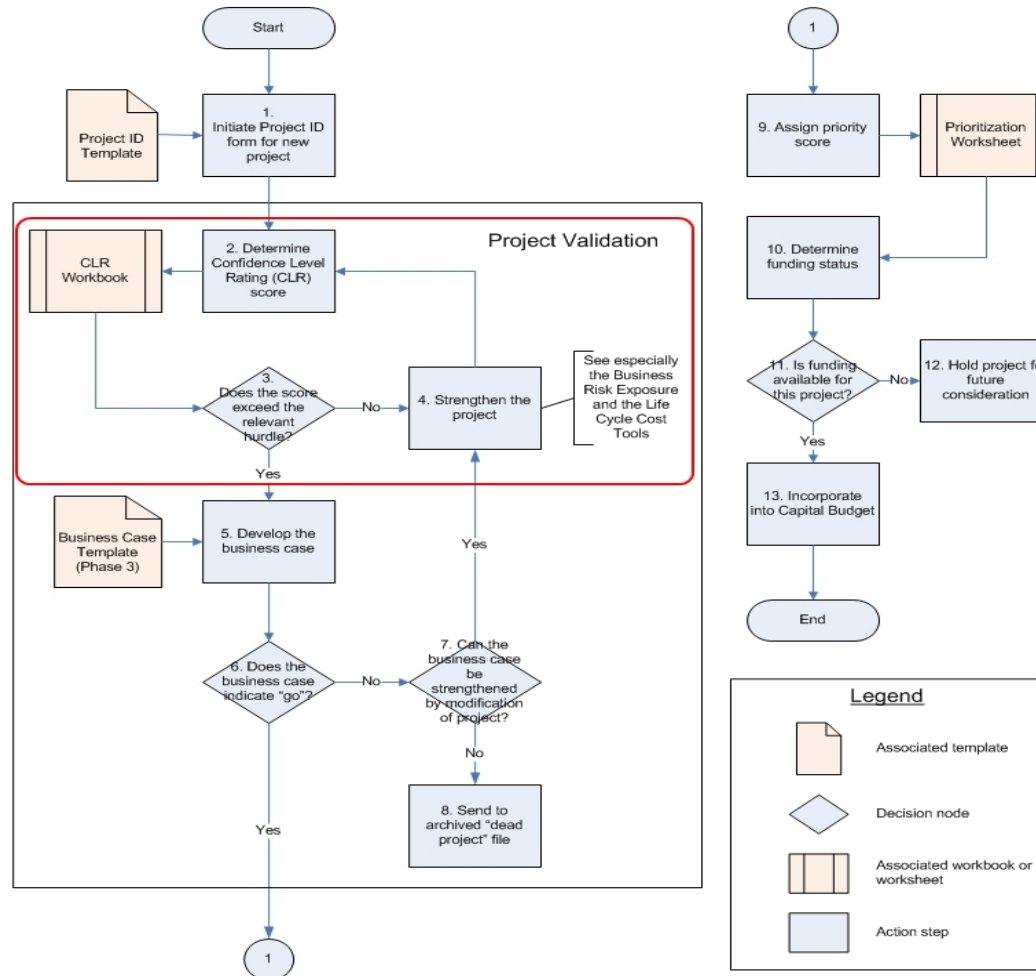
Common Structure

Navigation Bar

Content

Overview: What is Capital Project Validation and Prioritization?

Asset management can be described as a collection of best management practices that, when applied within a structured framework, systematically guides investment in all stages of an asset's life cycle – planning, acquisition, operations, maintenance, renewal, and decommissioning. This investment is intended to represent the best mix of operations, maintenance and capital for sustained performance over the life of the asset. Ideally, asset performance is measured against clearly a defined level of service and is based upon calculated risk tolerance.

The objective of asset management is to develop a concise but comprehensive set of integrated management strategies (including operations, maintenance, and capital) for all assets in the enterprise. These strategies form the heart of an Asset Management Plan. This Plan systematically;

- identifies the current state (performance) of the assets;
- articulates the level of performance (service) that the assets need to sustain into the future;
- identifies those assets that are "critical" to sustained performance
- integrates operations, maintenance, and capital investment strategies (based on the above) to sustain performance at lowest total cost of ownership; and
- describes a fiscal strategy to fund the integrated strategies.

In short, asset management is about rigorous investment decision-making – as ultimately manifested in the operating and capital budget arena.

Because of the substantial scale of capital programs over the life of a utility, capital programming is a rich source of potential diseconomies to the utility. These diseconomies can derive from the following;

- over-investment in non-mission critical related assets;
- under-investment in mission critical assets;
- imbalance among capital, maintenance, operation and renewal investment;
- misdirected expenditures for repair versus renewal;
- unnecessary or irrelevant levels and types of inventory materials and related expenses driven by non-standardized capital specification;
- overspending on operations and maintenance to compensate for design shortcomings and misspecification;
- overspending or underspending on risk management (business risk);
- mistiming investment (investing too early or too late) relative to the likelihood and consequence of failure; and
- revenue loss and dissatisfied stakeholders and regulators due to performance failures and lack of system availability.

Capital investment is one of the most important decision processes a utility faces. The stakes are very high. Poor decisions – and especially wrong decisions - will likely prove very costly. High-quality decisions – those recommended projects in which we have high confidence that they are the right investment at the

"How to Use this Tool"

How to use this Tool

This Capital Investment Validation and Prioritization Tool is intended as a step by step guide for the asset management practitioner who needs systematic assistance to assure that the collection of projects in a proposed capital investment program represents the very best investment in its asset base that the utility can make. **Unfortunately, no tool can make the validation and prioritization of a wide range of project opportunities fool proof. While the Tool can facilitate a proper and rigorous application, each analysis will require careful and systematic application - and the application of good common sense at every step.**

This Tool combines step by step process guidance with substantive content about each task in assigning a validation and a prioritization score to a project or a group of projects.

Tasks

The process of developing a capital valid and prioritized capital investment plan (including assigning a validation score and a prioritization score) is broken down into seven tasks in this Tool (of which tasks 2 through 8 are validation and prioritization procedures). These tasks are summarized into one "Step" or block ("Execute Tasks as Depicted on the Process Diagram to the Right") on the left of the screen in a "navigation bar" and one process diagram on the right.

- Each of the thirteen tasks is depicted in procedural order in a single work process diagram.

- The decision as to which technique to use is guided by the process diagram where yes/no decision points are shown as diamonds and action tasks are depicted as boxes (see graphic below).

Each Tool Has "What Is '…'?"

Overview: What is Capital Project Validation and Prioritization?

Asset management can be described as a collection of best management practices that, when applied within a structured framework, systematically guides investment in all stages of an asset's life cycle – planning, acquisition, operations, maintenance, renewal, and decommissioning. This investment is intended to represent the best mix of operations, maintenance and capital for sustained performance over the life of the asset. Ideally, asset performance is measured against clearly a defined level of service and is based upon calculated risk tolerance.

The objective of asset management is to develop a concise but comprehensive set of integrated management strategies (including operations, maintenance, and capital) for all assets in the enterprise. These strategies form the heart of an Asset Management Plan. This Plan systematically;

- identifies the current state (performance) of the assets;

- articulates the level of performance (service) that the assets need to sustain into the future;

- identifies those assets that are "critical" to sustained performance

- integrates operations, maintenance, and capital investment strategies (based on the above) to sustain performance at lowest total cost of ownership; and

- describes a fiscal strategy to fund the integrated strategies.

In short, asset management is about rigorous investment decision-making – as ultimately manifested in the operating and capital budget arena.

Because of the substantial scale of capital programs over the life of a utility, capital programming is a rich source of potential diseconomies to the utility. These diseconomies can derive from the following;

- over-investment in non-mission critical related assets;

- under-investment in mission critical assets;

- imbalance among capital, maintenance, operation and renewal investment;

- misdirected expenditures for repair versus renewal;

- unnecessary or irrelevant levels and types of inventory materials and related expenses driven by non-standardized capital specification;

- overspending on operations and maintenance to compensate for design shortcomings and misspecification;

- overspending or underspending on risk management (business risk);

- mistiming investment (investing too early or too late) relative to the likelihood and consequence of failure; and

- revenue loss and dissatisfied stakeholders and regulators due to performance failures and lack of system availability.

Capital investment is one of the most important decision processes a utility faces. The stakes are very high. Poor decisions – and especially wrong decisions - will likely prove very costly. High-quality decisions – those recommended projects in which we have high confidence that they are the right investment at the right time – result from high-quality capital project development processes coupled with high-quality data. Decisions based on high quality processes and high quality data have a high probability of generating those outcomes that were anticipated by the decision-maker. The objective of project validation is to systematically weed out those projects on the "wish list" that can and should be deleted, deferred, or recast into a more cost effective solution.

BEST PRACTICE IN CIP MANAGEMENT – AN ASSET MANAGEMENT FRAMEWORK

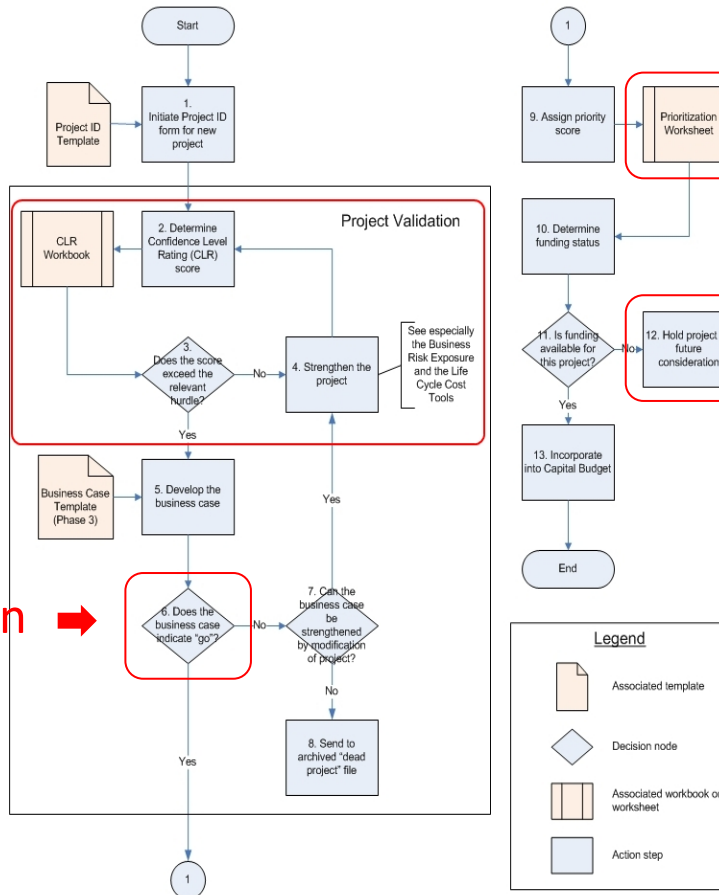Figure 1 below depicts an asset management perspective or framework within which a capital investment program is developed. Systematically determining the nature, size, and timing of the "gap" between current capacity and future needs is the critical first step of a good CIP program. But, as the figure

Logic Diagram Steps/Tasks with Embedded Workbook or Template

Left Clicking Any Box with the Mouse…

…Opens the Text Associated with that Step/Task

Determine initial "confidence level rating"

Most capital investment program processes start with project identification, then move directly to prioritization. While both steps are required, we suggest that this two step process is ineffective, especially where capital funds are dear. No matter how careful or rigorous the identification and prioritization process, prioritization of projects that are poor solutions to the problems at hand or that are poorly timed with respect to demand or life cycle requirements merely leads to a rank-ordered set of inadequate projects. Limited resources are likely misdirected; had the projects been more thoroughly developed (a stage between identification and prioritization called validation), the prioritized projects would likely have taken a different form, be deferred, or even eliminated.

A more systematic approach is to systematically determine whether we have;

- The right projects,
- At the right time,
- At the right cost,
- For the right reasons.

Good capital investment decision-making involves two separate factors;

- the quality of the work processes behind the decision-making (have we asked all of the right questions and executed systematic and thorough analysis?) and
- the quality of the data/information available to the decision-maker to be used in the decision.

High quality decisions result from high quality work-processes coupled with high quality data. No amount of excellent data work can completely overcome inadequate work processes (failure to raise and address the right questions) and, conversely, no amount of sophisticated work processes can fully compensate for poor data. The confidence level rating methodology assesses both the quality of the capital investment program development work-process that leads to decision-making and the quality of the data/information available to the decision-maker to be used in the decision.

The capital investment program project validation process is designed to identify exactly where, for each project, improvements in decision-making confidence can be derived through improvements in process and/or data relevant to that given project. Results are generated at both the project level (where additional focus is needed to strengthen the quality of the project proposal) and at an organizational level (how to select the single best mix of capital investment program opportunities). Patterns emerging from across all projects can, of course, help direct where organizational effort should be expended to improve those organizational processes and that data relevant to the agency-wide capital programming process.

The project validation process and the role confidence level rating plays in the process are depicted below. Note that confidence level scoring is often executed at least twice, once at inception of the project (ideally in conjunction with a carefully developed and well designed Project Identification Form) and once again after the project has been thoroughly developed. In reality, the confidence level rating is calculated as needed throughout the project development process until a passing level of confidence in the quality of the project solution is reached. Since the rating is a metric or score ranging from 0 (lowest) to 100 (highest), a minimum target score – called a "minimum hurdle level" - should be set below which no project should go forward for funding unless extreme circumstances dictate.

Worked Example

Worked Example

Project ID Form Template

(The template is self explanatory; it follows the 13 elements in the Confidence Level Rating plus integrates other highly relevant developmental information. The form should be viewed as dynamic and updated as the project develops. The Template itself should be modified and refined to fit the unique requirements of each utility environment.)

Validation - Confidence Level Rating

The following graphic depicts an application of the Confidence Level Rating Workbook to a candidate capital project (click on the image to open the example workbook). This image is referred to as the "base graphic" in the discussion that follows.

A Confidence Level Rating Workbook should be completed for each project (note the Project Name and related information is filled out at the top of the form in the base graphic above). Moving from left to right on the example project screen, note the following (the numbered section headers below refer to outlined columns in graphic above):

1. Project Value Chain Values
The values in this column (denoted in graphic above with the number "1") represent the weights assigned by the assessor to each of the 13 elements. The total values should equal 100%. Values are set in the Value Chain tab which can be accessed on the tab bar at the bottom of the worksheet (see "A" in graphic above). In this example, the highest value has been assigned by the assessor to the role of understanding the Consequence of Failure and Business Risk Exposure score in the validation process.

|	Quality Element/Value Chain	Value
1	Understanding of existing service standards	4%
2	Knowledge of existing assets	15%
3	Current demand for service	5%
4	Projected future demand	9%
5	Predicted modes of service failure	10%
6	Probability timing of failure	8%
7	Consequence of failure and identification of Business Risk Exposure	18%
8	Quality of proposed maintenance program	2%
9	Appropriateness of recurrent operations costs	2%
10	Appropriateness of solutions assessed	5%

Future Work

- Predictive Model for Remaining Life of Pipes –capture and develop the deterioration curves based on environmental, soil, structural, hydraulic, and other factors.
- The deterioration modeling task for the pipe infrastructure will consist of the following major Tasks:
  1. data collection;
  2. model development and verification; and
  3. piloting of the proposed model with participating utilities;

SUMMARY

- On-line knowledge base with techniques, tactics and tools to support all levels of AM

- Two levels - Intro and Practitioners

- Fully narrated Advanced Asset Management Workshop materials

- Links to Laterals database and CA Selection tool

- Predictive Model for Remaining Life of Pipes

Questions
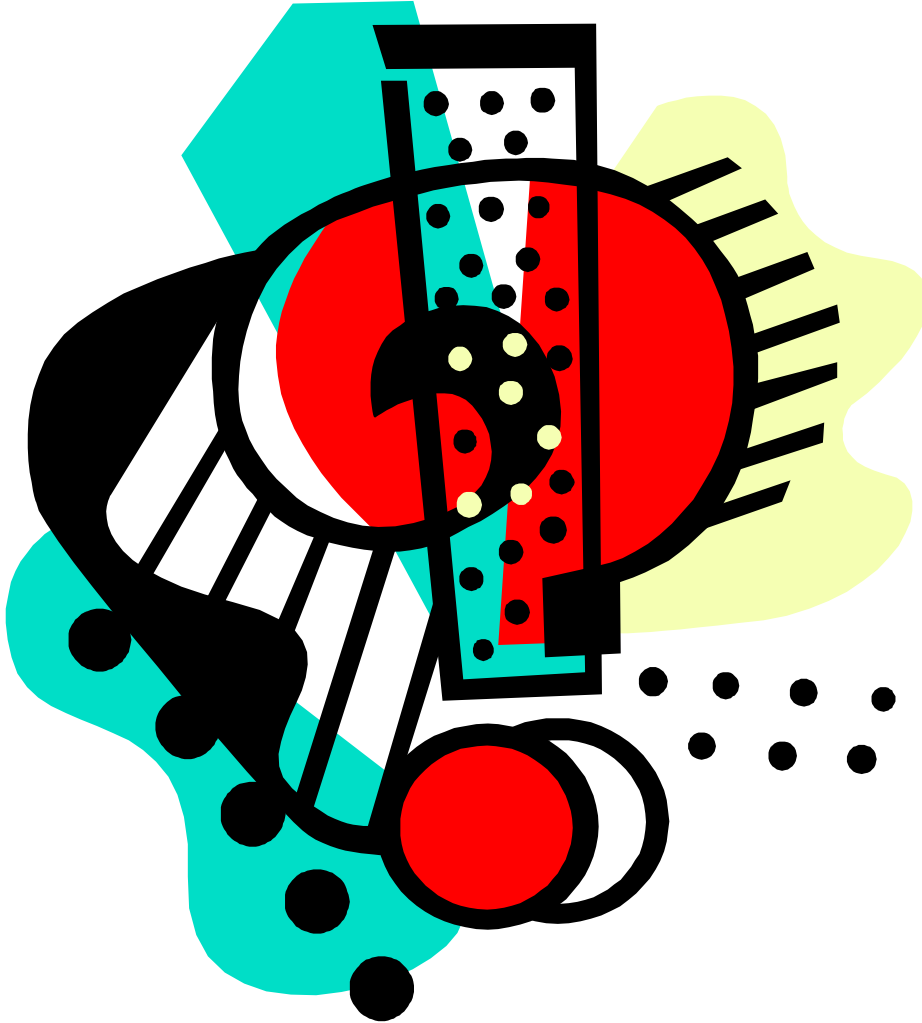
Walter Graf
Program Director
Water Environment Research Foundation
635 Slaters Lane, Suite G-110
Alexandria, VA 22314
Office Phone: (571) 384-2102
wgraf@werf.org
http://www.werf.org
LinkedIn in. WERF Strategic Asset Management User Group