AM LEADING PRACTICES
& Lessons Learned on Capital Planning

CWEA Webinar
June 23, 2016
Webinar Speakers

CRAIG DALY
Pure Technologies, Chair, Chesapeake AWWA

LINDA BLANKENSHIP
Arcadis

KEVIN SLAVEN
Arcadis
# Presentation Agenda

## Asset Management Leading Practices & Lessons Learned on Capital Planning

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:00 – 1:05</td>
<td>Welcome from the Committee Vice Chair and Introductions (Craig Daly)</td>
</tr>
<tr>
<td>1:05 - 1:20</td>
<td>Overview of Leading Practices in the U.S. (Linda Blankenship)</td>
</tr>
<tr>
<td>1:20 – 1:40</td>
<td>Approaches and Tools for Capital Planning and Prioritization (Kevin Slaven)</td>
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<tr>
<td>1:40 – 1:50</td>
<td>Case Study Examples</td>
</tr>
<tr>
<td>1:50 - 2:00</td>
<td>Q&amp;A, Wrap-up</td>
</tr>
</tbody>
</table>
Your Presenters

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Utility Economic and Political Environment

Customers

Quality

Compliance

Capital

Utility Optimization

Revenue

Aging Infrastructure
With Less
Typical Drivers in the US are Evolving...

**Capital Budgets**
- “Wish list”
- Unaffordable
- Regulatory requirements

**State/Federal Requirements**
- NPDES permits and consent decrees
- SRF loans

**Bond Rating**
- Rating agencies starting to look for it

**Technology Issues**
- Incomplete datasets
- Poor hierarchies
- Lack of value
Asset Management Definition – adapted from USEPA…

Asset Management is a body of management practices that...

- Targets the acceptable level of risk to the organization
- Delivers service levels customers desire and regulators require
- Applies to the entire portfolio of infrastructure assets at all levels of the organization
- Seeks to minimize total costs of acquiring, operating, maintaining, and renewing assets
- Works within an environment of limited resources
WERF Convened International Research Agenda Setting Meeting in 2002

UK, Australia, NZ, Canada presentations

- New elements of risk, levels of service, business cases

Laid out a recommended research agenda

- Protocols for condition assessment and asset life
- Life cycle models and methods
- Plan guidance and templates
- Case studies
- Asset value methodologies
Asset Management Evolution: Two Widely Recognized Frameworks

- **British Standard PAS55-1**: 2001
- **British Standard PAS55-1 Update**: 2006
- **EPA/WERF WaterRF AM Framework**: 2008
- **ISO 55000 AM Standard**: 2010
- **International Org. for Standardization**: 2011
- **British Standard PAS55-1 to be withdrawn**: 2012
- **IIMM International Infrastructure Management Manual**: 2004
- **IIMM International Infrastructure Management Manual Update**: 2005
- **IWA Aquamark Benchmark**: 2006
- **IWA Aquamark Benchmark Update**: 2007
- **USEPA Best Practice Guide**: 2008
- **WERF SIMPLE Tools**: 2009
- **IIMM International Infrastructure Management Manual Update**: 2010
- **IWA Aquamark Benchmark Update**: 2011
- **IWA Aquamark Benchmark Update**: 2012
- **FHWA TAMP Guide**: 2013
- **IIMM International Infrastructure Management Manual Update**: 2014
- **Institute for Sustainable Infrastructure Envision™**: 2015
- **IIMM International Infrastructure Management Manual Update**: 2016

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Introduction to Best Practices

ISO 55000 – “what” a program requires

• A management system standard, like others you may be familiar with such as ISO 9001, ISO 14001, etc.
  ➢ ISO 55000 – Overview, Principles and Terminology
  ➢ ISO 55001 – Requirements
  ➢ ISO 55002 – Guidelines
ISO 55000 Maturity Assessment Has 39 Questions

<table>
<thead>
<tr>
<th>No</th>
<th>Clause</th>
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</thead>
<tbody>
<tr>
<td>4.1</td>
<td>Understanding the organization and its context</td>
</tr>
<tr>
<td>4.2</td>
<td>Understanding the needs and expectations of stakeholders</td>
</tr>
<tr>
<td>4.3</td>
<td>Determining the scope of the asset management system</td>
</tr>
<tr>
<td>4.4</td>
<td>Asset management system</td>
</tr>
<tr>
<td>5.1</td>
<td>Leadership and commitment</td>
</tr>
<tr>
<td>5.2</td>
<td>Policy</td>
</tr>
<tr>
<td>5.3</td>
<td>Organizational roles, responsibilities and authorities</td>
</tr>
<tr>
<td>6.1</td>
<td>Actions to address risks and opportunities for the asset management system</td>
</tr>
<tr>
<td>6.2.1</td>
<td>Asset management objectives</td>
</tr>
<tr>
<td>6.2.2</td>
<td>Planning to achieve asset management objectives</td>
</tr>
<tr>
<td>7.1</td>
<td>Resources</td>
</tr>
<tr>
<td>7.2</td>
<td>Competence</td>
</tr>
<tr>
<td>7.3</td>
<td>Awareness</td>
</tr>
<tr>
<td>7.4</td>
<td>Communication</td>
</tr>
<tr>
<td>7.5</td>
<td>Information requirements</td>
</tr>
<tr>
<td>7.6.1</td>
<td>Documented information general</td>
</tr>
<tr>
<td>7.6.2</td>
<td>Creating and updating documented information</td>
</tr>
<tr>
<td>7.6.3</td>
<td>Control of documented information</td>
</tr>
<tr>
<td>8.1</td>
<td>Operational planning and control</td>
</tr>
<tr>
<td>8.2</td>
<td>Management of change</td>
</tr>
<tr>
<td>8.3</td>
<td>Outsourcing</td>
</tr>
<tr>
<td>9.1</td>
<td>Monitoring, measurement, analysis and evaluation</td>
</tr>
<tr>
<td>9.2</td>
<td>Internal audit</td>
</tr>
<tr>
<td>9.3</td>
<td>Management review</td>
</tr>
<tr>
<td>10.1</td>
<td>Nonconformity and corrective action</td>
</tr>
<tr>
<td>10.2</td>
<td>Preventive action</td>
</tr>
<tr>
<td>10.3</td>
<td>Continual improvement</td>
</tr>
</tbody>
</table>

The Radar chart shows the average score range per clause.

Note that Clauses 1 through 3, namely Clause 1 – Scope, Clause 2 – Normative references and Clause 3 – Terms and Definitions are not used for an ISO 55000 gap assessment.)
1. What is the current state of my assets?
   - System layout
   - Data hierarchy
   - Standards inventory
   - Develop asset registry

2. What is the required LOS?
   - Valuation, life cycle costing
   - Determine life cycle and replacement costs
   - Demand analysis
   - Balanced scorecard
   - Performance metric
   - Set target Levels of Service (LoS)

3. Which assets are critical?
   - Failure mode and effects analysis
   - Business Risk
   - Desktop / Interviews
   - Optimize Capital Investment

4. What are my best CIP and O&M strategies?
   - Confidence level rating
   - Strategic validation
   - Optimized decision making
   - Optimize O&M Investment
   - Root cause analysis
   - Reliability centered and Predictive maintenance
   - Optimized decision-making

5. What is my best funding strategy?
   - Renewal annuity
   - Asset management plan
   - Policies and strategies
   - Annual budget
   - Build AM Plan
WERF’s SIMPLE Knowledge Base Provides Extensive Tools Including SAM GAP
WERF SAM-GAP Has 150 Statements

The SAM-GAP assessment tool takes the form of a detailed and comprehensive multiple-choice questionnaire.
SIMPLE Tools Address Breadth of Asset Management Topics

Contents

This topic covers the following areas:

- Asset Hierarchal Tool
- Condition Assessment Tool
- Remaining Effective Life Tool
- Life Cycle Costing Tool
- Level Of Service Tool
- Business Risk Exposure Tool
- Benefit Cost Tool
- End of Asset Life Tool
- Business Case Tool
- Capital Investment Validation and Prioritization Tool
- Asset Management Plan Tool
- SAM-GAP, Asset Management Assessment Tool
WERF Report Benchmarked 36 Utilities to Identify Leading Practices

For strategic asset capital planning:

• Predicting likely failure modes
• Life-cycle cost-based optimized decision making (repair, rehab, replace)
• State-of-the-asset portfolio reporting (long term view)
Best in Class Programs Use a Blended Approach

ISO 55000
The Organization
Leadership
Plans
Support
Operation
Performance Evaluation
Improvement

WERF SAM GAP
Processes & Practices
Information Systems
Data & Knowledge
Service Delivery
Organization Issues
People Issues
Asset Mgmt. Plans

AM Success
Leading Practice Concepts of Asset Management for Capital Planning

- Levels of Service Based on Customer and Stakeholder Expectations
- Risk Management Based on Likelihood and Consequence of Failure
- CIP Using Life Cycle Cost, Business Cases and Prioritization

= Leading Practice Asset Management
Leading Practice Asset Management Should Align with Overall Organization Strategy

- Strategic Vision
  - Environmental Policy
  - Regulatory and Public Policy

- Service Levels
  - Asset Management Plan
  - Business Plan
  - CIP Plan
  - Funding Plan
  - Performance Management

- Elected and Appointed Officials
- Customers and Stakeholders

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Service Levels Build Transparency and Stakeholder Relationships

<table>
<thead>
<tr>
<th>SL Category</th>
<th>Water</th>
<th>Wastewater</th>
</tr>
</thead>
</table>
| Reliability | • water main breaks  
               • unaccounted for water  
               • worst served customers | • sewer blockages / collapses  
                                       • SSOs / CSOs  
                                       • spills / backups |
| Quality     | • customer complaints (pressure, taste/odor, color) | • odor complaints from pump stations and WWTPs |
| Customer Service | • outage response  
                      • call center performance | • event response  
                                   • call center performance |
| Regulatory  | • water quality compliance | • discharge permit compliance |

Water Distribution

Current Performance Trends and Issues
- Stable performance driven by rehabilitation and renewal program of 100 miles per year.
- Continued focus on oldest cast iron pipe and worst served areas.
- 2007 performance impacted by spike of 75 third party damage incidents during downtown light rail construction.
Leading Practice Asset Management Should Be Risk-Based

**Probability of Failure**
- Based on asset condition and performance standards

**Consequence of Failure**
- Based on Triple Bottom Line principles:
  - Economic
  - Environmental
  - Social

\[
\text{Asset Risk Score} = \text{Probability} \times \text{Consequence} \times \text{Redundancy/Mitigation}
\]
IIMM Provides Concepts for Standardized Condition Scoring

**DESCRIPTION OF CONDITION**

1. VERY GOOD CONDITION
   - Only normal maintenance required

2. MINOR DEFECTS ONLY
   - Minor maintenance required (5%)

3. MAINTENANCE REQUIRED TO RETURN TO ACCEPTED LEVEL OF SERVICE
   - Significant maintenance required (10-20%)

4. REQUIRES RENEWAL
   - Significant renewal/upgrade required (20-40%)

5. ASSET UNSERVICEABLE
   - Over 50% of asset requires replacement

*Figure 3.3.4: Condition Rating Model*
## Risk-Based Approach and CIP Planning
Evaluates All Potential Failure Modes

<table>
<thead>
<tr>
<th>Condition Type</th>
<th>Failure Mode</th>
<th>Description</th>
<th>Typical Assessment Method</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Performance</strong></td>
<td>Capacity</td>
<td>Does not meet demand (flow, loading, storage volume, etc.)</td>
<td>Test or Desktop</td>
</tr>
<tr>
<td></td>
<td>Level of Service</td>
<td>Does not meet functional needs (permits, levels of service)</td>
<td>Desktop</td>
</tr>
<tr>
<td></td>
<td>Efficiency</td>
<td>Not lowest cost alternative (chemicals, power, labor, availability, obsolescence)</td>
<td>Desktop</td>
</tr>
<tr>
<td><strong>Physical</strong></td>
<td>Mortality</td>
<td>Current state of repair and operation as influenced by age, historical maintenance and operating environment</td>
<td>Test, Visual, Desktop</td>
</tr>
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</table>
Leading Practice Capital Planning Uses a Business Case Evaluation

Typical Business Case Evaluation Approach

- Project need (broadly stated)
- Evaluation of alternatives and life cycle costs
- Recommended project
- Evaluation of various criteria as needed

CIP Plan

- Prioritize CIP funding based on validated projects
- Use criteria based on risk and other important factors (economic, environmental and social)
Project Level Business Cases Can Consider a Broad Range of Factors

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Capital Project Business Case</th>
</tr>
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<tbody>
<tr>
<td>Project Summary Information</td>
<td></td>
</tr>
<tr>
<td>Project: Disposal of Oilsludge at the Waverly Wastewater WWTP</td>
<td></td>
</tr>
<tr>
<td>Project Owner</td>
<td>Virginia Beach DPU</td>
</tr>
<tr>
<td>Project Site</td>
<td>Waverly Wastewater WWTP</td>
</tr>
<tr>
<td>Project Title</td>
<td>Disposal of Oilsludge at the Waverly Wastewater WWTP</td>
</tr>
<tr>
<td>Project Category</td>
<td>Replacement/Modernization</td>
</tr>
<tr>
<td>Project Schedule</td>
<td>Start Date</td>
</tr>
<tr>
<td>Phase 1 - Pre-Construction</td>
<td>01/2010</td>
</tr>
<tr>
<td>Phase 2 - Construction</td>
<td>03/2010</td>
</tr>
<tr>
<td>Phase 3 - Commissioning</td>
<td>05/2010</td>
</tr>
</tbody>
</table>

- Physical Condition
- Asset Performance
- Strategic Plan Alignment
- Regulatory/Environmental
- Level of Service/Reliability
- O&M and Safety
- Public Benefit
- Financial
- Efficiency/Energy
- Community/Growth
Life Cycle Cost Analysis Can Be a Challenge

WERF report provides guidance on:

- Quantifying benefits
- Comparing alternatives
- Selecting a discount rate
Steps to Bundle, Validate and Prioritize CIP

Assess and Analyze Asset Data and Establish Policies and Procedures

Conduct Asset Inventory and Condition Assessment

Develop 5/20 Year Capital Investment Plan (CIP)

Analyze and Review Financial and Rate Implications

---

**Steps to Bundle, Validate and Prioritize CIP**

1. **Assess and Analyze Asset Data and Establish Policies and Procedures**
2. **Conduct Asset Inventory and Condition Assessment**
3. **Develop 5/20 Year Capital Investment Plan (CIP)**
4. **Analyze and Review Financial and Rate Implications**

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**Project Priority**

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Priority</th>
<th>Project Type</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greens Wet Well and ORF Improvements</td>
<td>High</td>
<td>Growth / Augmentation</td>
<td>$1,000,000</td>
<td>$4,000,000</td>
<td>$300,000</td>
<td>$7,900,000</td>
<td></td>
</tr>
<tr>
<td>Aurora S Pump Station Improvements</td>
<td>Med High</td>
<td>Growth / Renewal</td>
<td>$100,000</td>
<td>$100,000</td>
<td>$100,000</td>
<td>$300,000</td>
<td></td>
</tr>
<tr>
<td>PS Replacement</td>
<td>Low</td>
<td>Growth</td>
<td>$10,000</td>
<td>$10,000</td>
<td>$10,000</td>
<td>$30,000</td>
<td></td>
</tr>
<tr>
<td>Renewal / Rehabilitation / Replacement Projects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-4</td>
<td>Village of Hamburg Collection System</td>
<td>High</td>
<td>Renewal</td>
<td>$592,000</td>
<td>$1,000,000</td>
<td>$50,000</td>
<td>$1,642,000</td>
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<tr>
<td>5</td>
<td>Replacement of ACP along Transit Road*</td>
<td>High</td>
<td>Renewal</td>
<td>$500,000</td>
<td>$1,300,000</td>
<td>$100,000</td>
<td>$1,900,000</td>
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<td>6-8</td>
<td>Batavia Park PS and Collection System Improvements</td>
<td>High</td>
<td>Renewal</td>
<td>$250,000</td>
<td>$500,000</td>
<td>$300,000</td>
<td>$1,050,000</td>
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<td>9-12</td>
<td>Holland Avenue Sewer Replacement</td>
<td>High</td>
<td>Renewal</td>
<td>$800,000</td>
<td>$200,000</td>
<td>$800,000</td>
<td>$2,800,000</td>
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<tr>
<td>13-18</td>
<td>East Aurora Collection System Replacement NYS DOT</td>
<td>Low</td>
<td>Renewal</td>
<td>$2,000,000</td>
<td>$2,000,000</td>
<td>$2,000,000</td>
<td>$6,000,000</td>
</tr>
<tr>
<td><strong>Total - Renewal / Rehabilitation / Replacement</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$6,082,000</td>
</tr>
</tbody>
</table>

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**Total - All Projects**

| | | | | | |
| $7,712,000 | $7,615,000 | $9,845,000 | $3,280,000 | $25,252,000 |

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Case Study 1, NYC DEP

How It Got Started

- Wanted to make decisions based on data and be a “data-driven” organization
- Wanted to develop a risk-based CIP

Resulting Benefits

- Developed data management tools
- Project bundling and cost estimating
- Capital planning with project prioritization of validated project
DEP’s Goals for the Overall Project in Phase I

- Update the DEP’s 4 and 10-year Capital Improvement Program by fall of 2010
- Define consistent risk methodologies, tools, and practices
- Provide a transparent and objective approach for stakeholders and gain acceptance
- Employ systematic approach to condition assessment, project bundling and cost estimating
Overall Project Workflow in Phase I

1. Asset Condition, Criticality, and Risk Assessment (Field and Desktop)
2. Project Bundling and Cost Estimating
3. Business Case Development and Prioritization
4. Develop Final 4 and 10 Year CIP Document
5. Develop ARI-IMS Tool
Well-Document Guidelines for Vertical Assets Customized for DEP

Guide Documents Created for Each Bureau Including Desktop Guides

Outlines Physical, Performance and Criticality criteria and scoring

Sample Interview Questionnaires and list of documents to review

Photos for physical condition of each score

Allows for repeatable process and future DEP staff participation
Risk Tool to Analyze Data, Score Asset Risk and Bundle Projects

- Maintains the asset hierarchy and data for each Bureau: 50,000+ assets
- Manages all field data on physical and performance condition and criticality
- Applies the “business rules” to calculate risk
- Recommends “project bundles” for each Facility in the hierarchy
- Manages the Business Cases for all proposed projects
- Creates the final CIP
Example Business Case and Sections

Full Business Case Includes:

1. Project Summary
2. Project Scope and Drivers
3. Project Cost Accuracy
4. Project Schedule & Cost
5. Project Justification
6. Project Constraints
7. Condition, Consequence of Failure and Risk Analysis
8. Project Scoring
Validated Projects Are Prioritized

Factors That Are Evaluated

- Physical Condition
- Performance Condition
- Regulatory/Environmental
- Service Level/Reliability
- Energy Efficiency
- Public Image
- Growth/Public/Community
- O&M and Hazard
- Financial
Lessons Learned

1. Develop, test and apply a standardized process

2. Prioritize using a 2 step process - risk and other important factors

3. Evaluate programs, not just facilities and assets
Case Study 2, Columbus, Ohio

How It Got Started

- Wanted to develop a centralized office to implement a best in class asset management program
- Focused on risk assessment, performance management, and capital prioritization

Resulting Benefits

- Developed asset management program roadmap and Levels of Service for customer communication
- Developed robust business cases evaluation process to better prioritize their CIP
- Defensible CIP for Affordability Analysis
Scoring Criteria: Criteria Ranking

- Number and size of overflows
- Leaky sewers having a downstream impact
- Public exposure to overflows
- Water in basement event
- Structural/Operations and Maintenance concerns
- Water Quality
- SCREAM Data
- Exposure risk: discharges to tributaries, near parks, schools
- Number of WIBs
- Complex analysis, little weight
- Number of SSO locations and number of activations
- Difficult to objectively score, little weight
- High interest - kept as final parameter

Social parameters:
- Community acceptance
- Ability to implement (cleanly, ethically)
- Neighborhood involvement
Applied Risk at Pipe Level to Develop Projects
Tools Were Used to Streamline Processes
Sustainable Financial Projections

- Capital Prioritization
- Affordability Analysis
- Funding Options

Helps Balance Capital Funding and Rate Impacts
Case Study 3, DC Water

How It Got Started

✓ Wanted to better understand authority risk and develop LOS measures to communicate with stakeholders
✓ Focus on streamlining capital investment planning process – wanted to understand their long-term investment needs

Resulting Benefits

✓ Developed advanced risk framework to prioritize inspection and assessment
✓ Develop capital planning tool to better prioritize their CIP
✓ Streamlined project selection process
Tools Were Used to Streamline Processes
AWWA AM Committee Survey Shows Many Still Need to Progress with BCEs

More Progress with Risk Evaluations and Service Levels
Lessons Learned for CIP Planning

- Non-critical projects tend to cluster in the middle
- Provide a different path for projects that are critical e.g. safety-related
- Pilot the process, fine-tune it, train staff and then roll it out to avoid frustration
- Overall savings by doing the right project
- Data driven decisions
- Use automated tools
Questions?

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Improving quality of life.

Thank you