Fundamentals of Asset Management

Step 8. Optimize Capital Investment
A Hands-On Approach
Tom’s bad day…
Fourth of 5 core questions

4. What are my best O&M and CIP investment strategies?
   - What alternative management *options* exist?
   - Which are the *most feasible* for my organization?
AM plan 10-step process

1. Develop Asset Registry
2. Assess Condition, Failure Modes
3. Determine Residual Life
4. Determine Live Cycle & Replacement Costs
5. Set Target Levels of Service (LOS)
6. Determine Business Risk ("Criticality")
7. Optimize O&M Investment
8. Optimize Capital Investment
9. Determine Funding Strategy
10. Build AM Plan

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

Confidence Level Rating; Strategic Validation; ORDM
Recall view 4: Management framework
Balancing future demand with current capabilities

Current Demand Stream

Supply-Production Stream

Future Demand Stream

Assets Available

Gap

Assets Required

Asset Management Strategy (AMP)

Existing Assets

Maintainable

Existing Assets

Renewable

New Assets Augmentation

Reconfigurable Disposable Assets

Non-asset Solutions

Focus of CIP

Fundamentals of Asset Management
The CIP process *locks* in life cycle costs!

65-85% of all life-cycle costs are “locked-in” here!

Life-cycle O&M costs often are 5-10 (even 20) times initial construction costs.

Life-cycle cost reduction opportunities diminish
Deriving the CIP investment program – a best practice model

1. The strategic CIP “Business Plan”
   - What are we going to do and why?
   - What will it cost?
   - How will it be funded?
   - Life-cycle impact on LOS, rates, and financial condition

2. On time and on budget
   - Managing costs
   - Managing schedules and deliverables
   - Managing contracts and changes

3. Integration into the portfolio of assets
   - Registry
   - Start-up, shake-down, burn-in, commissioning
   - Manuals, spares, and service
   - Initiating the maintenance regimen

Project development & authorization

1. Identification
   - Validation
   - Prioritization
   - Financing

2. Execution
   - Control

3. Handover
Capital investment is made up of two major types of projects

**Renewal**
- Repair
- Refurbish/restore
- Replace

**Augmentation**
- Functionality (LOS/efficiency)
- Capacity
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   • Manuals, spares, and service
   • Initiating the maintenance regimen
Project identification: Moving to “best practice”

“Champion” model

- Plant “wish list"
- Collection “wish list"
- Collection “wish list”
- IT, etc., “wish list”
- Unknown requirements!

“Structured” model

AMP (whole portfolio)
- Inventory
- Condition
- Failure modes
- Residual life
- Replacement $
- LOS
- ODM

**Project Development** (optimal Investment)
The project development process

1. "At risk" assets
2. Existing CIP
3. Strategic drivers

4. Initial projects list
5. Validation & prioritization
6. CIP funding strategies
7. CIP document
The “primary failure mode” gives insight into “strategic drivers” at work

<table>
<thead>
<tr>
<th>Failure Mode</th>
<th>Definition</th>
<th>Tactical Aspects</th>
<th>Management Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Capacity</strong></td>
<td>Volume of demand exceeds design capacity</td>
<td>Growth, system expansion</td>
<td>(Re)design</td>
</tr>
<tr>
<td><strong>LOS</strong></td>
<td>Functional requirements exceed design capacity</td>
<td>Codes &amp; permits: NPDES, CSOs, OSHA, noise, odor, life safety; service, etc.</td>
<td>(Re)design</td>
</tr>
<tr>
<td><strong>Mortality</strong></td>
<td>Consumption of asset reduces performance below acceptable level</td>
<td>Physical deterioration due to age, usage (including operator error), acts of nature</td>
<td>O&amp;M optimization, renewal</td>
</tr>
<tr>
<td><strong>Efficiency</strong></td>
<td>Operations costs exceed that of feasible alternatives</td>
<td>Pay-back period</td>
<td>Replace</td>
</tr>
</tbody>
</table>

NPDES is National Pollutant Discharge Elimination System, CSOs are combined sewer overflows, and OSHA is Occupational Safety and Health Administration.
The project development process

1. "At risk" assets
2. Existing CIP
3. Strategic drivers
4. Initial projects list
5. Validation & prioritization
6. CIP funding strategies
7. CIP document
“At risk” assets

- High business risk exposure scores
- Very low remaining useful lives
- Poor condition scores or scores approaching designated minimum acceptable levels
- Poor performance scores
- Poor reliability scores
- No redundancy
- Imminent major failure mode of “capacity” or “level of service”
Each project should have a CIP project identification sheet that identifies…

- Proposed scope
- Location
- Background & context
- Rationalization
- Fiscal requirements
- Design issues
- Permits required
- Comments
Deriving the CIP investment program – a best practice model

1. The strategic CIP “Business Plan”
   - What are we going to do and why?
   - What will it cost?
   - How will it be funded?
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2. On time and on budget
   - Managing costs
   - Managing schedules and deliverables
   - Managing contracts and changes

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   - Registry
   - Start-up, shake-down, burn-in, commissioning
   - Manuals, spares, and service
   - Initiating the maintenance regimen

Project
- Identification
- Validation
- Prioritization
- Financing
- Execution
- Control
- Handover
Driving down the cost of CIP

Can we…

- Eliminate projects?
- Defer projects?
  - Change maintenance?
  - Change operations?
- Shift to more appropriate Optimized Renewal Decision Making (ORDM) solution (repair, refurbish, replace)?
- Find a non-asset solution?
CIP validation

How do we know that we have…

- The right projects?
- At the right time?
- At the right cost?
- For the right reasons?
CIP Validation

How do we “validate”?  
- We produce a rigorous *business case* for all projects that justifies the timing and project solution including:  
  - Life cycle cost (capital and O&M)  
  - “Triple bottom line” risks (financial, social, and environmental)  
- We *sufficiently analyze* in a step-by-step approach to ensure that we have reached an *acceptable level of confidence* (confidence level rating—CLR)  
- We set the sophistication of analytical process to match the *risks, value of the capital, and life cycle costs* to be invested
Validation as a “decision” filter

- Existing CIP/“wish list”
- Project list
- AMP (whole portfolio)
- Valid?
  - Yes: Proceed
  - No: Delete, Defer, Redo
Process steps

CLR is confidence level rating, BRE is business risk exposure, LCC is life cycle cost, CIP is capital improvements program.
Process steps

CLR is confidence level rating, BRE is business risk exposure, LCC is life cycle cost, CIP is capital improvements program.
Measuring our confidence in our proposed projects and solutions

How confident are we that we are recommending the right *solution* at the right *time* at the right *cost*?

\[
\text{Best Appropriate Process} \quad + \quad \text{Quality of Date Used} \quad = \quad \text{Confidence Level Rating (CLR)}
\]

\[
\frac{70\%}{2} + \frac{40\%}{2} = 55\%
\]
Confidence level rating process steps

Step 1
Project concept by project sponsor

Step 2
Build business case by assessor

Step 3
Comments on business case by peer reviewer

Step 4
Review and rank business case by CIP committee
CLR: 13 elements to be considered

1. **Existing standard of service?**
   What is the purpose of the asset? Why is it there?

2. **Knowledge of existing asset or facility (renewal)**
   - What condition is the asset in?
   - What is its performance? It’s reliability?

3. **Current asset utilization (renewal)**
   What is the asset actually delivering vs. what do I require the asset to do?
CLR: 13 elements to be considered, cont.

4. Future demands and reliability
   What increase in level of service is expected in the future?

5. Prediction of reliability and failure mode (renewal)
   Of the four failure modes (Capacity, Level of Service, Mortality and Efficiency), which one is most eminent?

6. Timing of reliability / renewal failure
   How likely is this failure to occur?

7. Consequence of reliability and renewal failure
   What is the impact of this failure?
8. Quality of proposed maintenance program
   How good are my estimates for maintenance costs for this project? Do I understand the most appropriate regimen across its life cycle?

9. Appropriateness of operating budgets
   How good are my estimates for operating costs for this project?

10. Appropriateness of renewal solution
    Have we systematically considered all nine treatment options (do nothing, status quo, operate differently, maintain differently, repair, refurbish/rehabilitate, replace, decommission, and non-asset based)?
CLR: 13 elements to be considered, cont.

11. **Assessment of capital costs**
   How good are my estimates for capital costs?

12. **Assessment of benefits (risk reduction)**
   - What am I really getting for doing this project and have I adequately quantified it?
   - Will this provide real benefit to stakeholders?
   - Have I done the homework to understand the benefits?

13. **Appropriateness of evaluation process**
   Have I balanced business risk and all (life cycle) costs and benefits and documented them in a business case?
## Confidence Level Assessment & Rating

**LEVEL 2: Overall Confidence Levels LOS Capital Improvement Projects**

<table>
<thead>
<tr>
<th>No.</th>
<th>Quality Element</th>
<th>Project Value Chain</th>
<th>Process Effectiveness</th>
<th>Data &amp; Knowledge Quality</th>
<th>Effectiveness Score</th>
<th>Quality Score</th>
<th>Quality Rating</th>
<th>Cost Years Eval</th>
<th>Rating Gap</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>External Regulation (Civil)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Understanding of existing service**

1. **Existing Standard of Service**
   - 2% Formal written standard adopted by legislative body
   - Large technical group - sound, accurate knowledge
   - 100% 60% 80% 2% 0%
2. **Knowledge of Existing Asset / Facility**
   - 4% Internal specific knowledge based on informal records applied
   - Large technical group - sound, accurate knowledge
   - 50% 60% 55% 2% 2%

**Demands placed on service**

3. Current Demands for Service
   - 0% Current demand specifically analyzed and estimated
   - Full data and costs down to maintenance managed item level
   - 100% 100% 100% 0% 0%
4. Future Demands for Service
   - 5% Future demand specifically analyzed and projected
   - Full data and costs down to maintenance managed item level
   - 100% 100% 100% 5% 0%

**Service failures**

5. **Predicted Modes of Service Failure**
   - 0% Major (strategic) failure modes analyzed
   - Large technical group - sound, accurate knowledge
   - 75% 60% 66% 0% 0%
6. **Probability / Timing of Failure**
   - 0% Formal analysis at facility/major process or higher level
   - Moderate data from asset management information system
   - 76% 65% 60% 0% 0%
7. **Consequence of Failure**
   - 15% Specific but informal consideration given
   - Medium technical group - moderate knowledge
   - 50% 60% 50% 6% 6%

**Analysis approach**

8. **Quality of Proposed Maintenance Programs**
   - 7% Formal analysis at facility/major process or higher level
   - Large technical group - sound, accurate knowledge
   - 75% 60% 68% 5% 2%
9. **Appropriateness of Recurrent Budgets**
   - 10% Formal analysis at facility/major process or higher level
   - Large technical group - sound, accurate knowledge
   - 75% 60% 68% 7% 3%
10. **Appropriateness of Renewal Solutions Considered**
    - 10% Formal analysis at facility/major process or higher level
    - Key basic data from asset management information system
    - 75% 75% 75% 8% 3%
11. **Assessment of Capital Cost Estimates**
    - 12% Formal analysis at asset or lower level
    - Large technical group - sound, accurate knowledge
    - 100% 60% 80% 10% 2%
12. **Assessment of Benefits (Risk Reduction)**
    - 15% Formal analysis at facility/major process or higher level
    - Key basic data from asset management information system
    - 75% 75% 75% 11% 4%
13. **Appropriateness of Economic Evaluation Process**
    - 20% Specific but informal consideration given
    - Medium technical group - moderate knowledge
    - 50% 60% 50% 16% 16%

**TOTALS** 100% 60% 80% 2% 0%

"Gap" is the difference between a "perfect" score of 100 and actual score.
### Scoring “protocol”

#### Table 3: Scoring the Processes & Practices

<table>
<thead>
<tr>
<th>Assessment Score</th>
<th>Processes &amp; Practice Followed</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>No process applied to quality element</td>
</tr>
<tr>
<td>25%</td>
<td>Some consideration given to process</td>
</tr>
<tr>
<td>50%</td>
<td>Base Biology &amp; Genetics applied</td>
</tr>
<tr>
<td>70%</td>
<td></td>
</tr>
<tr>
<td>80%</td>
<td></td>
</tr>
<tr>
<td>90%</td>
<td></td>
</tr>
<tr>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

#### Description of Data Used

<table>
<thead>
<tr>
<th>Assessment Score</th>
<th>Description of Data Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>No data available</td>
</tr>
<tr>
<td>25%</td>
<td>Some minor data available</td>
</tr>
<tr>
<td>40%</td>
<td>Small Delphi Group - poor knowledge</td>
</tr>
<tr>
<td>50%</td>
<td>Medium Delphi Group - reasonable knowledge</td>
</tr>
<tr>
<td>60%</td>
<td>Large Delphi Group - sound accurate knowledge</td>
</tr>
<tr>
<td>75%*</td>
<td>Key base principle data from AMIS</td>
</tr>
<tr>
<td>85%*</td>
<td>Secondary data from AMIS</td>
</tr>
<tr>
<td>100%*</td>
<td>Full tertiary data &amp; costs down to MMI</td>
</tr>
</tbody>
</table>
Weighted gap improvements

Renewal Weighted GAP

Quality Elements

- Existing Standards of Service
- Knowledge of Existing Asset / Facility / Resources Providing Service
- Current Demands
- Future Demands / Reliability
- Prediction of Reliability / Renewal Failure Mode
- Timing of Reliability / Renewal Failure
- Consequence of Failure to Make this Investment
- Quality of Proposed Maintenance Program (if applicable)
- Appropriateness of Recurrent Operations & Maintenance Budgets
- Appropriateness of Solutions Assessed & Adopted
- Assessment of Capital Cost Estimates
- Assessment of Benefits (Risk Reduction)
- Appropriateness of Economic Evaluation Process Undertaken

% GAP
CIP “hurdle” stages

<table>
<thead>
<tr>
<th>Source</th>
<th>Period (years)</th>
<th>Minimum CLR rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM plan</td>
<td>16-25</td>
<td>60%</td>
</tr>
<tr>
<td>AM plan</td>
<td>11-15</td>
<td>70%</td>
</tr>
<tr>
<td>10-year CIP 90%</td>
<td>6-10</td>
<td>80%</td>
</tr>
<tr>
<td>5-year CIP</td>
<td>2-5</td>
<td>85%</td>
</tr>
<tr>
<td>Design expenditure approved</td>
<td>1</td>
<td>90%</td>
</tr>
</tbody>
</table>
Process steps

CLR is confidence level rating, BRE is business risk exposure, LCC is life cycle cost, CIP is capital improvements program.
Recall: Business risk exposure drives work program

Work program response

- **High / High**: Immediate work (D)
- **High / Low**: Aggressive monitoring (B)
- **Low / High**: Aggressive monitoring (C)
- **Low / Low**: Sample monitoring (A)
**BRE 1—simple approach**

Business risk exposure (BRE) increases (higher numbers) as probability of failure (PoF) and consequence of failure (CoF) increase.

<table>
<thead>
<tr>
<th>Probability of Failure</th>
<th>Consequence of Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (1)</td>
<td>Low (1)</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>High (3)</td>
<td>High (3)</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>9</td>
</tr>
</tbody>
</table>

Fundamentals of Asset Management
Calculating business risk exposure (BRE) – project level

\[ \text{Business Risk Score} = \text{Probability of Failure} \times \text{Consequence of Failure} \times \text{Redundancy} \]

- **Probability of Failure**
  - Use design or standard life table
  - Adjust for:
    - Design standard
    - Construction quality
    - Material quality
    - Operational history
    - Maintenance history
    - Operating environ.
    - External stresses

- **Consequence of Failure**
  - Consider:
    - Safety, health, and welfare
    - Environmental impact
    - Process criticality
    - Repair costs
    - Revenue and aggravation impact on customers and agency

- **Redundancy**
  - Consider:
    - Peak vs. average
    - Age and condition
    - Operating environ.
    - Failure mode

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Fundamentals of Asset Management
Process steps

Project identification

CLR

BRE

LCC

Business case

CLR revision

Prioritization by CIP committee

Budget book

CLR is confidence level rating, BRE is business risk exposure, LCC is life cycle cost, CIP is capital improvements program

Fundamentals of Asset Management
Recall: Defining life cycle cost

\[ \text{Life cycle cost} = \text{original cost} - \text{salvage value} + \text{operating costs} + \text{maintenance costs} + \text{renewal costs} + \text{decommissioning costs} \]
### Life cycle cost – for each feasible option

<table>
<thead>
<tr>
<th>A</th>
<th>B (%)</th>
<th>C Amount ($)</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Discount Rate</td>
<td>1.0%</td>
<td>1.0%</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Repair/Maintenance</td>
<td>Total</td>
<td>Avg Annual $</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Capital</td>
<td>$ 4,500</td>
<td>$ 4,500</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Operations</td>
<td>$ 2,033.91</td>
<td>$ 360.00</td>
<td>$ 402.50</td>
<td>$ 414.50</td>
<td>$ 427.01</td>
<td>$ 439.62</td>
<td>$ -</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Maintenance</td>
<td>$ 1,803.29</td>
<td>$ 360.00</td>
<td>$ 360.00</td>
<td>$ 365.00</td>
<td>$ 365.00</td>
<td>$ 371.48</td>
<td>$ -</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Total Costs</td>
<td>$ 5,337.20</td>
<td>$ 5,200.00</td>
<td>$ 750.25</td>
<td>$ 775.15</td>
<td>$ 793.00</td>
<td>$ 811.30</td>
<td>$ -</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 PV Total Costs</td>
<td>$ 5,259.14</td>
<td>$ 5,200.00</td>
<td>$ 750.25</td>
<td>$ 775.15</td>
<td>$ 793.00</td>
<td>$ 811.30</td>
<td>$ -</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Fundamentals of Asset Management
Life cycle cost – for each feasible option

<table>
<thead>
<tr>
<th>Description</th>
<th>Do nothing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option number</td>
<td>Analyze</td>
</tr>
<tr>
<td>Option Status</td>
<td>2003</td>
</tr>
<tr>
<td>Proposed Year of Commissioning</td>
<td>Number of Years to Analyze</td>
</tr>
<tr>
<td>Operating Costs (Annual)</td>
<td></td>
</tr>
<tr>
<td>Expected increased production income</td>
<td></td>
</tr>
<tr>
<td>Increased rate income</td>
<td></td>
</tr>
<tr>
<td>Condition a</td>
<td>Condition b</td>
</tr>
<tr>
<td>Chemicals / other inputs</td>
<td>Other -a</td>
</tr>
<tr>
<td>Other -b</td>
<td>Increase Production or Income Sub-total</td>
</tr>
<tr>
<td>Labor resource</td>
<td>Labor resource</td>
</tr>
<tr>
<td>Maintenance Costs (Annual)</td>
<td></td>
</tr>
<tr>
<td>Preventative maintenance</td>
<td></td>
</tr>
<tr>
<td>Corrective maintenance</td>
<td></td>
</tr>
<tr>
<td>Predictive maintenance</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
<tr>
<td>Maint. Benefits Sub-total</td>
<td></td>
</tr>
<tr>
<td>Safety / OHS / Risk</td>
<td></td>
</tr>
<tr>
<td>Expected reduction in Loss Time Injuries / Medical Treatment Injuries (BTRE) compared to Option 1 - Status Quo.</td>
<td></td>
</tr>
<tr>
<td>Total cost reduction from reduced LTI’s &amp; MTI’s</td>
<td></td>
</tr>
<tr>
<td>Business Risk Exposure</td>
<td></td>
</tr>
<tr>
<td>Safety / OHS (Annual) Sub-total</td>
<td></td>
</tr>
<tr>
<td>Improved Levels of Service (Annual)</td>
<td></td>
</tr>
<tr>
<td>What are the areas and estimated annual saving expected from implementing this project compared to the Status Quo?</td>
<td></td>
</tr>
<tr>
<td>Improved Levels of Service Sub-total</td>
<td></td>
</tr>
</tbody>
</table>

Fundamentals of Asset Management
Process steps

- Project identification
- CLR
- BRE
- LCC
- Business case
- CLR revision
- Prioritization by CIP committee
- Budget book

CLR is confidence level rating, BRE is business risk exposure, LCC is life cycle cost, CIP is capital improvements program.
Elements of a “business case”

- Executive Summary
- Part 1, Demand and Supply
  - Objectives
  - Project background
  - Drivers & failure modes
- Part 2, Options Analysis
  - Feasible options defined
  - For each option:
    - Business risk exposure
    - Life cycle costing
    - Confidence level rating (CLR)
  - Summary tables
- Part 3, Recommendation
  Recommended option and description
Options analysis - summarized

<table>
<thead>
<tr>
<th>Option</th>
<th>Business Risk</th>
<th>Capital ($)</th>
<th>Annual Operations</th>
<th>Annual Maintenance</th>
<th>PV of Benefits</th>
<th>NPV</th>
<th>Adjusted Annualized PV</th>
<th>Benefit Cost</th>
<th>Pay Back Period</th>
<th>Total PV/ CLR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status Quo</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do Nothing / Run to Fail</td>
<td></td>
<td></td>
<td></td>
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<td>Operate Differently</td>
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<td>Maintain differently</td>
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<td>Refurbish / Rehabilitation</td>
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<td>Replace</td>
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<td>Decommission</td>
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<td>Non Asset Solutions</td>
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<td>(Other options)</td>
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</table>
## Moving forward: Project validation decision matrix

<table>
<thead>
<tr>
<th>High BRE (&gt;1M)</th>
<th>Medium BRE</th>
<th>Low BRE (&lt;50K)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High CLR (&gt;84)</strong></td>
<td>Proceed with project, no changes</td>
<td>Consider proceeding with project if financial criteria are met and funding is available</td>
</tr>
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</tr>
<tr>
<td><strong>Medium CLR (56-84)</strong></td>
<td>Consider</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Proceed with project</td>
<td></td>
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<tr>
<td></td>
<td>• Deferral or delay</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Increase CLR</td>
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<td></td>
<td>Consider</td>
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<tr>
<td></td>
<td>• Deferral or delay</td>
<td></td>
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<tr>
<td></td>
<td>• Breakup project and proceed with parts</td>
<td></td>
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<tr>
<td></td>
<td>• Increase CLR</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Consider</td>
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<tr>
<td></td>
<td>• Deferral or delay</td>
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<td></td>
<td>• Project breakup</td>
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<td></td>
<td>• Cancellation</td>
<td></td>
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<tr>
<td></td>
<td>• Increase CLR</td>
<td></td>
</tr>
<tr>
<td><strong>Low CLR (&lt;56)</strong></td>
<td>Consider</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Deferral or delay</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Project breakup</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Proceed with project using design consultant</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Increase CLR</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Consider</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Mothball</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Deferral or delay</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Cancellation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Increase CLR</td>
<td></td>
</tr>
</tbody>
</table>
Deriving the CIP investment program – a best practice model

1. The strategic CIP “Business Plan”
   - What are we going to do and why?
   - What will it cost?
   - How will it be funded?
   - Life-cycle impact on LOS, rates, and financial condition

2. On time and on budget
   - Managing costs
   - Managing schedules and deliverables
   - Managing contracts and changes

3. Integration into the portfolio of assets
   - Registry
   - Start-up, shake-down, burn-in, commissioning
   - Manuals, spares, and service
   - Initiating the maintenance regimen

Project

1. Identification
2. Execution
3. Handover

Validation
Prioritization
Financing
Control
“Prioritization” rank-orders validated projects

### A. Public Health/Safety, Mandated Program, BOC Irrevocable Commitment, Phase Completion

<table>
<thead>
<tr>
<th>Points</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>Urgent to meet emergency situations to remedy or prevent a major health / safety hazard.</td>
</tr>
<tr>
<td>19</td>
<td>Essential to remedy or prevent a major health / safety hazard; Essential to comply with legally mandated programs and avoid penalty; Essential to comply with irrevocable commitment by the BOC.</td>
</tr>
<tr>
<td>15</td>
<td>Essential to complete a project phase, otherwise the system will not be operational.</td>
</tr>
<tr>
<td>6</td>
<td>Very positive economic impact; Ongoing support by BOC for county grants match and outside agency grants; Project identified as highest priority by BOC or County Manager; Potential hazard – deferral of project would increase significant level of hazard.</td>
</tr>
<tr>
<td>3</td>
<td>Potential hazard – deferral of project would not increase significant level of hazard.</td>
</tr>
<tr>
<td>0</td>
<td>Project does not apply to the aforementioned criteria.</td>
</tr>
</tbody>
</table>

### B. Service Delivery, Fiscal Impact, Leverage

<table>
<thead>
<tr>
<th>Points</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>The project creates revenues or identifies savings in excess of the project cost and is justified by a cost benefit analysis; Implementation plans of the project are required prior to capital allocation and cost savings reduce the base operating budget.</td>
</tr>
<tr>
<td>6</td>
<td>Project significantly improves service delivery which will substantially reduce subsequent operating or capital costs; County funds are reimbursed by the federal or state government at a rate of 50% or greater.</td>
</tr>
<tr>
<td>5</td>
<td>Project significantly improves service delivery and will be utilized by multiple departments with little or no impact on future operating or capital costs (less than $20,000 per year); Essential operating capital to meet service growth and/or mandated programs.</td>
</tr>
<tr>
<td>4</td>
<td>Project significantly improves service delivery with little or no impact on future operating or capital costs (less than $10,000 per year); County funds are reimbursed by the federal or state government at a rate less than 50%.</td>
</tr>
<tr>
<td>3</td>
<td>Project improves service delivery with no impact on future operating or capital costs (less than $10,000 per year) Essential operating capital to meet service growth and / or mandated programs.</td>
</tr>
<tr>
<td>2</td>
<td>Project significantly improves service delivery with moderate impact on future operating or capital costs ($10,000 – $50,000 per year)</td>
</tr>
<tr>
<td>1</td>
<td>Project significantly improves service delivery with high impact on future operating or capital costs (more than $50,000 per year)</td>
</tr>
<tr>
<td>0</td>
<td>Project does not significantly improve service delivery; Project balance available for annual program; Project requires further study before consideration.</td>
</tr>
</tbody>
</table>
Example: Possible prioritization factors & weights

<table>
<thead>
<tr>
<th>Factor</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Health/Safety</td>
<td>15</td>
</tr>
<tr>
<td>Federal or State Mandated Program</td>
<td>15</td>
</tr>
<tr>
<td>Local Irrevocable Commitment</td>
<td>15</td>
</tr>
<tr>
<td>Business Risk Exposure</td>
<td>10</td>
</tr>
<tr>
<td>Service Delivery Impact</td>
<td>10</td>
</tr>
<tr>
<td>Fiscal Impact</td>
<td>10</td>
</tr>
<tr>
<td>Conformance with Plan / Policies; Phase Completion/</td>
<td>8</td>
</tr>
<tr>
<td>Efficiency Improvement</td>
<td>7</td>
</tr>
<tr>
<td>Leverage</td>
<td>6</td>
</tr>
<tr>
<td>Project Interdependence</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total Maximum Score</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
Alternative to prioritization factor weighting

Assume agency CIP limit of $25M

<table>
<thead>
<tr>
<th>No</th>
<th>Project description</th>
<th>Cost $M</th>
<th>B/C ratio</th>
<th>PBP yrs</th>
<th>CLR</th>
<th>BRE</th>
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<tbody>
<tr>
<td>256</td>
<td>South trunk renewal</td>
<td>4.2</td>
<td>2.42</td>
<td>2.5</td>
<td>83</td>
<td>610</td>
</tr>
<tr>
<td>102</td>
<td>Expand plant automation</td>
<td>6.5</td>
<td>2.35</td>
<td>3.5</td>
<td>63</td>
<td>411</td>
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<tr>
<td>16</td>
<td>Renew digester heaters</td>
<td>2.8</td>
<td>2.10</td>
<td>4.0</td>
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<td>219</td>
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<tr>
<td>205</td>
<td>New CMMS</td>
<td>8.5</td>
<td>1.95</td>
<td>5.0</td>
<td>69</td>
<td>712</td>
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<tr>
<td>167</td>
<td>Office accommodation</td>
<td>4.7</td>
<td>1.35</td>
<td>6.2</td>
<td>72</td>
<td>813</td>
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<tr>
<td>150</td>
<td>Siphon renewals</td>
<td>2.6</td>
<td>1.30</td>
<td>7.2</td>
<td>73</td>
<td>471</td>
</tr>
</tbody>
</table>
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   - Initiating the maintenance regimen
The strategic CIP financial planning model

Traditiona l process

CIP wish list
CIP tactical “championing”
Static financial projection
CIP/budget

Improved process

CIP strategic validation process
Dynamic Financial model
Strategic plan workshops
CIP strategic business plan
Baseline: Projection of future life-cycle costs
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Project

1. Identification
   - Validation
   - Prioritization
   - Financing

2. Execution
   - Control

3. Handover
Project handover “best practices”

- Have contractor/vendor build asset registry at handover
  - Use retainage to assure
  - Give contractor/vendor asset registry protocol
- Collect baseline performance data after “burn-in” and store with asset ID
- Set up maintenance regimen (reactive, preventive, and predictive) at outset
- Incorporate manuals into EDMS
- Set up spares re-supply protocol
Adapt the CIP business process!

“As Is”

“To Be”
Key points from this session

*Given my system, what are my best capital investment strategies?*

**Key Points:**
- A cost-effective CIP is about the right solutions at just the right time – a balancing of demand and risk/consequence
- Review your CIP to determine the ‘confidence level’ you have in it – good practices plus good data lead to high confidence decisions
- Decide to proceed with or defer a given project based on the risk it represents to your agency
- For those projects you defer, undertake the necessary analysis to lift the confidence level to where you feel good about proceeding
- The quality of the CIP development process and the quality of the data available determine the level of confidence that can be assigned to the CIP
- A good CIP requires a Strategic CIP Business Plan to fit funding to projects

**Associated Techniques:**
- Project development and authorization
- Project identification
- CIP validation
- Project business case
- Strategic CIP Business Plan
- Business risk exposure
- Confidence level metrics
Tom’s spreadsheet

![Spreadsheet Image]

Fundamentals of Asset Management