Value Engineering in Durham Region, Different Approaches Achieve the Same Result – Millions of Dollars in Savings

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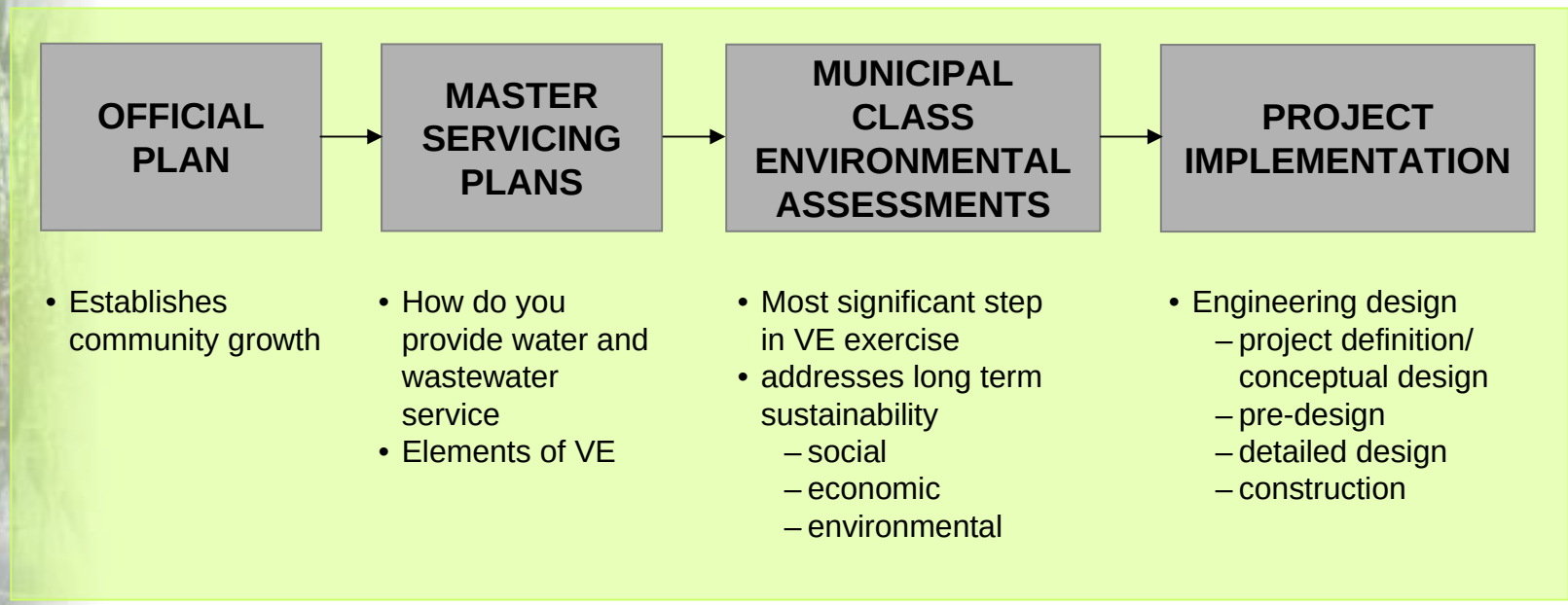
Presentation Overview

- Overview and Benefits of Value Engineering in the Water Sector
- What is a Wastewater Treatment Plant ?
- Case Studies
  - Courtice WWTP
  - Duffin Creek WWTP
- Summary and Conclusions

VE Overview and Benefits



VE Overview and Benefits

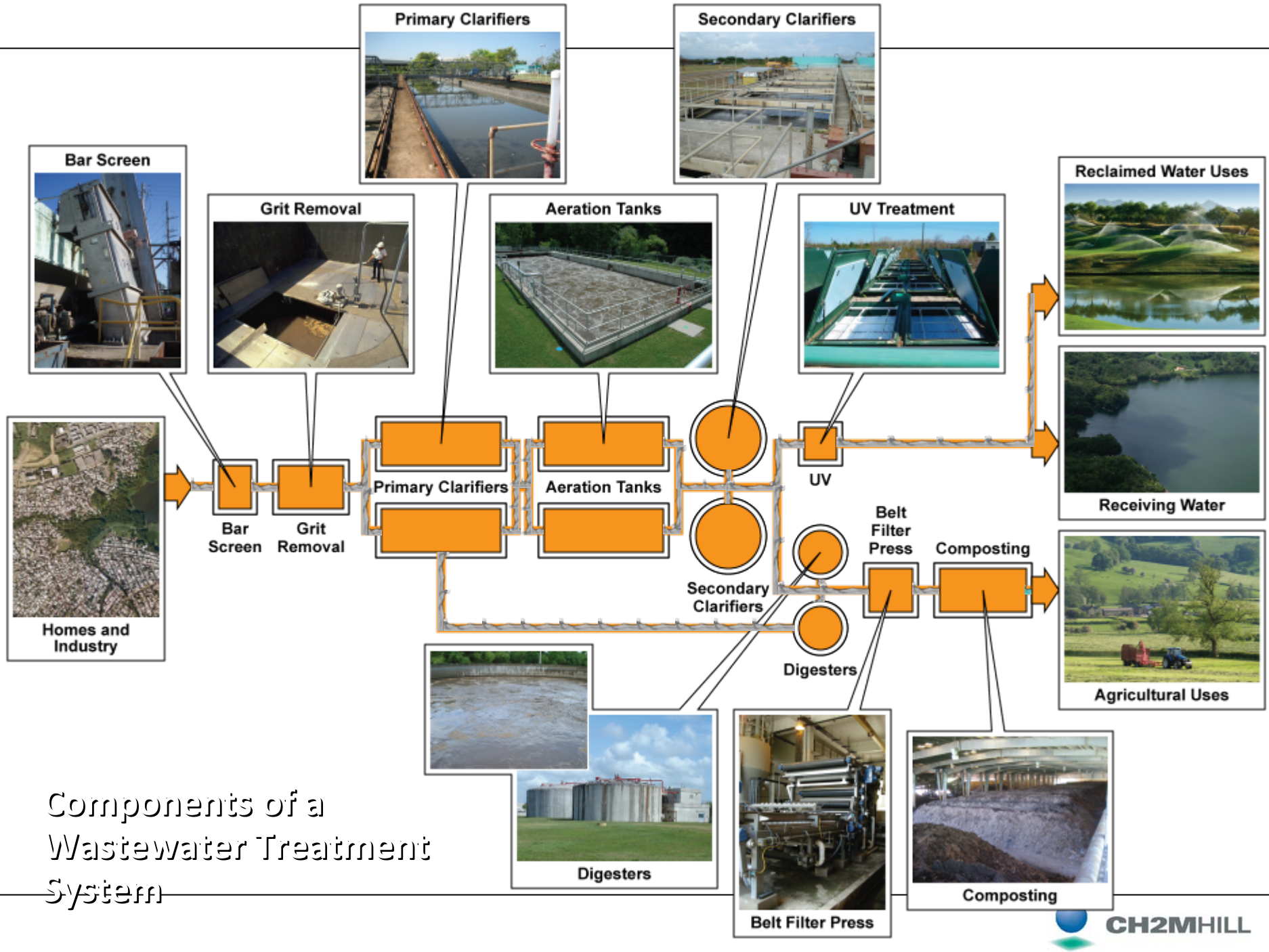
- Increase Overall Value
  - Value = Function / Cost
- Focus is often on lowest life cycle cost
  - sometimes first cost as well
- Other Benefits
  - provides owners with confidence that they are making the right choices
  - demonstrates to stakeholders responsible stewardship of tax dollars

VE Overview and Benefits

- Implementation
  - VE often held at the concept, pre-design and detailed design stages
  - Five Phases
    - *Information Gathering/ Functional Analysis*
      - what are you trying to optimize
    - *Brainstorming*
      - generate lots of ideas for improving the project
    - *Analyze*
      - shortlist the best ideas, develop and evaluate
    - *Propose*
      - submit potential changes for team consideration
    - *Owner Assessment and Decision Making*
      - cost, schedule and technical assessment

VE Overview and Benefits

- Typical Team Composition
  - Owner
    - *Project Manager, Operations, Planning*
  - Design Team
    - *Project Manager, Design Lead, Engineering Disciplines, Cost Estimator*
  - VE Team
    - *Facilitator, Senior Engineer, Cost Estimator, Specialty Disciplines*
      - often is a 3rd party firm



Components of a Wastewater Treatment System

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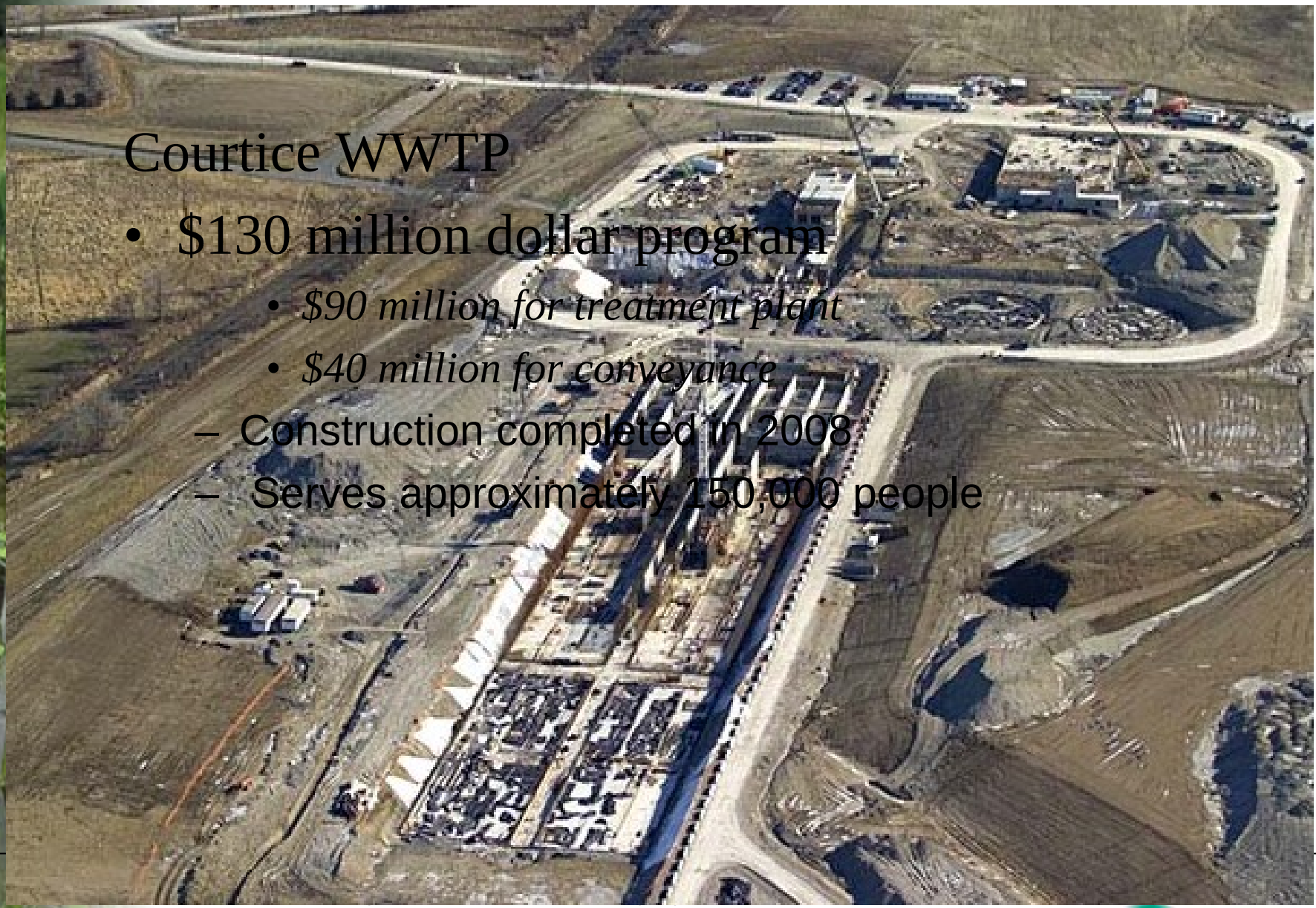
Case Studies



Courtice WWTP

- $130 million dollar program
  - *$90 million for treatment plant*
  - *$40 million for conveyance*
  - Construction completed in 2008
  - Serves approximately 150,000 people

Case Studies

Courtice WWTP

- VE held in 2002
  - VE Team
    - *Region of Durham (Owner)*
    - *Courtice Design Team*
    - *Courtice VE Team*
  - example of an “internal” VE
    - *the VE team was comprised of senior engineers and a certified VE specialist from the same consulting firm as the design team but who were not involved in the day to day design*

Case Studies

Courtice WWTP

- VE held at two points
  - Conceptual was planned
  - Detailed design held to address cost escalation
  - Overview
    - *more than 100 proposals or ideas were evaluated*
    - *35 were selected for further analysis*
      - 28 were cost savings
      - 7 deferred spending
    - *total proposed savings of $37 million*
      - $23 million identified at the conceptual design stage

Case Studies

Courtice WWTP

- Overall VE Objectives
  - Look for opportunities to reduce costs as the current cost estimates exceeded those prepared during the EA
  - Review and validate the current cost estimate
  - Recommend cost savings by deferral

Case Studies

Courtice WWTP

- Cost Saving Ideas
  - Change influent pumping station design to submersible pumps
  - Change disinfection process from ultraviolet light to chemical disinfection
  - Reduce level of redundancy for solids treatment
  - Receive septage off-site rather than build on-site facilities
  - Use open cut construction rather than tunneling for outfall
  - Change solids digester mixing technologies
  - Eliminate redundant service tunnel and optimize tunnel width
  - Reduce the number of buildings by combining separate chemical buildings
  - employ “package” standby power unit complete with enclosure rather than in a building

Case Studies

Courtice WWTP

- Cost Deferral Ideas
  - Defer future pumping station for Courtice catchment area until needed by development
  - Defer screenings at plant since initially only screened flow will be received
  - Defer implementation of treatment for ammonia removal
  - Defer demolition at plant to be retired

Case Studies

Courtice WWTP

- Proposals provided to Owner and Design Team for consideration
  - Owner leads deferral and first cost vs. life cycle cost decisions
  - Design Team assesses technical feasibility
- So what was implemented ?
  - $4 million in deferral
  - $10 million in cost savings

Case Studies

Courtice WWTP

- Some observations
  - while it might be expected that the internal VE team might be constrained, they were not and came up with many creative proposals
  - important that the senior engineers on VE team have the appropriate experience and understand both functional and detailed design
  - process provided great benefit in understanding some of the many decisions and trade-offs that are made in facility design
  - encourages team building and respect among various project stakeholders, operations, engineering, planning and design

Case Studies

Duffin Creek WWTP

- $450 million dollar program
  - currently under construction with construction to be completed in 2010
  - largest single capital project ever undertaken by the Regions
  - provides for both liquid and solids treatment capacities
- Designed to provide service for 1.3 million people in York and Durham region

Case Studies

Duffin Creek WWTP

- First VE held in 2006 at Conceptual Design Stage
  - VE Team
    - *Region of Durham and Region of York (Owners)*
    - *Duffin Design Team*
    - *Duffin VE Team*
  - example of an “external” VE
    - *the VE team was lead by senior engineers from an external 3rd party consulting firm*

Case Studies

Duffin Creek WWTP

- VE's held at the conceptual, 30, 60 and 90% design stages
  - First VE held in 2006 at Conceptual Design Stage
  - Later VEs change focus to quality and removing ambiguity from contract documents

Case Studies

Duffin Creek WWTP

- Objectives at Conceptual Design
  - Options to advance the project schedule
  - Review of constructability
  - Review of construction phasing
  - Identify cost saving opportunities
  - Review process decisions for fatal flaws

Case Studies

Duffin Creek WWTP

- Overview
  - more than 200 proposals and ideas evaluated
  - 60 proposals developed at the conceptual design stage
  - over $100 million in potential savings identified
  - project scope components identified that increased first cost but also increased value
  - over 50 project suggestions

Case Studies

Duffin Creek WWTP

- Cost Savings Ideas
  - renegotiate with environmental regulators for less stringent treatment requirements
  - use existing outfall to provide contact time for disinfection
  - modify existing works to realize increased capacity
  - review design basis for solids generation
  - reduce clarifier costs by decreasing area and increasing depth
  - use existing sludge dewatering equipment for ash dewatering

Case Studies

Duffin Creek WWTP

- Cost Deferral Ideas
  - defer mercury control components subject to success of source control program
  - defer upgrade of secondary solids digesters for primary service
  - build for a shorter design horizon; reduce project scale by 50%
  - replace only one fluidized bed incinerator

Case Studies

Duffin Creek WWTP

- Schedule Advancing Ideas
  - Plan and obtain permits and approvals at earliest possible time
  - Provide budget contingency for schedule acceleration
  - Streamline procurement and approval process
    - *partnering with Purchasing*
  - Develop detailed work plan that identifies both internal and external project requirements

Case Studies

Duffin Creek WWTP

- Same process followed as for Courtice
  - Owner leads deferral first cost vs. life cycle cost and schedule decisions
  - Design Team assesses technical feasibility
- So what was implemented ?
  - $30 million in deferral
  - $10 million in cost savings

Case Studies

Duffin Creek WWTP

- Some observations
  - The objectives of the VE were customized for the project to include other value propositions, not just reducing first cost
  - The number of ideas evaluated needs to be balanced with the time available for evaluation
    - *too many ideas can dilute the effort for analysis of any one single idea*
  - Important to have the right people
    - *3rd party VE could be more susceptible to an adversarial relationship with the design team*
  - External VE team not constrained in questioning even the most fundamental assumptions
  - Process contributed to the owners confidence that they were making the right decisions

Summary and Conclusions

- Most Significant Savings Opportunities Identified at the Conceptual Design Stage
  - $23 million for Courtice
  - over $100 million for Duffin Creek
- Both “Internal” and 3rd party VE are effective
  - 3rd party may offer more creative solutions
  - Internal may be more practical
- Adversarial relationships are avoided by allowing Design Team to analyze the technical acceptability
- Process contributed to the owners confidence that they were making the right decisions

Thank - you

- Questions ?