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Value Planning of City of Hamilton's Woodward Ave. WWTP and RTC Improvements

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By: Paul Johnson, CVS

Hamilton Harbour

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Why Use Value Planning (Value Engineering)?

- Focus on essential functions, not systems or procedures
- Embraces creativity and out of the box thinking
- Uses life-cycle cost analysis for decision making
- Provides an organized framework for alternative development
- Consistently achieves the desired results (from 5:1 to 50:1 ROI)

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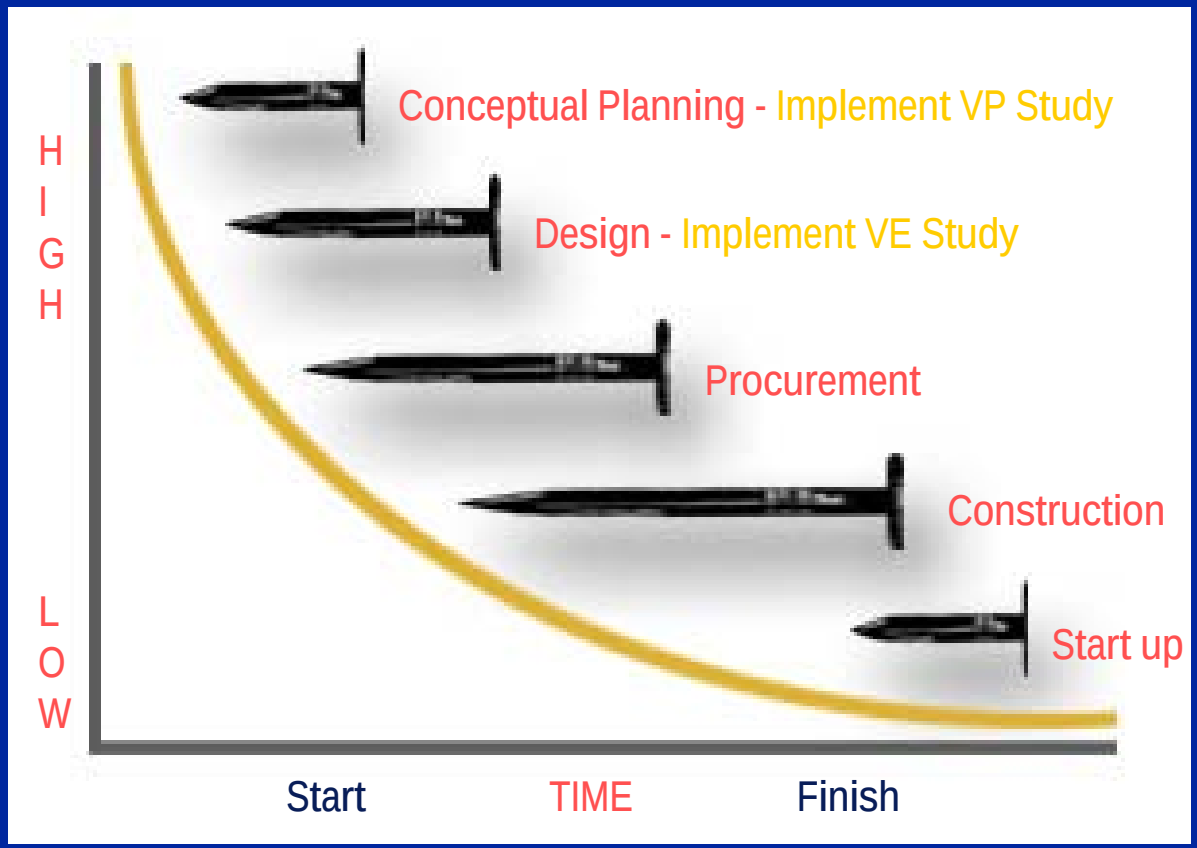
When and Why to Use Value Engineering/Value Planning



VP/VE is a proven methodology that enhances function and reduces cost

VP early in design gains Project Team's acceptance of appropriate alternative

VE at Mid-Design reduces cost without impacting function

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Value Planning (VP)

- VP Differs from Traditional VE at Early to Mid Design
- VP at Concept Design focuses on Function
- V = F/C
- VP is Collaborative with Design and Owner and Objective VP Representatives
- Requires Owner's Belief in and Support of the VP Process, to Achieve Beneficial Results

Value Planning Employs the Following Steps

- **Pre-Study Planning**
- **Information**
  - City and Design Teams' Overviews
  - Team Focus Q/A
  - Functional Analysis
  - Establishment of Alternative Evaluation Criteria
- **Creative (Brainstorming)**
- **Analysis and Ranking of Concepts**
  - Pass/Fail of Alternative Solutions
  - Screening of Alternative Concepts
- **Development and Refinement of Concepts**
- **Presentation**
- **Implementation**

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Project Description

- **Hamilton: 500,000 people**
- **Domestic and Industrial Wastewater**
- **Existing Woodward Ave WWTP in City of Hamilton**
  - New Pumping Station
  - Provision for New Tertiary Treatment
  - Increasing Capacity:
    - *Average Flow: From current 409 MLD, to 500 MLD*
    - *Peak Flow: From current 614 MLD, to 1000 MLD*
  - Improve Quality of Treated Effluent into Hamilton Harbour & Lake Ontario to Exceed Environmental Goals
- **Flows from Rain Events (CSO's)**

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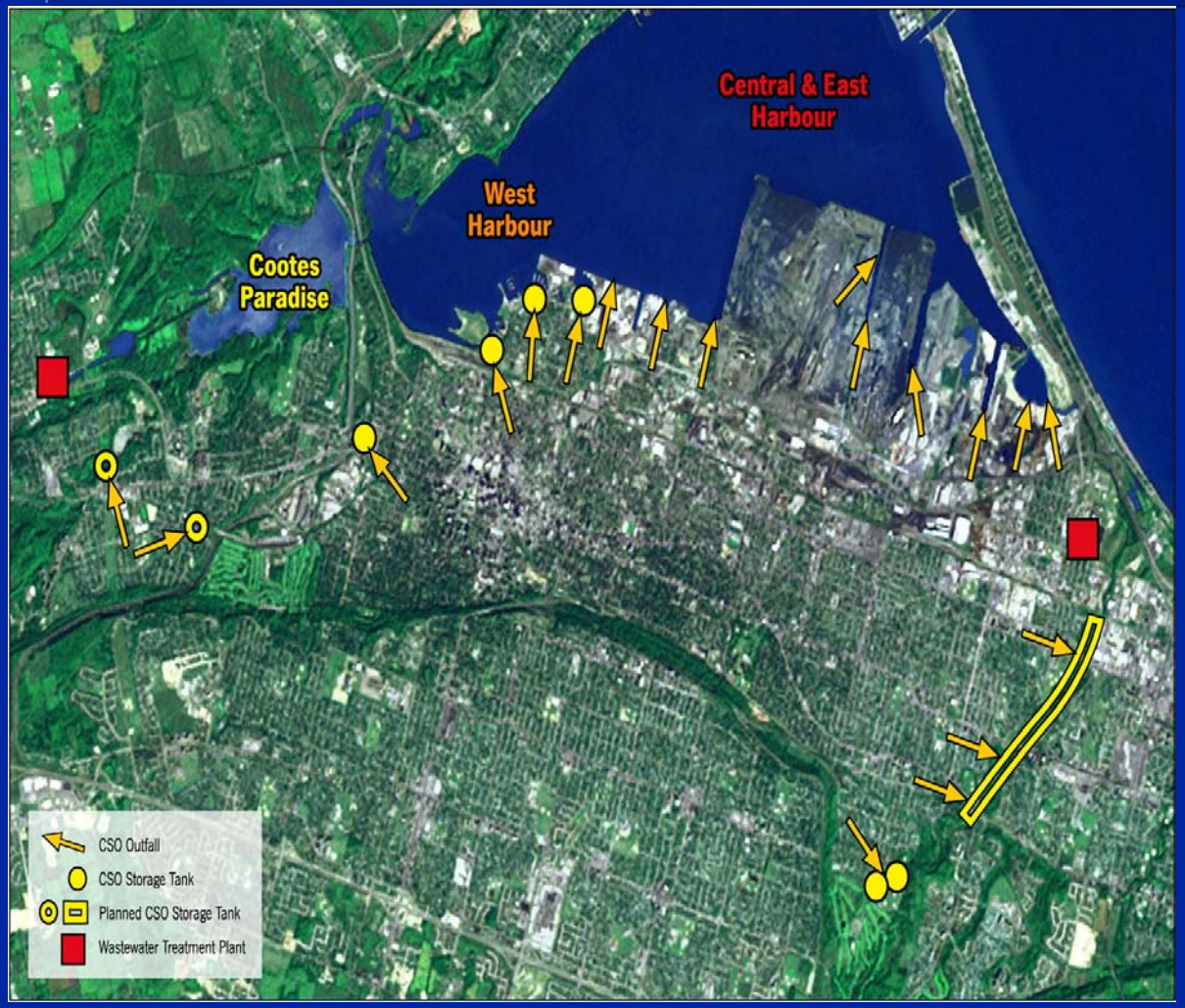
Wastewater System Overview

by City of Hamilton



- Highly complex combined system
- 2,100 km of sewers
- 600 km combined sewers
- 52 km^2 combined sewershed
- 200 diversion structures
- 23 CSO locations
- 8 CSO control tanks
- 3 wastewater treatment plants
- Serviced population 400,000
- Various areas of sensitivity related to the environment and public health

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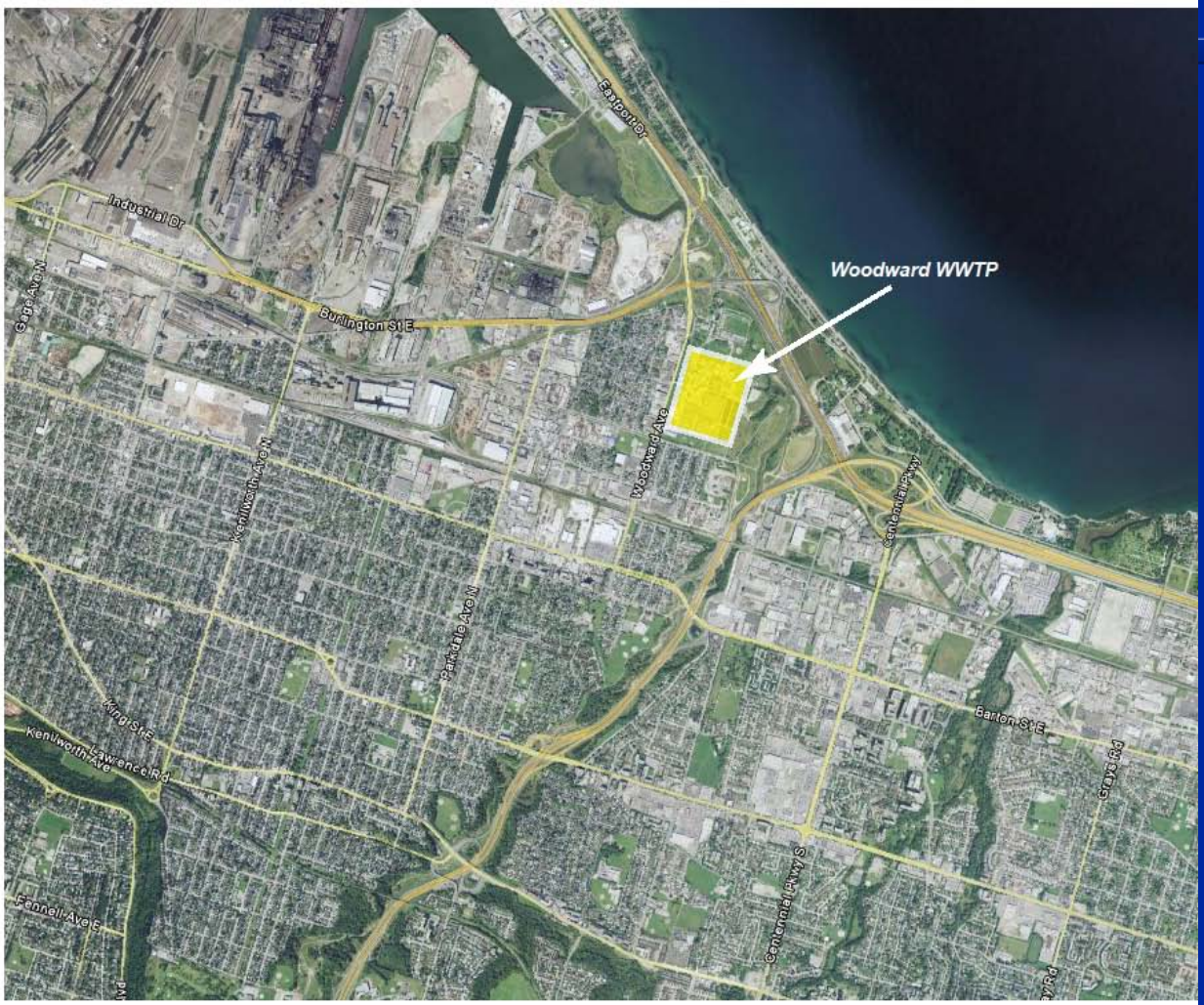
Woodward Ave WWTP Location, City of Hamilton, Ontario



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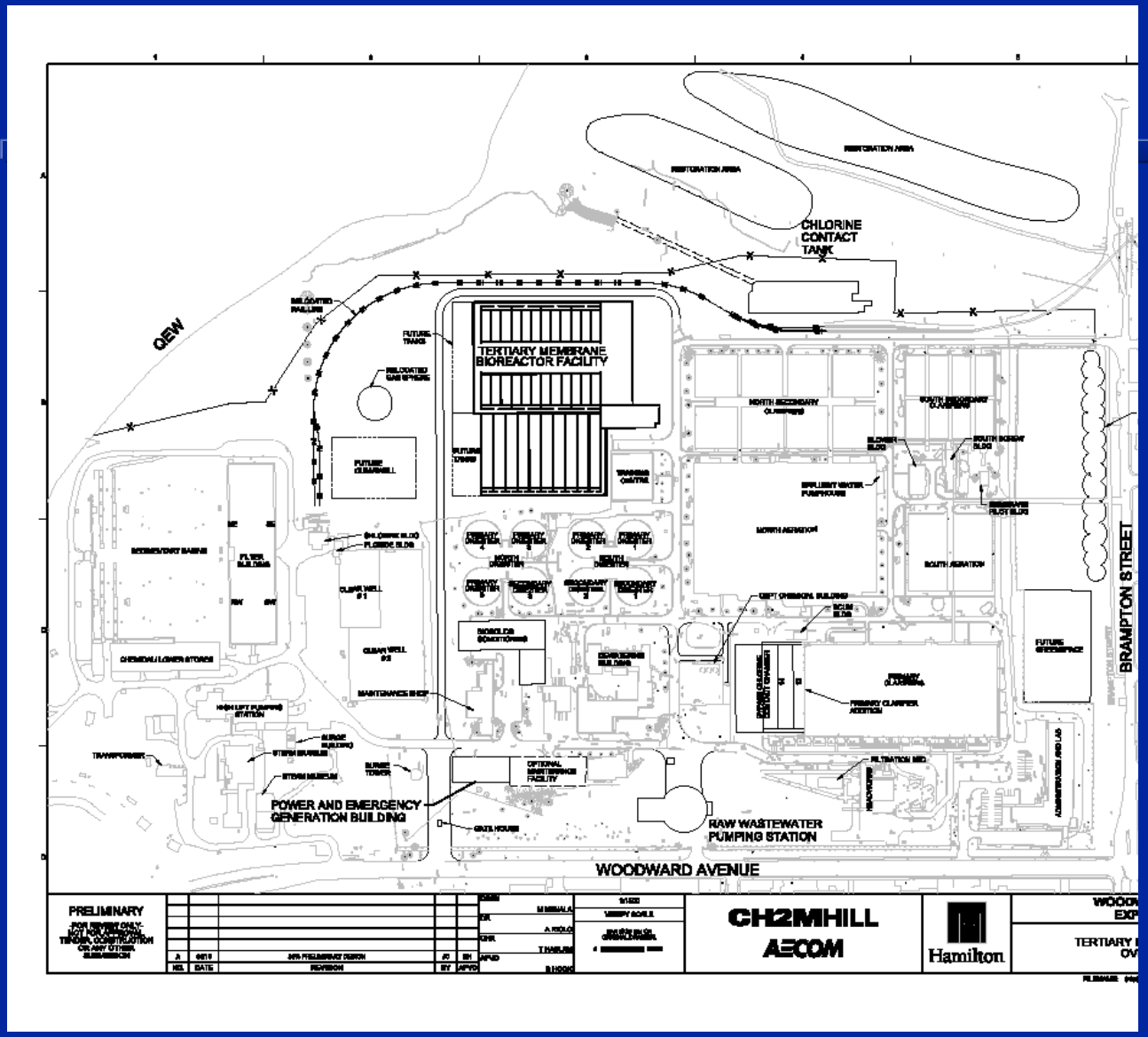
Woodward Ave WWTP Site Plan



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Woodward Ave WWTP, Aerial

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Focus of Hamilton VP Study

- **$700 Million Program over 5 Years**
- **Establish Preferred Technologies and Cost Saving Opportunities:**
  - WWTP Improvements
  - Real Time Control (RTC)
  - Flood Control in City
- **4-Day Study, March-April, 2010**

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Value Planning Team

- **Outside Technical Professionals**
  - Regulatory Expert
  - RTC O&M
  - RTC and Collection System Modeling
  - WWTP Process Mechanical
- **Design Representatives**
  - 4 Firms for WWTP and RTC
- **City of Hamilton**
  - Client: Dan Chauvin, Director, Water and Wastewater
  - Numerous City Staff
- **VE/VP Facilitator**
- **Overall VP Team: 13 full time + 10 part time**

Hamilton Value Planning Team

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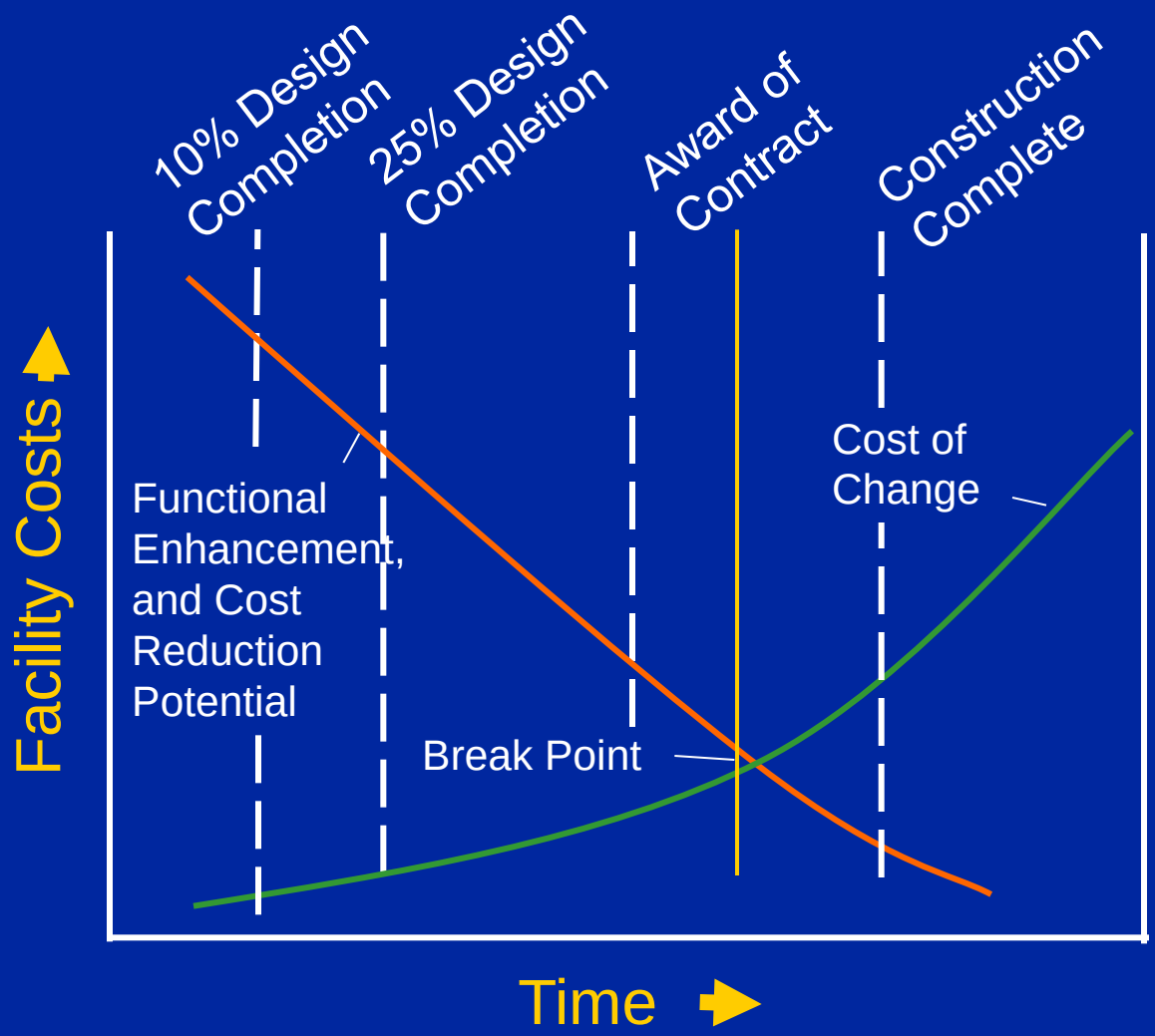
Opportunities for Improvement During Facility Life Cycle



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Owner Objectives for VP Study
by City of Hamilton

- To validate, and adjust as required, the preferred strategies and approaches for all three major WW expansion components (Flooding, RTC and Woodward Expansion) in an integrated manner that maximizes synergies, reduces cost and schedule and maximize benefit to overall City objectives
- Document the approach and results of the VP Study (both what was accepted and changed as well as what was analyzed and dismissed) and develop an integrated document of the preferred strategies that will be used to further develop the program delivery strategies and communications plan

Scope Subject to VP Process

Sub-Project	Opportunity
Membrane Plant	Minimizing peak and sustained flows may reduce size and cost of Membrane Bio-Reactor (MBR).
Pump House	Rebuild vs.. Replace may expedite schedule and/or cost.
Real Time Control (RTC)	Significant complexities in regulator chambers, controls and decision software being proposed. Alternative solutions may simplify and reduce cost? Accommodating peak flows associated with flooding at key regulators allowing flooding team to proceed independently.
Flooding (Basements, Streets)	Delineating clear design boundaries between RTC and mitigation of basement flooding.

Estimated Capital Cost

Tertiary Membrane Bioreactor (TMBR)	$266 M
Power Upgrades	$67 M
Incinerator	$65 M
Dewatering/Biogas	$60 M
Raw Sewage Pumping Station	$52 M
Real Time Control (RTC)	$50 M
Flood Control	$50 M
Primary Clarifiers	$45 M
Other	$20 M
Contingency	$25 M
Total	$700M

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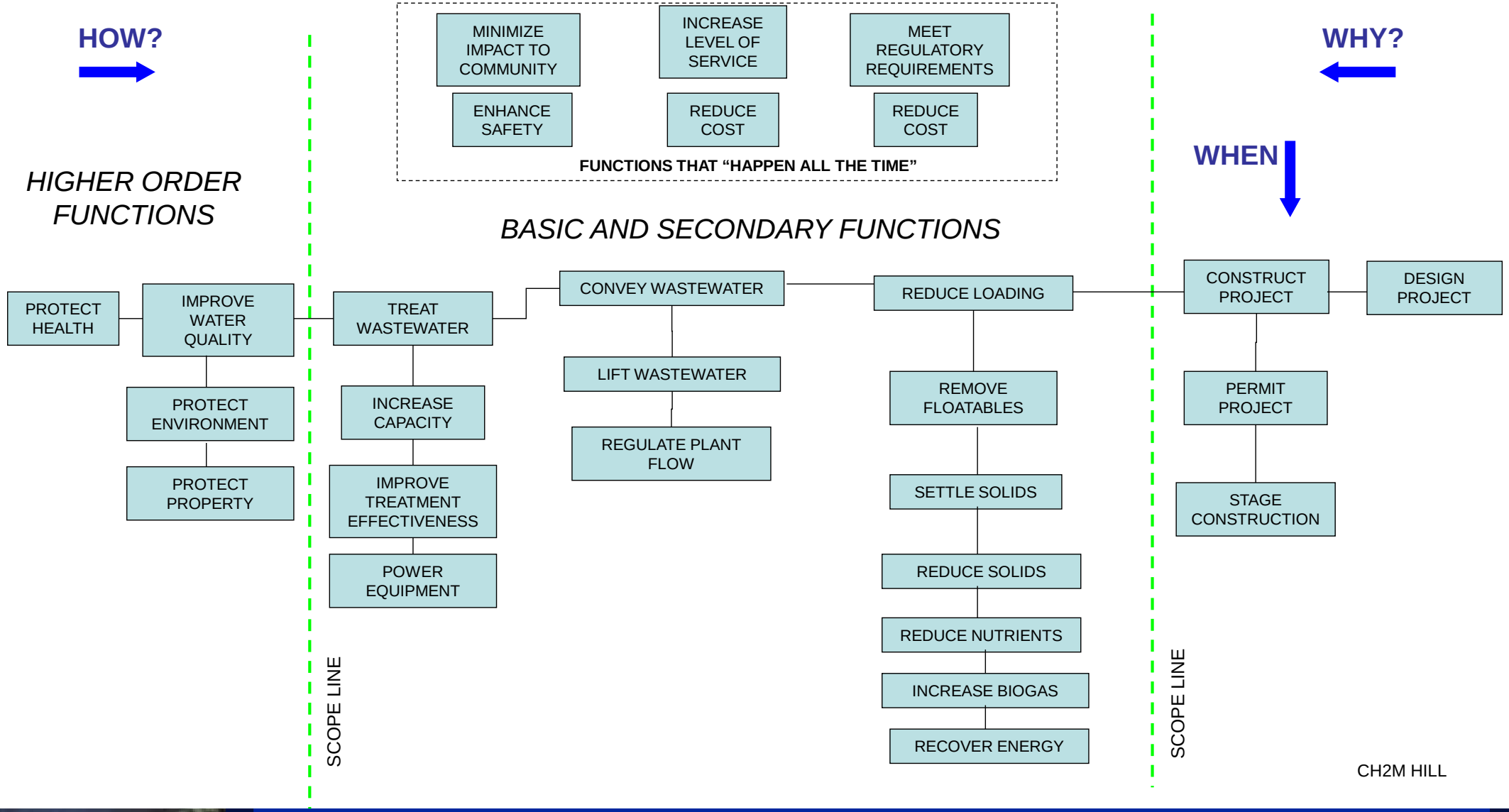
FUNCTION ANALYSIS SYSTEM TECHNIQUE (FAST) DIAGRAM
HAMILTON WWTPE AND RTC PROGRAM



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Criteria for Evaluation of Plant Process, RTC, Basement Flooding Proposals

Criterion	Priority
Compatibility with Environmental Study Report	High
Compatibility with MOE and RAP Targets	High
Applicability to Existing Plant	High
Treatment Effectiveness (WWTP)	High
Effectiveness of CSO Control (RTC)	High
Effectiveness of LEED Flood Control	High
Project Delivery	Moderate
Ease and Consistency of Operation (WWTP)	High
Ease and Consistency of Operation (RTC)	High
Ease and Consistency of Operation (Flood Control)	High

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Criteria for Evaluation of Plant Process, RTC, Basement Flooding Proposals

Criterion	Priority
City Acceptance	High
Contractor Ability to Construct	Moderate
Schedule	High
Initial Cost	High
Life Cycle Cost	High
Responds to Plant Upgrade Requirement	High
Responds to Combined Sewer Overflow Rqmt's	High
Alternative Responds to Basement Flooding	High
Links to Integration of Program Components	High
Sustainability and Energy Footprint	Moderate

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VP Proposal Format

- **Review of VP Proposal Format with Subjective Criteria Evaluation along with Quantitative Evaluation**

Value Planning Study Results at Concept Design

- **6 VP Proposals Suggested**
- **Potential Savings:**
  - Initial: $56 million; Future: $7 million
  - Life Cycle: $63 million
- **2 Proposals Rejected**
- **3 Proposals Accepted or Modified**
- **1 Proposal Requires Further Review**
- **Estimated Accepted Savings Range:**
  - $13 Million to $26 Million (2% to 4% of $700 M)
  - Subject ROI: Approx. 130–to-1 (for $13 M Savings)

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Key Results from VP Study

- **Staying with Design Basis for Tertiary Membrane BioReactor (TMBR) (versus Disk Filtration explored in VP Study)**
  - Component Value: $300 million
- **Validated Design Basis for Replacement of Raw Sewage Pumping Station, versus Upgrade**
  - Component Value: $52 million
- **Accepted Proposal: Phase Program by Sizing WWTP for Initial Population Growth**
  - Initial Cost Saving: $10 million
- **Revise RTC to Omit a New Pumping Station**
  - Cost Saving: $3.4 million
- **Phase In CSO Regulators in RTC over Time to Meet Initial Loading Targets**
  - Proposal under Further Review for Possible $13 M Savings

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Value Planning/Value Engineering Balances Cost, Reliability, and Performance Issues

VE (VP) is a proven management technique that uses a systematic approach to identify the best functional balance between the cost, reliability and performance of a product or project to meet the owner's objectives

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Summary

- With Proper Endorsement of Value Planning, the Process Results in Consensus Among Owner and Design Teams
- VP is a Methodical and Documented Effort Demonstrating Due Diligence and Results to Withstand Public Scrutiny and Board Oversight
- VP Sets Stage for Further Design, Freer of Challenges
- Demonstrated Savings of $13+ M, with ROI of At Least 130-to-1, for the City of Hamilton's WWTP and RTC Improvement Program
- Mid-Design VE Studies Follow for Major Components
- Q/A