Creating Resources from Wastewater
(WTD mission statement)

* King County is committed to:
  * protecting water quality and preventing pollution
    * not just about treating sewage anymore
  * recovering and reusing the products of the wastewater treatment process (2012)
    * recycle/reclaim water (325 million gallons, BW capacity 20 mgd)
    * recycle solids into nutrient rich biosolids (118k wet tons)
    * generate energy from waste gases (1.3 million kilowatt hrs)
    * methane gas sold (1.83 million therms)
Facts and Figures

* Customers and Service Area
  * serve 415 square miles (3 counties)
  * serve 1.5 million people
  * wholesale provider to 34 local agencies

* System Design Criteria
  * 279 mgd average wet weather flow
  * 232 mgd average dry weather flow
  * 897 mgd instantaneous maximum capacity
Facts and Figures cont.

* Facilities
  * 5 treatment plants
  * 47 pump stations
  * 391 miles of conveyance lines
  * 4 marine outfalls, 38 CSO outfalls

* Overall Financial
  * $20 billion estimated cost to replace entire system
  * $2.8 billion planned capital expenditures thru 2030
Capital Program

* Workload
  * $200 million annual capital budget
  * 200 active projects
    * typical capital facility project size - $14 million
    * largest capital project - $1.89 billion
    * average capital project about 10 years
    * typical asset management project size - $200,000
  * 150 active contracts (design and construction)

*Note – WTD does not make regulations, rather complies with State and Federal requirements*
**Project Planning and Delivery (PP&D) Section:**

* delivers capital facilities to operations
* responsible for implementing and managing both engineering/design and construction
* organized into 5 major units
  - engineering and technical resources
  - planning and asset management
  - construction management
  - project management
  - project control and contract management
WTD Project Control

* Major Areas of Involvement:
  * cost engineering (projects and program)
  * estimating (small projects, change orders)
  * electronic information management systems
  * contract management
  * scheduling
  * public disclosure
WTD Estimating and Capital Project Budgeting

* Estimating generally thought of as construction take-offs/unit pricing
  * WTD does not have significant estimating resources
  * small projects, amendments, change orders estimated in-house
  * larger construction estimates developed by consultants

* Capital project budgeting encompasses planning through completion
  * total cost of delivering the capital project
  * total capital project budgets are developed in-house

* Project and contract definitions
  * the terms project and contract are not synonymous
1999 - Created first comprehensive project database
2001 - Created initial budgeting model
2004 - Implemented standard project cost format and budget model
2004 – WTD’s PRISM (Project Information System Management) electronic PM tool goes live
  -forecasting
  -modeling
  -cashflow
  -scheduling
  -contingency
  -actuas ($’s, hours, phase)
  -trending
  -contracts
  -reporting
  -new initiatives/modifications
2005 – WTD began Project Management Institute (PMI training)
* 2008 – BFO study of WTD’s historical capital performance
* 2010 – Began developing and implementing changes based upon BFO findings (projects take longer and cost more)
* 2011 – PRISM introduces multilevel cost models (type and size)
* 2014 – PRISM implements revisions to contingency standards
* 2014 – PRISM introduces sustainability requirements
* Historical data set and PRISM updated annually ($4.5 billion)
Public Sector Estimating Challenges

- Public sector budget process initially requires publication of very preliminary information
- Conceptual/planning cost and scope required prior to project approval
- Must budget a specific single point cost for each project
  - cannot budget a range of potential costs
  - too large a budget and project will not go forward
  - too small a budget brings about accusations
- Tendency to be overly optimistic
- Do not follow industry standard estimating practices
WTD Planning Level Capital Estimating Challenges

- Long range plans currently out to 2050
  - based on flow sensors, modeling, census data, growth patterns, etc.

- Comprehensive plans (including costs) published 20+ years in advance
  - identification and need of future projects very accurate
  - scope/assumptions used as basis for planning costs not always representative of actual alternative

- Project cannot officially start until approved by Council

- Complexity, technology, regulations and initiatives are difficult to predict 20+ years in advance

- Lowest cost not always driver (scope, quality, schedule, political, etc.)

- Every project is unique (topo, flow, head, capacity, mostly underground, etc.)
Planning Level Estimating
Challenges cont.

* Planning level information basis for Council approval, rate setting (annual budget) and long term policy
  * 0 to 2% project definition
  * preferred alternative not known
  * general assumptions regarding scope, siting, etc.
  * public involvement, mitigation not known
  * must budget finite numbers, not ranges

* Planning cost is the cost always remembered by public
Scope versus Budget

- PC involvement starts when Comprehensive Planning transfers project to Project Planning and Delivery (PP&D) team

- Emphasize link between written scope, budgeted scope and contingency
  - written scope and budgeted scope often conflict
    - written scope state delivery of a completed project
    - budgeted scope can be very literal
  - if it isn’t in the estimate, it isn’t in the scope

- Accurate project budget is reliant upon realistic Total Cost of Construction

- Allowances and contingencies often misunderstood
Baseline is when project team puts its stamp on the project scope, schedule and budget

Baseline is set after preliminary engineering begins on preferred alternative

Accuracy of actual costs compared to baseline costs is much more accurate

considerable improvement since 2008
Project Cost Categories

* Construction costs
  - construction
  - outside utilities
  - owner furnished equip
  - sales tax

* Non-construction costs (a.k.a. allied or soft costs)
  - engr./design
  - planning services
  - staff labor/burden
  - construction mgmt.
  - permitting
  - initiatives (art, sustainability)

* Land acquisition/right-of-way

* Project contingency
Estimated construction costs should reflect expected construction bid values:

- known or expected construction or project costs not budgeted, cannot be defaulted to project contingency
  - misleading and underscores total construction/project scale

- low construction estimate effectively underfunds all other aspects of project budget and contingencies
  - allied costs, sales tax, construction change and other forecasted costs all calculated as a percent of construction budget
Non-Construction Costs

* Employ model to help predict total project costs
  * models are based upon $4.5 billion of completed WTD capital projects
  * allied/soft costs are initially based upon percentages of construction
    * 15 different cost models (seamless to users)
  * land costs, mitigation, etc. are not modeled
  * later estimates/forecasts are combination of built-up costs and modeled costs
Contingency

- Contingency is not a catch-all that covers items not contained within the estimate, does not cover modified or new scope
  - Known-knowns, known-unknowns, unknown-unknowns

- Allowances and contingencies often misunderstood
  - estimator’s allowances
  - design allowance
  - construction change order contingency
  - project contingency
## WTD Contingency Matrix

<table>
<thead>
<tr>
<th>WTD Estimate Deliverables</th>
<th>AACE Estimate Classes and Characteristics</th>
<th>WTD Construction Contingency</th>
<th>Project Contingency</th>
</tr>
</thead>
<tbody>
<tr>
<td>WTD Phase Estimate</td>
<td>AACE Estimate Class</td>
<td>Degree of Project Definition</td>
<td>Estimate Use Typical Accuracy Range</td>
</tr>
<tr>
<td>Planning Phase (1)</td>
<td>Class 5</td>
<td>0% to 2%</td>
<td>Conceptual Screening</td>
</tr>
<tr>
<td></td>
<td>CST GATE 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preliminary Design Phase (2)</td>
<td>Class 4</td>
<td>1% to 15%</td>
<td>Order of Magnitude Concept Study Feasibility</td>
</tr>
<tr>
<td></td>
<td>CST GATE 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Class 3</td>
<td>10% to 40%</td>
<td>Budget Authorization Control</td>
</tr>
<tr>
<td></td>
<td>CST GATE 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Final Design Phase (3)</td>
<td>Class 2</td>
<td>30% to 70%</td>
<td>Control</td>
</tr>
<tr>
<td></td>
<td>CST GATE 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Class 1</td>
<td>70% to 100%</td>
<td>Check Estimate Bid/Order Change Order</td>
</tr>
</tbody>
</table>

*Note: CST GATE 1, 2, 3, 4 refer to different stages or critical points in the project.*
Effort Began in 2003 to Position WTD for Data Management Needs
* Microsoft SQL Database with Servoy User Interface
* Programming Executes and Standardizes Business Processes
* Completed Transition from Multiple Legacy Systems in 2009
* Used to Manage 200 Projects & 150 Contracts Per Year
* Historical Records for 2000 Projects & 1000 Contracts
* Categorizes 20 Years of Historical Financial Data ($4.5B)
* 10 Years of Detailed Project Budget Data
* Automated Daily Project Expenditure Updating
**PRISM**

*Project Information System Management Database*

- **Consistent Business Practices**
  - Budgeting
  - Scheduling
  - Payments, Amendments and Change Orders
  - Reporting

- **Comprehensive Coverage**
  - Intranet User Accessibility
  - Contains All Capital Projects and Contract
  - Historical Records

- **Centralized Data Management**
  - Development and Deployment Control
  - Data Integrity and Standardization
PRISM
Project Information System Management Database

* **Project Management**
  * General Info, Scope, Status, Schedule, Multi-Year Budgets, Cost Reporting, Actuals Reconciliation, Contract Requests, Prioritization/Ranking, Variance Analysis

* **Contract Management**
  * General Info, Firms, Payments, Task/SOV Tracking, Amendments, Change Orders, RCOs/RCPs, Work-order Management, Authorization Levels

* **Reporting**
  * Current to Baseline or Multi-Year Budget and Schedule Variances
  * Monthly Expenditure to Budget Variance
  * Quarterly Detailed Project and Contract Status Reports
  * Mandated Reporting
  * Budget Submittal Packages
  * Ad-Hoc Reporting-User Specified Criteria
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**PRISM**
Project Information System Management Database
PRISM
Project Forecasting/Budgeting

* 49 Line Item Capability
* Actuals Mapped to Line Items
* 24 Line Items Modeled Based on Construction Cost
* 3 Line Items Auto-Calculated (Overhead/Sales Tax/Sustainability)
* Access to Past Forecasts/Budgets
* Baseline and What if Scenario Capability
* Nominal and Escalated $
* Contingency Model
* Schedules Also Saved with Budgets
## Project Forecasting/Budgeting

### Access Past Budgets

### Forecast by Category

### Variance to Cost Model
Contingency Model

Contingency Ranges

Variance to Model

PM Forecast

Model Calculation
Budget Variance-Current to Baseline

Access Past Months/Years
Select Budgets
Evaluate Current Year or Lifetime

Actuals Reported By Month, Year to Date and Life to Date
Calculates Variance
### Schedule Variance - Current to Baseline

**Select Budgets for Comparison**

Select datasets for comparison:
- Dataset 1: 2015 Rate / 2014 Initial Cash
- Dataset 2: Gate 3-Baseline (05/10/2010)

**Calculates Variance**

<table>
<thead>
<tr>
<th>Phase</th>
<th>Start Date</th>
<th>Finish Date</th>
<th>Current</th>
<th>Dataset 1</th>
<th>Dataset 2</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1 Planning</td>
<td>05/01/2008</td>
<td>08/19/2009</td>
<td>Actual</td>
<td>Automatic</td>
<td>Automatic</td>
<td>No Change</td>
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<tr>
<td>Phase 2 Preliminary Design</td>
<td>08/19/2009</td>
<td>01/15/2010</td>
<td>Actual</td>
<td>Automatic</td>
<td>Automatic</td>
<td>No Change</td>
</tr>
<tr>
<td>Phase 3 Final Design</td>
<td>01/15/2010</td>
<td>05/30/2012</td>
<td>Actual</td>
<td>Automatic</td>
<td>Manual</td>
<td>No Change</td>
</tr>
<tr>
<td>Phase 5 Close Out</td>
<td>01/04/2015</td>
<td>05/01/2015</td>
<td>Forecast</td>
<td>Manual</td>
<td>Manual</td>
<td>No Change</td>
</tr>
<tr>
<td>Phase 6 Land Acquisition</td>
<td>11/17/2014</td>
<td>Forecast</td>
<td>Automatic</td>
<td>125 Day Increase</td>
<td>125 Day Increase</td>
<td>No Change</td>
</tr>
</tbody>
</table>
Project Control delivers on management’s commitment and investment toward improving project estimating and budgeting.

We are a neutral party providing information, analysis and reporting for decision makers.

We provide tools and reports for senior management resulting in consistent policies and performance measurement.

We provide accessible tools and information for Project Managers to improve estimating accuracy and improved project delivery.

Change is inevitable. We must be flexible and adaptable to changing requirements.
Questions / Contact Info.

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