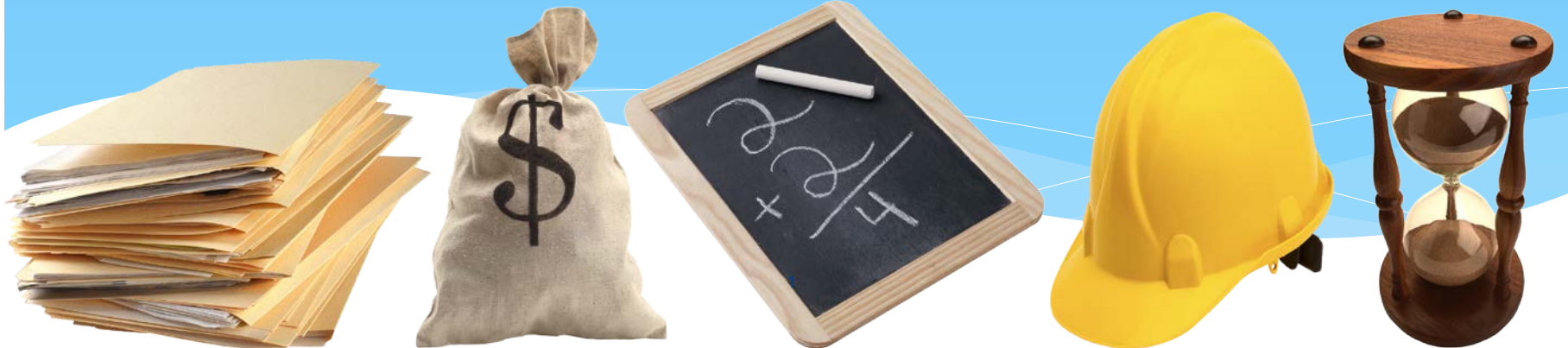


# Project Control From A Public Owner's Perspective

## KC Wastewater Treatment Division

Northwest Construction Consumer Council

June 25, 2014



# 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

# Capital Project Organization

- \* 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



# PC Chronology, Understanding and Refining WTD Business Processes

- \* 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
  - actuals (\$’s, hours, phase)
  - modeling
  - trending
  - cashflow
  - contracts
  - scheduling
  - reporting
  - contingency
  - new initiatives/modifications
- \* 2005 – WTD began Project Management Institute (PMI training)

# Chronology cont.

- \* 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 Budgeting

- \* 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)

  - enr./design

  - planning services

  - staff labor/burden

  - construction mgmt.

  - permitting

  - initiatives (art,

sustainability)

- \* Land acquisition/right-of-way

- \* Project contingency



# Total Cost of Construction

- \* 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

WTD Estimate Deliverables	AACE Estimate Classes and Characteristics					WTD Construction Contingency			Project Cont.
	AACE Estimate Class	Degree of Project Definition	Estimate Use <i>Typical Purpose or Use of Estimate</i>	AACE Expected Accuracy Range <i>Typical Variation in Low and High Ranges</i>	Preparation Effort <i>Typical Degree of Effort Relative to Least Cost Index of 1</i>	Construction Pricing Uncertainty Factor	Construction Definition Uncertainty Factor	Construction Change Order Contingency	
WTD Phase									
Estimate									
Planning Phase (1)									
Project Identification (a.k.a. Transfer Document/Charter)	Class 5	0% to 2%	-Conceptual Screening	L: -20% to -50% H: +30% to +100%	1	Up to 5%	25%	10%	30%
» CST GATE 1									
Preliminary Design Phase (2)									
◊ Initial Cost Plan	Class 4	1% to 15%	-Order of Magnitude -Concept Study -Feasibility	L: -15% to -30% H: +20% to +50%	2 to 4	Up to 3%	20%	10%	25%
◊ Alternatives Analysis Estimates									
» CST GATE 2									
◊ Develop Preferred Alternative	Class 3	10% to 40%	-Budget -Authorization -Control	L: -10% to -20% H: +10% to +30%	3 to 10	Up to 2%	15%	10%	15%
◊ Baseline Estimate									
» CST GATE 3									
Final Design Phase (3)									
◊ 60% Design Estimate	Class 2	30% to 70%	-Control	L: -5% to -15% H: +5% to +20%	4 to 20	Up to 1%	10%	10%	10%
◊ 90% Design Estimate	Class 1	70% to 100%	-Check Estimate -Bid/Tender -Change Order	L: -3% to -10% H: +3% to +15%	5 to 100	0%	0%	10%	5%
◊ 100% Bid Document Estimate									
Implementation Phase (4)									
◊ Bid Opening/Engineer's Estimate									
◊ Construction Change Order and Work Order Estimates									

# PRISM

## Project Information System Management Database

- \* 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

# 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
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  - \* Budget Submittal Packages
  - \* Ad-Hoc Reporting-User Specified Criteria



# 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

PRISM: Project Information System Management Database

Announcements Reminders Projects Contracts Reports/Links System

Project Number & Name Program Project Manager

Info Scope Status Schedule Financials Contracts Reporting Fixed Assets PTA Sustainability

Misc Evaluation Forecast Subprojects Cost Report Actuals Lifetime Chart Budget

Current Forecast for Jan 2014 Forward

Access Past Budgets

Current Forecast	2014	2015 +	2016 +	2017 +	2018 +	2019 +	2020 +	2021...	= Forecast +	Actuals thru Dec 2013	= Total -	Model	= Difference
<b>CONSTRUCTION</b>	803,495	12,126,142	12,126,118	3,741,148					28,798,903	11,765	28,808,668	28,822,506	-13,838
Construction Contracts	791,859	12,114,506	12,114,483	3,736,300					28,767,148	10,065	28,787,212	28,747,559	19,653
Owner Furnished Equipment													
Outside Agency Construction													
Other Capital Charges	11,636	11,636	11,636	4,848					39,755	1,701	41,456	74,947	-33,491
<b>NON-CONSTRUCTION</b>	2,615,748	2,160,489	1,961,161	504,977					7,242,374	9,438,382	16,680,756	14,869,634	1,811,122
Engineering Services	829,841	352,624	401,431	54,428					1,638,123	4,735,075	6,373,198	5,888,700	484,498
Planning & Management Services	272,318	744,098	712,277	286,578					2,015,271	156,447	2,171,717	2,409,014	-237,296
Permitting & Other Agency Support	330,847	58,495	37,500						432,842	808,228	1,241,070	334,585	906,484
Right-of-Way	525,000	135,000	67,500						727,500	1,030,451	2,357,951	2,357,951	
Misc. Service & Materials	79,905	85,879	84,832	17,175					247,791	72,167	319,958	441,662	-121,694
Non-WTD Support	65,932	65,932	65,932	14,798					212,594	101,510	314,104	414,886	-100,782
WTD Staff Labor	285,130	404,767	344,613	74,365					1,108,875	1,128,117	2,236,992	1,703,012	533,980
Indirect Burden	220,976	313,694	267,075	57,633					859,378	806,387	1,665,765	1,319,834	345,931
<b>PROJECT RESERVE</b>				4,022,438					4,022,438		4,022,438	4,022,438	
Project Contingency				4,022,438					4,022,438		4,022,438	4,022,438	
<b>SETTLEMENTS, REIMBURSEMENTS, &amp; INITIATIVES</b>												40,150	-40,150
Settlements, Reimbursements & Initiatives												40,150	-40,150
Sustainability													
1% for Art													
Uncommitted/Adjustment													
<b>PROJECT TOTAL</b>	3,419,242	14,286,631	14,087,279	8,268,562					40,061,715	9,450,147	49,511,862	47,754,729	1,757,133

Forecast by Category

Variance to Cost Model

Open All Close All Refresh Save As... Log Model Budget QA Allied QA

Master Level Beginning 2014 Appropriation = \$35,746,968 Remaining Balance = \$35,335,933 (Beginning - YTD Actuals)

Escalate?  No  Yes

All Projects My Projects Selected Project Search Results

Quickfind:

Help Report an Issue Password P5.2

# Contingency Model

Model Update

	Model Input		Forecast		Difference
Construction Contracts	\$13,194,794		\$13,194,794		\$0
Mitigation Construction Contracts	\$0		\$0		\$0
Owner Furnished Equipment	\$0		\$0		\$0
<b>Construction Total</b>	<b>\$13,194,794</b>		<b>\$13,194,794</b>		<b>\$0</b>
Change Order Contingency	\$1,648,000	10 %	\$1,648,000	10 %	\$0
Design Contingency	\$3,296,000	25 %	\$3,296,000	25 %	\$0

Main Finance Contingency Design Contingency

Contingency Planning (Project = 30% Design = 25% Change Order = 10%)  
(Phase Selected on Info Tab = Planning)

Change Order Contingency 10 %  
Design Contingency 25 %  
Project Contingency 30 %

Contingency Analysis	Forecast %	Forecast Amount	Input	Calculated	Difference	% Over/Under Calculated
Change Order Contingency	10%	\$1,648,000	10%	\$1,649,079	-\$1,079	-0%
Design Contingency	25%	\$3,296,000	25%	\$3,298,699	-\$2,698	-0%
Project Contingency	30%	\$9,527,500	30%	\$9,524,629	\$2,871	0%
<b>Total Contingency</b>		<b>\$14,471,500</b>		<b>\$14,472,407</b>	<b>-\$907</b>	<b>-0%</b>

Phase	Project <sup>1</sup> Contingency	Design <sup>2</sup> Contingency	Change Order <sup>3</sup> Contingency
Planning/New	30%	25%	10%
Predesign	25%	20%	10%
Gate 3	15%	15%	10%
Final Design	10%	10%	10%
Implementation	5%	0%	10%

1. Percentage is applied to total project cost not including Project Contingency.  
2. Percentage is applied to Construction only.  
3. Percentage is applied to Construction and Design Contingency.

Print

Contingency Ranges

PM Forecast

Model Calculation

Variance to Model



# Budget Variance-Current to Baseline



PRISM: Project Information System Management Database

Announcements Reminders Projects Contracts Contacts Reports/Links System

Project Number & Name

Info Scope Status Schedule Financials Reporting Fixed Assets PTA Sustainability

Misc Evaluation Forecast Subprojects Cost Report Actuals Lifetime Chart Budget

Cost Report Key Tier Phase ANNUAL ACTUALS 2014 ANNUAL BUDGET/FORECAST LIFETIME ACTUALS & BUDGET/FORECAST ESCALATED

Jun (open) ... Spent Spent YTD Jun (open) 20 Jun (open) 20 Current Forecast YTD 2014 Adopted / % Spent YTD Difference Spent LTD Jun 2014 Current Forecast LTD Gate 3-Baseline % Spent % Spent Difference % Diff

Category	Spent	Spent YTD	Current Forecast	YTD 2014 Adopted	% Spent	YTD	Difference	Spent LTD	Current Forecast	LTD Gate 3-Baseline	% Spent	% Spent	Difference	% Diff	
<b>CONSTRUCTION</b>	6	351	Current Forecast				-3,471,876	12,116	30,257,837	0%	24,206,675	0%	6,051,162	25%	
Construction Contracts	6	351	2015 Rate / 2014 Initial Cashflow				-3,471,527	10,416	30,214,874	0%	24,145,949	0%	6,068,925	25%	
Owner Furnished Equipment			2013 Mid Year Update												
Outside Agency Construction			2014 Adopted / 2013 Final Cashflow												
Other Capital Charges			2013 Adopted/2012 Final Cashflow				-349	1,701	42,963	4%	60,726	3%	-17,763	-29%	
<b>NON-CONSTRUCTION</b>	12,202	406,015	2012 Adopted / 2011 Final Cashflow		3%	311,738		9,844,397	16,911,830	58%	15,414,270	64%	1,497,560	10%	
Engineering Services		135,741	2011 Mid Year Update		7%	50,482		4,870,816	6,413,271	76%	6,097,604	80%	315,666	5%	
Planning & Management Serv		25,075	272,318	9%	597,597	4%	-315,279	181,522	2,263,991	8%	2,184,746	8%	79,245	4%	
Permitting & Other Agency S		22,667	336,847	7%	70,620	32%	266,227	830,894	1,245,108	67%	269,538	308%	975,571	362%	
Right-of-Way		13,663	525,000	3%	69,525	20%	455,475	1,644,114	2,366,112	69%	2,386,001	69%	-19,889	0%	
Misc. Service & Materials		865	79,905	1%	82,302	1%	-2,397	73,032	328,075	22%	364,654	20%	-38,579	-10%	
Non-WTD Support		459	3,436	65,932	5%	67,910	5%	-1,978	104,946	321,469	33%	367,021	29%	-45,552	-12%
WTD Staff Labor		6,628	115,938	285,130	41%	404,310	29%	-119,181	1,244,055	2,277,018	55%	3,213,867	39%	-936,849	-29%
Indirect Burden		5,115	88,630	220,976	40%	242,586	37%	-21,611	895,018	1,696,785	53%	530,839	169%	1,165,946	220%
<b>PROJECT RESERVE</b>									4,395,426		6,235,260		-1,839,833	-30%	
Project Contingency									4,395,426		6,235,260		-1,839,833	-30%	
<b>SETTLEMENTS, REIMBURSEMENT</b>															
Settlements, Reimbursements:															
<b>INITIATIVES</b>		4,669							4,669		21,534	22%	-21,534	-100%	
Sustainability															
1% for Art		4,669							4,669		21,534	22%	-21,534	-100%	
Uncommitted/Adjustment															
<b>PROJECT TOTAL</b>	12,202	411,035	3,419,242	12%	6,579,380	6%	-3,160,138	9,861,182	51,565,093	19%	45,877,738	21%	5,687,356	12%	

Open All Close All

Note: Only months that have actuals posted are shown.

Master Level Beginning 2014 Appropriation = \$35,746,968 Remaining Balance = \$35,335,933 (Beginning - YTD Actuals) Rebuild Continuous Monthly

All Projects My Projects Selected Project Search Results

Help Report an Issue Password P5.4

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

PRISM: Project Information System Management Database

Announcements Reminders Projects Contracts Reports/Links System

Project Number & Name Project Manager

Info Scope Status Schedule Financials Contracts Reporting Fixed Assets PTA Sustainability

Milestones Phases

WTD Phase: Implementation KC Phase: Implementation

Select Datasets for Comparison:  
 Dataset 1: 2015 Rate / 2014 Initial Cas... Dataset 2: Gate 3-Baseline (05/10/2010)

N/A	Phase	Current		Current - Dataset 1 Difference	Dataset 1 - Dataset 2 Difference
<input type="checkbox"/>	Phase 1 Planning	Start: 05/01/2008 Actual Finish: 08/19/2009 Actual	Automatic	No Change	No Change
<input type="checkbox"/>	Phase 2 Preliminary Design	Start: 08/19/2009 Actual Finish: 01/15/2010 Actual	Automatic	No Change	149 Day Increase
<input type="checkbox"/>	Phase 3 Final Design	Start: 01/15/2010 Actual Finish: 05/30/2012 Actual	Manual	No Change	61 Day Decrease
<input type="checkbox"/>	Phase 4 Implementation	Start: 06/04/2012 Actual Finish: 11/17/2014 Forecast	Manual	No Change	27 Day Increase
<input type="checkbox"/>	Phase 5 Close Out	Start: 01/04/2015 Forecast Finish: 05/01/2015 Forecast	Manual	No Change	74 Day Increase
<input checked="" type="checkbox"/>	Phase 6 Land Acquisition	Start: ... Finish: ...			
Substantial Completion		11/17/2014 Forecast	Automatic	No Change	125 Day Increase

All Projects My Projects Selected Project Search Results

Quickfind: \_\_\_\_\_

Help Report an Issue Password P4.1

Select Budgets for Comparison

125 Day Increase

Calculates Variance

# Conclusion

- \* 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.



<http://www.kingcounty.gov/environment/wtd.aspx>

Hans Erickson – [hans.erickson@kingcounty.gov](mailto:hans.erickson@kingcounty.gov)

Paul Galeno – [paul.galeno@kingcounty.gov](mailto:paul.galeno@kingcounty.gov)

Lisa Taylor – [lisa.taylor@kingcounty.gov](mailto:lisa.taylor@kingcounty.gov)