RW Block Consulting, Inc.

San Francisco Public Utilities Commission
Revenue Bond Oversight Committee (RBOC)

Construction Management Services – RBOC Evaluation of Lessons Learned Water System Improvement Program (WSIP)

PROJECT CS-363 FINAL REPORT

October 22, 2015

RW Block Consulting, Inc.

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EXECUTIVE SUMMARY

R.W. Block Consulting, Inc. (RWBC) was engaged by the San Francisco Public Utilities Commission-Revenue Bond Oversight Committee (RBOC) to conduct an evaluation of the knowledge management practices utilized by the Water System Improvement Program (WSIP) and the applicability of such lessons learned to the Sewer System Improvement Program (SSIP). The focus of this engagement was to capture lessons learned from the WSIP and, through a comparison of program features and characteristics between the WSIP and SSIP, provide recommendations on which WSIP lessons learned are most applicable to the SSIP program. RWBC has distilled 585 lessons learned into 10 executive level knowledge management themes as shown in this section below. RWBC prioritized these 10 themes based on the potential impact they would have on the SSIP and WSIP (as applicable). Within each theme we provide the basis or features which we believe warranted the prioritization order. In addition, for each identified theme, RWBC provides the point in the capital program development cycle where each theme would impact the SSIP and WSIP (as applicable) as shown in Figure 1 below.

Figure 1 - Program Lifecycle and Applicability of Themes

	Program Lifecycle				
Theme	Planning	Design	Bid/Award	Construction	Closeout
Budget					
Contingency					
Lessons learned					
Project delivery					
Contracting					
Change management					
Bidding					
Financial and schedule reporting					
Risk assessment					
Design					

1. Budget: consider the utilization of a 'stress test' of future programs budgets. By 'stress test' we mean conducting an evaluation of impacts to project/program budgets utilizing scenario analysis such as evaluating the budgetary impacts to modifying contingency rates, application of historical WSIP change order rates to forecast construction costs, and similarly, through the application of different project delivery cost structures. Expanded discussion on this topic can be found under the PROJECT DELIVERY, CHANGE MANAGEMENT, and CONSTRUCTION BIDDING, and LESSONS LEARNED sections of this report. We believe this is the most impactful lesson learned as the WSIP benefitted from a very favorable bidding environment yet many projects that were very well scoped, encountered a wide range of unforeseen conditions and operational challenges that resulted in budgetary pressures. Lifecycle: planning and pre-design phases of budget development would be the most critical phases of the project delivery cycle affected by this theme.
2. Application of contingency: consider utilization of a more deliberate and flexible approach to initial assignment of contingency to project budgets to be reflective of project-specific risk. A flexible approach entails the assignment of contingency reflective of each project's risk profile rather than a standardized allocation of contingency based on a percentage of expected construction costs. Assignment of contingency would be evaluated utilizing existing forecast cost/schedule to completion and risk management processes as the project is implemented. Specifically, contingency levels could be more closely aligned with the expected risk of the project for factors such as probability to encounter unforeseen conditions, complexity of construction, duration of project, or other similar parameter. More detailed discussion and additional background information about this topic can be found in the sections titled OVERVIEW OF WSIP, CONSTRUCTION BIDDING, and LESSONS LEARNED at the end of this report. In a similar vein as the Budget theme, contingency setting is a critical element of budget development and project implementation. An approach that is more closely aligned to a specific project's characteristics and resulting risk profile is an extremely important theme

learned on the WSIP program where contingency setting was initially based on a standard percent of construction cost basis. Lifecycle: contingency setting is a theme that impacts all aspects of the lifecycle through construction completion to ensure proper funds are in place to complete needed scope of work.

3. The lessons learned process could be further enhanced to fully leverage the lessons learned being generated through various presentations, forms, and shutdown reports, as well as daily activities at the project site. We found that all project staff interviewed for this and past projects were very well qualified for their assigned tasks and responsibilities. As such we believe that the lessons learned generated from this pool of resources would not only benefit WSIP but also other programs such as the SSIP implementing similar program management processes and structures. Seven recommendations to enhance the knowledge management culture of the WSIP are provided in the Lessons Learned Process section of this report. Additional information pertaining to this topic can be found in sections LESSONS LEARNED PROCESS, LESSON LEARNED, and EXHIBIT 7 of this report. We believe that the WSIP (and SSIP) could have benefitted from a more robust knowledge management framework and resulting lessons learned process. The WSIP team developed a wide range of lessons learned based on the successful implementation of very complex projects. A more robust knowledge management framework might have provided the entire program team and SFPUC with the benefit of earlier understanding and adoption of lessons learned on a wider scale. Similarly, a robust knowledge management framework would be extremely beneficial for the SSIP. Lifecycle: ensuring that a robust lessons learned process is in place covers all aspects of a program's life cycle to ensure continuous improvement at all phases of program implementation.
4. Project Delivery: consider development of performance metrics (such as daily unit costs for key project delivery costs) against which various elements of project delivery performance can be measured. The development of a standardized methodology to charge these elements to projects (e.g. allocated or direct) should also be clearly identified in the cost

accounting/budgeting policy for both contract awards (commitments) and expenditures. WSIP data reviewed shows that rates for certain elements of project delivery, such as construction management and departmental charges, were higher than baseline rates. Higher costs were driven by longer than expected durations driven by realization of unforeseen conditions as well as slower than planned ramp-down of project delivery staffing. Agreed upon project delivery metrics would serve to better communicate project delivery financial performance externally while also providing measurable performance data benchmarks. Refer to sections titled PROJECT DELIVERY and LESSONS LEARNED for additional analysis and information on this topic. Project delivery is a critical tool to implement capital programs: delivery structures dictate the manner in which the project and program management teams administer implementation activities. Given the importance of this activity and magnitude of resulting costs, we believe that project delivery is a very important theme that impacts all aspects of program implementation activities. Lifecycle: project delivery affects the entire delivery lifecycle of programs from planning to closeout.

5. Contracting: consider added coordination of requirements set forth under the technical specifications and general conditions to ensure that conflicting terms or conditions contained in these two key contract documents are minimized. Additional information on this topic can be found in the LESSONS EARNED section of this report as well as EXHIBIT 7. The language within each construction agreement drives the behaviors of SFPUC and contractors in the implementation of projects. This theme was found to be important as coordination and general conditions language can mitigate a wide range of operational issues. Lifecycle: this theme primarily impacts the construction phase of the program delivery lifecycle.
6. Change Management: in general, the change management process utilized by the WSIP is robust and has been shown to work well on a wide range of projects and difficult negotiating conditions. Additional information on this topic is contained in the sections titled CHANGE MANAGEMENT and LESSONS LEARNED of this report. We believe that management of change

orders is very impactful in the successful performance of the WSIP where there were in excess of 2,400 change orders approved with an aggregate value of $321 million. We believe that the robust change order process developed in the WSIP could be successfully applied to the SSIP. We also note that the change management process may have to be modified for the SSIP if the construction management at risk (CMAR) delivery structure is utilized for construction delivery. **Lifecycle:** change management is a construction-phase lifecycle theme.

7. **Bidding:** the traditional design-bid-build with selected qualification utilized on WSIP to deliver most of the projects worked well. Bid results show over $400 million in bid savings realized on the WSIP utilizing this methodology. Subsequent sections of this report titled CONSTRUCTION BIDDING and LESSONS LEARNED contain additional information on this topic. We believe that the bidding environment realized on the WSIP is not expected to be as favorable in the bidding of the SSIP projects, and as such similar savings should not be expected to be realized. **Lifecycle**: this theme is centered on the project delivery phase of the program lifecycle which occurs upon completion of the design phase.
8. **Financial and Scheduling Reporting:** the WSIP has developed comprehensive financial and scheduling reporting at all levels of the program. The WSIP has demonstrated very robust capability in this area. We note that over 5,000 pages of data were utilized to create the tables, exhibits, and figures contained in this report. Data and analysis associated with this issue is provided in EXHIBITS 1-7 as well as CHANGE MANAGEMENT, CONSTRUCTION BIDDING, and PROJECT DELIVERY SECTIONS of this report. **Lifecycle:** financial and schedule reporting cover the entire lifecycle of capital development.
9. **Risk assessment:** the Risk Assessment process is well developed and has evolved into a mature approach to evaluation of project and program risk. For further reading please refer to sections titled RISK MANAGEMENT and LESSONS LEARNED of this report. **Lifecycle:** risk assessment and management affects the entire lifecycle of a program.

10. Design: our interviews and project data reviewed showed that benefits could be gained by added owner involvement in the design development process through added involvement in review of design deliverables, especially at the 35% and 65% levels. Also expressed during the interview process were the potential benefits of having certain key project staff (especially Construction Management staff) assigned to work earlier into the project design phase so they can have added input into this process. Please refer to sections titled DESIGN, LESSONS LEARNED, and EXHIBIT 7 of this report for additional information and analysis pertaining to this topic. Enhanced owner involvement during the design development phase is critical to ensuring higher quality documents that reflect owners design intent and improved alignment with operating requirements upon completion of construction. Lifecycle: this theme is centered on the design phase of the program lifecycle.

Using the themes provided above, the RBOC can develop an operational framework to review the SSIP as shown in Figure 2 below.

Figure 2 - RBOC Oversight Framework Based on Themes Identified

Theme	Oversight Activity
Budget	Review budgeting methodology and ensure that stress tests are performed as prescribed. Require that prior to implementation activities are undertaken that budget stress results be presented to RBOC.
Contingency	Ensure that contingency-setting is aligned with project risk profile. Require that periodic reporting be provided to RBOC to demonstrate alignment of risk/contingency.
Lessons learned	Request quarterly and annual lessons learned presentations and analysis be provided.
Project delivery	Request more granular presentation on elements of project delivery, monitoring, and reporting.
Contracting	Request presentations be made highlighting coordination language/general conditions language enhancements are reflected in construction contracts.
Change management	Continue the utilization of existing change management processes. Modifications to such should be presented if SSIP utilizes CMAR delivery method.
Bidding	Request bid analysis presentation be made on a quarterly basis.
Financial and schedule reporting	Continue the utilization of financial and schedule reporting structures which are familiar to the public and RBOC.
Risk assessment	Request quarterly updates of risk assessment results for programs.
Design	Request semi-annual presentation on how owner involvement has been achieved in design efforts.

The sections that follow highlight the field work conducted to reach these conclusions including review of project functions such as budgeting and financial controls, change management, bidding, design, quality assurance/quality control, risk management, and lessons learned processes. Other activities performed under this engagement included conducting multiple project site visits and interviews with project staff, extensive discussions with WSIP and SSIP project and program management staff, as well

as review of more than 10,000 pages of documents provided to RWBC for review. Finally, we also note that this engagement is not structured nor intended to be an audit of the WSIP or SSIP programs.

We would like to acknowledge the WSIP and SSIP program and project management teams, who made themselves accessible, invested their time to compile and answer extensive document requests, and were, at all times, professional and courteous. We appreciate the opportunity to prepare this report as the final deliverable under procurement CS-363 Construction Management Services – RBOC Evaluation of Lessons Learned Water System Improvement Program (WSIP)

Respectfully submitted,

R. W. Block Consulting, Inc.

ENGAGEMENT SCOPE OF WORK

RWBC was engaged by the San Francisco Public Utilities Commission-Revenue Bond Oversight Committee (RBOC) to conduct an evaluation of the knowledge management practices utilized by the Water System Improvement Program (WSIP) management team and the applicability of lessons learned from such practice to the Sewer System Improvement Program (SSIP). It is important to note that the focus of this engagement is to capture lessons learned from the WSIP and, through a comparison of program features associated with the SSIP, provide recommendations on which WSIP lessons learned are most applicable to the SSIP. This engagement is not structured nor intended to be an audit of either the WSIP or SSIP.

To achieve this overarching objective, RWBC evaluated the actual WSIP lessons learned process to identify the level of practice and definition of knowledge management practices. In addition, RWBC conducted site visits of 6 WSIP projects to evaluate how lessons learned practices were performed at the project level along the following areas of study: (1) budgetary and accounting controls; (2) design; (3) change management; (4) risk assessment; (5) quality control/quality assurance; and (6) delivery methods.

Our analysis of the budgetary and accounting controls included an evaluation of how these are constructed to achieve a transparent structure in financial reporting to internal and external stakeholders. Given that a major portion of the SSIP in the next few years will be to design major work elements, we reviewed the design process to evaluate lessons learned. Areas of study associated with design is the level of involvement by the SFPUC, whether stated processes and procedures were generally followed by SPFUC staff, and the extent to which field and operational staff were/are involved in the design process. The review of change management (change orders) was comprised of an evaluation of the manner in which WSIP handled a wide range of project modifications under a wide range of conditions. Areas of study included approval method, definition, and understanding of root

causes. Associated with change management are claims management. RWBC understands the need to manage and evaluate sensitive claim information and as such provide aggregated data in this report to ensure maintaining the confidentiality of this information. As the WSIP developed so did the risk assessment approach and process from a generally defined process to a structured approach. Areas evaluated under risk assessment included the structure and application of this activity and integration of such into cost and schedule forecast evaluation. Both quality control (QC) (internal) and quality assurance (QA) (external) are extremely important to limit costly mistakes that may not be revealed until after construction is completed. Areas of study include lessons learned about the QA/QC process such as the effectiveness of the process. The final areas studied as delivery methods including an evaluation of bid results and metrics contained within the results of bid WSIP projects. These 6 areas of study were evaluated for the six projects visited, which served as the basis for making program-wide assessments and capture of lessons learned. The 6 projects visited and evaluated are as follows:

1. Calaveras Dam Replacement (CUW37401)
2. New Irvington Tunnel (CUW35901)
3. Bay Division Pipeline Reliability Upgrade Tunnel (CUW36801)
4. Harry Tracy Water Treatment Plant Long Term Improvements (CUW36701)
5. Crystal Springs/San Andreas (CSSA) Transmission System Upgrade (CUW37101)
6. Lincoln Pipeline (CUW31201)

RWBC conducted site visits at each of the 6 projects and interviewed project staff to discuss lessons learned and their experience with the lessons learned process. We further conducted analysis of the WSIP scope, delivery methods, and characteristics of the work to provide an overall view of the program, challenges, and successes. Similarly, we conducted an overall assessment of the SSIP such as features, budget, scope, delivery methods, and general characteristics of the work. Critical program areas of each program are compared and contrasted to facilitate identification lessons learned that would be good candidates to be applied from the WSIP to the SSIP.

Upon having a deeper understanding of the features of the WSIP and SSIP, RWBC compiled a detailed listing of lessons learned on the WSIP. A detailed listing of all lessons learned is included as (Exhibit 7). RWBC aggregated the detailed listing of lessons learned from the WSIP into program-level themes which are analyzed in more detail under titled "Lessons Learned".

OVERVIEW OF WSIP

The City of San Francisco's regional and local drinking water systems serve 26 wholesale customers and regional retail customers in Alameda, Santa Clara, and San Mateo Counties, and 800,000 retail customers in San Francisco. Much of the water supply system's infrastructure was constructed in the early to mid-1900s and many components were nearing the end of their working life. Additionally, crucial facilities cross or are in close proximity to three major earthquake faults, and required seismic upgrades. In 1995 the SFPUC staff commenced a Facility Vulnerability Study, and completed Phase I of this effort which was a facility assessment. Phase II of the study continued throughout the rest of the 1990s, and evaluated the system's vulnerability to hazards such as earthquakes, landslides, flood, and fire, as well as the impacts of age related deterioration. Following a 2000 California State Auditor's report on the City's pace for assessing weaknesses and completing capital projects of the water system, the SFPUC completed a $4.3 billion long range capital improvement plan for the water and sewer systems. This plan included required improvements to the water systems which would enhance the SFPUC's ability to provide reliable, affordable, high quality drinking water to its customers in an environmentally sustainable manner.

In May 2002 the SFPUC adopted a $2.9 billion Capital Improvement Program (CIP) (what would later be expanded and transformed into the WSIP) to rebuild and retrofit the regional water system to improve system reliability, especially to ensure seismic safety. As the SFPUC was taking this action, certain wholesale water customers of the SFPUC worked with state legislators to secure state legislation to ensure the system was rebuilt. California Assembly Bill (AB) 1823 was enacted in 2002. It amended

the state water code to require the SFPUC to adopt and implement the CIP, and to submit progress reports to the Joint Legislative Audit Committee, the California Seismic Safety Commission and the Department of Health Services, among other requirements. To fund these improvements, California Senate Bill (SB) 1870 was also enacted in 2002 which, among other things, created the San Francisco Bay Area Regional Water System Financing Authority who has the authority to issue revenue bonds for the purpose of funding water system improvements. SB 1870 grants the San Francisco Bay Area Regional Water System Financing Authority the authority to issue bonds with a two-thirds approval of the Authority's voting members, and does not require approval from a vote of the general public.

On November 5, 2002 voters of the County of San Francisco approved three Propositions (A, E and P) related to the funding of SFPUC projects. Proposition "A" approved issuing revenue bonds and/or other forms of revenue financing in an amount not to exceed $1,628,000,000 to finance the acquisition and construction of improvements to the City's water system. Proposition "E" approved ending the water and sewer rate freeze, and instructed the City to use excess funds to operate and maintain the utility systems prior to transferring excess funds to the City's General Fund. Proposition "P" established the RBOC whose stated purpose was to "…create a committee to oversee the City's use of utility revenue-bond funds. The committee would report to the Mayor, Board of Supervisors, and SFPUC on whether these bond funds were being used for authorized purposes."

In 2003 San Francisco Public Utility Commission (SFPUC) approved the CIP, which was a 13-year, $3.628 billion program to improve and upgrade the region's water supply, treatment and distribution system.

The CIP's primary purpose to cost-effectively provide:

- Water quality standards
- Delivery reliability
- Seismic reliability

- Water supply goals (including affordability)

The CIP was based on a budget of $3.628 billion and had a scheduled completion in 2016. It was anticipated that over the next 13 years the CIP would be completed including the planning, environmental review and permitting, design, construction, and closeout phases.

In 2005 the scope of the CIP was significantly revised to incorporate Levels of Service (LOS) goals adopted by the SFPUC. This resulted in revising the program's budget and schedule to include the additional scope of work to achieve the LOS goals. The LOS goals were:

1. Water Quality
    - Design improvements to meet current and foreseeable water quality requirements.
    - Provide clean unfiltered water from Hetch Hetchy Reservoir and filtered water from local watersheds.
    - Continue to implement watershed protection.
2. Seismic Reliability
    - Design improvements to meet current seismic standards.
    - Deliver basic service to the East/South Bay, Peninsula and San Francisco Regions within 24 hours after a major earthquake. Basic service is defined as 229 mgd.
    - Restore facilities to meet an average demand of 300 mgd within 30 days after a major earthquake.
3. Delivery Reliability
    - Provide operational flexibility to allow planned maintenance shutdowns of facilities without interrupting service.
    - Provide operational flexibility to minimize service interruption due to unplanned outages.

- Provide operational flexibility and capacity to replenish local reservoirs.
- Meet average annual demand of 300mgd under the condition of one planned shutdown and one unplanned shutdown.

4. Water Supply
   - Meet average annual water demand from watersheds for retail and wholesale customers during non-drought years through 2018.
   - Meet delivery needs during dry years through 2018 with a 20% system reduction in service during extended drought periods.
   - Diversify water supply options during non-drought and drought periods.
   - Improve new water sources and drought management to include groundwater, recycled water, conservation and transfers.
5. Sustainability
   - Protect watershed ecosystems.
   - Meet requirements for the protection of fish and wildlife habitats.
   - Manage natural resources and systems to protect public health and safety.
6. Cost Effectiveness
   - Ensure the cost effective use of funds.
   - Maintain a gravity- driven system.
   - Implement a regular inspection and maintenance program for all facilities.

This program was renamed the Water System Improvement Program (WSIP) with a revised budget of $4.343 billion and a scheduled completion in mid-2014. Between 2005 and 2014 the WSIP budget and schedule have been revised to reflect adjustments in scope, and revised design and construction schedules. During this time bottoms up design and construction management estimates were added and actual construction management and design costs added. The following is summary of the WSIP's budget and schedule revisions as shown in Table 1, below.

Table 1 - WSIP budget history

Revision Date	Budget	Completion Date
2005 (Baseline)	$4.343B	Jun-14
2007	$4.392B	Dec-14
2009	$4.586B	Dec-15
2011	$4.586B	Jul-16
2013	$4.640B	Apr-19
2014 (Current)[1]	$4.765B	May-19

The WSIP is implemented and managed by SFPUC/City staff, with the support of a program management consultant, various specialty consultants, design professionals and construction managers. SFPUC as well as other oversight agencies including the Bay Area Water Supply and Conservation Agency (BAWSCA), City of San Francisco Board of Supervisors, and the SFPUC Revenue Bond Oversight Committee (RBOC), provide oversight for the WSIP. The SFPUC is headed by the General Manager. The Assistant General Manager for Infrastructure oversees the WSIP. Reporting to the Assistant General Manager for Infrastructure is the WSIP Director.

The program is currently being managed and administered by approximately 87 SFPUC/City staff and 195 consultants for a total WSIP staff of 282. Through March 2014, the Regional Projects have incurred expenditures of approximately $2.800 billion or 76% of WSIP's current approved budget.

[1] All projects with the exception of the Calaveras Dam Replacement, the Regional Groundwater Storage and Recovery Project, and the Alameda Creek Recapture Project will also go beyond 2016 project.

Project Development and Controls

Project Development: once a need is identified, a team of SFPUC begins a planning process to identify the scope, budget and schedule for a project, or projects, to address the need. This process defines all aspects of a project including environmental impacts, facility and system benefits, construction impacts on facility and system operations, required design and construction professional expertise, project phasing, coordination with other WSIP projects, and potential project challenges and risks. This process is structured to result in developing a project plan which can be successfully implemented within the overall WSIP plan.

Following development of an approved project plan, the implementation of projects is accomplished by SFPUC and other City staff managing design and environmental consultants. Given that some WSIP projects being located in rural areas, the environmental work has required extensive site investigations, field review, applicable agency coordination and the development of Environmental Impact Assessment Reviews (EIAR). The extensive environmental work is required to better define the constraints, mitigation approaches, and other regulatory requirements which will impact the final design and the project's construction phasing.

The design process has dedicated oversight from the WSIP project management team, and structured design reviews throughout. As the plans and specifications are developed, reviews by WSIP staff and others are performed at the 35%, 65% and 95% levels of completion. These reviews allow for comments and discussion regarding the overall scope, design details, construction phasing, constructability and other implementation issues/concerns. Once the design has been completed the project is publicly advertised to solicit construction bids, bids are received and evaluated by WSIP staff, and the construction project is awarded to the lowest qualified bidder.

During construction, management of the construction contract is assigned to qualified Construction Management (CM) staff. The CM can be comprised of a consultant, SFPUC/City staff, or a combination of both. The CM staff provides overall management and administration of the construction contract and will represent SFPUC in the administration of construction. The project CM staff provides administrative support, quality assurance, inspection of the work for conformance with the contract documents, resolution of issues and change orders, monitoring of jobsite safety, scheduling expertise and cost estimators, approval of contractor progress payments, general oversight of the contractor's schedule, and ultimately acceptance of the completed work.

Controls: budgetary controls is comprised of a structured approach to establishing and managing individual project budgets. Project budgets are developed to reflect all project costs including:

- Construction Costs including a Contingency Allowance
- Management Costs (project delivery)
- Pre-Design Planning (project delivery)
- Environmental Review Reports and Permitting (project delivery)
- Engineering Review/Consultant costs for the design process (project delivery)
- Construction Management (project delivery)
- Other City/SFPUC Departments (project delivery)
- Environmental Compensation/Mitigation (project delivery)
- Art Commission Fees (project delivery)
- Security Upgrades (project delivery)
- Legal and Real Estate Fees for the procurement of property and easements (project delivery)
- Director's Reserve (other)

All of the above, except the construction cost and Director's Reserve, are considered project delivery, or soft costs, and are required to develop, implement and manage the projects. As project's progress the cost for their individual budget components are tracked and reported. Adjustments to project budgets are made as required, and may require a reallocation of contingency, transfer of available budget amounts within a region or within WSIP depending on the forecasts of other projects. If funds are not available for transfer, the WSIP budget is increased.

In order to monitor and track the WSIP budget and schedule, SFPUC has developed several reporting and management systems. Among other capabilities, these systems are capable of tracking all cost and schedule impacts to the program. The main system, CMIS, provides real time information to users on the status of all activities of a project from planning through construction. Routine reporting and access to real time information is essential for the proper management of WSIP, with the added benefit that surprises can generally be avoided. With a program of this magnitude, budget and schedule surprises cannot be tolerated. While issues will develop and should be expected on a project with a long duration and facing many unknowns, the sooner problems and issues can be identified and mitigated.

Construction costs represent the largest portion of any project budget and these costs are tracked, monitored and reported through formalized procedures and reporting systems established by the SFPUC. The adjusted construction budget for a project is established when the bids are received, and generally includes a 10% contingency allowance. The contingency allowance is intended to cover unforeseen conditions, SFPUC initiated design changes, design error and omissions, regulatory requirements changes and other issues which can develop during a project's duration. During construction actual and potential costs and schedule impacts are tracked and reported in the following categories:

- Base contract – value of executed construction contract based on bids received

- Change Orders (CO) – revisions to the original scope impacting the project's cost and/or schedule which have been formally approved. It is generally funded from the project's contingency.
- Pending Change Orders – revisions to the original scope affecting cost or schedule which have been negotiated with the contractor by the CM staff but not yet received final approval from the City.
- Potential Change Orders – cost and/or schedule changes that are known to the CM staff that are either proposed by the contractor or CM. While potential changes are logged and tracked, the final cost and schedule impacts have not been finalized. Accordingly, the cost and schedule impacts are preliminary. These costs are included in the cost at completion forecast.
- Trends – known issues with a probable impact to a project's cost or schedule that have yet to be proposed or processed as a Potential Change Order. These costs are logged and taken into consideration when determining the forecast completion costs for any project.
- Risks – are strategic and overall project outcomes that may have cost or schedule impacts and are ranked based on the probability of occurrence. As projects progress, risks are added to a Risk Register as they are identified, and are deleted once the risk has passed or has been avoided. The main purpose of risk identification is to understand the risks to the project and remain aware of these potential impacts as projects are implemented, and to either avoid or mitigate risks as feasible. The value of risks is not included in the forecast to completion, yet may be used to assess adequacy of project contingency.

The monitoring and tracking of changes in a project's cost and schedule is essential to properly monitor and control the WSIP budget and schedule. It is also essential to assure that entitlement for all changes

have been assessed, and the associated cost/schedule impacts are fair and reasonable. Accordingly, the SFPUC procedures provide for proper review and require specific management level reviews for approval. WSIP change order approval limits are as shown on Table 2, below.

Table 2 - WSIP change order approval authority

Approving Authority	Authority Limit for Cost Changes	Authority Limit for Schedule Changes
Regional Project Manager	2% per CO	None
WSIP DD- Construction	4% per CO	<5% Cumulative
WSIP Director	6% per CO	5-10% Cumulative
AGM – Infrastructure	>6% per CO	None
SFPUC Commission	>10% Cumulative	>10% Cumulative

The above approval limits are general and the actual limit may be dependent on the value of the construction contract. A more detailed description of the exact approval limits is provided in the SFPUC Procedures as Exhibit 5 in PM 5.02 WSIP Project Change Management, Rev.3. The referenced Exhibit 5 provides approval authority for cost and time increases to designated SFPUC management positions provided the project remains within the 10% contingency allocated for time and costs for each project. Should an individual change order or the cumulative value of change orders amounts or time extensions exceed 10% of the original bid amount and project schedule, all future changes require the approval of the SFPUC Commission. The reporting requirements for the WSIP's information and status, including costs and time adjustments, identifies issues early enough to prevent surprises to SFPUC Management or the SFPUC Commission. The approval process and levels of authority are used throughout the project's life, including the planning, environmental, design and construction phases. Schedule and budget changes can occur during these phases, and can either have direct impacts on the phase's cost/schedule and/or impact later phases (e.g. construction). As noted previously, the WSIP budgets

and completion dates have been adjusted as required during the life of the program to achieve established level of services (LOS) goals.

WSIP Status

The WSIP is comprised of 83 projects: 35 local and 48 regional projects. The 35 local projects are located within the City and only serve the city. The local projects are divided between Local Improvement Projects and Local Water Supply Projects with the later managed by the Water Enterprise Capital Improvement Program. While the overall WSIP Program has a 2019 completion date, the Local Improvement Projects are scheduled for completion by September 2015. Of the 35 Local Projects, only two remain in construction. The other 33 projects are either completed or in the process of being closed out. Through March 2014, 73% of the overall WSIP budget has been expended and 93% of the budget for the Local projects has been expended. The remaining two Local Improvement Projects in construction, including remaining contingency, represent 7% of the remaining Local project budget. The latest Quarterly Report (Q3 FY13-14) indicates that there is sufficient contingency remaining in the program to accommodate known forecasted change orders and trends for these remaining two construction projects.

The 48 Regional projects serve San Francisco and 26 regional agencies receiving their water supply from SFPUC with a budget of $3.675 billion. The WSIP budget allocation between the Local and Regional project with expenditures through March 2014 is as shown on Table 3, below.

Table 3 - WSIP budget and expenditure status

Element	Budget	Expenditures
Regional Projects	$3.675B	$2.794B
Local Improvement Projects	$0.338B	$0.315B

Element	Budget	Expenditures
Local Water Supply Projects	$0.281B	$0.041B
Finance	$0.471B	$0.407B
Total	$4.765B	$3.558B

The Regional Projects are generally in rural and suburban locations and are composed of treatment plant upgrades/rehabilitation and improvements, new pipelines, repair of existing pipelines, new tunnels for transmission, new storage facilities, improvements to existing storage facilities, and environmental improvements. The Regional Projects are divided into six management Regions with the current status of the projects (as of March 2014) as shown on Table 4, below.

Table 4 - WSIP project status distribution

Region	Planning/ Design	Construction	Complete/ Closeout	Total
San Joaquin	0	2	2	4
Sunol Valley	1	3	6	10
Bay Division	0	3	6	9
Peninsula	1	2	14	17
San Francisco Regional	1	0	2	3
Support Projects	0	5	0	5
Total	3	15	30	48

The Regional Support Projects include:

- Environmental Mitigation and Maintenance of Mitigation Areas
- Habitat Restoration
- Restoration of WSIP Construction Project sites

- Procurements for Conservation Easements
- WSIP Security Upgrades at the Projects including Access Control

WSIP PROJECT SITE VISITS

From March 17, 2014 through March 28, 2014, RWBC conducted site visits of 6 projects as listed below:

1. Calaveras Dam Replacement (CUW37401)
2. New Irvington Tunnel (CUW35901)
3. Bay Division Pipeline Reliability Upgrade Tunnel (CUW36801)
4. Harry Tracy Water Treatment Plant Long Term Improvements (CUW36701)
5. Crystal Springs/San Andreas (CSSA) Transmission System Upgrade (CUW37101)
6. Lincoln Pipeline (CUW-31201)

The sections that follow provide an overview of each site visit including interview results and data gathered. For each project RWBC provides general scope, budgetary, and time performance, to provide contextual information that can be used to provide context to lessons learned.

Calaveras Dam Replacement (CUW37401)

The Calaveras Dam Replacement project entails the construction a new 210 foot high dam downstream of the existing dam. The storage capacity of the existing dam has been reduced significantly by the California Division of Safety of Dams as a result of reductions in the allowable pond elevation given the lack of seismic resistance of the existing structure. The new dam is designed to resist a maximum credible earthquake on the Calaveras Fault. The project includes new spillway and stilling basin construction, a new intake tower and shaft, and fish screens and ladders. During construction the project has experienced material unanticipated sub-surface conditions, primarily located at the left abutment, regarding faults and ancient landslides requiring significant design revisions and additional construction

work. These issues have been the primary contributor for the project's significant cost increase and schedule extensions, which is a primary driver for projected cost and schedule overruns impacting the overall WSIP. The design for this project was prepared by URS Corporation and the construction is being performed by Dragados USA/Flatiron West/Sukut Construction, JV. The 2005 baseline estimated completion date for the project was May 25, 2012. The current estimated project completion date is May 24, 2019, which represents 2,554 days of additional time. Added time is primarily driven by two types of impacts: (a) pre-construction delays associated with fisheries permitting issues in Alameda Creek below the Calaveras Dam and the planning for mitigation of Naturally Occurring Asbestos (NOA); and (b) construction delays, most of which is associated with the extensive unforeseen site conditions. Table 5, below, provides a comparison of the budget history for the Calaveras Dam Replacement project.

Table 5 - Calaveras Dam Replacement Budget Comparison (2005 Baseline to Current Budget)

Project Budget Summary[2]						
	2005 Base Line Budget	% of Budget	Current Approved Budget	% of Budget	Difference	% Difference (2005 to Current)
Construction/Contingency	$192,752,000	72.5%	556,453,501	77.5%	$363,701,501	188.7%
Environmental Compensation/Mitigation	$11,980,000	4.5%	1,150,000	0.2%	($10,830,000)	-90.4%
Security Upgrades		0.0%	19,000	0.0%	$19,000	0.0%
Sub - Total Construction	**$204,732,000**	**77.0%**	**557,622,501**	**77.6%**	**$352,890,501**	**172.4%**
Management Cost	$7,600,042	2.9%	15,009,552	2.1%	$7,409,510	97.5%
Pre-Design Planning	$4,954,722	1.9%	6,035,024	0.8%	$1,080,302	21.8%
Environmental Planning & Review	$5,157,949	1.9%	16,164,645	2.3%	$11,006,696	213.4%
Environmental Compliance		0.0%	2,035,207	0.3%	$2,035,207	0.0%
Engineering/Design	$19,491,323	7.3%	28,403,242	4.0%	$8,911,919	45.7%

[2] Data extracted from SPUC WSIP Q3 2013/2014 Quarterly Report

Construction Management	$21,664,466	8.1%	78,841,047	11.0%	$57,176,581	263.9 %
Construction Management	*$21,664,466*	*8.1%*	*69,206,208*	*9.6%*	*$47,541,742*	*219.4%*
Engineering Support		*0.0%*	*9,634,839*	*1.3%*	*9,634,839*	*0.0%*
Department & Agency Support/Fees	$1,928,000	0.7%	2,677,451	0.4%	$749,451	38.9 %
Legal ROW & Support		*0.0%*	*1,049,412*	*0.1%*	*$1,049,412*	*0.0%*
Operations Support	*Incl. above*	*0.0%*	*1,628,039*	*0.2%*	*$1,628,039*	*0.0%*
Art Commission Fee	$400,000	0.2%	5,000	0.0%	($395,000)	-98.8%
Real Estate		0.0%	0	0.0%	$0	0.0%
Director's Reserve		0.0%	11,518,096	1.6%	$11,518,096	0.0%
Sub- Total Soft Cost	**$61,196,502**	**23.0%**	**$160,689,264**	**22.4%**	**$99,492,762**	**162.6%**
Total Budget	**$265,928,502**	**100%**	**$718,311,765**	**100%**	**$452,383,263**	**170.1%**
% Soft Cost to Construction Budget		29.9%		28.8%		

Our evaluation of construction costs highlight the impact of unforeseen conditions encountered on this project and is summarized in Table 6. Table 7, meanwhile, contains an analysis of change order costs by reason code. Change order data shows that 96.7% of approved change orders are attributable to differing site conditions, of which change order #47, $99.3 million accounts for 59.7% of the total approved cumulative change order to date to deal with the discovery of an ancient landslide in the left abutment slope of the proposed dam location[3]. We also note that the Pending Change Orders, Potential Change Orders, and Trends are forecasting an additional time for contract completion, above and beyond the current time extensions already approved on this project. Although these Change Orders have not yet been approved, SFPUC notes the necessary costs and time extensions are reflected in the March 2014 budget and schedule for this project.

[3] There are additional change orders approved that are also associated with this condition, yet we included this change to highlight the impact of differing site conditions encountered.

Table 6 - Evaluation of Construction Costs and Change Orders

Construction Summary[4]			
	Amount		As Percent of Original Contract Amount
Original Contract Amount	$259,571,850	(a)	
Approved Change Orders	$165,239,289	(b)	63.7%
Current Contract Amount	**$424,811,139**	(c)=(a)+(b)	
Pending Change Orders	$2,517,195	(d)	
Potential Change Orders	$618,388	(e)	
Trends	$75,044,634	(f)	
Total	**$78,180,217**	(g)=(d)+(e)+(f)	30.1%
Current Contract Forecast Amount[5]	**$502,991,356**	(h)=(c)+(g)	
Difference From Bid Amount	$243,419,506	(i)=(h)-(c)	
Current Construction Contingency	$192,043,612	(j)	74.0%
Forecast Contingency Remaining	($51,375,894)	(k)=(i)-(j)	

There are 72 approved change orders on this project with an aggregate value totaling $166.1 million. As shown in Figure 3, the majority of the impact was realized well into construction of this project[6]

[4] Data extracted from SPUC WSIP Q3 2013/2014 Quarterly Report

[5] Data extracted from SPUC WSIP Q3 2013/2014 Quarterly Report

[6] Change Order #47 was approved when the project was approximately 23% complete based on the project duration that excluded the 761 days approved through this change order. Including the added time approved by Change Order #47 the percent complete was reduced to 16% given that this change order added over two years to the completion date of this project.

Table 7 - Change Order Analysis by Reason Code

Allocation of Approved Change Orders by Cause[7]				
	No. of Change Orders	% of Total CO	CO Amount	% of CO Amount
Differing Site Conditions	34	47.2%	$160,553,124	96.7%
Design Omission	5	6.9%	$156,930	0.1%
Design Error	3	4.2%	$378,462	0.2%
Owner Request	6	8.3%	$308,055	0.2%
Other	16	22.2%	$3,826,590	2.3%
Regulatory Requirement	3	4.2%	$355,712	0.2%
Risk Mitigation	5	7.0%	$515,916	0.3%
Total[8]	72	100.0%	$166,095,789	100.0%

In addition to the information provided in Table 7 pertaining to summary values of approved change orders by reason code, RWBC created a time-based plot of change orders by reason code where the approved change orders are plotted against the percent time (construction duration) when the applicable change was approved. In order to simplify the number of curves included in Figure 3[9], we summarized change order into three broad categories: design related changes (errors, omissions), differing site conditions, and other (including owner requested changes, risk management changes and any other modification that was not related to design or differing site conditions). As reflected in the data analyzed the largest change was identified early in the project and the project team was able to

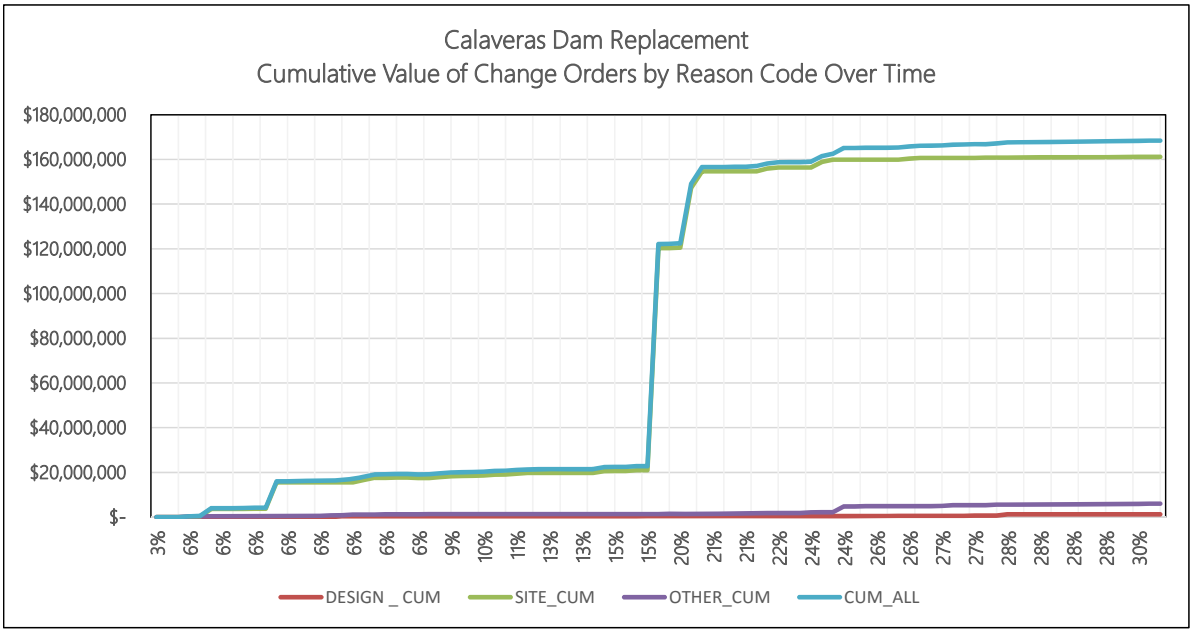
[7] Data extracted from SPUC WSIP Q3 2013/2014 Quarterly Report

[8] The differing values shown for approved construction change orders in Table 2 and Table 3 are the result of report timing differences. RWBC sought to use the most current available data for change order values which as of a date (change order extract for the WSIP provided to RWBC on August 4, 2014) later than the available SFPUC WSIP Quarterly Report.

[9] This graph provides the cumulative value of approved change orders (defined as fully executed change orders) grouped into three major reason codes: design, differing site conditions, and other. Design (reflected as DESIGN_CUM in Figure 3) includes architect/engineer errors and omissions, site conditions (reflected as SITE_CUM in Figure 3) include all modifications resulting from encountering differing site conditions, and other (reflected as OTHER_CUM in Figure 3) incorporates all other reason codes including owner requested changes, risk mitigation, and alternative means and methods, for example. A fourth plot line is included which is the cumulative value over project time (reflected as CUM_ALL in Figure 3) for all approved change orders.

negotiate a very complex modification without having a resulting claim. This is significant given the general contractor is a first time joint venture (partners had not worked under this arrangement previously) which added to the risk profile of the project. Detailed information on approved change orders is provided as EXHIBIT 1.

Figure 3-Calaveras Dam Replacement Change Order Approval Over Time By Reason Code



New Irvington Tunnel (CUW35901)

The project will construct a new 3.5 mile tunnel with an 8.5 foot diameter steel water line parallel to the existing Irvington Tunnel. The tunnel will be excavated using conventional hand mining methods and will be approximately 13' by 14' in a horseshoe configuration. At the Irvington Portal, the water line will connect to Bay Division piping, and at the Alameda Portal the water line will connect to the discharge of the new mixing manifold being constructed as part of the Alameda Siphons #4 project and to the existing overflow shaft. A unique characteristic of this project is that it is one of the few projects in the United States to be mined using traditional mining methods (drill-blast vs. tunnel boring machine), which presented several challenges, including identification and training of qualified labor. The project

was also re-classified from 'potentially-gassy' to a 'gassy' tunnel, which resulted in a material change in the manner in which construction operations within the tunnel are conducted. Other challenges encountered during the project have included higher than anticipated dewatering requirements and differing soil and rock conditions. As a result of these challenges the 2005 baseline estimated completion date of September 17, 2013 has been extended to March 11, 2016, an increase in project time of 910 days. The project was designed by URS Corporation, Inc. and the general contractor is Tutor, Perini, Southland-JV. Table 8, below, provides a comparison of the budget history for the New Irvington Tunnel project.

Table 8 - New Irvington Tunnel Budget Comparison (2005 Baseline to Current Budget)

Budget Summary						
	2005 Baseline Budget	% of Budget	Current Approved Budget	% of Budget	Difference	% Difference (2005 to Current)
Construction/Contingency	$169,393,000	78.9%	271,122,509	80.0%	$101,729,509	60.0%
Environmental Compensation/Mitigation	$3,854,000	1.8%	80,000	0.0%	($3,774,000)	-97.9%
Security Upgrades		0.0%	16,889	0.0%	$16,889	0.0%
Sub - Total Construction	**$173,247,000**	**80.7%**	**271,219,398**	**80.0%**	**$97,972,398**	**56.6%**
Management Cost	$6,484,911	3.0%	6,667,675	2.0%	$182,764	2.8%
Pre-Design Planning	$3,679,089	1.7%	3,908,000	1.2%	$228,911	6.2%
Environmental Planning & Review	$3,388,000	1.6%	4,330,359	1.3%	$942,359	27.8%
Environmental Compliance		0.0%	2,708,273	0.8%	$2,708,273	0.0%
Engineering/Design	$13,551,000	6.3%	16,854,666	5.0%	$3,303,666	24.4%
Construction Management	$10,164,000	4.7%	28,227,917	8.3 %	$18,063,917	177.7 %
Construction Management	*$10,164,000*	*4.7%*	*20,481,156*	*6.0%*	*$10,317,156*	*101.5%*
Engineering Support		*0.0%*	*7,746,761*	*2.3%*	*$7,746,761*	*0.0%*
Department & Agency Support/Fees	$1,694,000	0.8%	930,131	0.3%	($763,869)	-45.1 %
Legal ROW & Support		*0.0%*	*311,307*	*0.1%*	*$311,307*	*0.0%*
Operations Support	*Incl. above*	*0.0%*	*618,824*	*0.2%*	*$618,824*	*0.0%*
Art Commission Fee	$79,000	0.0%	2,603	0.0%	($76,397)	-96.7%

Real Estate	$2,363,000	1.1%	2,411,973	0.7%	$48,973	2.1%
Director's Reserve		0.0%	1,850,000	0.5%	$1,850,000	0.0%
Sub- Total Soft Cost	**$41,403,000**	**19.3%**	**$67,891,597**	**20.0%**	**$26,488,597**	**64.0%**
Total Budget	**$214,650,000**		**$339,110,995**		**$124,460,995**	**58.0%**
% Soft Cost to Construction Budget		23.9%		25.0%		

As shown in Table 8, above, there has been a significant increase to the cost of construction, which similar to the Calaveras Dam Replacement project, stems from encountered field conditions. Given the added time to complete this project we also see that soft costs, especially construction management costs have more than doubled. Unlike the Calaveras Dam Replacement project, the Management Cost for this project only increased by 2.8% over the 2005 Baseline Estimate. Table 9, below, provides a more detailed breakdown of construction only costs to date and forecast cost at completion.

Table 9 - Evaluation of Construction Costs and Change Orders

Construction Cost Summary			
	Amount		As Percent of Original Contract Amount
Original Contract Amount	$226,657,700	(a)	
Approved Change Orders	$28,137,232	(b)	12.4%
Current Contract Amount	**$254,794,932**	(c)=(a)+(b)	
Pending Change Orders	$290,265	(d)	
Potential Change Orders	$1,420,831	(e)	
Trends	$7,453,003	(f)	
Total	**$9,164,099**	(g)=(d)+(e)+(f)	4.0%
Current Contract Forecast Amount	**$263,959,031**	(h)=(c)+(g)	16.5%
Difference From Bid Amount	$37,301,331	(i)=(h)-(c)	
Current Construction Contingency	$30,671,265	(j)	13.5%
Forecast Contingency Remaining	($6,630,066)	(k)=(i)-(j)	

Similar to the Calaveras Dam Replacement Project, the majority of approved changes on the New Irvington Tunnel Project were the result of encountered conditions, accounting for 92.5% of the total change order value as shown in Table 10, below.

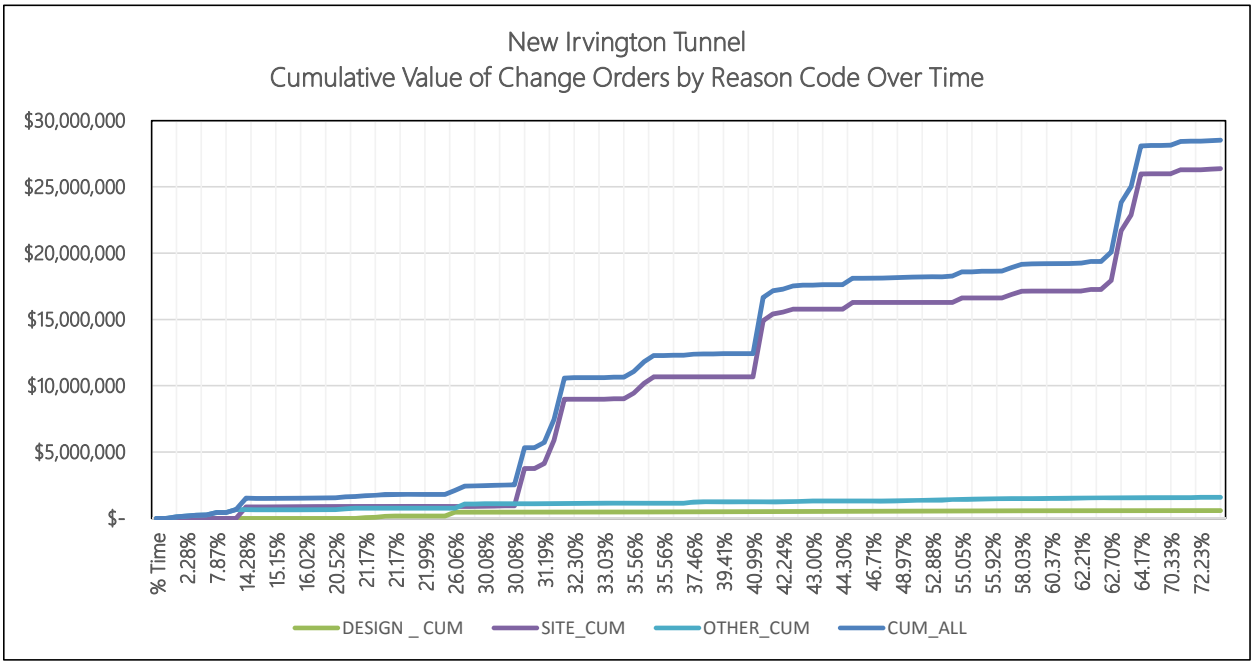
Table 10 - Change Order Analysis by Reason Code

Allocation of Change Orders by Cause				
	No. of Change Orders	% of Total CO	CO Amount	% of CO Amount
Differing Site Conditions	35	33.7%	$26,290235	92.5%
Design Omission	11	10.6%	$189,170	0.7%
Design Error	5	4.8%	$387597	1.4%
Owner Request	19	18.3%	$775,848	2.7%
Other	29	27.9%	$302,617	1.1%
Regulatory Requirement	5	4.7%	$482,030	1.6%
Risk Mitigation	0	0.0%	$0	0.0%
Total	104	100.0%	$28,427,497[10]	100.0%

In addition to the evaluation of approved change orders by reason code, RWBC evaluated the cumulative value of changes over project time as shown in Figure 4, below. The interesting behavior of approved changes is that increases to changes stemming from encountered conditions occurred at three periods in the project (30% complete, 40% complete, and 62.7% complete). It is not implied by RWBC that there is anything inappropriate, but rather highlights the cost drivers behind the most material changes to the value of construction. This also highlights the difficulty project teams have in predicting such changes, regardless of risk mitigation or risk assessments conducted on projects. Detailed approved change order information is provided as EXHIBIT 2.

[10] The differing values shown for approved construction change orders in Table 9 and Table 10 are the result of report timing differences. RWBC sought to use the most current available data for change order values which as of a date (change order extract for the WSIP provided to RWBC on August 4, 2014) later than the available SFPUC WSIP Quarterly Report at the time of the writing of this report.

Figure 4 - New Irvington Tunnel Change Order Approval Over Time By Reason Code



Bay Division Pipeline Reliability Upgrade Tunnel (CUW36801)

The BDPL is a tunnel project that will extend 5 miles under San Francisco Bay, and is adjacent to the marshlands between the vicinity of the Ravenswood Valve Lot and the Newark Valve Lot. The Bay Division tunnel is being constructed using a Tunnel Boring Machine (TBM) (as opposed to the traditional mining methods used to excavate the New Irvington Tunnel project). The final tunnel lining will consist of a 9-foot- diameter welded steel pipeline. The tunnel will terminate at each end with vertical shafts and a connection to the BDPL Nos. 1, 2, and 5 piping manifolds. The two new piping manifolds are being provided under the BDPL Reliability Upgrade Pipeline Project. The excavated tunnel spoils are anticipated to be used as part of the conversion of adjacent salt ponds to marshland. The portion of the existing BDPL Nos. 1 and 2 that are to be replaced by the new Bay Division tunnel will be capped on each end and will be abandoned in place. The new Bay Tunnel will link the existing segments of BDPL Nos. 1 and 2 and the future BDPL No. 5 in the East Bay with those on the Peninsula. The existing

portions of BDPL Nos. 1 and 2, which were built in the 1920's and 1930's, lay along the bay floor and on trestles that cross over environmentally sensitive marsh land. The pipe and the trestle are in a deteriorated condition. The Bay Division Tunnel will bypass these environmentally sensitive wetlands. The project is approximately 92% complete as of March 31, 2014. The 2005 Baseline completion date was estimated to be achieved by January 31, 2012, while the current forecast project completion is March 31, 2016. Table 11, below, provides a detailed breakdown of this project's budget elements in the 2005 Baseline Budget compared to the current approved budget. Design of this project was accomplished by Jacobs Associates while the construction contractor is Michaels Tunneling, Jay Dee, Coluccio – Bay Tunnel JV.

Table 11 - Bay Division Pipeline Reliability Upgrade Project Budget Comparison (2005 Baseline to Current Budget)

Project Budget Summary - (includes CUW 36801 Tunnel, CUW36802 Pipeline, and 36803 Relocation of BDPL 1&2)[11]						
	2005 Base Line Budget	% of Budget	Current Approved Budget	% of Budget	Difference	% Difference (2005 to Current)
Construction/Contingency	$430,092,000	75.2%	$383,399,738	75.0%	($46,692,262)	-10.86%
Environmental Compensation/Mitigation	$20,608,000	3.6%	$1,053,164	0.2%	($19,554,836)	-94.89%
Security Upgrades		0.0%	$45,284	0.0%	$45,284	0.00%
Sub - Total Construction	**$450,700,000**	**78.8%**	**$384,498,186**	**75.2%**	**($66,201,814)**	**-14.69%**
Management Cost	$17,476,000	3.1%	$10,263,132	2.0%	($7,212,868)	-41.27%
Pre-Design Planning	$8,738,000	1.5%	$4,741,995	0.9%	($3,996,005)	-45.73%
Environmental Planning & Review	$8,738,000	1.5%	$5,775,584	1.1%	($2,962,416)	-33.90%
Environmental Compliance		0.0%	$7,362,671	1.4%	$7,362,671	0.00%
Engineering/Design	$33,062,638	5.8%	$29,615,514	5.8%	($3,447,124)	-10.43%

[11] In the 2005 WSIP Budget the Bay Division Pipeline Reliability Upgrade Project was a single line item that included the Tunnel, Pipeline and Relocation of BDPL 1&2, and detailed 2005 information for these three components was unavailable. In the March 2014 WSIP Budget these three projects were presented as separate line items. In order to perform an accurate comparison to the 2005 budget the three projects (CUWs 36801, 36802, and 36803) had to be combined, and is the information presented in the "Current Approved Budget" column. The "2005 Base Line Budget" information is from the "Bay Division Pipeline Reliability" line in the 2005 WSIP budget.

Project Budget Summary - (includes CUW 36801 Tunnel, CUW36802 Pipeline, and 36803 Relocation of BDPL 1&2)[11]						
Construction Management	$43,689,000	7.6%	$49,302,099	9.6%	$5,613,099	12.85%
Construction Management	*$43,689,000*	*7.6%*	*$38,853,788*	*7.6%*	*($4,835,212)*	*-11.07%*
Engineering Support	*$0*	*0.0%*	*$10,448,311*	*2.0%*	*$10,448,311*	*0.00%*
Department & Agency Support/Fees	$4,369,000	0.8%	$8,626,055	1.7%	$4,257,055	97.44%
Legal ROW & Support		*0.0%*	*$3,884,194*	*0.8%*	*$3,884,194*	*0.00%*
Operations Support	*Incl. Above*	*0.0%*	*$4,741,861*	*0.9%*	*$4,741,861*	*0.00%*
Art Commission Fee	$250,000	0.0%	$51,000	0.0%	($199,000)	-79.60%
Real Estate	$5,000,000	0.9%	$7,794,852	1.5%	$2,794,852	55.90%
Director's Reserve		0.0%	$3,500,000	0.7%	$3,500,000	0.00%
Sub- Total Soft Cost	**$121,322,638**	**21.2%**	**$127,032,902**	**24.8%**	**$5,710,264**	**4.71%**
Total Budget	**$572,022,638**		**$511,531,087**		**($60,491,551)**	**-10.58%**
% Soft Cost to Construction Budget		26.9%		33.0%		

Unlike the Calaveras Dam Replacement and the New Irvington Tunnel projects, these three projects are being delivered under budget (current forecast is 10% less than the original estimate). Savings realized from these projects are being utilized to fund additional costs in other projects of the WSIP. The balance of the information provided and discussed on this section will relate to the Bay Tunnel (CUW 36801) only, and not three projects presented in Table 11. The amount of change orders approved on this project was only 1.1% of the original contract amount, while there remains an additional $5.6 million in pending change orders and trends as shown in Table 12, below.

Table 12 - Evaluation of Construction Costs and Change Orders

Construction Summary			
	Amount		As Percent of Original Contract Amount
Original Contract Amount	$215,294,530	(a)	
Approved Change Orders	$2,314,641	(b)	1.1%

Construction Summary			
Current Contract Amount	$217,609,171	(c)=(a)+(b)	
Pending Change Orders	$0	(d)	
Potential Change Orders	$2,017,504	(e)	
Trends	$3,570,000	(f)	
Total	$5,587,504	(g)=(d)+(e)+(f)	2.6%
Current Contract Forecast Amount	$223,196,675	(h)=(c)+(g)	3.7%
Difference From Bid Amount	$7,902,145	(i)=(h)-(c)	
Current Construction Contingency	$7,475,760	(j)	3.5%
Forecast Contingency Remaining	($426,385)	(k)=(i)-(j)	

One interesting feature of this project is that the majority of the approved change orders were the result of owner requests. Extensive 4-stage geotechnical exploration was undertaken on the Bay Tunnel project, however detailed geotechnical investigation was not allowed on approximately a quarter of the tunnel alignment given the environmental sensitivity of this affected area. As a point of comparison the Calaveras Dam Replacement and New Irvington Tunnel projects both had extensive geotechnical exploration program yet realized a large amount of changes as a result of differing site conditions. This exemplifies the underlying nature of risk in undertaking any construction activity. Table 13, below, provides a summary of all approved change orders segregated by reason code.

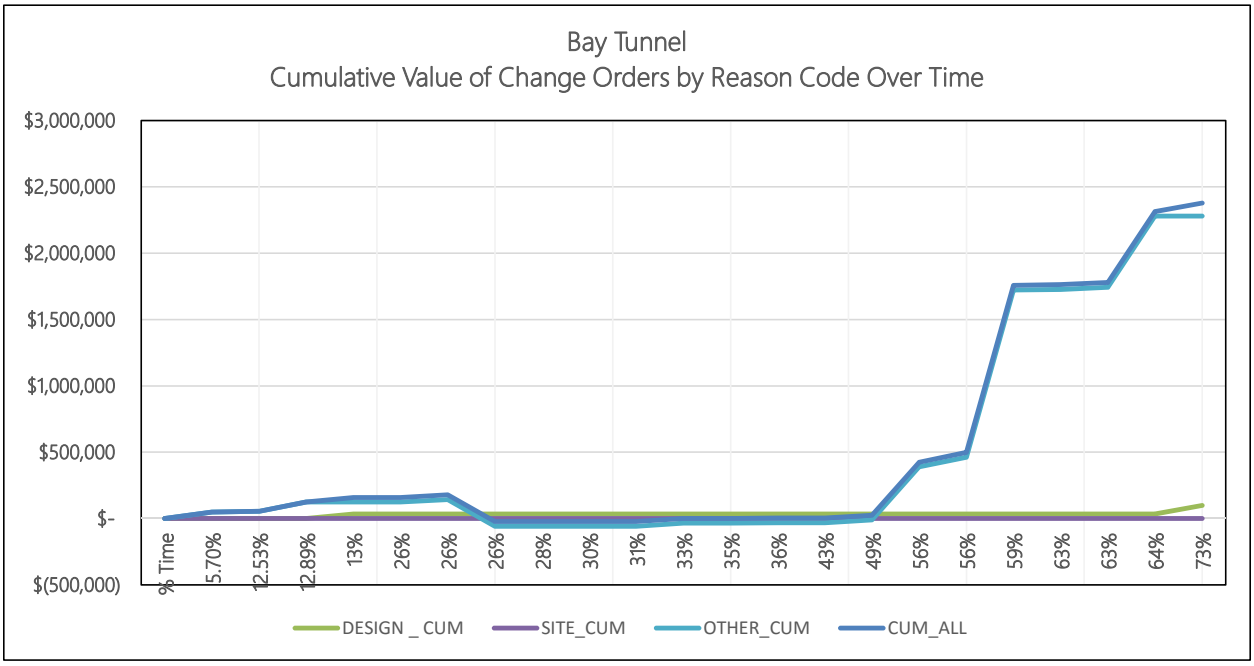
Table 13 - Change Order Analysis by Reason Code

Allocation of Approved Change Orders by Cause				
	No. of Change Orders	% of Total CO	CO Amount	% of CO Amount
Differing Site Conditions	0	0.0%	$0	0%
Design Omission	2	9.1%	$35,183	1.5%
Design Error	0	0%	$0	0%
Owner Request	12	54.6%	$1,997,988	86.3%

Other	3	13.6%	($200,000)	-8.6%
Regulatory Requirement	1	4.5%	$2,906	0.1%
Risk Mitigation	4	18.2%	$478,564	20.7%
Total	**22**	**100.0%**	**$2,314,641**	**100.0%**

As shown in Figure 5, below, although the number of approved change orders in this project are relatively low compared to other projects in the WSIP, most have come well into construction (between 49%-73% complete based on time). Detailed change order information is provided as EXHIBIT 3.

Figure 5 - Bay Division Pipeline Reliability Tunnel Change Order Approval Over Time By Reason Code



Harry Tracy Water Treatment Plant (CUW36701)

The Harry Tracy Water Treatment Plant (HTWT), in conjunction with the Crystal Springs Reservoir System (Upper and Lower Crystal Springs Reservoirs) and San Andreas Reservoir, serves as the emergency back-up and supplementary water supply system for the entire San Francisco Peninsula and City of San

Francisco. The purpose of this project is to improve delivery reliability and provide seismic upgrades at this regional water treatment plant to achieve a sustained capacity of 140 million gallons per day (mgd) for at least 60 days, and to provide 140 (mgd) within 24 hours following a seismic event on the San Andreas Fault. The sustainable capacity would be provided through the addition of filters, upgrades to various systems, and seismic retrofits of critical process units. The project consists of: seismic and hydraulic improvements to various treatment units and includes expansion of the filtration process capacity by adding five new filters. In addition, a new 11 million gallon Treated Water Reservoir will be built to replace the two existing treated water reservoirs. The HTWTP project also includes improvements to the sludge handling and wash-water systems and provides a new additional wash-water tank to enhance the plant's performance, and improvements to key valves and pipelines conveying the raw water supply to the plant and treated water to the distribution system. The 2005 Baseline estimated this project to be completed by April 8, 2014, while the current forecast completion date is January 4, 2016, reflecting 636 days of added time.

As shown on Table 14, below, this project has also experienced significant increases in cost given extensive identification and realization of differing site conditions and associated re-sequencing of construction activities to minimize impacts.

Table 14 - Harry Tracy Water Treatment Plant Budget Comparison (2005 Baseline to Current Budget)

Project Budget Summary						
	2005 Base Line Budget	% of Budget	Current Approved Budget	% of Budget	Difference	% Difference
Construction/Contingency	$123,690,000	73.8%	195,021,299	70.1%	$71,331,299	57.7%
Environmental Compensation/Mitigation	$2,656,000	1.6%	467,000	0.2%	($2,189,000)	-82.4%
Security Upgrades	$0	0.0%	150,000	0.1%	$150,000	0%
Sub - Total Construction	**$126,346,000**	**75.4%**	**195,638,299**	**70.3%**	**$69,292,299**	**54.8%**

Project Budget Summary						
Management Cost	$4,947,423	3.0%	6,029,516	2.2%	$1,082,093	21.9%
Pre-Design Planning	$2,474,213	1.5%	4,769,799	1.7%	$2,295,586	92.8%
Environmental Planning & Review	$2,474,213	1.5%	1,896,345	0.7%	($577,868)	-23.4%
Environmental Construction Compliance	$0	0.0%	907,956	0.3%	$907,956	0%
Engineering/Design	$14,843,273	8.9%	20,661,416	7.4%	$5,818,143	39.2%
Construction Management	$14,842,878	8.9%	37,206,383	13.4%	$22,363,505	150.7 %
Construction Management	*$14,842,878*	*8.9%*	*26,561,264*	*9.6%*	*$11,718,386*	*79.0%*
Engineering Support		*0.0%*	*10,645,119*	*3.8%*	*$10,645,119*	*0.0%*
Department & Agency Support/Fees	$1,237,000	0.7%	3,864,898	1.4%	$2,627,898	212.4 %
Legal ROW & Support	*$0*	*0.0%*	*853,420*	*0.3%*	*$853,420*	*0%*
Operations Support	*Incl. Above*	*0.0%*	*3,011,478*	*1.1%*	*$3,011,478*	*0%*
Art Commission Fee	$405,000	0.2%	799,999	0.3%	$394,999	97.5%
Real Estate	$0	0.0%	0	0.0%	$0	0%
Director's Reserve	$0	0.0%	6,463,724	2.3%	$6,463,724	0%
Sub- Total Soft Cost	**$41,224,000**	**24.6%**	**$82,600,036**	**29.7%**	**$41,376,036**	**100.4%**
Total Budget	**$167,570,000**		**$278,238,335**		**$110,668,335**	**66.0%**
% Soft Cost to Construction Budget		32.6%		42.2%		

This project is extremely complex featuring very constrained physical work environments coupled with complex construction work in the areas of process piping and systems, intricate structural installations, as well as very precise phasing requirements. Even with these challenges, the project team has done well to minimize modifications realized on this project as shown on Table 15, below.

Table 15 - Evaluation of Construction Costs and Change Orders

Construction Summary			
	Amount		As Percent of Original Contract Amount
Original Contract Amount	$174,197,000	(a)	
Approved Change Orders	$4,344,955	(b)	2.5%
Current Contract Amount	**$178,541,955**	(c)=(a)+(b)	
Pending Change Orders	$1,260,925	(d)	
Potential Change Orders	$338,503	(e)	
Trends	$8,245,402	(f)	
Total	**$9,844,830**	(g)=(d)+(e)+(f)	5.7%
Current Contract Forecast Amount	**$188,386,785**	(h)=(c)+(g)	8.1%
Difference From Bid Amount	$14,189,785	(i)=(h)-(c)	
Current Construction Contingency	$23,424,299	(j)	13.4%
Forecast Contingency Remaining	$9,234,514	(k)=(i)-(j)	

Table 16, below, provides a breakdown of the reason-codes associated with approved change orders to date. Of the 6 projects evaluated, this project realized the highest percent of change orders for design error and omissions, totaling 45.7% of the total value of change orders approved on this project.

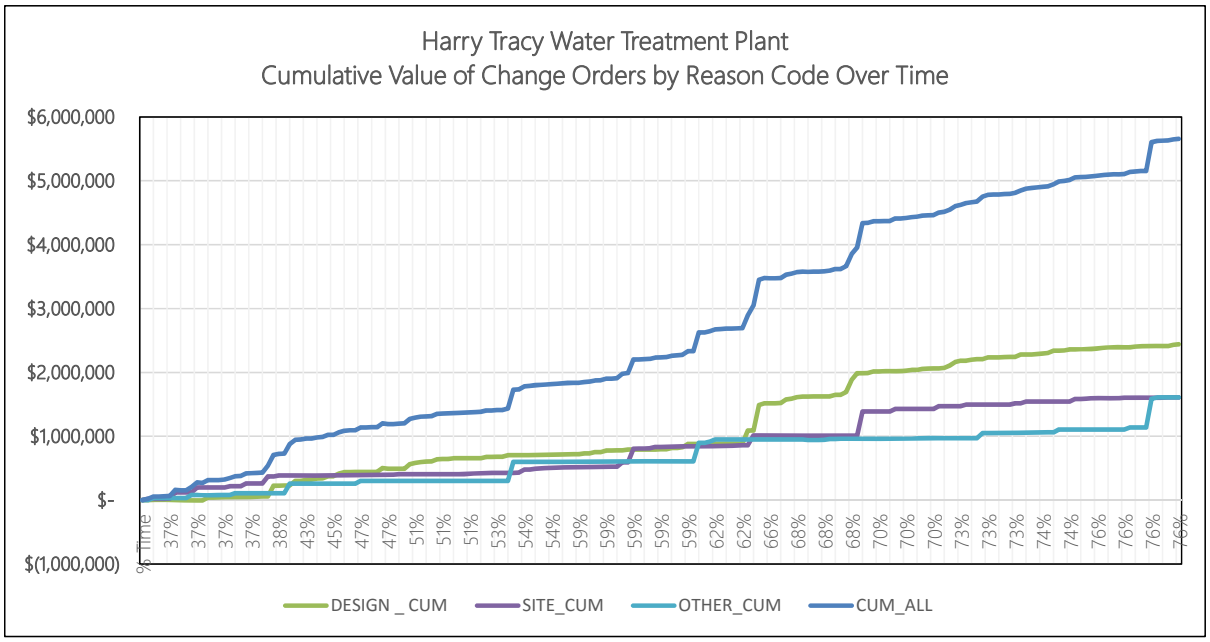
Table 16 - Change Order Analysis by Reason Code

Allocation of Approved Change Orders by Cause				
	No. of Change Orders	% of Total CO	CO Amount	% of CO Amount
Differing Site Conditions	51	32.3%	$1,471,138	32.6%
Design Omission	39	24.7%	$911,276	20.2%
Design Error	35	22.1%	$1,150,008	25.5%
Owner Request	18	11.4%	$206,544	4.6%

Allocation of Approved Change Orders by Cause				
Other	15	9.5%	$770,916	17.1%
Regulatory Requirement	0	0%	$0	0%
Risk Mitigation	0	0%	$0	0%
Total	158	100.0%	$4,509,882	100.0%

Figure 6, below, shows that changes occurred throughout this project under a high frequency lower dollar volume than the other 5 projects evaluated. The project team has had to deal with a high volume of requests for change from the general contractor which in many instances did not have merit, yet required program management resources to address. Aside from the time extension from the 2005 Baseline, this issue was a driver in the 79% increase to construction management costs as well as the 21.9% management costs (ref. Table 14 for details). Detailed approved change order information is provided as EXHIBIT 4.

Figure 6 - Harry Tracy Water Treatment Plan Change Order Approval Over Time By Reason Code



Crystal Springs/San Andreas (CSSA) Transmission System Upgrade (CUW37101)

The Crystal Springs/ San Andreas (CSSA) Transmission System Upgrade is a series of inlet and outlet structures, pipelines, and pumping facilities that move water from the Crystal Springs Reservoirs north to San Andreas Lake and the Harry Tracy Water Treatment Plant, and then into the water distribution pipelines. This transmission system ensures that the San Francisco Peninsula's emergency and supplemental water supply can be quickly moved into the water pipes leading to residential taps. The construction contract for the CSSA Transmission System upgrade was awarded to Kiewit Infrastructure West, Inc. Design of this project, meanwhile, was performed by URS Corporation and SFPUC. The project area (including all construction, staging, and access areas) encompasses approximately 135 acres and is comprised of seven distinct project components running approximately 7.6 miles across the Peninsula Watershed. The project includes upgrades to the water transmission pipeline adjacent to the Sawyer Camp Trail, the outlet structures at Crystal Springs and San Andreas reservoirs, and the Upper Crystal Springs Dam culverts, and the construction of a new Crystal Springs Pump Station. The project consists of improvements to facilities necessary to transport water from the Upper Crystal Springs Reservoir, through the Lower Crystal Springs Reservoir, to the San Andreas Reservoir, and, ultimately to the Harry Tracy Water Treatment Plant. Specifically, improvements will be made to the Upper Crystal Springs Dam discharge culverts, the Lower Crystal Springs outlet structures, the Crystal Springs Pump Station (CSPS), the Crystal Springs/San Andreas Pipeline, and the San Andreas outlet structures. The 2005 Baseline project completion date was estimated to be reached by April 1, 2014, while the current forecast project completion date is June 30, 2015, approximately 455 days beyond the initial project completion date. Table 17, below, provides a detailed budget component breakdown and variance analysis between the 2005 Baseline Budget and the current approved budget.

Table 17 - CSSA Budget Comparison (2005 Baseline to Current Budget)

Budget Summary						
	2005 Baseline Budget	% of Budget	Current Approved Budget	% of Budget	Difference	% Difference
Construction/Contingency	$112,046,000	75.4%	140,153,985	69.8%	$28,107,985	25.1%
Environmental Compensation/Mitigation	$3,125,000	2.1%	430,000	0.2%	($2,695,000)	-86.2%
Security Upgrades		0.0%	89,000	0.0%	$89,000	0%
Sub - Total Construction	**$115,171,000**	**77.5%**	**140,672,985**	**70.1%**	**$25,501,985**	**22.1%**
Management Cost	$5,026,922	3.4%	5,324,042	2.7%	$297,120	5.9%
Pre-Design Planning	$3,244,605	2.2%	3,985,042	2.0%	$740,437	22.8%
Environmental Planning & Review	$2,641,892	1.8%	4,008,455	2.0%	$1,366,563	51.7%
Environmental Construction Compliance	$0	0.0%	4,482,256	2.2%	$4,482,256	0%
Engineering/Design	$10,854,235	7.3%	11,717,891	5.8%	$863,656	8.0%
Construction Management	$10,084,000	6.8%	25,321,400	12.6 %	$15,237,400	151.1 %
Construction Management	*$10,084,000*	*6.8%*	*17,582,995*	*8.8%*	*$7,498,995*	*74.4%*
Engineering Support		*0.0%*	*7,738,405*	*3.8%*	*$7,738,405*	*0.0%*
Department & Agency Support/Fees	$1,120,000	0.8%	1,651,035	0.8 %	$531,035	47.4 %
Legal ROW & Support		*0.0%*	*235,049*	*0.1%*	*$235,049*	*0%*
Operations Support	*Incl. Above*	*0.0%*	*1,415,986*	*0.7%*	*$1,415,986*	*0%*
Art Commission Fee	$440,000	0.3%	80,500	0.0%	($359,500)	-81.7%
Real Estate		0.0%	56,090	0.0%	$56,090	0%
Director's Reserve		0.0%	3,479,811	1.7%	$3,479,811	0%
Sub- Total Soft Cost	**$33,411,654**	**22.5%**	**$60,106,522**	**29.9%**	**$26,694,868**	**79.9%**
Total Budget	**$148,582,654**		**$200,779,507**		**$52,196,853**	**35.1%**
% Soft Cost to Construction Budget		29.0%		42.7%		

Similar to the Harry Tracy Water Treatment Plant project, this project realized many (number) of changes resulting from design errors and omissions (39.1%) and about just as many encountered conditions (44.7%). Also consistent with the project dynamics of Harry Tracy Water Treatment Plan project, this project expended a high level of administrative effort answering extensive requests for information (RFI) issued by the contractor, many of which were extraneous, yet needed to be evaluated and answered. As shown in Table 18, there are yet a significant amount of potential change orders and trends which are expected to double the forecast value of expected changes on this project.

Table 18 - Evaluation of Construction Costs and Change Orders

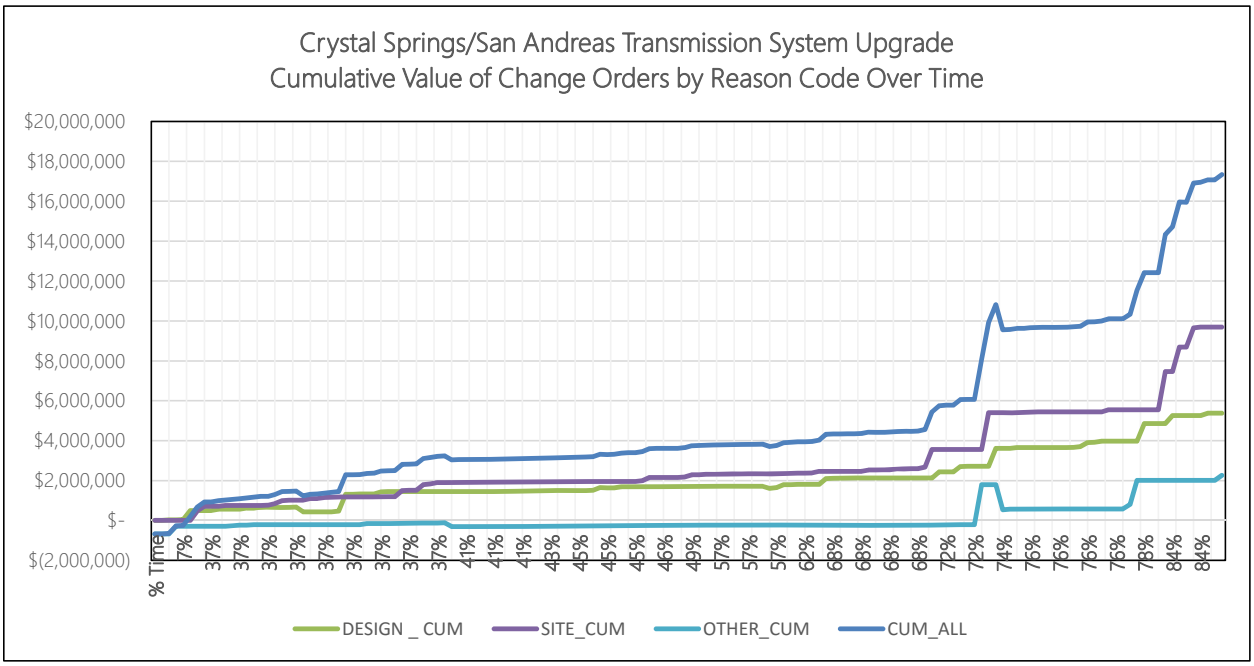
Construction Cost Summary			
	Amount		Percentage As Percent of Original Contract Amount
Original Contract Amount	$99,763,000	(a)	
Approved Change Orders	$12,413,160	(b)	12.4%
Current Contract Amount	**$112,176,160**	(c)=(a)+(b)	
Pending Change Orders	$4,960,517	(d)	
Potential Change Orders	$1,572,030	(e)	
Trends	$17,549,951	(f)	
Unapproved Changes Total	**$24,082,498**	(g)=(d)+(e)+(f)	24.1%
Current Contract Forecast Amount	**$136,258,658**	(h)=(c)+(g)	36.6%
Difference From Bid Amount	$36,495,658	(i)=(h)-(c)	
Current Construction Contingency	$36,429,379	(j)	36.5%
Forecast Contingency Remaining	($66,279)	(k)=(i)-(j)	

Table 19 - Change Order Analysis by Reason Code

Allocation of Approved Change Orders by Cause				
	No. of Change Orders	% of Total CO	CO Amount	% of CO Amount
Differing Site Conditions	52	36.9%	$5,553,813	44.7%
Design Omission	54	38.3%	$2,371,952	19.1%
Design Error	6	4.3%	$2,479,914	20.0%
Owner Request	4	2.8%	$405,509	3.3%
Other	14	9.9%	-$1,281,949	-10.3%
Regulatory Requirement	7	5.0%	-$346,496	-2.8%
Risk Mitigation	4	2.8%	$3,230,417	26.0%
Total	**141**	**100.0%**	**$12,413,160**	**100.0%**

As shown in Figure 7, below, the rate of change is materially growing towards the end of the project (starting around 72% time complete) which does not lend itself to completion of work on time and/or avoiding claims being submitted by the general contractor associated with acceleration or delays. We understand there have been schedule issues throughout this project with the general contractor submitting multiple recovery schedules. The additional feature is that the rate of change is expected to increase significantly as there are remains $19 million (ref. Table 18 trends and potential change orders) of changes expected to be realized (in the last 25% of the project duration). Detailed approved change order information is provided as EXHBIT 5.

Figure 7 - CSSA Change Order Approval Over Time By Reason Code



Lincoln Pipeline (CUW-31201)

Under this project approximately 13,000 LF of 48-inch steel pipe was installed. The project resulted in litigation with the contractor. Reportedly the contractor was financially over-extended, which resulted in the SFPUC issuing joint checks to subcontractors and suppliers. The designer for this project was SFPUC while the contractor was Mitchell Engineering. This project was started on June 21, 2004 and completed on November 10, 2006. The 2005 Baseline budget for this project[12] totaled $14.7 million while the reported current budget was $13.2 million. Of this total, the construction contract totaled $8,644,069 and there were 15 approved change orders totaling $740,043[13]. RWBC did not attempt to verify the accuracy of the change order data provided for this project in the same manner as on other WSIP projects and assumed that such is comprehensive and reflective of actual conditions. Additional budgetary information is not available in a manner that allows for a detailed comparison of project data as provided for the previous five projects.

CHANGE MANAGEMENT

In addition to the evaluation of change order reason codes and approval rates for the 5 projects evaluated above, we also evaluated the entire population of change orders for the WSIP[14]. Program wide there were 2,451 approved change orders with an aggregate value of $321.2 million as shown on Table 20, below. In aggregate, the changes resulting from differing site conditions comprise the majority of approved change orders to date at 73.10%.

[12] March 2007 WSIP Quarterly Report

[13] Application for Payment #24 project CUW-31201 shows 11 approved change orders totaling $447,367.39 while data from WSIP program management team shows there were 15 approved change orders totaling $740,043. For this section we utilized the data provided by the WSIP program management team.

[14] Change order data provided by WSIP program management team July/August 2014

Table 20 - Overall WSIP approved change orders[15]

Reason for Change	Number of Changes	Value of Changes	As % of total
Site Conditions	680	$234,754,062.59	73.10%
Design Error	311	20,985,000.28	6.53%
Customer Request	482	18,657,853.66	5.81%
Other	410	18,324,444.46	5.71%
Design Omissions	385	11,840,880.29	3.69%
Regulatory Requirements	143	9,812,388.39	3.06%
Risk Mitigation	40	$ 6,785,008.69	2.11%
Total	2,451	$321,159,638.37	100.00%

Finding detailed change order data covering a similar period, sample size, and detailed information on reason codes is a very difficult task. However, RWBC has a comparable set of data for a large hub airport in the Southeast United States which routinely implements $100-$300 million annual in capital spend. For this client, the sample size is 3,676 change orders approved between 2007-2014 on 223 completed and active construction projects delivered primarily through a design-bid-build, hard bid method with a small proportion of projects delivered using a design-build, hard bid method. We fully recognize that the nature, location, and administration of these projects is different, yet believe this data is useful to highlight different behaviors of change order approval reason codes in different conditions. RWBC was authorized to provide the data results only for this sample size.

In order to provide a comparison of reason codes we summarized WSIP codes into three: (1) site conditions; (2) design errors and omissions; and (3) other. As shown on Table 21, the breakdown of WSIP change order reason codes is shown as column "A" while the benchmark data shown as column "B". We note that this comparable data is NOT intended to be used to evaluate any WSIP change

[15] Change order data provided by WSIP program management team July/August 2014

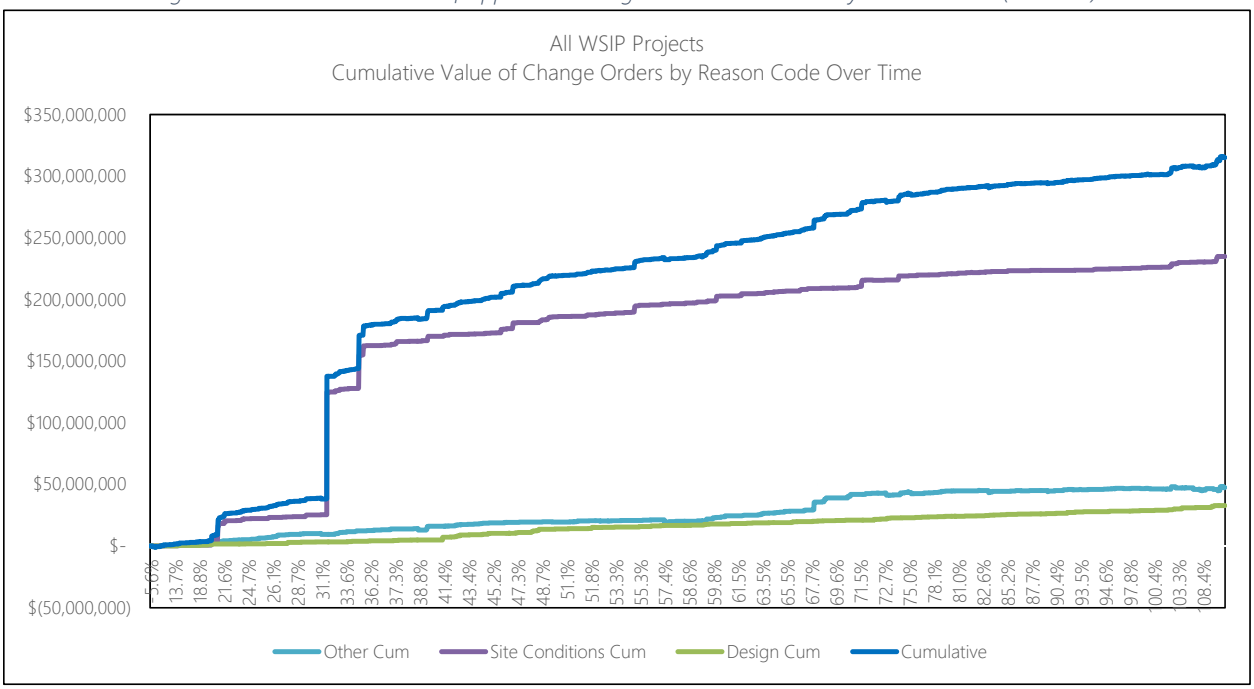
order behavior, but rather to provide context on the breath of variances that can occur in change order approval behavior.

Table 21 - Change Order Reason Code Benchmark

Reason for Change	Number of Changes	Value of Changes	As % of Total	Comparable Entity As % of Total
			(A)	(B)
Site Conditions	680	$234,754,062.59	73.10%	23.62%
Design Errors and Omissions	696	$ 32,825,880.58	10.22%	27.56%
Other	1,075	$ 53,579,695.21	16.68%	48.82%
Total	2,451	$321,159,638.37	100.00%	100.00%

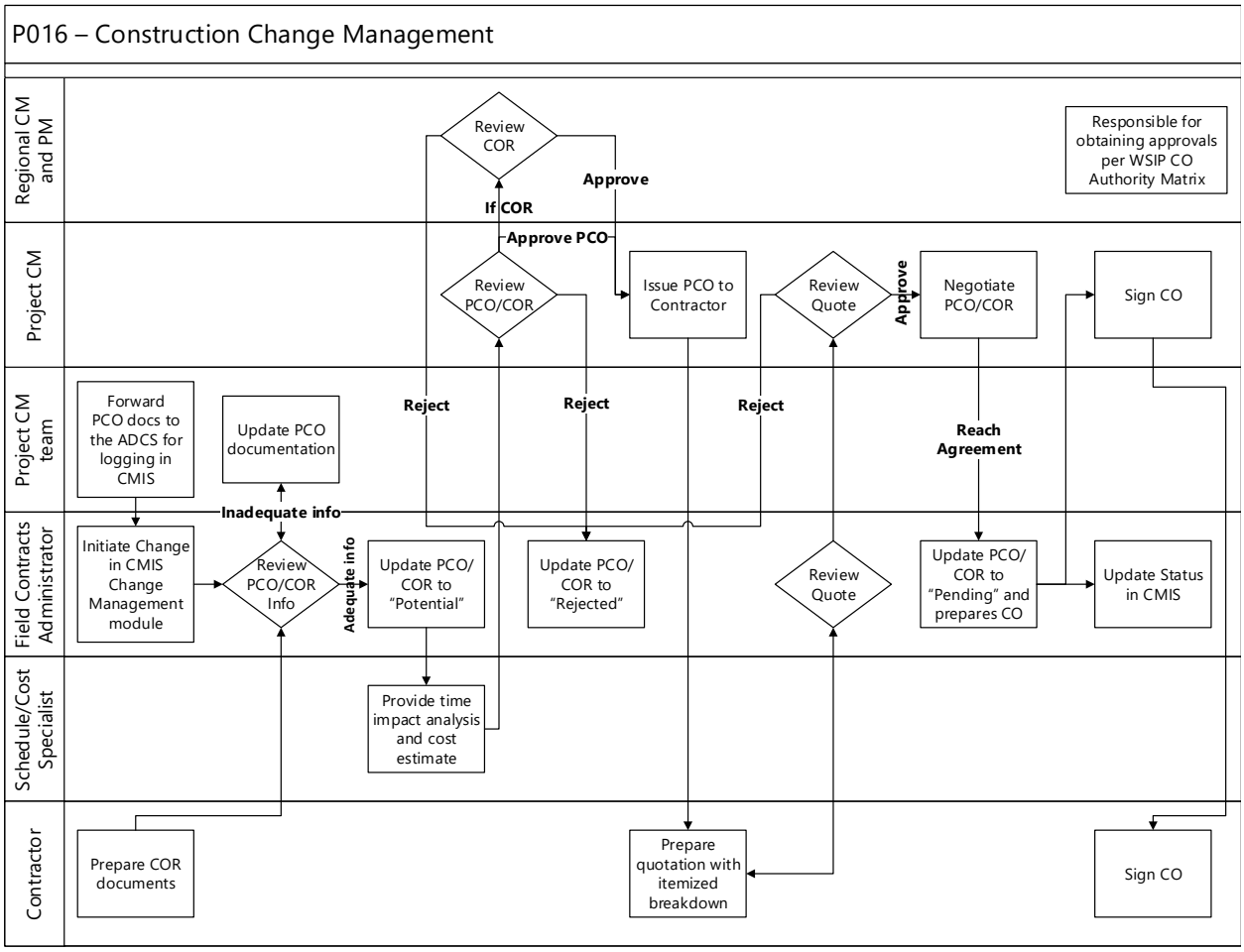
Another interesting aspect of WSIP change order approval behavior is the rate and time (when during the completion of a project) when changes were approved. As shown in Figure 8, below, overall, the WSIP change order approval rates are consistent with a proactive approach to change order management as we see steady slopes (aside from the large changes to the Calaveras Dam Replacement Project). As can be expected, there are also singular projects that do not necessarily exhibit this behavior such as CSSA, which can be expected on a program of this magnitude. We note that, aside from the drastic increase in cumulative value of approved Change Orders driven by the Calaveras Dam Replacement project, the WSIP project/program team readily moved to review and approve Change Order requests in a timely fashion (rather than letting open issues remain until the end of the project which would be reflected by much higher slope increases to cumulative curves shown in Figure 8, below.

Figure 8 – Cumulative Value of Approved Change Orders Over Time By Reason Code (All WSIP)



The WSIP program management team followed a prescribed methodology for identification, review, and approval of construction change orders. Our site visits show that in general all visited projects followed the same methodology for administering the construction change order process. There may be stylistic differences which are reflective of each staff's own approach to achieving prescribed activities within a process, yet this is to be expected. Figure 9, below, provides a detailed process flow map developed by RWBC to highlight the steps involved in the preparation, review, and approval of construction change orders.

Figure 9 - Construction change management process flowchart



PROJECT DELIVERY COSTS

As defined for the WSIP, project delivery covers a wide range of elements as follows: project management/program management, planning, environmental (CEQA, permitting, construction compliance), design, construction management, and engineering support during construction. The specific categories of project delivery/soft costs for the 5 projects analyzed (and the WSIP) are outlined on Table 22, below.

Table 22 - Project Delivery Costs Categories and Cost Allocation Methodology

Project Delivery Element	Description	Cost allocation (allocated/direct)
Management Cost	Program and project management costs	Allocated for certain types based on ratio of active construction as well as direct for others such as SQS.
Pre-Design Planning	To enable project definition, review of alternatives, program-level schedule/cost	Direct
Environmental Planning & Review	Similar to planning but to understand regulatory environment, permits, identification of agencies with jurisdiction on project; associated field inspection	Direct with exception of the Programmatic EIR which was a one-time all-projects effort done under WSIP program funding.
Environmental Compliance	Coordination with regulatory agencies	Direct
Engineering/Design	Design of the work	Direct
Construction Management	Management of the project	Direct
Department & Agency Support/Fees	Costs for staff assigned to a project	Direct
Legal ROW & Support	Right of way/real estate support	Direct
Operations Support	Operations support of projects, including shutdowns during construction.	Direct
Art Commission Fee	Art commission related costs	Direct
Real Estate	Real estate	Direct
Director's Reserve	Funds held in reserve within individual project budgets which may be used for unexpected needs that arise only if approved in writing by the WSIP Director	n/a

As shown in Table 23, below, the program delivery costs in the WSIP, cover a very broad set of costs which include phases in the program, such as planning, which may not be used by other comparable agencies in their definition of project delivery costs. This is an important feature to understand, especially if project delivery costs on the WSIP are compared to peer agencies and/or other capital programs' project delivery costs. Also important to understand are the various factors that can impact the magnitude of soft costs including: project duration, project scope, complexity of project scope, project administration requirements, and cost charging methodology to projects, for example. Further, much more information is reflected in the current estimate than the 2005 Baseline estimate: many differing site conditions have been realized, administrative requirements are better gauged given known and established (good or bad) relations between project participants such as the designer and general contractor (more challenging administrative conditions, where there may be friction between designer/owner/contractor would require a higher level of involvement by the owner resulting in higher project management costs, for example). Project delivery evaluation is provided with this context in mind. We also note that the percent change evaluation does not reflect the weight of each parameter evaluated (e.g. a larger value will have less sensitivity to budget changes than a smaller value). However the data in Table 23, below, is useful to understand and evaluate how each element of the project delivery budget is behaving compared to the 2005 Baseline estimate.

RWBC conducted an evaluation of various aspects of project delivery costs to see if we could identify data that could be used to identify lessons learned. We will highlight and discuss those elements shaded in blue on Table 23, below, which includes: management costs, environmental review, construction management, and Department & Agency Support/Fee.

Table 23 – Budget Comparison 5 Projects

	Calaveras Dam Raplacement	New Irvington Tunnel	Bay Division Pipeline - 3 Projects	Harry Tracy Water Treatment Plant	Crystal Springs/ San Andreas Tranmission System Upgrade	Average (5 Projects)
Budget Element	**% Change Current to 2005 Baseline**					
Construction/Contingency	188.69%	60.06%	-10.86%	57.67%	25.09%	50.41%
Environmental Avoidance/Mitigation	-90.40%	-97.92%	-94.89%	-82.42%	-86.24%	-92.47%
Security Upgrades	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Sub - Total Construction	**172.37%**	**56.55%**	**-14.69%**	**54.84%**	**22.14%**	**44.80%**
Management Cost	97.49%	2.82%	-41.27%	21.87%	5.91%	4.23%
Pre-Design Planning	21.80%	6.22%	-45.73%	92.78%	22.82%	1.51%
Environmental Planning & Review	213.39%	27.81%	-33.90%	-23.36%	51.73%	43.64%
Environmental Compliance	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Engineering/Design	45.72%	24.38%	-10.43%	39.20%	7.96%	16.83%
Construction Management	263.92%	177.72%	12.85%	150.67%	151.10%	117.93%
Construction Management	*219.45%*	*101.51%*	*-11.07%*	*78.95%*	*74.37%*	*71.92%*
Engineering Support (Const)	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*
Department & Agency Support/Fees	38.87%	-45.09%	97.44%	212.44%	47.41%	71.53%
Legal ROW & Support	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*
Operations Support	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*
Art Commission Fee	-98.75%	-96.71%	-79.60%	97.53%	-81.70%	-40.34%
Real Estate	0.00%	2.07%	55.90%	0.00%	0.00%	39.38%
Director's Reserve	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Sub- Total Soft Cost	**162.58%**	**63.98%**	**4.71%**	**100.37%**	**79.90%**	**66.91%**
TOTAL	**170.11%**	**57.98%**	**-10.58%**	**66.04%**	**35.13%**	**49.62%**
Original Contract Value	$259,571,850	$226,657,700	$335,958,242	$174,197,000	$99,763,000	$219,229,558
Approved Change Orders	$165,239,289	$28,137,232	$29,965,900	$4,344,955	$12,413,160	$48,020,107
Current Contract Value	$424,811,139	$254,794,932	$365,924,142	$178,541,955	$112,176,160	$267,249,666
Projected Time Extensions	**82.37%**	**32.64%**	**26.79%**	**8.52%**	**52.35%**	**37.27%**

On average, the five projects evaluated project additional construction budget requirements totaling 50.41% and projected durations which are 37.27% longer than those identified in the 2005 Baseline budget. Overall, soft costs increased on average by 49.62%, which roughly correlates to the percent change in construction budget estimates yet somewhat higher than the overall projected increases to performance periods. Within the soft costs we evaluated certain elements to highlight certain variances that may not correlate to construction and performance period duration such as Management Costs – 4.2%, Construction Management – 117.9%, and Department/Agency Costs/Fees – 71.5%.

For Construction Management costs we conducted a unit price budget analysis as shown in Table 24, below. The unit price comparison performed entailed calculating a daily Construction Management rate per the original project duration and compared this metric using current forecast Construction Management costs against current estimate project durations: this is another way to view the original assumed daily cost to perform this function compared to current estimated conditions. As previously explained there are many concurrent factors that can impact these costs, however, it is interesting to see how Bay Division Pipeline Projects were able to reduce Construction Management costs given a moderate increase to the forecast project duration. We also note that Construction Management costs are directly charged to each project based on actual staff/hours worked.

Table 24 - Construction Management Costs for 5 Projects Evaluated

	2005 Baseline Budget Construction Management Costs	Current Budget Construction Management Costs	Original Project Duration (Days)	Current Project Duration (Days)	2005 Baseline CM $/Day	Current CM $/Day	% Increase (2005 Baseline CM $/Day vs. Current CM $/Day)
	(A)	(B)	(C)	(D)	(E)=(A)/(C)	(F)=(B)/(D)	(G)=(F)-(E)/(E)
Calaveras Dam Replacement	$21,664,466	$69,206,208	1,458	2,659	$14,859	$26,027	75.16%
New Irvington Tunnel	$10,164,000	$20,481,156	1,388	1,841	$7,323	$11,125	51.92%
Bay Division Pipeline - Tunnel, Pipeline and BDPL 1&2	$43,689,000	$38,853,788	1,855	2,180[16]	$23,552	$17,823	-24.33 %
Harry Tracy Water Treatment Plant	$14,842,878	$26,561,264	1,443	1,566	$10,286	$16,961	64.89%
Crystal Springs/ San Andreas Transmission System Upgrade	$10,084,000	$17,582,995	978	1,490	$10,311	$11,801	14.45%

As previously discussed, Management Costs are for program management services allocated to projects using two primary methodologies as described in the preceding section.

[16] 1,946 for the Bay Tunnel's (CUW36801) construction duration + 234 days for the BDPL 1&2 (CUW36803) construction which occurred prior to the Tunnel's NTP. The Bay Division Pipeline (CUW36802) construction was concurrent with the Bay Tunnel's construction, and therefore no duration adjustment was required.

Table 25 - Management Costs for 5 Projects Evaluated

Project	2005 Baseline Budget- Management Costs	Current Budget - Management Costs	Original Project Duration (Days)	Current Project Duration)	2005 Baseline CM $/Day	Current CM $/Day	% Increase (2005 Baseline CM $/Day vs. Current CM $/Day)
	(A)	(B)	(C)	(D)	(E)=(A)/(C)	(F)=(B)/(D)	(G)=(F)-(E)/(E)
Calaveras Dam Replacement	$7,600,042	$15,009,552	1,458	2,659	$5,213	$5,645	8.29%
New Irvington Tunnel	$6,484,911	$6,667,675	1,388	1,841	$4,672	$3,622	-22.48%
Bay Division Pipeline – Tunnel, Pipeline and BDPL 1&2	$17,476,000	$10,263,131	1,855	2,180	$9,421	$4,708	-50.03 %
Harry Tracy Water Treatment Plant	$4,947,423	$6,029,516	1,443	1,566	$3,429	$3,850	12.30%
Crystal Springs/ San Andreas Transmission System Upgrade	$5,026,922	$5,324,042	978	1,490	$5,140	$3,573	-30.48%

As shown on Table 25, above, it is interesting to note that although the average overall increase in Management Costs for the five projects increased on average by 4.23%, the unit price based on applicable project durations for 3 out of the 5 projects, actually decreased from the 2005 Baseline budget projection. Even the largest budget increase to Management Costs realized on the Calaveras Dam Replacement project has a resulting unit price that is only 8.29% higher than the 2005 Baseline estimate. In general this cost element behaves as would be expected, given that a ramp down in the program should result in lower unit costs. Similar metrics can be developed using the ratio of construction value (original and current) compared to construction management costs to test correlation of budgeting approaches in 2005 and current.

The project delivery cost that behaved in a manner that significantly deviates from expected outcomes are Department/Agency Costs-Fees. In 2007 Agency Fees were removed from "Dept. & Agency Fees", and this category was renamed "Other SFPUC/City Departments". Agency Fees were assigned to "Management Costs", and additional detail was provided for what comprised "Other SFPUC/City Departments". This additional detail included identifying costs by "Legal Project Support" and "Operations Support" whose costs were previously included in "Dept. & Agency Fees", plus adding a

new category of cost "Legal ROW Support". Legal ROW Support, which represents 0.84% of total Project Delivery Costs, was previously not included anywhere in the WSIP cost forecasts. However, had it been included in the 2005 Budget, these costs would have been included in "Dept. & Agency Fees". Given the size and complexity of the WSIP, we view this likely oversight in the 2005 budget as a minor budget refinement in 2007, but one that should be included in the SSIP from the start. We have not adjusted the 2005 and 2014 information presented in this report to reflect these budget realignments. However, to illustrate the relatively small impacts these realignments would have, and to provide an accurate 2005 to 2014 comparison of the Management Costs and Dept. & Agency Fees categories, Table 26, below, presents the data for these two categories in their original 2005 categories. Placing the $3.5 million in Agency Fees included in the 2014 budget back into its 2005 category does not materially change the budgets when compared to the overall Project Delivery costs.

Table 26 - Management and Dept. Agency Costs Budget Comparison 2005 to 2014

	Management Cost			Dept & Agency Fees					Total
	Program	Project	Total	Agency Fees	Legal ROW Support	Legal Project Support	Operations Support	Total	Project Delivery Costs
2005	$55,889,000	$123,111,973	$179,000,973	Included	Not Budgeted	Included	Included	$24,294,000	$869,553,000
2014	$68,803,635	$147,169,646	$215,973,281	$0	$10,658,874	$14,729,015	$25,395,501	$50,783,390	$1,273,087,977
Agency Fee Adjustment	($2,052,579)	($1,457,779)	($3,510,358)	$3,510,358	$0	$0	$0	$3,510,358	$0
Adjusted 2014	**$66,751,056**	**$145,711,866**	**$212,462,922**	**$3,510,358**	**$10,658,874**	**$14,729,015**	**$25,395,501**	**$54,293,748**	**$1,273,087,977**
% Variance	-2.98%	-0.99%	-1.63%	0.00%	0.00%	0.00%	0.00%	6.91%	0.00%
Variance % of Project Delivery Costs	-0.16%	-0.11%	-0.28%	0.28%	0.00%	0.00%	0.00%	0.28%	0.00%

As shown on Table 27, below, 4 of the 5 projects budgets increased from the 2005 Baseline estimate, which follows a similar trend when evaluated on a unit price basis.

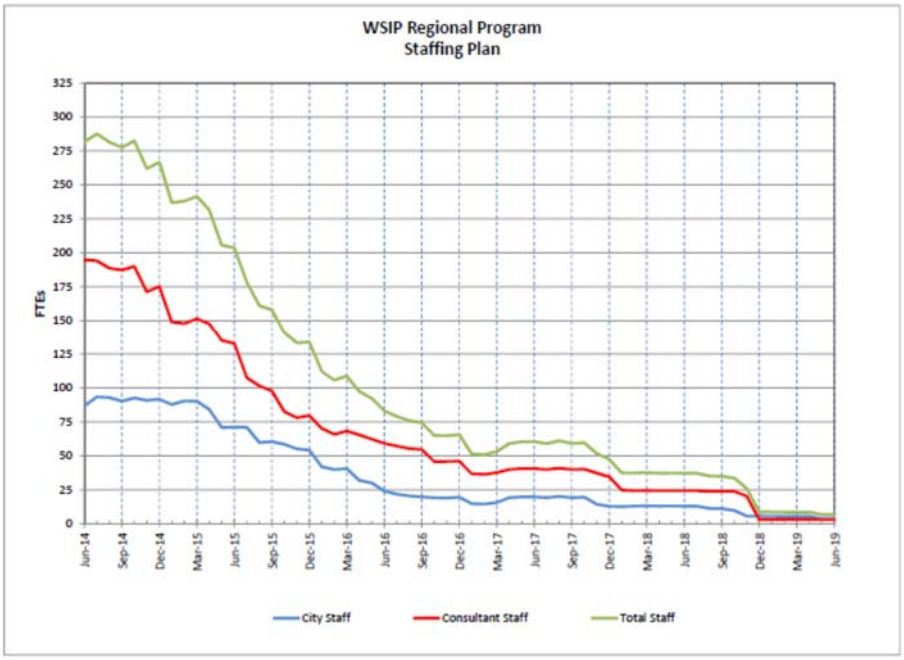
Table 27 - Department/Agency Costs/Fees for 5 Projects Evaluated

Project	2005 Baseline Budget- Department- Agency Costs	Current Budget - Department- Agency Costs	Original Project Duration (Days)	Current Project Duration)	2005 Baseline Fee $/Day	Current Fee $/Day	% Increase (2005 Baseline Fee$/Day vs. Current Fee $/Day)
	(A)	(B)	(C)	(D)	(E)=(A)/(C)	(F)=(B)/(D)	(G)=(F)-(E)/(E)
Calaveras Dam Replacement	$1,928,000	$3,633,169	1,458	2,659	$1,322	$1,366	3.33%
New Irvington Tunnel	$1,694,000	$930,510	1,388	1,841	$1,220	$505	-58.59%
Bay Division Pipeline Upgrade Projects	$4,369,000	$8,626,055	1,855	2,180	$2,355	$3,957	68.00%
Harry Tracy Water Treatment Plant	$1,237,000	$3,865,346	1,443	1,566	$857	$2,468	187.93%
Crystal Springs/ San Andreas Transmission System Upgrade	$1,120,000	$1,767,005	978	1,490	$1,145	$1,186	3.56%

Given that most of project delivery elements are allocated based on direct costs and that in general delivery costs have increased at rates higher than either approved increases to construction and in certain cases time, would lead to the conclusion that project delivery costs to implement the remaining WSIP work require higher levels of effort than initially thought, slower ramp down of soft costs given less construction value to oversee, or a combination of these factors. However, the rate of ramp down as planned appears to properly reflect adequate rates of ramp down activity[17] as shown in Figure 10, below.

[17] Staffing level data provided by WSIP program

Figure 10 - WSIP Program Staffing Plan



In aggregate the 2005 Baseline showed that project delivery costs were 31.4% of the construction budget, while the current approved budget shows this same value to be 45.65%., representing an increase of 45.4%[18]. The overall increase in project delivery costs for the WSIP totaling 45.4% would compare to the 55.9% increase for the five projects evaluated. As an additional data point, we also compiled project delivery cost information for project delivery with the following results: Seattle Public Utility Commission 53.9% rate for project delivery costs as a percent of construction[19] and Washington Suburban Sanitary Commission at 25.2%[20] for soft costs.

[18] FY 2013-2014 WSIP Quarterly Report, 3rd Quarter
[19] Seattle Public Utility Commission, December 2011 Estimating Guidelines
[20] WSSC FY 2015-2010 Capital Improvement Plan October 2013

CONSTRUCTION BIDDING

With the exception of the Tesla Treatment Facility – CUW 38401 which was delivered using a design-build delivery method, projects within the WSIP were delivered through a design-bid-build methodology utilizing a competitive bid process that resulted in the award of a lump sum contract to the lowest bidder that submitted a bid meeting all bid requirements. On larger projects (typically greater than $20 million in construction value), there was a prequalification process to ensure that only bidders met project requirements were allowed to bid. Smaller value projects (typically less than $20 million in construction value) did not utilize prequalification as part of the bid process. WSIP construction projects were awarded in the period from October 2003 through April 2014, with the majority of bids received from 2008 to 2012[21]. The bidding environment during the period of highest construction bid activity (2008-2012) was also very favorable given the significant economic downturn experienced by the US economy. As shown in Table 28, below, the majority of bids received benefitted from very flat escalation at 1.17%, [22] versus 3.45% average for the period 2003-2007, for example.

Table 28 - Engineering New Record - Construction Cost Index (CCI)[23]

YEAR	MONTH	CCI	%CHG	AVG. Period
2014	Aug	10,897.59	0.00%	
2014	Jul	10,897.59	-0.02%	
2014	Jun	10,899.59	0.03%	
2014	May	10,895.84	0.01%	N/A
2014	Apr	10,894.84	0.03%	
2014	Mar	10,891.84	-0.03%	

[21] Bid data contained in EXHIBIT 6 provided by WSIP program management team

[22] This is a national average. Bidding conditions in San Francisco may have differed. Data only intending to show general bidding conditions.

[23] The Engineering News Record – CCI is comprised of 200 hours of common labor at the 20-city average of common labor rates, plus 25 cwt of standard structural steel shapes at the mill price prior to 1996 and the fabricated 20-city price from 1996, plus 1.128 tons of Portland cement at the 20-city price, plus 1,088 board-ft of 2 x 4 lumber at the 20-city price. Source www.enr.com

YEAR	MONTH	CCI	%CHG	AVG. Period
2014	Feb	10,894.59	-0.02%	
2014	Jan	10,896.34	0.00%	
2013	Dec	10,898.84	5.25%	
2012	Dec	10,355.09	1.47%	
2011	Dec	10,204.79	0.83%	
2010	Dec	10,120.29	4.09%	1.17%
2009	Dec	9,722.17	-0.61%	
2008	Dec	9,781.67	7.12%	
2007	Dec	9,131.81	0.25%	
2006	Dec	9,108.66	7.64%	
2005	Dec	8,462.45	2.84%	3.45%
2004	Dec	8,228.39	5.64%	
2003	Dec	7,788.80	1.89%	
2002	Dec	7,644.46		

More specifically RWBC evaluated all bid results on the WSIP and found that in aggregate, the low bid values were 16% lower than the aggregate value of Engineer estimates, representing bid underruns of $401.9 million. Aside from contingency, this underrun provided the WSIP program with funds to offset added costs of changes (2,451 approved change orders totaling $321.2 million – Reference Table 21 for more details. Summary metrics of bid results are provided in Table 29, below. Detailed bid result analysis is provided as EXHIBIT 6.

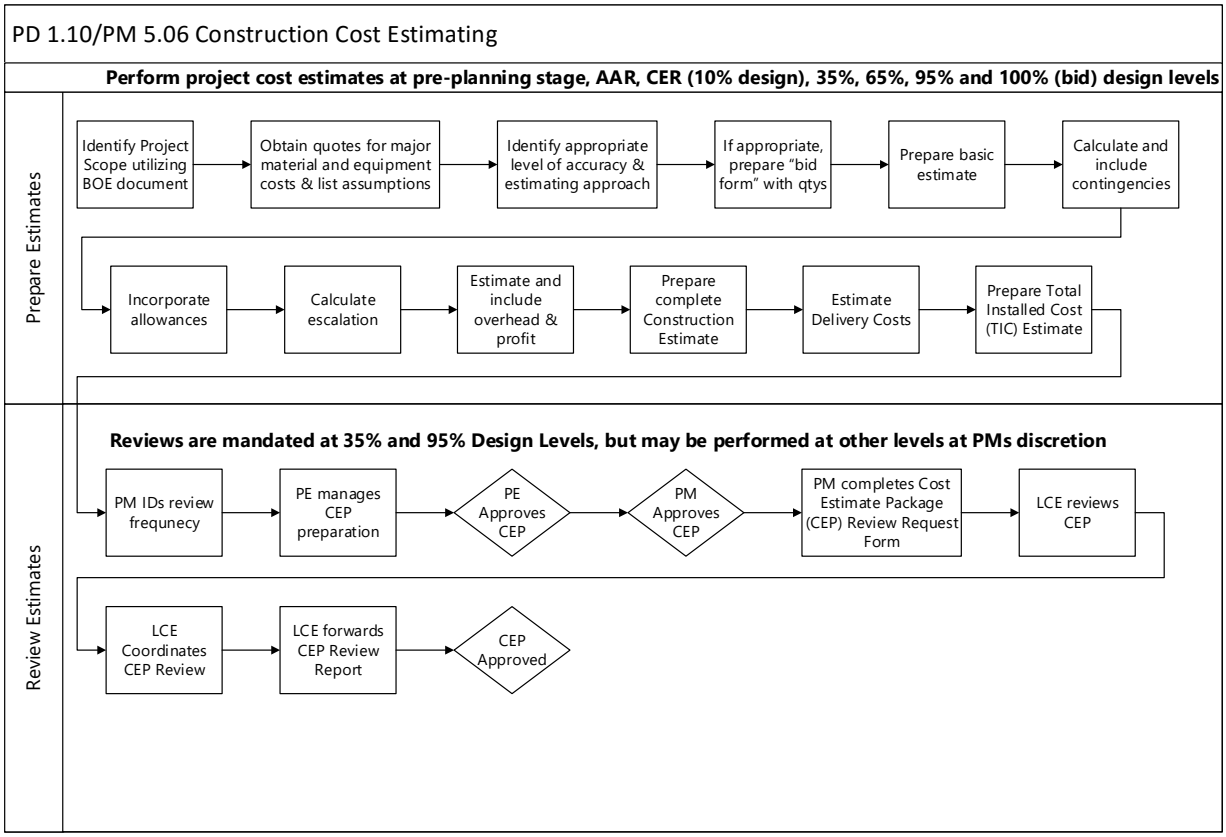
Table 29 - WSIP Bid Results Summary

Number of Bids in Population	88	EA
Smallest Bid	$ 233,917	Standby Power Facilities - East Bay
Largest Bid	$ 259,571,850	Calaveras Dam Replacement

Period	Engineer's Estimate	Low Bid	Variance
	(A)	(B)	(C)=(A)-(B)
2003-2007	$ 208,324,694	$ 212,781,072	$ (4,456,378)
2008-2012	2,223,182,787	1,822,511,357	400,671,430
2013-2014	36,200,000	30,478,235	5,721,765
Total	$ 2,467,707,481	$ 2,065,770,664	$ 401,936,817

Favorable bid results cannot solely be attributable to the general construction bid environment. Other key contributing factors also include project and program management staff administering the bid/award process and designs that are of a quality resulting in pricing that is consistent and which attracts competition. In addition, RWBC reviewed the cost estimating procedures which provide a systematic and prescribed methodology to ensure all key estimating areas are addressed, while providing flexibility to accommodate estimates of a wide range of projects, as implemented in the WSIP. To highlight this feature, RWBC develop a process map of the WSIP construction cost estimating process as shown in Figure 11, below.

Figure 11 - Construction cost estimating process flow chart



DISPUTED COSTS

With the mere undertaking of construction activity there is always the possibility that project participants may have differences of opinion. The construction contracts utilized in the WSIP as well as WSIP change management procedures provide a systematic approach to notification, review, and processing of items that may be disputed. Given the sensitivity of claim information, RWBC will limit its discussion on aggregated information with a focus on the nature of the dispute, as this is one of the areas that could

best provide lessons learned information. As shown on Table 30, below, to date there are 55 construction disputes submitted on the WSIP totaling $25.6 million, of which, 37 have been resolved.[24]

Table 30 - WSIP Disputed Costs Summary

Root Cause	Number	Value[25]
Interpretation of Specifications	42	$ 10,900,000
Interpretation of Contract Terms	3	7,800,000
Performance of Work	10	6,900,000
TOTAL:	**55**	**$ 25,600,000**
Total Resolved	37	
Total Under Various Levels of Resolution	18	

We have aggregated the disputed costs into three root causes: (a) interpretation of the specification documents; (b) interpretation of contract terms; and (c) performance of the work. Interpretation of specifications captures different interpretations on allowable material substitutions, project definition of contaminated area and limits, dewatering and unsuitable soil excavation, project tie-ins, and material removal requirements. Interpretation of contract terms includes quantity measurement (especially in projects where unit pricing is driver for payment) and definition of milestone dates. Of the 37 resolved claims, 7 were resolved at the project level, 6 at the regional level, and 24 at the program. Resolution of disputes and authority to resolve claims triggers the resolution chain to be followed. Based on our review of WSIP processes, we find that the project and program management team followed stated protocols for dispute resolution and claims management.

[24] The WSIP construction agreements have a specific definition of claims as limited to certified Government Claims. Given this narrow definition, we refer to what would normally be called 'claims' as 'disputes'.

[25] Includes amounts that are finalized as well as in process. As such, this value may change in a material amount depending final resolution of all claims and disputes.

DESIGN

The engineering/design function on the WSIP primarily followed the traditional method of engaging an engineering/design firm to develop drawings and specifications for the work. There were instances where SPFUC conducted design, however this is the exception rather than the rule. On a program of this magnitude, complexity, and with a high probability for encountering differing site conditions we would expect resulting design costs to reflect such risk. Overall the current budget for engineering-design is $302.7 million compared to a construction budget totaling $2,022.9 million, yielding a percent ratio of design budget to construction of 14.9%[26]. The average comparable ratio of design to construction budgets for the 5 projects evaluated is 6.52%. We note there were significant increases to the construction value, primarily driven by those realized in the Calaveras Dam Replacement project, which lowered this ratio from the 2005 Baseline estimate of 8.58% as shown on Table 31, below.

Table 31 - Engineering-Design Fees 5 Projects Evaluated

Budget Element	Calaveras Dam Replacement	New Irvington Tunnel	Bay Division Pipeline Tunnel	Harry Tracy Water Treatment Plant	Crystal Springs/ San Andreas Transmission System Upgrade	Average (5 Projects)
2005 Baseline Construction	$204,732,000	$173,247,000	$450,700,000	$126,346,000	$115,171,000	$214,039,200
Current Construction	$557,622,501	$271,219,398	$232,823,924	$195,638,299	$140,672,985	$279,595,421
2005 Baseline Engineering-Design	$19,491,323	$13,551,000	$33,062,638	$14,843,273	$10,854,235	$18,360,494
Current Engineering-Design	$28,403,242	$16,854,666	$13,522,844	$20,661,416	$11,717,891	$18,232,012
% Engineering-Design/Construction - 2005 Baseline	9.52%	7.82%	7.34%	11.75%	9.42%	8.58%
% Engineering-Design/Construction – Current	5.09%	6.21%	5.81%	10.56%	8.33%	6.52%
% Change Engineering-Design/Construction - 2005 Baseline to Current	-46.50%	-20.55%	-20.82%	-10.10%	-11.61%	-23.98%

[26] 2013/2014 Q3 WSIP Quarterly Report.

There are many parameters that impact resulting engineering-design fees including the scope of work to be designed, potential for risk – e.g. differing site conditions, type of work (e.g. wastewater) and available pool of qualified designers, performance period, and regulatory compliance requirements including building, environmental, or other similar requirement. As a point of reference we conducted research and found that the Seattle Public Utilities Commission's estimating guidelines utilize a budgeting value of 16.5%[27] for engineering/design costs, which falls in line with comparable values being realized in the WSIP. We stress that this comparison is only provided as a general reference as there is a wide range of values that are utilized by peer public utility commission agencies reflective of their approach to this function and the work to be accomplished.

Based on interviews conducted at each of the projects visited the feedback received shows the teams generally felt that the design efforts were good yet there are opportunities for improvement in areas of owner involvement, geotechnical investigations, and interface with project management team.

Another metric that can be utilized to evaluate progress and quality of design is to evaluate the level of Requests for Information (RFI) issued on projects. As with any metric, the resulting data can be misinterpreted and we, again, provide this information as another data point to evaluate a certain function. For example, based on our previous work performed for the RBOC in 2013 to evaluate cost and schedule to completion forecasts, we conducted extensive interviews with Harry Tracy Water Treatment Plant and the Crystal Springs/San Andreas Transmission Upgrade projects and found that many of the RFIs issued by the general contractor were voluminous in nature given the strained relationship with the contractor. To a lesser degree, project staff expressed that RFIs on these projects were the result of design issues such as differing marine conditions, shutdowns, and coordination of drawings. As shown in Table 32 - RFI totals for 5 projects compared to Design fees as percent of

[27] Seattle Public Utility Commission estimating guidelines, December 12, 2011

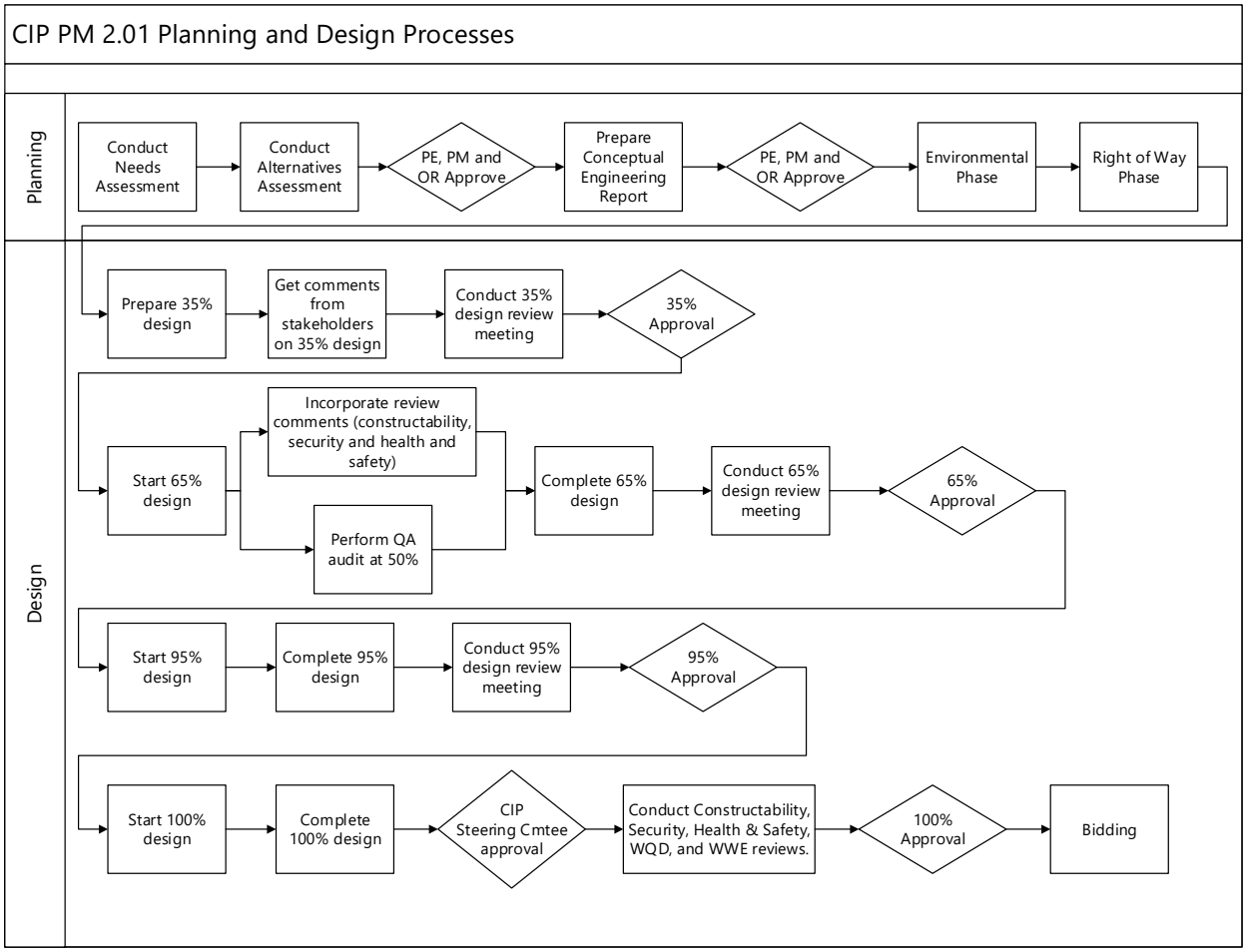
construction, below, we compared number of RFIs issued on the five projects analyzed against the value of design fees compared to construction value.

Table 32 - RFI totals for 5 projects compared to Design fees as percent of construction

Project	RFI (EA)	Current Design / Current Construction budget
Calaveras Dam Replacement	490	5.09%
New Irvington Tunnel	261	6.21%
Bay Division Pipeline Tunnel	52	5.81%
Harry Tracy Water Treatment Plant	1,263	10.56%
Crystal Springs/ San Andreas Transmission System Upgrade	1,387	8.33%

Based upon review of applicable documentation and interviews, we found that the project management team followed prescribed policies and procedures associated with the design process. RWBC also prepared a detailed process flow chart of the design (and planning) process to highlight the steps involved in developing design documents, in Figure 12, below.

Figure 12 - Planning and design processes flow chart

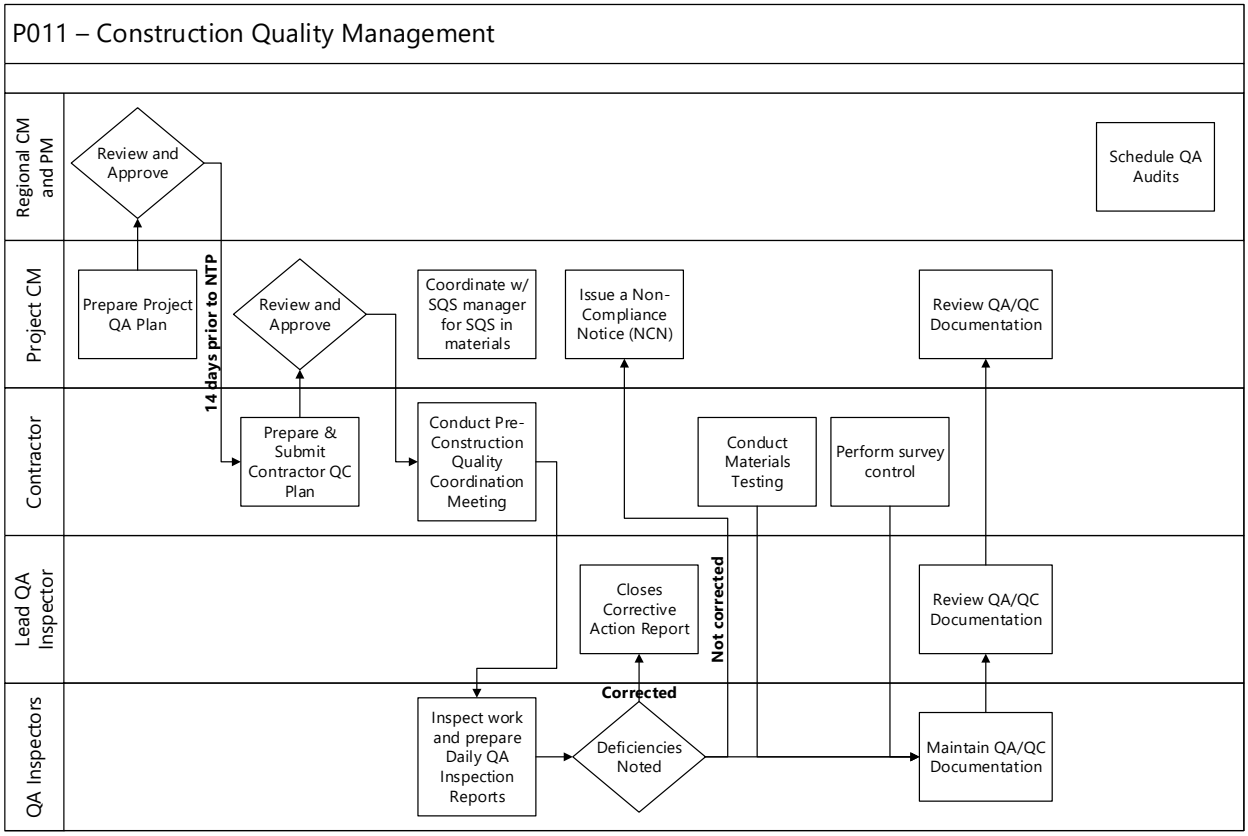


QUALITY ASSURANCE/QUALITY CONTROL

In general, quality assurance (QA) is a set of activities for ensuring quality in WSIP processes while quality control (QC) is the set of activities for ensuring quality in installations (products) such as structures, for example. Both QA and QC activities focus on identifying defects in the actual products produced. QA aims to prevent defects with a focus on process while QC aims to identify (and correct) defect in finished assemblies. In essence this entire engagement is a QA activity aimed at identifying and preventing issues in the SSIP program through identifying lessons learned in the WSIP. The QA/QC process for

construction is provided as Figure 13, below. We found that the WSIP QA/QC process is similar to that used on other large scale programs we have reviewed for other clients.

Figure 13 - Construction QA/QC process flowchart



The WSIP applied this process to conduct extensive inspections. RWBC extracted data from the QA/QC report for the 5 projects reviewed and found there were 34,227 QA/QC/Environmental inspections[28] as shown in Table 33 [29], below. We found that the WSIP for the projects evaluated, followed prescribed the QA/QC process. Of this total there 324 non-conforming issues identified, representing a 0.95%

[28] California Department of Parks and Recreation (DPR). Series 523 forms include historical/archeological buildings, structures, for example.

[29] Source is quality control reports from the five projects evaluated.

rate of non-conformance on very large complex projects. All non-conforming issues have been resolved.

Table 33 - WSIP QA/QC inspections

Project	QA	ENV	QC/DPR	Total Inspection Reports	NCN's[30]	% of NCN's
BDPL5TUN	4,154	1,134	1,005	6,293	23	0.37%
NIT	1,316	1,198	1,149	3,663	14	0.38%
CDRP	2,658	2,714	1,334	6,706	47	0.70%
HTWTP	6,781	643	1,668	9,092	97	1.07%
CSSA	4,058	3,534	881	8,473	143	1.69%
Total	**18,967**	**9,223**	**6,037**	**34,227**	**324**	**0.95%**

RISK MANAGEMENT

Regardless of project delivery method and contracting type utilized, the undertaking of construction entails the assumption of risk to all project participants. The risk profile of the WSIP is one where risk is introduced in multiple ways: large program size and number of projects, complexity of the work to be performed, location of work, and regulatory environment, to name a few. Table 34, below, contains our executive level assessment of inherent risk features of the WSIP[31].

Table 34 - WSIP risk profile

Element	Description	Major Risk Areas	Risk Level (H/M/L)
Program size	Large scale program ($4B+)	Bidding, project delivery	High

[30] Non-conforming results (NCN).

[31] Risks identified on Table 34 are intended to provide an executive level overview of program characteristics that have risk. Assignment of risk to different level represent RWBC's own subjective opinion based on our experience working with owners implementing similar size programs for the past 12 years. RWBC has conducted reviews of 15 programs with a value in excess of $1B.

Element	Description	Major Risk Areas	Risk Level (H/M/L)
Number of projects	83 projects	Interphase, coordination	High
Complexity of work	Wide range of scopes (dam, tunnels, treatment facilities, large diameter pipes, and pump stations)	CM expertise, qualified bidders, cost/time	High
Regulatory environment	Compliance with wider range of regulatory agencies (10+)	Cost/schedule impacts associated with compliance	High

The WSIP has a risk assessment process that has evolved from the start of the program to now where initially this process contained more variability in how risks were captured to a very structured process currently utilized. WSIP risks are captured in the Project Risk Register which captures the following parameters of each identified risk:

- Risk identification - risks are provided a unique identifier to enable sortation and analysis across projects
- Risk category – identification of the general source of risk including contractual, technical, safety, regulatory, operations, and management, for example.
- Project-specific attributes including assignment of individual to have point responsibility in tracking the applicable risk.
- Each risk contains identified probabilities of occurring including cost and schedule impacts and methodology for calculation of values.
- Risk mitigation strategies and data is also captured for each risk including mitigation actions taken (history) and identification whether risk identified has been mitigated (closed) or remains active.

The WSIP program management team captures risks and conducts various probability analyses to create different statistical projections of cost/time schedule impacts of risks identified. The December

13, 2013 WSIP Project Risk Register identified 95 risks with an aggregate value of $62 million[32]. Table 35, below, provides the distribution of risk by risk category.

Table 35 - WSIP risk distribution

Risk Category	Risk Count
Contractual	14
Technical	29
Operations	16
Regulatory	27
Community	3
Management	3
Quality	1
Safety	2
TOTAL:	95

OVERVIEW OF SSIP

The SSIP is a 20-year, $6.93 billion program to improve the sewer systems in the area served by the San Francisco Public Utilities Commission (SFPUC). The narrative that follows provides an overview of the entities involved in the SSIP, program elements, objectives and budget allocations, structure and management, and current status.

The SFPUC provides water, and collects and treats wastewater, and provides municipal power services for the City. The Waste Water Enterprise (WWE) of the SFPUC is the department responsible for managing, operating, and maintaining San Francisco's wastewater collection and treatment system, which also includes urban stormwater flows. The primary function of the WWE is to collect, treat, and dispose of wastewater and stormwater; and to control combined sewer discharges. Therefore, the

[32] Based on most likely cost calculation (80% confidence level)

WWE is responsible for protecting public health and the environment in a cost effective, responsible and reliable manner while meeting all governing regulations. In addition to serving San Francisco, the WWE provides limited wastewater treatment services to neighboring municipal customers. The City owns, operates and maintains 1,000 miles of sewers, 29,756 manholes, 20,999 catch basins/drains and 27 pump stations. There are five deep water effluent outfalls into the Bay, one Ocean outfall and 36 combined sewer discharge outfalls around the perimeter of the City.

Prior to the SSIP, the last master planning effort related to San Francisco's wastewater system began in 1974 to address the Federal Clean Water act of 1972, and resulted in construction activities that spanned from 1977 to 1997. The current planning efforts related to the City's wastewater infrastructure began in 2005. These planning efforts solicited public input from more than 60 organizations and stakeholders through workshops, briefings and/or presentations, with the purpose of sharing information, seeking input and direction, and receiving public comment at various phases of Sewer System Master Plan (SSMP) development. By July 2010, ten workshops had been conducted focusing on the current conditions of the sewer system and Level of Service (LOS) goals that will assist in defining the needed capital projects. These planning efforts resulted in the 2030 Sewer System Master Plan which is the document which provides the guiding principles for the SSIP.

With the Commission's support of the proposed LOS goals, the next steps for SSIP implementation involved developing a program schedule and budget, planning processes and designs, and initiating required environmental reviews. In February 2010 the SFPUC Commission directed SFPUC staff to proceed with the procurement of a Program Management Consultant (PMC) to assist City staff with the implementation of the SSIP. The AECOM-Parsons Joint Venture was selected as the PMC, and the PMC team began work on September 6, 2011. The first major task for the PMC was to evaluate the project sequencing, regulatory drivers, costs, LOS, schedule and other variables to confirm project specifics and develop a recommended Program, collectively known as Program Validation.

The purpose of program validation was to conduct technical and regulatory reviews based on the available information to verify the planning-level definition of the SSIP components were consistent with most current information, that program elements were integrated and validated, to ensure the SSIP meets SFPUC's endorsed objectives and LOS goals. The program validation process resulted in recommended refinements to the SSIP definition, schedule and budget and was approved in August 2012 by the SFPUC. The Final Validation Report and related Technical Memoranda were completed on May 7, 2013.

What follows is a brief outline of the issues with the sewer system that prompted the need for the SSIP, the guiding principles for the SSIP, and the SSIP's objectives and corresponding LOS goals to achieve these objectives.

The current system issues, which the SSIP will address, include:

- Aging infrastructure and the poor condition of existing facilities, little remaining useful life without significant improvements
- Seismic deficiencies and lack of structural integrity, which increase the system's vulnerability during earthquakes and large storms.
- Limited operating flexibility and lack of redundancy.
- Compliance with operational permits at all times including, but not limited to, the United States Environmental Protection Agency, the Regional Water Quality Control Board, the Bay Area Air Quality Management District, and San Francisco County Health.
- Managing stormwater in San Francisco's eight urban watersheds.
- Optimizing system performance and efficiency.
- Protecting public health, the environment, and conservation goals to safeguard our natural and human environments.
- Compliance with the SFPUC's Environmental Justice and Community Benefits Policy.

The following guiding principles have been established to guide the SSIP's development and execution:

- Protect public health and safety, and the environment.
- Ensure long-term sustainability and reliability of the sewer system.
- Minimize sewer system burdens on all sectors of the community and ensure no sector of the community bears a disproportionate share of the burdens of system operations.
- Promote environmental stewardship, including sustainable use of natural resources.
- Address the effects of climate change on the wastewater collection and treatment facilities.
- Develop and implement technologies to treat wastewater and biosolids in an efficient, sustainable, and environmentally benign fashion.
- Maximize employment and educational opportunities.

To address the stormwater system's current issues in accordance with the program's guiding principles, the following objectives and corresponding LOS goals which were established for the SSIP:

1. Objective: Provide a compliant, reliable, resilient and flexible system that can respond to catastrophic events
    - LOS Goal: Full compliance with State and Federal regulatory requirements applicable to the treatment and disposal of sewage and stormwater
    - LOS Goal: Critical functions built with 100% redundant infrastructure
    - LOS Goal: Primary treatment, with disinfection, must be online within 73 hours of a major earthquake
2. Objective: Integrate green and grey infrastructure to manage stormwater and flooding
    - LOS Goal: Control and manage flows from a three-hour storm that delivers 1.3 inches of rain
3. Objective: Provide Benefits to impacted communities
    - LOS Goal: Odors are to be limited to within the treatment facilities fence lines

- LOS Goal: Be a good neighbor. All projects will adhere to the Environmental Justice and Community Benefits policies

4. **Objective:** Modify the system to adapt to climate change
   - LOS Goal: New infrastructure mist accommodate expected sea level rise within the service life of the asset (i.e. 16 inches by 2050, 25 inches by 2070, and 55 inches by 2100)
5. **Objective:** Achieve economic and environmental sustainability
   - LOS Goal: Beneficial reuse of 100% of biosolids
   - LOS Goal: Non-potable water sources used to meet 100% of WWE facilities non-potable water demands
   - LOS Goal: Beneficial us of 100% of methane generated by WWE facilities
   - LOS Goals: Life-cycle costs stabilized to achieve future economic stability
6. **Objective:** Maintain ratepayer affordability
   - LOS Goal: Combined sewer and water bill will be within 2.5% of average CCSF household income for a single family residence

Budget

The SSIP is to be implemented in three overlapping phases. Phase 1 has an estimated cost of $2.71 billion, and will span from 2011 through 2022. Phase 2 has an estimated cost of $3.30 billion, and will span from 2015 through 2032. Phase 3 has an estimated cost of $0.93 billion, and will span from 2024 through 2033.

To achieve the stated goals and objectives of the SSIP, and to appropriately align the program management team's skill sets to the various projects, the SSIP is divided into three major subprograms:

1. Treatment Facility Projects: these projects will include both new biosolids facilities and treatment facilities for liquids and entrained solids. The treatment facility projects will address aging infrastructure and outdated technologies, while increasing seismic and operational

reliability, and reducing odors, noise, visual and other public impacts. Additionally, these projects are also intended to address long-term regulatory compliance by meeting current mandates, as well as accounting for projected future mandates.

2. Collection System Projects: these projects will increase the ability of the sewer system to collect and convey wastewater and stormwater, and will address the aging grey asset infrastructure (large diameter sewers, pump stations, transport/storage boxes, and combined sewer discharge structures). These projects will use an integrated approach of green and grey infrastructure to improve stormwater management during wet-weather. The on-going Urban Watershed Assessment process will characterize the challenges and opportunities in each of the eight watersheds in San Francisco through hydraulic modeling, condition assessments, and stakeholder input. The results of this process will contribute to the development of the green infrastructure projects throughout the system.
3. Program Wide Efforts: these efforts include program management and SSIP planning, and include condition assessments, project definition and prioritization, public outreach and education, analysis of impact on climate change, sustainability evaluations, and general program management tasks (program controls, change controls, and constructability reviews).

Program Wide Efforts also include building and facility projects to support the execution of the program. This encompasses relocation of existing facilities, demolition of obsolete buildings, and conversion of facilities for program occupancy. Specific projects include acquisition, relocation and demolition of the Central Shops property, and the departmental transfer and site clearance of the former Asphalt Plant property. Table 36 - SSIP budget summary Table 36, below, provides a breakdown of the SSIP budget by phase.

Table 36 - SSIP budget summary

Proposed Sub-Programs *As of August 28, 2012*	Phase 1 ($ Millions)	Phase 2 ($ Millions)	Phase 3 ($ Millions)	Total Project Cost Estimate ($ Millions)
TREATMENT PLANTS				
New Biosolids Digester Facilities	$1,596	$371	$ -	$1,967
Southeast Water Pollution Control Plant (SEP) Treatment Improvements	340	357	103	800
Oceanside Water Pollution Control Plant	183	177	104	464
North Point Wet-Weather Facility Improvements	114	310	200	624
TREATMENT PLANTS - Subtotal	$2,233	$1,215	$407	$3,855
COLLECTION SYSTEMS				
Reliability and Operational Improvements	$221	$309	$308	$838
Green Infrastructure	63	169	168	400
Central Bayside System Improvements (CBSIP)	70	1,173	-	1,243
Westside Pump Station Expansion	-	277	-	277
COLLECTION SYSTEMS - Subtotal	$354	$1,928	$476	$2,758
PROGRAM MANAGEMENT	$125	$152	$43	$320
PROGRAM TOTALS	$2,712	$3,295	$926	$6,933

Program Management Structure

The delivery of the SSIP is the responsibility of the WWE Capital Program Director, and ultimately the SFPUC Assistant General Manager (AGM) for Infrastructure and the SFPUC General Manager. Its implementation will be led by City Staff in the Infrastructure Division of the SFPUC and Department of Public Works (DPW). The SFPUC and DPW staff will utilize consultants as necessary to provide key support roles in the delivery of the SSIP. A key to the success of the SSIP is the total integration of SFPUC, DPW, and consultant resources under an integrated team with clear understanding of roles for all participants, responsibilities and authority. This integrated team approach requires colocation of staff

resources. SSIP implementation is managed at three levels: Program, Sub-Program and Project. The structure of each level, and each level's responsibilities are outlined below.

- Program Level – led by the WWE Capital Program Director who will be supported by a Deputy Director or Pre-Construction and a Deputy Director of Construction. They will manage and direct all aspects of the implementation and delivery of the SSIP, including strategic direction of the program. Reporting directly to the WWE Capital Program Director are managers responsible for Program Planning & Permitting, Program Controls, Program Administration, Construction Technical Adviser. These managers and advisors are responsible for the management and monitoring of their functional areas program-wide.
- Sub-Program Level – There are three SSIP Sub-Programs: (a) Treatment and Biosolids Facilities; (b) Collection Systems; and (c) Buildings and Facilities of the program. Each of the three Sub-Programs is led by a Senior Project Manager who reports to the appropriate Deputy Director, depending on whether the project is in Pre-Construction or Construction. Each Senior Project Manager is supported by a Senior Project Engineer and a Senior Construction Manager. This team provides oversight of the individual projects assigned to each Sub-Program through all phases. Additionally, although not within the SSIP scope, a SSIP Senior Project Manager is also designated to coordinate with the Departments responsible for the Street Work and Renewal and Replacement (R&R) Projects given their interrelationship with the SSIP Projects and their importance to successfully completing the SSIP scope.
- Project Level – Project Managers are assigned to individual projects and report to the Senior Project Manager of the applicable Sub-Program. The Project Manager is responsible for overseeing the delivery through all the phases of the project, and is supported by a Project Engineer, an Environmental Project Manager, a Resident Engineer, and an Operations Representative (who interfaces with WWE Operations and reports to the WWE Operations Representative Lead). These project teams are responsible for the day-to-day management

of the detailed project design contracts, the construction contacts, and various other aspects (QA/QC, etc.) of each of the projects.

Financial Controls

The SSIP and the WWE must comply with all the financial policies of the CCSF and the SFPUC including the requirements related to previous bond sales, such as ensuring that revenues are sufficient for Operations and Maintenance (O&M), Debt, and Renewal and Replacement programs. A summary of these financial policies can be found in the Adopted Budget 2012-13 and 2013-14 submittal to the GFOA[33]: http://www.sfwater.org/modules/showdocument.aspx?documentid=2881. The SSIP has one additional financial policy which was adopted as a LOS goal by the SFPUC on August 28, 2012, which is to maintain ratepayer affordability. To maintain the rate payer affordability of the SSIP, the SFPUC must ensure that the combination of water and sewer rates does not exceed 2.5% of the average household income for San Francisco residents.

Program Controls

Once a project budget has been established by the SSIP Program Director, the Project Controls Manager for the Program and the SSIP Deputy Directors will work together to ensure that the program is on, or below, the approved budget. Program and project control processes are utilized to forecast costs, update budgets, and track actual costs.

The purpose of SSIP Program Controls is to provide systematic processes for program/project planning, controlling, estimating and reporting to management. SFPUC Project Management Bureau has a Project Controls group which will provide additional resources to the SSIP, if needed. The SSIP Program and Project Controls key activities include the following:

[33] Government Finance Officers Association (GFOA)

- Baselines – Establish baselines are the approved initial budgets and schedules for a program or project. The current baseline incorporates any approved changes into the original baseline. Actual performance is compared to the current baseline values to determine if performance is within acceptable variance thresholds.
- Planning and Scheduling –Master schedules are developed for the SSIP and three subprograms to guide the overall program. Phase level and detailed level schedules are developed for the individual projects using a standardized work breakdown structure (WBS) to manage each phase of the SSIP and each project. All schedules are cost and resource loaded, and baselines are established for measuring the SSIP's actual progress relative to the planned schedule.
- Change Management – A formal change management procedure has been established to identify and track changes within the SSIP. This procedure identifies the impacts of changes to the SSIP's scope. There impacts are then evaluated to quantify the changes effect on the SSIP's baseline schedules, baseline budgets, and forecasts. Change management is an integral component of project controls, and is incorporated into the cost and schedule processes.
- Cost Control – Standard program and project cost control procedures and practices have been developed for the SSIP. The Earned Value Method (EVM) will be used for cost control once each schedule is detailed to task level. Core elements of the Cost Control are:
    1. Utilizing realistic schedules using a standardized WBS.
    2. Assigning appropriate budgets to the work elements to be performed.
    3. Establishing cost accounting structure and cost collection process.
    4. Establishing baselines for schedule and cost performance.
    5. Establishing metric systems to measure progress with respect to planned work.
    6. Monitoring progress through variances and establishing reporting process.
    7. Controlling changes, and setting trending and forecasting process.
    8. Establishing a corrective action plan process for cost variances identified in the forecasting process.

- Cost Estimating – Estimating services will be required at different times of the program and project life cycles, and at a minimum will be utilized during: budgeting, scope creep analysis/control, validation for alternative selection, change orders evaluation, and bidding. These services will be used to increase the confidence level of budgets and forecasts, and to evaluate the reasonableness of submitted change orders.
- Reporting – Several standard reports will be issued on a routine basis to provide timely, relevant, analytical and transparent information about the SSIP's status to various program and project stakeholders. The reports will provide analysis of current data, with forecasts of future performance, based on trends and statistical analysis, and will be designed to match the information needs of the various levels of management within the SSIP delivery organization.
- The standard reports will likely include: staff charges, expenditures to date, remaining encumbrances, and allocations by phase and work breakdown structure. Additionally, on a monthly basis, project managers and functional managers will be provided detailed EVM based variance reports, and senior project managers and Bureau Managers will be provided summary level reports. Quarterly and Annual reports that will be prepared for senior management and other stakeholders.
- Risk Management – The SSIP will undertake a comprehensive program risk assessment and develop a Risk and Contingency Management Plan in order to provide optimized risk allocation among program participants, and appropriate levels of contingency in the SSIP's budgets and schedules. The risk assessments will identify risks, evaluate their probability of occurrence and severity of impact utilizing a formalized and standard process. Risk assessments will be performed at both the program and project levels. Once the risks have been identified and quantified, mitigating strategies will be developed for each risk. The various risks will be reviewed and updated periodically throughout the course of the SSIP at the program and project level.

- Program risks are risks that may impact multiple projects or the manner in which the Program implements its portfolio of projects (i.e., technical, contracting, regulatory). The Program Management Consultant will prepare a comprehensive program assessment and develop a Risk and Contingency Management Plan for the SSIP at the program level.
- Project risks are those risks that are specific to a particular project (i.e. physical location, land ownership, geology, hydraulics). Each project team is responsible for preparing a comprehensive project assessment and developing a Risk and Contingency Management Plan for their project.

QA/QC

The SSIP has established quality management requirements for all phases of the program (planning, design and construction) to meet the desired level of quality throughout the program. Quality management will be administered at both the program level and the project level. The program level processes will focus on Quality Assurance (QA), which verifies that Quality Control (QC) requirements and procedures have been effectively implemented by the appropriate SSIP project teams, consultants, and contractors. The project level will contain both QA and QC processes. The SSIP project team will establish the QC requirements for each project, and the project's consultants and contractors will develop and implement appropriate QC procedures to achieve these requirements. The SSIP project team will implement appropriate QA processes to verify the QC procedures have been effectively implemented by the project's consultants and contractors.

Contracting Approach

CCSF contract processes identifies established protocol for contracting for planning, design, design support during construction, construction management, and construction services needed for the SSIP. These processes will be managed by the SFPUC Infrastructure Division Contracts Administration Bureau (CAB). The project participants for which the CAB will procure include the Program Management

Consultant and PMC sub-consultants/subcontractors, professional services consultants, and construction contractors.

The Program Director will be responsible for Program Management Consultant contract execution during all phases of the SSIP. The SSIP management team will execute and monitor the terms and conditions of all the remaining SSIP contracts through the CAB. The CAB will provide a central service that ensures consistent contracting processes and procedures for all phases of the construction, professional services, emergency and informal contracting practices, and the CAB will process all progress payments.

SSIP Status (As of March 31, 2014)

The following is an overview of the SSIP as of March 31, 2014:

- $73.2 million has been spent on Phase 1 projects, including $17.75 million on the North Shore Force Main, which translate to 3.3% complete for Phase 1 on a spent cost basis.
- The reported approved program budget was $2.209 billion vs. a SFPUC approved Phase 1 budget of $2.712 billion.
- The current cost forecast indicates the Phase 1 program will be over budget by $21 million given issues encountered on the North Shore to Channel Force Main Drainage Improvement Project (CWWSIPNC01).
- Five projects are identified as being outside of established threshold limits:

  Projects in Construction

  1. North Shore to Channel Force Main Drainage Improvement Project (CWWSIPNC01) – for the cost issue discussed above, and the forecasted completion is two (2) months beyond the approved completion date, due to impacts from differing site conditions.

2. Southeast Plant Oxygen Generation Plant (CWWSIPSE01)[34] – is forecasted to be six (6) months beyond the approved completion date, due to noise from the exhaust silencer exceeding specified limits in the contract.

Projects in Planning

1. Richmond Transport Modeling (CWWSIPCSSR01) – is forecasted to be 3.8 months beyond the approved completion date. Three (3) months of this is due to adding three (3) months to the schedule for task order and project close-out which were not included in the baseline schedule.
2. Collection System Condition Assessment (CWWSIPCSSR02) – is forecasted to be 5.4 months beyond the approved completion date. 2.4 months is for extra time needed for the inspection of the Division Street box and Hunter Point Tunnel, and the remaining three (3) months is due to adding three (3) months to the schedule for task order and project close-out which were not included in the baseline schedule.
3. Kansas and Marin Streets Sewer Improvements (CWWSIPCSSR03) – is forecasted to be 16.8 months beyond the approved completion date. This schedule impact is due to time needed to obtain a Right of Way (ROW) easement acquisition associated with the alternative recommended by the project team. The proposed duration includes performing design-at-risk work during the ROW acquisition phase to mitigate the overall schedule impact.

- Thirty-three (33) projects are currently in Planning/Preliminary design phase. Planning/preliminary design continues for projects at all three treatment facilities and various aspects of the Collection System as well as for the Urban Watershed Assessment.
- No projects are in close-out or complete.

[34] The North Shore Force Main project was not part of the SSIP approved by the City Commission at the end of the validation process.

Phase I SSIP Projects

Treatment Plants Projects

Southeast Plant Biosolids Digester Facilities Project (BDFP) – CWWSIPDP01 – The proposed $1.186 billion Biosolids Digester Facilities Project includes the planning, design and construction of new digestion and solids handling processes, which would replace the existing aged failing systems at the Southeast Water Pollution Control Plant (SEP). SEP is located adjacent to residents. The existing biosolids facilities employ aging/outdated technologies for treatment, structural design and odor control. The new facilities are proposed to be located in the southeast area of San Francisco adjacent to SEP. They will include state-of-the art treatment processes producing biogas and Class A biosolids that can be reused for beneficial purposes. The new replacement facilities will meet SSIP levels of service requirements, optimize operations and maintenance demands, satisfy present and future seismic and structural requirements, and minimize odor and visual impacts of the new Biosolids Digester Facilities Project on the surrounding community. Currently, the forecasted construction notice to proceed is in January 2018 with a forecasted project completion in June 2022.

Southeast Plant Oxygen Generation Plant – CWWSIPSE01 – As a result of the Clean Water Act of 1972, the secondary treatment process, which is achieved through the use of high purity oxygen (HPO), was implemented at Southeast Plant. During wet weather the regulatory permit requires that the Southeast Plant treat up to 150 million gallons per day, to the secondary level. The two existing, 66 tons per day (TPD), cryogenic oxygen generation plants that were placed in operation in 1981 are becoming extremely difficult to maintain, and have failed two times in the past year. This is a $13.0 million project to replace the antiquated oxygen plants with two technologically advanced 45 TPD oxygen generation plants. This will allow WWE Operations to have optimum control on the utilization of oxygen (based on the influent variations), thus significantly reducing the energy consumption. The construction notice to proceed was issued on January 23, 2013, and its current forecasted project completion is February 2015.

Southeast Plant Existing Digester Roof Repairs – CWWSIPSE03 – This $27.19 million project is intended to maintain existing critical facilities in operation with sufficient capacity and reliability to produce Class B biosolids until new facilities are in- service. Project elements of this project include the following major component: Repair/replacement of the roofs for a total of five digesters and associated appurtenances. The construction notice to proceed was issued on April 1, 2013 and the current forecasted project completion is in September 2017.

Southeast Plant Primary Sludge Handling Improvements – CWWSIPSE06 – This $20.86 million project comprises the following components: a new building to house primary sludge screens, grit removal equipment, grit washing and clarification equipment, and ancillary equipment including pumps and a new Gravity Belt Thickener (GBT). It also includes rehabilitation of the two existing GBT units, and replacement of existing odor control equipment and upgrades to existing exhaust fans. Currently, the forecasted construction notice to proceed is in May 2015 with a forecasted project completion in May 2017.

Southeast Plant Seismic Reliability and Condition Assessment Improvements – CWWSIPSE08 – As part of the condition assessment effort, numerous seismic, condition and operational issues associated with the existing facilities will require remedial attention before other program projects are completed. This $58.10 million project represents immediate improvements to the existing facilities at Southeast Plant (SEP) identified as part of the condition assessment effort that are not specifically included as part of another near-term Phase 1 project. This project includes both, items for rehabilitation, such as concrete spalling repair, and seismic retrofit of process tanks and buildings. Any defects not affecting permit compliance, biosolids class, or life safety issues may be deferred. Currently, the plan is to execute this work under three different contracts with forecasted construction notices to proceed of October 2015, December 2015 and January 2017, and currently it is forecasted this project will be complete in December 2019.

Southeast Plant Primary/Secondary Clarifier Upgrades – CWWSIPSE04 – While the primary clarifiers at Building 042 have covers, they are not adequate to provide effective odor control at this location. An odor control system is required to effectively treat odors from the primary treatment process. This $17.40 million project includes a 30,000 cubic feet per minute (cfm) active odor control system to treat odors from the head space in the seven (7) primary clarifier tanks. This system will include fans, ducting, and odor control units (OCUs). The covers for all seven (7) clarifiers in Building 042 will also be repaired as part of this project. A two-stage treatment state-of-art odor control system is included and consists of a biological scrubber followed by activated carbon as a polishing step. A 5,000 cfm OCU will be constructed for each MLSS Channel (North and South), and will include fans, ducting, and necessary treatment units. Like the other near-term odor control projects, the two-stage treatment system will include a biological wet scrubber followed by activated carbon. A condition assessment will also be performed to develop a scope for repairs to such items as concrete and rotating arm assemblies, which will be incorporated in this project. Currently, the forecasted construction notice to proceed is in March 2016 with a forecasted project completion in April 2018.

Southeast Plant Building 521 Replacement – CWWSIPSE05 – This $32.09 million project for upgrades to the existing disinfection system and related process includes the following major components:

- Construct a new electrical building (Building 521A) to house switchgear, motor control centers, and other panels for electrical power distribution and process control of motors associated with secondary and primary effluent in the vicinity of the chlorination control station (Building 521).
- Demolish existing electrical gear, refurbish sampling station, relocate mud valve actuators, update Distributed Control System (DCS) control station, and install a hydraulic power pack in existing Building 521.
- Provide W3 supply pumps of same number, size and type as existing, except equipped for variable speed operation and installed upstream of the dechlorination reactor to replace the

existing pumps. Construct new sodium bisulfite containment area, storage tanks, and feed pumps as required to replace existing tanks and pumps.

Southeast Plant Facility-wide Distributed Control System Control Upgrades – CWWSIPSE07 – This $62.99 million project addresses Distributed Control System (DCS) upgrades within the SEP. Real-time monitoring of liquid levels in all transport/storage boxes, liquid levels at all CSD structures, flow rates at all pump stations, and flow rates at all outfalls in Bayside and Westside facilities will enhance WWE's ability to optimize the use of existing storage, conveyance, and treatment capacity. Performing hardware and software upgrades, and integrating field instrumentation, control devices, communications hardware, processing hardware, interface hardware and associated software packages into a unified system are required to provide real-time, system-wide monitoring and control. Coordination of monitoring parameters in various systems to reflect geo-spatial relationships will also be required to maintain compatibility and consistency of the input data used for system control. This project includes funding for planning, design and construction of improvements for the DCS elements associated with SEP and funding only for planning and design for DCS elements associated with NPF and OSP. Currently, the forecasted construction notice to proceed is in October 2017 with a forecasted project completion in February 2021.

Southeast Plant New Headworks (Grit) Replacement – CWWSIPSE02 – This $184.89 million project involves the construction of a new 250 million gallon per day (MGD) Headworks facility, consisting of one-three story building, demolition of the two existing Headworks buildings and installation of fine screens with washer/compactor units, ten high efficiency grit removal units, and two stage odor control equipment. The project also includes upgrades to the Influent Lift Station (ILS) comprising of replacement of mechanical barscreens and lift pumps, and addition of washer/compactor units and odor control improvements. Currently, the forecasted construction notice to proceed is in March 2017 with a forecasted project completion in March 2020.

North Point Wet-Weather Facility Outfall System Rehabilitation – CWWSIPTPNP01 – A condition assessment of the four North Shore outfalls located at Piers 33 and 35, revealed issues with manhole covers, the liner, and inadequate air relief. It is therefore necessary to rehabilitate the outfalls. This $29.97 million project consists of a detailed Outfall inspection, and the following minimum improvements:

- Pipe interior relining
- Installation of air release valves
- Structural support improvements
- Cathodic protection

This project will improve the operational reliability of the outfall system and therefore ensure regulatory compliance during wet weather. Currently, the plan is to execute this work under two different contracts with forecasted construction notices to proceed of June 2015 and January 2016, and currently it is forecasted this project will be complete in December 2018.

North Shore Wet-Weather Pump Station Improvement and Disinfection – CWWSIPTPNP02 – This $66.61 million project includes construction of a new pump screen channel and wet well structure located adjacent to the existing North Shore Pump Station (NSS) or within the abandoned Building 010. The pump station expansion would include a new wet-weather coarse screen and new wet-weather pumping equipment. The project includes the construction of a pump station to accommodate two 75 million gallon per day (MGD) pumps. The project also includes upgrades to the power system to provide redundancy and improve the reliability of the power in keeping with the Level of Service requirements for power service redundancy. An interconnection between North Point Wet-Weather Facility (NPF) and NSS power services will be provided to allow NPF to be back fed from the redundant feeder serving NSS. The implementation of this project will ensure efficient operation and maintain full regulatory compliance at all times. Currently, the forecasted construction notice to proceed is in July 2017 with a forecasted completion in December 2019.

Oceanside Water Pollution Control Plant Fine Screen and Grit Removal Enhancements – CWWSIPTPOP01 – This $3.70 million project consists of the following major components: Replacement of the three existing screens with new ¼-inch fine screens, installation of dedicated screenings washer compactors for each screen, replacement of the three existing grit removal units with higher efficiency fine grit removal units, structural modifications to raise the channels, and the construction of new concrete tanks to house the fine grit removal units. All the modifications will take place within the existing Headworks building. This project started in July 2013, and has a forecasted project completion in June 2017.

Oceanside Water Pollution Control Plant Digester Gas Utilization Upgrade – CWWSIPTPOP03 – This $48.23 million project is comprised of three major sub-projects: Replacement of the gas storage vessel and digester gas condition equipment; Replacement of the existing cogeneration units (IC engines); and Construction of a new, permanent Fats, Oil and Grease (FOG) receiving facility. Currently, the forecasted construction notice to proceed is in June 2017 with a forecasted project completion in June 2020.

Collection System Projects

Westside Pump Station Reliability Improvements – CWWSIPTPOP02 – This $68.26 million project is comprised of the following six components: Screening improvements to increase grit removal, including a new screening channel constructed below grade, replacement of existing screens, installation of a new HVAC system to absorb waste heat from electrical equipment, replacement of existing pumps to provide pump redundancy, increase of power feeder capacity to allow for power source redundancy, replacement of existing odor control units, and improvements to the existing flushing (W3-recycled water) line to prevent grit and debris accumulation. Currently, the forecasted construction notice to proceed is in February 2018 with a forecasted project completion in September 2021.

Westside Pump Station Redundant Force Main Improvements – CWWSIPTPOP04 – This $37.85 million project includes construction of a redundant new force main from the Westside Pump Station (WSS) to Oceanside Water Pollution Control Plant (OSP). In order to avoid the beach erosion risk associated with the Great Highway alignment, the second force main would have an alternate alignment. This alignment would be longer than the existing force main and run east along Sloat Boulevard, then south on Highway 35 to the OSP Pretreatment Building (011). Major components of this project include the following:

- Installation of 6,400 linear feet of new force main; and
- Street pavement demolition and restoration, traffic control, and relocation of impacted utilities.
- Currently, the forecasted construction notice to proceed is in January 2018 with a forecasted project completion in June 2021.

Central Bayside System Improvement Project (CBSIP) – CWWSIPCT01 – This $70 million project is for the planning and pre-engineering phases of a project to replace the Channel Street Pump Station (CHS) and the Channel Force Main with gravity conveyance structures for dry-weather and wet-weather flows. This project will also determine/implement the optimal storm water management control strategies for the Bayside Wastewater System. The conceptual design includes an approximately twenty-three foot or larger inside diameter tunnel from CHS to the SEP with a deep lift station near the plant's headworks adjacent to Evans Avenue. Consolidation/modification of existing satellite pump stations along the alignment will be considered and addressed during the planning phase. A thorough urban watershed analysis to determine the volume of flows that need to be managed and the corresponding combination of green infrastructures/grey infrastructure storm water control solutions will also be conducted. Appropriate green infrastructure elements will be incorporated into the final project. This project started in July 2012 and has a forecasted completion in September 2016.

Islais Creek Green Infrastructure – CWWLID02 – This $5.36 million project is also referred to as "Mission & Valencia Green Gateway". The project is for green features which include approximately 4,700 square feet of bio-filtration beds, 18,000 square feet of permeable paving in the parking lanes, and 2 new plazas with permeable paving. These features will also enhance street greening, bicycle safety, pedestrian safety, and community beautification. As part of this project additional stormwater flows will be managed along 29th Street, Tiffany Avenue, Duncan Street, and San Jose Avenue. Currently, the forecasted construction notice to proceed is in February 2015 with a forecasted project completion in October 2018.

Sunset Green Infrastructure – CWWSIPFCDB01 – The objective of this $16.33 million project is to redesign Sunset Boulevard to maximize the capture and retention of stormwater using infiltration basins and bio-retention planters. The project will create a green corridor connecting Golden Gate Park to the vicinity of Lake Merced that increases the water infiltration and the biodiversity of the area, while decreasing the volume of runoff entering the sewer system and the amount of water used to irrigate the Boulevard's landscaping. This project is also referred to as "Sunset Boulevard Greenway." Currently, the forecasted construction notice to proceed is in October 2015 with a forecasted project completion in August 2019.

North Shore Green Infrastructure – CWWSIPFCDB02 – The objective of this $2.07 million project is to redesign Spofford and Ross Alleys between Clay Street and Jackson Street to maximize stormwater capture and detention using terraced, lined, flow-through planters and permeable pavement. This project is also referred to as "Chinatown Green Alleys". Currently, the forecasted construction notice to proceed is in December 2015 with a forecasted project completion in December 2019.

Lake Merced Green Infrastructure – CWWSIPFCDB03 – This $6.70 million project proposes to install bio-retention planters within new bulb outs and linear vegetated strips adjacent to the curb within 9

blocks of Holloway Avenue. This project will showcase surface stormwater management improvements within a dense residential setting and a disadvantaged community. This project is also referred to as "Holloway Green Street". Currently, the forecasted construction notice to proceed is in July 2015 with a forecasted project completion in July 2019.

Sunnydale Green Infrastructure – CWWSIPFCDB04 – This $3.06 million project includes two green nodes in Sunnydale watershed; a mini plaza on Sunnydale Avenue and a rain garden at the eastern end of McLaren Park. These green nodes are being designed to maximize the removal of street stormwater runoff from the combined sewer system. This project is also referred to as "Visitacion Valley Green Nodes". Currently, the forecasted construction notice to proceed is in September 2015 with a forecasted project completion in July 2019.

Richmond Green Infrastructure – CWWSIPFCDB05 – This $7.13 million project includes the redesign of a street to maximize stormwater capture and infiltration. Bio-retention planters and pervious paving are proposed improvements. The preliminary alternatives are Sea Cliff, Cabrillo Street and Arguello Boulevard. This project is also referred to as "Baker Beach Green Street". Currently, the forecasted construction notice to proceed is in January 2016 with a forecasted project completion in June 2019.

Yosemite Green Infrastructure – CWWSIPFCDB06 –This $13.57 million project diverts stormwater flows from the sewer using swales, vegetated channels, rain gardens, piped sections and a constructed wetland/detention basin/bio-swale system. This project is also referred to as "Upper Yosemite Creek Daylighting". The upper reach of the Yosemite Creek Daylighting project would daylight the creek along a portion of the historic creek path, from Yosemite Marsh in McLaren Park to Woolsey and Hamilton Streets. Currently, the forecasted construction notice to proceed is in December 2015 with a forecasted project completion in August 2019.

Advanced Rainfall Prediction – CWWSIPFCRP01 – This $15.38 million project would provide the SFPUC with better rainfall forecasting capabilities, especially 4 to 8 hours in advance of an event, which would be beneficial in managing wet-weather flows in the combined collection system. This is accomplished by improving the spatial, temporal, and volumetric accuracy of rainfall prediction in partnership with the National Oceanic and Atmospheric Administration (NOAA). NOAA would procure and install three new radar stations outside the City of San Francisco, develop rainfall prediction models tailored to San Francisco, verify model performance using existing rain gages, and deliver real-time rainfall prediction data. Currently, the forecasted construction notice to proceed is in April 2015 with a forecasted project completion in June 2019.

Operational Decision System Phase 1 – CWWSIPFCRP02 – This $630,000 project involves implementing an operational decision system to provide real-time decision support in a portion of the collection system. This first phase of implementation will demonstrate the system architecture and operational benefits of one available software tool for decision support in the Griffith/Sunnydale area. The system will be implemented in a manner that it could be expanded to a potential City-wide implementation during the future Phase 2. The construction notice to proceed was issued in August 2013, and has a forecasted project completion in September 2015.

Richmond Transport Modeling – CWWSIPCSSR01 – This $150,000 project is part of the Collection System Reliability Subprogram within the SSIP. Flow issues have been observed in the Richmond Transport Tunnel, a wastewater transport and storage (T/S) tunnel that conveys flow in the northwest section of the City. The initial purpose of the project is to perform condition assessment of the hydraulic issues observed by obtaining assistance from experts on computer-modeling and analyses to determine the cause of flow issues, such as geysering at air vents and lifting of manhole covers in the area. Depending on the outcome of the analyses, additional project work may be recommended for

implementation. This project started in March 2013 and its current forecasted completion is in June 2014.

Collection System Condition Assessment – CWWSIPCSSR02 – This $1.07 million project is part of the Collection System Reliability Subprogram within the SSIP. The purpose of the project is to determine the Condition Assessment Approach and Perform detailed condition assessment of various assets of the Collection System, including: large conveyance tunnels, large concrete transport/storage boxes, sewer force mains, and combined system discharges. Condition assessment of pumps and pump stations has been completed under separate project. The work includes development of condition assessment approach, condition assessment plan, inspections of the most critical assets, and development of improvement recommendations (including prioritization, scope, schedule, and costs information). The results from this project would be used to define and prioritize collection system projects. This project started in May 2013 and its current forecasted completion is in January 2015.

Kansas and Marin Streets Sewer Improvements – CWWSIPCSSR03 – This $12.52 million project is part of the Collection System Reliability Subprogram within the SSIP. The Marin and Kansas Streets Sewer Improvement project will provide system improvements to the sewer system conveyance from the Islais Creek Watershed east of Highway 101 to the Contract C Transport/Storage Sewer Box. Following the improvements from the Interim Capital Improvement Project (CIP), Cesar Chavez St Sewer Improvement Phase 1, additional conveyance needs were identified at this project location. Preliminary planning was completed in the Interim CIP and this project will include the final planning, design, right-of-way acquisition, environmental review and construction of sewer improvements. Currently, the forecasted construction notice to proceed is in November 2016 with a forecasted completion in November 2017.

Van Ness BRT Sewer Improvements – CWWSIPCSSR04 – MTA has initiated the Van Ness Bus Rapid Transit Project for transit/street improvements on Van Ness Avenue from Market Street to Lombard Street. SFPUC is partnering with MTA on this project by cost sharing of necessary sewer replacements within the project limits. In addition, SFPUC is sponsoring green infrastructure improvements along the sidewalks of Van Ness Avenue from Turk Street to Hayes Street. The sewer replacements and green infrastructure improvements are estimated to cost $14.00 million. Currently, the forecasted construction notice to proceed is in December 2015 with a forecasted project completion in February 2018.

Better Market Street Condition Assessment – CWWSIPCSSR05 – The $500,000 Better Market Street Condition Assessment Project includes sewer condition assessment of sewer assets on Market Street from Steuart Street to Octavia Street. As part of DPW's Better Market Street Program (currently in initial planning phase), existing sewer facilities on Market Street between Steuart and Octavia Street may need to be relocated and upgraded. PMB will be providing project management services with technical support by DPW Hydraulics. WWE Collection Division will be performing the initial condition assessment of the existing sewers on Market Street. The condition assessments will help determine the scope of sewer work on this project. This project started in January 2014, and is forecasted to be complete in December 2014.

Geary BRT Condition Assessment – CWWSIPCSSR06 – The $500,000 Geary BRT Condition Assessment Project includes sewer condition assessment effort on Geary Street from Gough Street to 25th Avenue. As part of CTA's Geary Corridor Bus Rapid Transit Program (currently in initial planning phase), existing sewer facilities on Geary Street between Gough and 25th Avenue may need to be relocated and upgraded. PMB will be providing project management services with technical support by WWE and DPW. The condition assessments will help determine the scope of sewer work on the project. This project started in January 2014, and is forecasted to be complete in June 2015.

Central Subway Sewer Improvements – CWWSIPCSSR07 – This $4.0 million project is part of the Collection System Reliability Subprogram within the SSIP. This project includes major sewer improvements to be constructed under the Central Subway Project led by SFMTA. The scope of the sewer improvements are as follow:

- Rehabilitate 78" diameter brick sewer on 4th Street from Brannon to King Streets;
- Install 48" and 18" diameter sewers on 4th Street from Bryant to Brannon Streets; and
- Reconnect 30" diameter force main on 4th Street from Bryant to King Streets.

The construction of these sewer improvements in conjunction with MTA's Central Subway Project will ensure system reliability and minimize the potential of sewer construction impacts to this congested corridor within the duration of the SSIP. Currently, the forecasted construction notice to proceed is in March 2014 with a forecasted project completion in March 2016.

North Shore to Channel Force Main Drainage Improvement – CWWSIPNC01 – This originally budgeted $31.55 million, with a current forecasted cost of $52.55 million, project will provide a redundant force main to the portion of the existing North Shore Force Main (NSFM) which has no redundancy, and is most vulnerable for failure. The vulnerable portion of the existing NSFM failed in 2006, 2008 and most recently in March 2012 and June 2012. Separate emergency contracts were issued in 2012 and emergency repairs on the existing force main has been completed; however, a portion of the existing force main cannot be fully-rehabilitated until the redundant force main is in-service. The scope of work for this project includes installation of approximately 3,000 linear-feet of force mains on Drumm Street and Spear Street and construction of a valve-vault in the sidewalk area on The Embarcadero, between Washington and Broadway Streets. The construction notice to proceed was issued on May 29, 2012, and is currently forecasted to be complete by December 2014.

Program Management Projects

Urban Watershed Assessment and Planning – CWWSIPUW01 – Many of the SSIP's proposed projects are focused on improvements to surface drainage and collection system management in San Francisco. The $14.31 million SSIP Urban Watershed Assessment (UWA) and Planning Task will evaluate and recommend alternatives that balance the use of grey (for example, pipelines) versus green infrastructure (for example, low impact design) for improvements to watershed surface drainage and collection system management. The SSIP will utilize an integrated watershed management approach and use comprehensive hydrologic and hydraulic modeling and analysis to investigate the health of the City's watersheds and collection system and identify potential opportunities for stormwater capture, conveyance, detention and possible reuse to address issues of flooding as well as combined sewage conveyance and storage. Project implementation will require the hydrologic and hydraulic analysis of each of the eight drainage basins and will include: identification of various solutions to each basin's unique set of flooding and other challenges; evaluation of the social, economic and environmental values of alternatives that meet the level of service with a Triple Bottom Line (TBL) tool and the optimization and prioritization of projects for each basin. The work will address life cycle costs and detailed operation and maintenance requirements. This project started in October 2011, and is forecasted to be complete in September 2015.

Land Reuse of 1800 Jerrold Avenue – CWWSIPPRPL91 – This $113.59 million project includes the acquisition of this site for possible near-term and long-term SFPUC use. This 6.04 acre site on Jerrold Avenue between Quint and Rankin, is adjacent to the Southeast Plant and is currently occupied by another city department, Fleet Management under the Office of Contract Administration. The site is used as a central shop for vehicle repairs. Acquisition of the site by the SFPUC would be beneficial because there are very few empty or underutilized sites around the SEP; and, after completion of any necessary planning and environmental reviews, this site can serve a variety of functions to support the

SEP's short and long term efforts. Currently, the forecasted construction notice to proceed is in January 2016 with a forecasted project completion in June 2018.

Land Reuse of 1801 Jerrold Avenue – CWWSIPPRPL92 – This $9.16 million project includes the acquisition of this site for both near-term and long-term use by the SFPUC. This 1.54 acre site is currently under the jurisdiction of the Department of Public Works. It was formerly used as an asphalt plant that has not been operational for many years. Acquisition of the site by the SFPUC would be beneficial because there are very few empty or underutilized sites around the SEP; and, after completion of any necessary planning and environmental reviews, this site can serve a variety of functions to support the SEP's short and long term efforts. . Currently, the forecasted construction notice to proceed is in July 2015 with a forecasted project completion in April 2016.

Biofuel Alternative Energy – CWWBAE01 – The $9.56 million Biofuel/Alternative Energy Program will determine if it is feasible and cost-effective for the SFPUC to generate bioenergy (e.g. Biofuel or cogenerated power) as a byproduct of processing the fats, oils, and grease (FOG) and/or food waste collected throughout the City. Feasibility will be determined through pilot studies and analysis that will evaluate whether adoption of Biofuel energy programs into the SFPUC's wastewater infrastructure (collection systems and/or treatment processes) would reliably and cost effectively enhance performance and sustainability. This project started in July 2011, and is forecasted to be complete in September 2014.

WSIP VS. SSIP ATTRIBUTES

In order to provide context on lessons learned from the WSIP program that could be applied to the SSIP RWBC developed a matrix highlighting different attributes associated with each program. Table 37, below, contains an executive level overview of each major program attributed (labeled as "Element") for the WSIP and the SSIP. There are certain attributes with resulting risks and activities that are

transferable between programs such as budget, scheduling, accounting controls, risk management. Bidding environments, on the other hand, are much broader in nature and its reflection in higher than planned construction inflation (or deflation) cannot readily be predicted, yet there are certain lessons learned that may still transfer. The section that follows aims to explain each attribute listed on Table 37, below and how it may apply or transfer between the two programs.

Table 37 - Comparison of WSIP and SSIP attributes

Element	WSIP	SSIP
Budget	$4.765 Billion current estimate (increase of $0.4B from 2005 estimate)	$6.93B (3 phases)
Duration	Current 16 years (original 13 years)	20 years (3 phases)
Regulatory requirements	Complex regulatory environment: many regulatory agencies (10+)	Complex regulatory environment: many regulatory agencies (10+)
Worksite location	Urban and non-urban environments. Many sites with complex phasing and difficult work areas given limited access or physical work areas.	High density urban with constrained work sites.
Type of work	Multiple infrastructure: dam, tunnels, treatment facilities, pipelines, pump stations, and reservoirs.	Primarily treatment facilities, pumping stations, process-piping.
Bidding environment	Very favorable (most bid let during 2008-2012, a unique bidding environment given economic downturn).	2014 - Construction escalation at 4% over first ten years. Based on information available, forecast bidding environment not as favorable as that experienced in 2008-2012.

Element	WSIP	SSIP
Delivery method(s)	Primarily design-bid-build (one project design/build)	Primarily design-bid-build; evaluating alternative delivery methods such as design/build and construction manager at risk (CMAR)
Construction bidder pool	Competitive environment with qualified contractors	Likely less competitive environment with qualified contractors
Designer bidder pool	Competitive environment with qualified vendors	Likely less competitive environment due to industry consolidation (e.g. AECOM acquisition of URS) with qualified vendors
Program management structure	Multi-tier - project, regional, and program wide management. Integrated program management team.	Multi-tier - program, sub-program, and project. Integrated program management team.
Process/procedures	Well developed and standardized.	Leveraged WSIP processes/procedures with program-specific modifications where applicable.
Program management system	CMIS in use for several years.	Primavera used for scheduling and cost control and CMIS TBD.

Budget - the budget of a program encompasses the entire cost to implement a project exclusive of financing costs and debt service. As a general rule, the larger the budget the higher financial risk. The budget is reflective of implementation risk, escalation, project delivery, and contingency. Both the WSIP and SSIP are large scale capital programs with complex installations and lengthy implementation periods that have strained the financial performance and benchmarks of the WSIP, under a very favorable bidding environment, and similar, if not more budget pressure should be expected on the SSIP given a comparatively less favorable bidding environment and longer performance period. It should be noted that a large element of the budget increase to the WSIP was driven by realized differing

site conditions encountered on the Calaveras Dam Replacement Project. Yet even with over $400 million in bid savings realized and absorbed, the WSIP is still projecting its budget to increase $430 million from the 2005 Baseline budget. This data is provided to highlight the magnitude of impacts that can be realized on this scale programs, especially those driven by unforeseen site conditions.

Duration – the total expected implementation for the program. The WSIP initially was forecast to have a long duration (13 years). Even with very sound schedule and cost controls the original duration increased by 3 years (roughly 25% increase in time from 13 to 16 years). The SSIP is planned to have a 20 year duration, providing greater opportunities for risk associated with time impacts, escalation, and other related impacts.

Regulatory requirements – both the WSIP and SSIP have a very high level of regulatory compliance either from stakeholders, environmental agencies, or other agencies having jurisdiction over one or more aspects of implementation.

Worksite location – the WSIP work locations were varied: from extreme urban environments (Lincoln Pipeline), semi-urban environments (Harry Tracy), to more isolated environments (Calaveras Dam Replacement). Worksites for the SSIP are expected to be much more site constrained and urban in nature. This feature will place a much higher premium on phasing and coordination for SSIP projects (and have much higher risk for schedule and cost impacts). Additionally, the SSIP may experience higher "mitigation" costs which are often incurred during urban construction to appease abutters to projects and maintain acceptable level of services to the general public.

Type of Work – the WSIP was comprised of projects covering a wide range of work types: tunneling (traditional and TBM), dam, process plants, reservoirs, large diameter pipelines, and pump stations. The SSIP is comprised primarily of process plants, pump stations, and, in general, projects with high level of process piping and structural work. If we were to take a single project from the WSIP that would be most like "typical" SSIP projects it would be the Harry Tracy Water Treatment project: constrained work locations, multiple work types in a confined area, and resulting complex phasing and shutdown schedules.

Bidding environment – the WSIP benefitted from a very favorable bidding environment (2008-2012) that resulted from a very unusual and severe economic downturn, which impacted the construction industry even more significantly than the general economy. As previous highlighted, over $400 million of bid savings were realized (even with some projects bid higher than engineer's estimates). The SSIP has a longer duration (20 years) than the WSIP and will be much more exposed to construction inflation than the WSIP.

Delivery methods – the WSIP was primarily delivered using a traditional design-bid-build delivery method with fixed priced/low bid construction contracts. General contractors were prequalified on projects with higher construction value or higher risk (about half). The SSIP is planned to follow a similar path, yet, based on discussions with the executive management team, the SSIP is willing to entertain alternative delivery methods if it mitigates risk.

Construction bidder pool and Designer pool – the size and breath of the WSIP and SSIP created national interest in construction bidder pool and designer bidder pool. We expect this feature to continue. However, with the consolidation that has been occurring in the Architect/Engineering (A/E) sector (AECOM's acquisition of URS being the latest) there will likely be fewer firms competing, especially for the larger project. Also, with the improving economy it is likely there will be fewer bidders for each project, as the contractors' capacity to perform work will likely be limited by the availability of qualified project management staff and craft workers. The availability of qualified staff and workers was a significant issue in the construction industry before the economic downturn in 2008. Given aging workforce issues with skilled workers in construction, and the downturn's impact on new workers in the industry between 2008 and 2012, it is likely the availability of qualified staff and workers will be an even larger issue as the economy continues to improve. This issue will likely impact the architect/engineer as well.

Process/procedures – processes and procedures used in the WSIP are well developed and mature. The SSIP has leveraged the use of these structures and processes and will, in general, continue to use similar approaches to manage the work.

Program management system – the WSIP utilizes the CMIS system: a customized Primavera Enterprise Contract Management System. CMIS has been in use of several years and is well understood by program controls staff. Project staff, however, has cited the system as having elements that are not readily understood. CMIS is a scheduling system configured and customized to provide program and contract management functionality. The WSIP program controls group spends significant effort reconciling expenditures to the City's core financial system, given that CMIS underlying platform may not provide the most flexible basis from which to create middleware to fully integrate into the City's financial system. The SSIP is looking at other state-of-the-art CMIS systems to implement for administering cost, contracts, and other program management areas.

LESSONS LEARNED PROCESS

WSIP procedure number WSIP P030-Lessons Learned dated August 26, 2009 sets forth the process to be followed in identification, capture, and dissemination of lessons learned on the WSIP. RWBC prepared a process flowchart, shown as Figure 16, below. There are three primary activities associated with the lessons learned process as set forth in WSIP P030: (a) identification and completion of lessons learned report; (b) data reviewed with project team to validate and vet lessons learned and entering into CMIS; (c) lessons learned is refined and enhanced and distributed to CM and PM staff for dissemination, while at the project level lessons learned are incorporated into the project closeout report. Based on the lessons learned documents provided, we found no documentation supporting that lessons learned are being entered into CMIS nor approval history associated with lessons learned formally executed by reviewers/approvals as outlined in procedure P030. We received extensive copies of *.pdf, *.ppt, *.docx documents. These document were comprised of lessons learned forms, PowerPoint presentations, and MS Word documents comprised of shutdown reports containing lessons

learned. None of the lessons learned documents provided to RWBC demonstrate that the process methodology was followed as prescribed such as sign-offs, reviews, and reporting capability of lessons

Figure 14 - Issues/Lessons Learned - Reporting Form

Issues / Lessons Learned Reporting Form

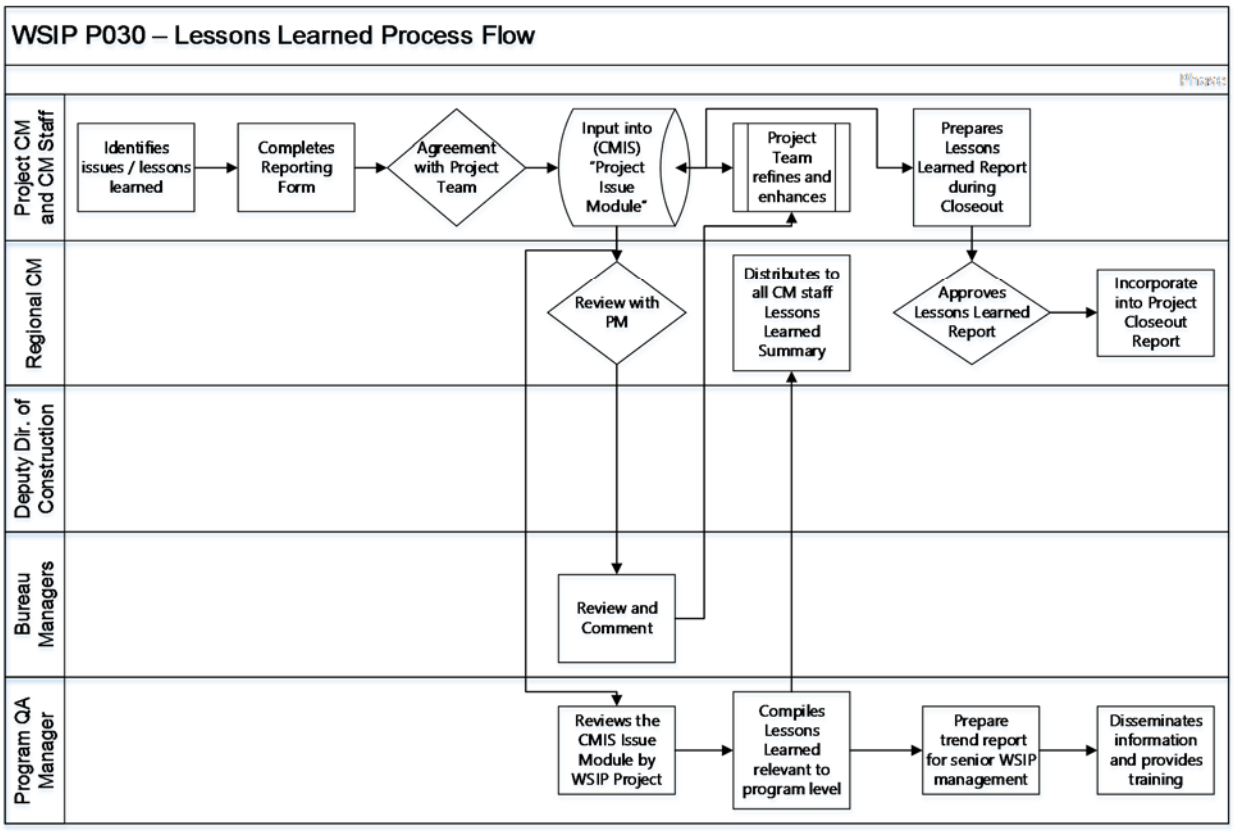
Construction Contract No.: WD-2568 Project Title: Bay Division Pipelines Nos. 3 and 4 Crossovers Facilities
Issue / Lessons Leaned Subject (reference below)*: **Valve Leakage Estimates Included in Contract and Residual Water in Pipeline at Turnover to Contractor**
Description: The valve leakage estimate included in Specification 01012-1.6.C was 100 gpm, and there were 3 contract sections discussing (differently) residual water remaining in the pipelines was included in Specs 01012, 01565, and 01650.
At Barron Creek BDPL4 and Bear Gulch BDPL3, there were valve leakage rates of 400 gpm and 150 gpm, respectively, which were not known until 2 days prior to pipe turnover. In each case, the contractor had to mobilize larger pumps, fittings, hoses, piping, tees, etc. to accommodate the additional valve leakage with only limited time. This resulted in a last minute scramble to find acceptable discharge locations for the greater volume of valve leakage, with the proper permits, dechlorination equipment, and additional materials to access the discharge locations, etc., which could have created a significant problem if other locations weren't found. The Contractor also claimed that the larger hoses, pipes, i etc., impacted the other work (ie welding) occurring around it, which made it less efficient. This had a significant cost impact on the project, and the contractor used this as a potential reason as leverage if the shut-down milestone was

learned from CMIS. Data from project staff interviews also show that there is variability of lessons learned capture at the project level. Documentation received would support these conclusions (Reference Figure 14[35] and Figure 15). We do note that there data generated on lessons learned is of a sound quality and demonstrates staff engaged in identifying lessons learned, both positive and negative.

[35] Partial form provided for illustrative purposes only

Figure 15 - WSIP safety lessons learned

Figure 16 - WSIP Lessons learned process flowchart



We believe that the WSIP lessons learned process could be further enhanced to fully leverage the amount of information currently being generated through various presentations, forms, shutdown reports, as well as daily activity reports. We found that all project staff interviewed for this and past projects were well qualified for their assigned tasks and responsibilities. As such we believe that the lessons learned generated from this pool of resources would further benefit not only the WSIP but also other capital programs, such as the SSIP. We recommend the following activities be considered by the WSIP management to further enhance the existing lessons learned process and more efficiently distribute this information through the program organization:

1. Formally add lessons learned discussion at weekly project meetings. It is not expected that lessons learned would be generated at each meeting but it is important to ensure project-level

staff awareness that this is an important topic to the WSIP program management and, ultimately, culture.

2. On a monthly basis assign project team to review lessons generated and distill key data or other information from raw data. Analysis could cover potential implications on other similar projects, recommendations for improvement, and potential impacts, for example.
3. Entry of developed lessons learned by the project team into CMIS. This may require development of a knowledge management module within the CMIS to accept this information into a centralized-web enabled location to be accessed by WSIP as well as allow the ability to extract reports on lessons learned.
4. Hold quarterly regional-level lessons learned with senior WSIP staff to evaluate ways to distribute key information identified throughout the organization.
5. We also recommend that the lessons learned process be further formalized to identify and reward project teams/staff who identify/implement knowledge management activities (lessons learned are not intended to highlight lack of staff performance).
6. Consider adding knowledge management as a dimension for performance evaluation of senior program staff.
7. Issuance of an annual lessons learned report capturing key knowledge management information generated and analyzed during the preceding year.

LESSONS LEARNED

RWBC utilized a wide range of sources to gather detailed lessons learned including review of program documents, interview with project staff on the six projects visited as well as program management staff. EXHIBIT 7 contains all 585 WSIP lessons learned captured under this engagement. From this pool, RWBC identified the following executive-level lessons learned:

1. Application of contingency: consider utilization of a more flexible approach to assignment of contingency to be reflective of project risk profile. The application of uniform contingency rates across projects may simplify the budgeting process, yet not adequately capture budgetary needs. The risk assessment process and budget validation process can be the vehicles under which this approach could be accomplished. Normal forecasting process can then be used to monitor budgetary performance.
2. Contracting: consider added coordination of specifications and contract language to ensure that conflicts between contract terms and technical design intent is minimized. For example, the CSSA project could have benefitted from enhanced coordination between general conditions and technical specifications to ensure there were no conflicting terms and to design intent. Similarly, the San Andres Pipeline No. 3 project staff found that improved language on payment terms pertaining to work to be performed outside of the City would have helped to better negotiate change order costs.
3. Budget: consider the utilization of a 'stress test' of future programs budgets utilizing the rates of changes realized as well as the bidding environment. This would provide additional data points to evaluate adequacy of budgets and most reflective of how operations are conducted by SFPUC. Projects such as the Harry Tracy Water Treatment Plant offer the most similar type of construction from the WSIP that would be expected on the SSIP. By 'stress test' we mean conducting an evaluation of impacts to project/program budgets utilizing scenario analysis such as evaluating the budgetary impacts to modifying contingency rates, application of historical WSIP change order rates to forecast construction costs, and similarly, through the application of different project delivery rates.
4. Project Delivery: consider development of performance metrics against which various elements of project delivery performance can be measured. The utilization of project delivery costs at a rate of 49.5% of construction costs can be an overall target, however additional metrics agreed upon at the program level could be evaluated to test the reasonableness of added costs resulting from

changes. WSIP data reviewed shows that rates for certain elements of project delivery, such as construction management and departmental charges were significantly higher than baseline rates. Agreed upon project delivery metrics would serve to better communicate performance externally.

5. Change Management: in general, the change management process utilized by the WSIP is robust and has shown to work well on a wide range of projects and difficult negotiating conditions.
6. Bidding: the traditional design-bid-build with selected qualification utilized on WSIP to delivery most of the projects worked well. Bid results show over $400 million in bid savings realized on the WSIP utilizing this methodology. Reasons identified as driving the success include utilizing a delivery method understood by industry specific designers and contractors used to conducting business in this manner. Introduction of alternative project delivery methods such as CMAR, will need to be evaluated to ensure contracts, designs, and contractors understand implications of operating under these contractual conditions.
7. Financial and Scheduling Reporting: the WSIP has developed comprehensive financial reporting at all levels of the program: project, region, and program. The standardization of these reports provides timely and easily understood financial information for internal and external stakeholders. Similarly for schedule reporting, there is a vast amount of information reported that provides clear and actionable scheduling information. WSIP has also developed capabilities to provide drill down reports such as change management, RFIs, and other similar project information. We note that over 5,000 pages of data were utilized to create the 36 tables, exhibits, and figures contained in this report.
8. The lessons learned process could be further enhanced to fully leverage the amount of lessons learned being generated through various presentations, forms, and shutdown reports, as well as daily activities at the project site. We found that all project staff interviewed for this and past projects were very well qualified for their assigned tasks and responsibilities. As such we believe that the lessons learned generated from this pool of resources would only benefit WSIP but also other

programs such as the SSIP implementing similar program management processes and structures. (Reference our 7 recommendations for enhancing this process in the preceding section)

9. Risk assessment: the risk assessment process is well developed and has evolved into a mature approach to evaluation of project and program risk. The resulting risk ledger is an example of the output that can be generated to actively manage a wide range of sources of risk at the project and program level.
10. Design: our interviews and project data reviewed showed that benefits could be gained by added owner involvement in the design development process through added involvement in review of design deliverables, especially at the 35% and 65% levels. Also expressed were the potential benefits of having certain key project staff brought earlier into the project design phase so they can have added input into this process.

EXHIBITS

RW Block Consulting, Inc.

EXHIBIT 1 – APPROVED CHANGE ORDERS CALAVERAS DAM REPLACEMENT

CO #	Date of Approval	% Time	DESIGN _ CUM	SITE_CUM	OTHER_CUM	CUM_ALL	Amount
18	30-Jul-12	2.60%	$ 7,950.00	$ 0.00	$ 0.00	$ 7,950.00	$ 7,950.00
19	30-Jul-12	2.60%	$ 9,911.84	$ 0.00	$ 0.00	$ 9,911.84	$ 1,961.84
4	23-Oct-12	5.93%	$ 9,911.84	$ 0.00	$ 65,000.00	$ 74,911.84	$ 65,000.00
1	23-Oct-12	5.93%	$ 9,911.84	$ 0.00	$ 366,025.00	$ 375,936.84	$ 301,025.00
2	23-Oct-12	5.93%	$ 9,911.84	$ 250,000.00	$ 366,025.00	$ 625,936.84	$ 250,000.00
3	23-Oct-12	5.93%	$ 9,911.84	$ 3,626,370.00	$ 366,025.00	$ 4,002,306.84	$ 3,376,370.00
5	23-Oct-12	5.93%	$ 9,911.84	$ 3,626,370.00	$ 369,831.88	$ 4,006,113.72	$ 3,806.88
6	23-Oct-12	5.93%	$ 9,911.84	$ 3,626,370.00	$ 388,628.35	$ 4,024,910.19	$ 18,796.47
10	24-Oct-12	5.97%	$ 9,911.84	$ 3,626,370.00	$ 438,258.35	$ 4,074,540.19	$ 49,630.00
11	24-Oct-12	5.97%	$ 9,911.84	$ 3,731,156.00	$ 438,258.35	$ 4,179,326.19	$ 104,786.00
12	24-Oct-12	5.97%	$ 9,911.84	$ 3,771,670.00	$ 438,258.35	$ 4,219,840.19	$ 40,514.00
13	24-Oct-12	5.97%	$ 9,911.84	$ 15,554,317.00	$ 438,258.35	$ 16,002,487.19	$ 11,782,647.00
14	24-Oct-12	5.97%	$ 9,911.84	$ 15,589,031.00	$ 438,258.35	$ 16,037,201.19	$ 34,714.00
15	24-Oct-12	5.97%	$ 9,911.84	$ 15,589,031.00	$ 540,614.35	$ 16,139,557.19	$ 102,356.00
16	24-Oct-12	5.97%	$ 9,911.84	$ 15,589,031.00	$ 639,364.35	$ 16,238,307.19	$ 98,750.00
20	24-Oct-12	5.97%	$ 9,911.84	$ 15,589,031.00	$ 639,364.35	$ 16,238,307.19	$ 0.00
21	24-Oct-12	5.97%	$ 9,911.84	$ 15,589,031.00	$ 773,722.35	$ 16,372,665.19	$ 134,358.00
22	24-Oct-12	5.97%	$ 329,911.84	$ 15,589,031.00	$ 773,722.35	$ 16,692,665.19	$ 320,000.00
23	24-Oct-12	5.97%	$ 329,911.84	$ 15,589,031.00	$ 1,147,946.35	$ 17,066,889.19	$ 374,224.00
25	24-Oct-12	5.97%	$ 329,911.84	$ 16,589,031.00	$ 1,147,946.35	$ 18,066,889.19	$ 1,000,000.00
17	24-Oct-12	5.97%	$ 329,911.84	$ 17,589,031.00	$ 1,147,946.35	$ 19,066,889.19	$ 1,000,000.00
7	24-Oct-12	5.97%	$ 329,911.84	$ 17,589,031.00	$ 1,220,251.35	$ 19,139,194.19	$ 72,305.00
8	24-Oct-12	5.97%	$ 329,911.84	$ 17,758,093.00	$ 1,220,251.35	$ 19,308,256.19	$ 169,062.00
24	24-Oct-12	5.97%	$ 329,911.84	$ 17,758,093.00	$ 1,220,251.35	$ 19,308,256.19	$ 0.00
9	24-Oct-12	5.97%	$ 329,911.84	$ 17,472,718.66	$ 1,220,251.35	$ 19,022,881.85	$ (285,374.34)
26	11-Jan-13	9.06%	$ 329,911.84	$ 17,472,718.66	$ 1,340,251.35	$ 19,142,881.85	$ 120,000.00
27	11-Jan-13	9.06%	$ 329,911.84	$ 17,972,718.66	$ 1,340,251.35	$ 19,642,881.85	$ 500,000.00
28	11-Jan-13	9.06%	$ 329,911.84	$ 18,322,718.66	$ 1,340,251.35	$ 19,992,881.85	$ 350,000.00
29	11-Jan-13	9.06%	$ 329,911.84	$ 18,389,718.66	$ 1,340,251.35	$ 20,059,881.85	$ 67,000.00
31	4-Feb-13	10.00%	$ 329,911.84	$ 18,507,475.66	$ 1,340,251.35	$ 20,177,638.85	$ 117,757.00
32	5-Feb-13	10.04%	$ 329,911.84	$ 18,653,998.66	$ 1,340,251.35	$ 20,324,161.85	$ 146,523.00
33	21-Feb-13	10.66%	$ 329,911.84	$ 18,987,075.66	$ 1,340,251.35	$ 20,657,238.85	$ 333,077.00
34	21-Feb-13	10.66%	$ 329,911.84	$ 19,125,550.66	$ 1,340,251.35	$ 20,795,713.85	$ 138,475.00
30	25-Feb-13	10.83%	$ 329,911.84	$ 19,465,550.66	$ 1,340,251.35	$ 21,135,713.85	$ 340,000.00
35	11-Apr-13	12.58%	$ 329,911.84	$ 19,721,690.66	$ 1,340,251.35	$ 21,391,853.85	$ 256,140.00
36	11-Apr-13	12.58%	$ 329,911.84	$ 19,721,690.66	$ 1,377,411.35	$ 21,429,013.85	$ 37,160.00
37	11-Apr-13	12.58%	$ 329,911.84	$ 19,721,690.66	$ 1,400,539.35	$ 21,452,141.85	$ 23,128.00
41	23-Apr-13	13.05%	$ 329,911.84	$ 19,721,690.66	$ 1,400,539.35	$ 21,452,141.85	$ 0.00
38	2-May-13	13.41%	$ 329,911.84	$ 19,721,690.66	$ 1,407,998.35	$ 21,459,600.85	$ 7,459.00
39	2-May-13	13.41%	$ 329,911.84	$ 19,725,851.66	$ 1,407,998.35	$ 21,463,761.85	$ 4,161.00
40	2-May-13	13.41%	$ 329,911.84	$ 19,753,311.66	$ 1,407,998.35	$ 21,491,221.85	$ 27,460.00

CO #	Date of Approval	% Time	DESIGN _ CUM	SITE_CUM	OTHER_CUM	CUM_ALL	Amount
42	7-Jun-13	14.82%	$ 329,911.84	$ 20,566,806.66	$ 1,407,998.35	$ 22,304,716.85	$ 813,495.00
43	7-Jun-13	14.82%	$ 329,911.84	$ 20,686,321.66	$ 1,407,998.35	$ 22,424,231.85	$ 119,515.00
45	7-Jun-13	14.82%	$ 381,911.84	$ 20,686,321.66	$ 1,407,998.35	$ 22,476,231.85	$ 52,000.00
46	7-Jun-13	14.82%	$ 381,911.84	$ 20,994,785.66	$ 1,407,998.35	$ 22,784,695.85	$ 308,464.00
44	7-Jun-13	14.82%	$ 451,911.84	$ 20,994,785.66	$ 1,407,998.35	$ 22,854,695.85	$ 70,000.00
47	17-Jul-13	16.39%	$ 451,911.84	$ 120,327,632.20	$ 1,407,998.35	$ 122,187,542.39	$ 99,332,846.54
48	8-Oct-13	19.63%	$ 451,911.84	$ 120,327,632.20	$ 1,442,742.11	$ 122,222,286.15	$ 34,743.76
49	8-Oct-13	19.63%	$ 451,911.84	$ 120,590,967.20	$ 1,442,742.11	$ 122,485,621.15	$ 263,335.00
50	8-Oct-13	19.63%	$ 451,911.84	$ 147,258,120.66	$ 1,442,742.11	$ 149,152,774.61	$ 26,667,153.46
53	23-Oct-13	20.22%	$ 451,911.84	$ 154,728,604.66	$ 1,442,742.11	$ 156,623,258.61	$ 7,470,484.00
51	5-Nov-13	20.72%	$ 463,421.84	$ 154,728,604.66	$ 1,442,742.11	$ 156,634,768.61	$ 11,510.00
52	5-Nov-13	20.72%	$ 463,421.84	$ 154,728,604.66	$ 1,456,575.53	$156,648,602.03	$ 13,833.42
54	14-Nov-13	21.07%	$ 478,891.84	$ 154,728,604.66	$ 1,456,575.53	$ 156,664,072.03	$ 15,470.00
55	14-Nov-13	21.07%	$ 478,891.84	$ 154,728,604.66	$ 1,556,575.53	$ 156,764,072.03	$ 100,000.00
56	14-Nov-13	21.07%	$ 478,891.84	$ 154,728,604.66	$ 1,833,454.53	$ 157,040,951.03	$ 276,879.00
57	12-Dec-13	22.17%	$ 478,891.84	$ 155,933,484.66	$ 1,833,454.53	$ 158,245,831.03	$ 1,204,880.00
58	12-Dec-13	22.17%	$ 478,891.84	$ 156,399,646.66	$ 1,833,454.53	$ 158,711,993.03	$ 466,162.00
59	6-Jan-14	23.15%	$ 478,891.84	$ 156,399,646.66	$ 1,841,848.00	$ 158,720,386.50	$ 8,393.47
60	6-Jan-14	23.15%	$ 478,891.84	$ 156,399,646.66	$ 1,884,540.00	$ 158,763,078.50	$ 42,692.00
62	30-Jan-14	24.09%	$ 478,891.84	$ 156,399,646.66	$ 2,134,540.00	$ 159,013,078.50	$ 250,000.00
64	30-Jan-14	24.09%	$ 478,891.84	$ 158,899,646.66	$ 2,134,540.00	$ 161,513,078.50	$ 2,500,000.00
65	30-Jan-14	24.09%	$ 478,891.84	$ 159,899,646.66	$ 2,134,540.00	$ 162,513,078.50	$ 1,000,000.00
70	30-Jan-14	24.09%	$ 478,891.84	$ 159,899,646.66	$ 4,762,605.40	$ 165,141,143.90	$ 2,628,065.40
61	3-Feb-14	24.25%	$ 478,891.84	$ 159,899,646.66	$ 4,762,605.40	$ 165,141,143.90	$ 0.00
63	21-Feb-14	24.95%	$ 478,891.84	$ 159,899,646.66	$ 4,862,355.40	$165,240,893.90	$ 99,750.00
68	11-Mar-14	25.65%	$ 478,891.84	$ 159,899,646.66	$ 4,862,355.40	$165,240,893.90	$ 0.00
66	13-Mar-14	25.73%	$ 478,891.84	$ 159,899,646.66	$ 4,860,750.40	$165,239,288.90	$ (1,605.00)
67	13-Mar-14	25.74%	$ 535,391.84	$ 159,899,646.66	$ 4,860,750.40	$ 165,295,788.90	$ 56,500.00
80	18-Mar-14	25.93%	$ 535,391.84	$ 160,349,646.66	$ 4,860,750.40	$ 165,745,788.90	$ 450,000.00
81	18-Mar-14	25.93%	$ 535,391.84	$ 160,699,646.66	$ 4,860,750.40	$ 166,095,788.90	$ 350,000.00
69	17-Apr-14	27.11%	$ 571,391.84	$ 160,699,646.66	$ 4,860,750.40	$ 166,131,788.90	$ 36,000.00
71	17-Apr-14	27.11%	$ 571,391.84	$ 160,699,646.66	$ 4,967,557.40	$166,238,595.90	$ 106,807.00
73	17-Apr-14	27.11%	$ 571,391.84	$ 160,699,646.66	$ 5,358,308.40	$166,629,346.90	$ 390,751.00
74	17-Apr-14	27.11%	$ 621,391.84	$ 160,699,646.66	$ 5,358,308.40	$ 166,679,346.90	$ 50,000.00
76	17-Apr-14	27.11%	$ 750,091.84	$ 160,699,646.66	$ 5,358,308.40	$166,808,046.90	$ 128,700.00
77	17-Apr-14	27.11%	$ 750,091.84	$ 160,749,673.11	$ 5,358,308.40	$ 166,858,073.35	$ 50,026.45
72	1-May-14	27.65%	$ 750,091.84	$ 160,749,673.11	$ 5,606,719.40	$ 167,106,484.35	$ 248,411.00
78	1-May-14	27.65%	$ 1,250,091.84	$ 160,749,673.11	$ 5,606,719.40	$ 167,606,484.35	$ 500,000.00
79	6-May-14	27.84%	$ 1,250,091.84	$ 160,899,673.11	$ 5,606,719.40	$ 167,756,484.35	$ 150,000.00
75	6-May-14	27.84%	$ 1,250,091.84	$ 160,899,673.11	$ 5,606,719.40	$ 167,756,484.35	$ 0.00
82	9-May-14	27.96%	$ 1,250,091.84	$ 160,899,673.11	$ 5,669,219.40	$ 167,818,984.35	$ 62,500.00
83	9-May-14	27.96%	$ 1,250,091.84	$ 160,899,673.11	$ 5,695,219.40	$ 167,844,984.35	$ 26,000.00
84	9-May-14	27.97%	$ 1,251,381.84	$ 160,899,673.11	$ 5,695,219.40	$ 167,846,274.35	$ 1,290.00
85	9-May-14	27.97%	$ 1,251,381.84	$ 160,899,673.11	$ 5,697,382.40	$ 167,848,437.35	$ 2,163.00
86	9-May-14	27.97%	$ 1,251,381.84	$ 160,954,673.11	$ 5,697,382.40	$ 167,903,437.35	$ 55,000.00

RW Block Consulting, Inc.

CO #	Date of Approval	% Time	DESIGN _ CUM	SITE_CUM	OTHER_CUM	CUM_ALL	Amount
87	9-May-14	27.97%	$ 1,251,381.84	$ 161,051,673.11	$ 5,697,382.40	$ 168,000,437.35	$ 97,000.00
90	9-May-14	27.97%	$ 1,251,381.84	$ 161,051,673.11	$ 5,897,382.40	$ 168,200,437.35	$ 200,000.00
89	13-May-14	28.13%	$ 1,260,070.84	$ 161,051,673.11	$ 5,897,382.40	$ 168,209,126.35	$ 8,689.00
92	3-Jul-14	30.12%	$ 1,260,070.84	$ 161,143,063.11	$ 5,897,382.40	$ 168,300,516.35	$ 91,390.00
93	3-Jul-14	30.12%	$ 1,260,070.84	$ 161,143,063.11	$ 5,910,168.40	$ 168,313,302.35	$ 12,786.00
94	3-Jul-14	30.12%	$ 1,260,070.84	$ 161,143,063.11	$ 5,984,808.40	$ 168,387,942.35	$ 74,640.00
95	3-Jul-14	30.12%	$1,263,564.38	$ 161,143,063.11	$ 5,984,808.40	$ 168,391,435.89	$ 3,493.54

RW Block Consulting, Inc.

EXHIBIT 2 – APPROVED CHANGE ORDERS NEW IRVINGTON TUNNEL

CO #	Date of Approval	% Time	DESIGN _ CUM	SITE_CUM	OTHER_CUM	CUM_ALL	Amount
1	19-Jul-10	-2.06%	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00
2	20-Jul-10	-2.01%	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00
4	7-Oct-10	2.28%	$ 0.00	$ 0.00	$ 106,279.00	$ 106,279.00	$ 106,279.00
3	8-Oct-10	2.33%	$ 0.00	$ 0.00	$ 166,279.00	$ 166,279.00	$ 60,000.00
5	10-Dec-10	5.75%	$ 0.00	$ 0.00	$ 232,946.00	$ 232,946.00	$ 66,667.00
6	18-Jan-11	7.87%	$ 0.00	$ 0.00	$ 254,584.92	$ 254,584.92	$ 21,638.92
7	18-Jan-11	7.87%	$ 0.00	$ 0.00	$ 443,167.98	$ 443,167.98	$ 188,583.06
8	1-Feb-11	8.63%	$ 0.00	$ 0.00	$ 446,501.33	$ 446,501.33	$ 3,333.35
9	16-May-11	14.28%	$ 0.00	$ 0.00	$ 664,731.33	$ 664,731.33	$ 218,230.00
10	16-May-11	14.28%	$ 0.00	$ 861,983.00	$ 664,731.33	$ 1,526,714.33	$ 861,983.00
12	27-May-11	14.88%	$ 0.00	$ 861,983.00	$ 632,561.33	$ 1,494,544.33	$ (32,170.00)
13	1-Jun-11	15.15%	$ 0.00	$ 861,983.00	$ 637,876.61	$ 1,499,859.61	$ 5,315.28
11	9-Jun-11	15.58%	$ 0.00	$ 861,983.00	$ 638,935.45	$ 1,500,918.45	$ 1,058.84
14	9-Jun-11	15.58%	$ 0.00	$ 861,983.00	$ 638,935.45	$ 1,500,918.45	$ 0.00
15	17-Jun-11	16.02%	$ 0.00	$ 886,983.00	$ 638,935.45	$ 1,525,918.45	$ 25,000.00
16	11-Jul-11	17.32%	$ 0.00	$ 886,983.00	$ 638,935.45	$ 1,525,918.45	$ 0.00
17	1-Sep-11	20.14%	$ 0.00	$ 886,983.00	$ 638,935.45	$ 1,525,918.45	$ 0.00
18	8-Sep-11	20.52%	$ 0.00	$ 886,983.00	$ 650,760.24	$ 1,537,743.24	$ 11,824.79
19	9-Sep-11	20.58%	$ 0.00	$ 896,782.00	$ 650,760.24	$ 1,547,542.24	$ 9,799.00
20	15-Sep-11	20.90%	$ 0.00	$ 896,782.00	$ 725,003.24	$ 1,621,785.24	$ 74,243.00
22	20-Sep-11	21.17%	$ 0.00	$ 896,782.00	$ 750,525.24	$ 1,647,307.24	$ 25,522.00
23	20-Sep-11	21.17%	$ 54,026.00	$ 896,782.00	$ 750,525.24	$ 1,701,333.24	$ 54,026.00
24	20-Sep-11	21.17%	$ 75,185.00	$ 896,782.00	$ 750,525.24	$ 1,722,492.24	$ 21,159.00
21	20-Sep-11	21.17%	$ 162,021.00	$ 896,782.00	$ 750,525.24	$ 1,809,328.24	$ 86,836.00
25	20-Sep-11	21.17%	$ 165,444.00	$ 896,782.00	$ 750,525.24	$ 1,812,751.24	$ 3,423.00
26	20-Sep-11	21.17%	$ 165,444.00	$ 896,782.00	$ 750,525.24	$ 1,812,751.24	$ 0.00
27	5-Oct-11	21.99%	$ 165,444.00	$ 896,782.00	$ 750,525.24	$ 1,812,751.24	$ 0.00
28	20-Oct-11	22.80%	$ 165,444.00	$ 896,782.00	$ 750,525.24	$ 1,812,751.24	$ 0.00
29	31-Oct-11	23.40%	$ 165,444.00	$ 896,782.00	$ 750,525.24	$ 1,812,751.24	$ 0.00
30	19-Dec-11	26.06%	$ 165,444.00	$ 896,782.00	$ 750,525.24	$ 1,812,751.24	$ 0.00
31	4-Jan-12	26.93%	$ 464,554.36	$ 896,782.00	$ 750,525.24	$ 2,111,861.60	$ 299,110.36
32	4-Jan-12	26.93%	$ 464,554.36	$ 896,782.00	$ 1,075,257.24	$ 2,436,593.60	$ 324,732.00
35	2-Mar-12	30.08%	$ 479,845.50	$ 896,782.00	$ 1,075,257.24	$ 2,451,884.74	$ 15,291.14
33	2-Mar-12	30.08%	$ 479,845.50	$ 896,782.00	$ 1,096,918.24	$ 2,473,545.74	$ 21,661.00
36	2-Mar-12	30.08%	$ 479,845.50	$ 913,147.00	$ 1,096,918.24	$ 2,489,910.74	$ 16,365.00
37	2-Mar-12	30.08%	$ 479,845.50	$ 934,993.84	$ 1,096,918.24	$ 2,511,757.58	$ 21,846.84
39	6-Mar-12	30.29%	$ 479,845.50	$ 948,799.82	$ 1,096,918.24	$ 2,525,563.56	$ 13,805.98
38	9-Mar-12	30.46%	$ 479,845.50	$ 3,748,799.82	$ 1,096,918.24	$ 5,325,563.56	$ 2,800,000.00
40	22-Mar-12	31.19%	$ 479,845.50	$ 3,748,799.82	$ 1,096,918.24	$ 5,325,563.56	$ 0.00
41	28-Mar-12	31.49%	$ 479,845.50	$ 4,146,103.16	$ 1,096,918.24	$ 5,722,866.90	$ 397,303.34
42	12-Apr-12	32.30%	$ 479,845.50	$ 5,926,508.89	$ 1,096,918.24	$ 7,503,272.63	$ 1,780,405.73
43	12-Apr-12	32.30%	$ 479,845.50	$ 8,989,535.72	$ 1,096,918.24	$ 10,566,299.46	$ 3,063,026.83

CO #	Date of Approval	% Time	DESIGN _ CUM	SITE_CUM	OTHER_CUM	CUM_ALL	Amount
44	23-Apr-12	32.90%	$ 479,845.50	$ 8,989,535.72	$ 1,137,090.20	$ 10,606,471.42	$ 40,171.96
45	23-Apr-12	32.90%	$ 479,845.50	$ 8,989,535.72	$ 1,142,049.20	$ 10,611,430.42	$ 4,959.00
46	25-Apr-12	33.03%	$ 479,845.50	$ 8,989,535.72	$ 1,142,049.20	$ 10,611,430.42	$ 0.00
47	18-May-12	34.26%	$ 479,845.50	$ 8,991,385.37	$ 1,142,049.20	$ 10,613,280.07	$ 1,849.65
48	24-May-12	34.58%	$ 479,845.50	$ 9,031,385.37	$ 1,142,049.20	$ 10,653,280.07	$ 40,000.00
51	11-Jun-12	35.56%	$ 479,845.50	$ 9,031,385.37	$ 1,142,049.20	$ 10,653,280.07	$ 0.00
49	11-Jun-12	35.56%	$ 479,845.50	$ 9,444,707.50	$ 1,142,049.20	$ 11,066,602.20	$ 413,322.13
50	11-Jun-12	35.56%	$ 479,845.50	$ 10,170,462.55	$ 1,142,049.20	$ 11,792,357.25	$ 725,755.05
52	11-Jun-12	35.56%	$ 479,845.50	$ 10,666,182.55	$ 1,142,049.20	$ 12,288,077.25	$ 495,720.00
34	18-Jun-12	35.96%	$ 479,845.50	$ 10,666,182.55	$ 1,142,049.20	$ 12,288,077.25	$ 0.00
54	16-Jul-12	37.46%	$ 485,688.50	$ 10,666,182.55	$ 1,142,049.20	$ 12,293,920.25	$ 5,843.00
55	16-Jul-12	37.46%	$ 493,426.50	$ 10,666,182.55	$ 1,142,049.20	$ 12,301,658.25	$ 7,738.00
53	16-Jul-12	37.46%	$ 493,426.50	$ 10,666,182.55	$ 1,217,686.20	$ 12,377,295.25	$ 75,637.00
57	21-Aug-12	39.41%	$ 493,426.50	$ 10,666,182.55	$ 1,231,313.20	$ 12,390,922.25	$ 13,627.00
56	21-Aug-12	39.41%	$ 493,426.50	$ 10,680,650.55	$ 1,231,313.20	$ 12,405,390.25	$ 14,468.00
60	19-Sep-12	40.99%	$ 500,885.50	$ 10,680,650.55	$ 1,231,313.20	$ 12,412,849.25	$ 7,459.00
58	19-Sep-12	40.99%	$ 504,896.50	$ 10,680,650.55	$ 1,231,313.20	$ 12,416,860.25	$ 4,011.00
59	19-Sep-12	40.99%	$ 504,896.50	$ 10,680,650.55	$ 1,238,268.60	$ 12,423,815.65	$ 6,955.40
61	25-Sep-12	41.35%	$ 504,896.50	$ 10,680,650.55	$ 1,238,268.60	$ 12,423,815.65	$ 0.00
62	12-Oct-12	42.24%	$ 504,896.50	$ 14,917,544.33	$ 1,238,268.60	$ 16,660,709.43	$ 4,236,893.78
63	12-Oct-12	42.24%	$ 504,896.50	$ 15,413,264.33	$ 1,238,268.60	$ 17,156,429.43	$ 495,720.00
65	22-Oct-12	42.78%	$ 504,896.50	$ 15,550,181.43	$ 1,238,268.60	$ 17,293,346.53	$ 136,917.10
66	22-Oct-12	42.78%	$ 504,896.50	$ 15,782,887.27	$ 1,238,268.60	$ 17,526,052.37	$ 232,705.84
67	26-Oct-12	43.00%	$ 504,896.50	$ 15,782,887.27	$ 1,293,263.24	$ 17,581,047.01	$ 54,994.64
64	26-Oct-12	43.02%	$ 504,896.50	$ 15,782,887.27	$ 1,293,263.24	$ 17,581,047.01	$ 0.00
68	19-Nov-12	44.30%	$ 543,839.50	$ 15,782,887.27	$ 1,293,263.24	$ 17,619,990.01	$ 38,943.00
70	19-Nov-12	44.30%	$ 543,839.50	$ 15,782,887.27	$ 1,296,909.24	$ 17,623,636.01	$ 3,646.00
69	28-Nov-12	44.81%	$ 543,839.50	$ 15,782,887.27	$ 1,296,909.24	$ 17,623,636.01	$ 0.00
72	10-Dec-12	45.44%	$ 543,839.50	$ 16,278,607.27	$ 1,296,909.24	$ 18,119,356.01	$ 495,720.00
71	2-Jan-13	46.71%	$ 543,839.50	$ 16,278,607.27	$ 1,296,909.24	$ 18,119,356.01	$ 0.00
74	8-Feb-13	48.70%	$ 543,839.50	$ 16,278,607.27	$ 1,299,550.24	$ 18,121,997.01	$ 2,641.00
73	8-Feb-13	48.73%	$ 543,839.50	$ 16,278,607.27	$ 1,299,550.24	$ 18,121,997.01	$ 0.00
76	13-Feb-13	48.97%	$ 560,118.50	$ 16,278,607.27	$ 1,299,550.24	$ 18,138,276.01	$ 16,279.00
75	13-Feb-13	48.97%	$ 560,118.50	$ 16,288,828.86	$ 1,299,550.24	$ 18,148,497.60	$ 10,221.59
77	12-Mar-13	50.43%	$ 560,118.50	$ 16,288,828.86	$ 1,363,942.24	$ 18,212,889.60	$ 64,392.00
78	26-Apr-13	52.88%	$ 560,118.50	$ 16,288,828.86	$ 1,363,942.24	$ 18,212,889.60	$ 0.00
79	9-May-13	53.58%	$ 562,393.50	$ 16,288,828.86	$ 1,363,942.24	$ 18,215,164.60	$ 2,275.00
80	3-Jun-13	54.98%	$ 562,393.50	$ 16,288,828.86	$ 1,363,942.24	$ 18,215,164.60	$ 0.00
81	5-Jun-13	55.05%	$ 562,393.50	$ 16,288,828.86	$ 1,413,942.24	$ 18,265,164.60	$ 50,000.00
83	14-Jun-13	55.54%	$ 562,393.50	$ 16,616,878.86	$ 1,413,942.24	$ 18,593,214.60	$ 328,050.00
82	19-Jun-13	55.83%	$ 562,393.50	$ 16,616,878.86	$ 1,413,942.24	$ 18,593,214.60	$ 0.00
84	21-Jun-13	55.92%	$ 562,393.50	$ 16,616,878.86	$ 1,460,097.24	$ 18,639,369.60	$ 46,155.00
85	24-Jul-13	57.74%	$ 562,393.50	$ 16,616,878.86	$ 1,460,097.24	$ 18,639,369.60	$ 0.00
87	25-Jul-13	57.76%	$ 562,393.50	$ 16,616,878.86	$ 1,480,934.24	$ 18,660,206.60	$ 20,837.00
86	30-Jul-13	58.03%	$ 562,393.50	$ 16,874,578.86	$ 1,480,934.24	$ 18,917,906.60	$ 257,700.00

RW Block Consulting, Inc.

CO #	Date of Approval	% Time	DESIGN _ CUM	SITE_CUM	OTHER_CUM	CUM_ALL	Amount
88	7-Aug-13	58.47%	$ 562,393.50	$ 17,121,997.03	$ 1,480,934.24	$ 19,165,324.77	$ 247,418.17
89	7-Aug-13	58.47%	$ 562,393.50	$ 17,143,338.59	$ 1,480,934.24	$ 19,186,666.33	$ 21,341.56
91	11-Sep-13	60.37%	$ 562,393.50	$ 17,143,338.59	$ 1,482,798.24	$ 19,188,530.33	$ 1,864.00
92	23-Sep-13	61.02%	$ 562,393.50	$ 17,143,338.59	$ 1,501,997.24	$ 19,207,729.33	$ 19,199.00
90	25-Sep-13	61.15%	$ 562,393.50	$ 17,143,338.59	$ 1,501,997.24	$ 19,207,729.33	$ 0.00
93	15-Oct-13	62.21%	$ 567,372.50	$ 17,143,338.59	$ 1,501,997.24	$ 19,212,708.33	$ 4,979.00
94	16-Oct-13	62.27%	$ 567,372.50	$ 17,143,338.59	$ 1,551,997.24	$ 19,262,708.33	$ 50,000.00
95	16-Oct-13	62.27%	$ 567,372.50	$ 17,259,978.59	$ 1,551,997.24	$ 19,379,348.33	$ 116,640.00
96	24-Oct-13	62.70%	$ 572,125.50	$ 17,259,978.59	$ 1,551,997.24	$ 19,384,101.33	$ 4,753.00
97	8-Nov-13	63.52%	$ 572,125.50	$ 17,952,275.49	$ 1,551,997.24	$ 20,076,398.23	$ 692,296.90
98	19-Nov-13	64.12%	$ 572,125.50	$ 21,694,650.88	$ 1,551,997.24	$ 23,818,773.62	$ 3,742,375.39
99	20-Nov-13	64.17%	$ 572,125.50	$ 22,884,308.91	$ 1,551,997.24	$ 25,008,431.65	$ 1,189,658.03
101	15-Jan-14	67.21%	$ 572,125.50	$ 25,964,265.73	$ 1,551,997.24	$ 28,088,388.47	$ 3,079,956.82
100	30-Jan-14	68.05%	$ 572,125.50	$ 25,999,970.73	$ 1,551,997.24	$ 28,124,093.47	$ 35,705.00
102	13-Mar-14	70.33%	$ 572,125.50	$ 25,999,970.73	$ 1,560,494.24	$ 28,132,590.47	$ 8,497.00
103	13-Mar-14	70.33%	$ 576,767.50	$ 25,999,970.73	$ 1,560,494.24	$ 28,137,232.47	$ 4,642.00
104	18-Mar-14	70.61%	$ 576,767.50	$ 26,290,235.38	$ 1,560,494.24	$ 28,427,497.12	$ 290,264.65
105	17-Apr-14	72.23%	$ 576,767.50	$ 26,290,235.38	$ 1,572,663.24	$ 28,439,666.12	$ 12,169.00
106	17-Apr-14	72.23%	$ 576,767.50	$ 26,290,235.38	$ 1,578,720.24	$ 28,445,723.12	$ 6,057.00
107	4-Jun-14	74.83%	$ 576,767.50	$ 26,334,657.43	$ 1,578,720.24	$ 28,490,145.17	$ 44,422.05
108	4-Jun-14	74.83%	$ 576,767.50	$ 26,364,365.39	$ 1,578,720.24	$ 28,519,853.13	$ 29,707.96

RW Block Consulting, Inc.

EXHIBIT 3 – APPROVED CHANGE ORDERS BAY TUNNEL

CO #	Date of Approval	% Time	DESIGN _ CUM	SITE_CUM	OTHER_CUM	CUM_ALL	Amount
1	21-Jul-10	5.70%	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00
2	1-Dec-10	12.53%	$ 0.00	$ 0.00	$ 49,645.75	$ 49,645.75	$ 49,645.75
3	8-Dec-10	12.89%	$ 0.00	$ 0.00	$ 54,318.25	$ 54,318.25	$ 4,672.50
4	8-Dec-10	12.89%	$ 0.00	$ 0.00	$ 124,318.60	$ 124,318.60	$ 70,000.35
7	20-Aug-11	25.99%	$ 35,182.57	$ 0.00	$ 124,318.60	$ 159,501.17	$ 35,182.57
8	22-Aug-11	26.09%	$ 35,182.57	$ 0.00	$ 124,318.60	$ 159,501.17	$ 0.00
9	23-Aug-11	26.14%	$ 35,182.57	$ 0.00	$ 143,118.60	$ 178,301.17	$ 18,800.00
11	30-Sep-11	28.09%	$ 35,182.57	$ 0.00	$ (56,881.40)	$ (21,698.83)	$ (200,000.00)
13	3-Nov-11	29.84%	$ 35,182.57	$ 0.00	$ (56,881.40)	$ (21,698.83)	$ 0.00
12	21-Nov-11	30.77%	$ 35,182.57	$ 0.00	$ (57,377.34)	$ (22,194.77)	$ (495.94)
14	5-Jan-12	33.08%	$ 35,182.57	$ 0.00	$ (57,377.34)	$ (22,194.77)	$ 0.00
16	10-Feb-12	34.93%	$ 35,182.57	$ 0.00	$ (34,328.88)	$ 853.69	$ 23,048.46
15	7-Mar-12	36.26%	$ 35,182.57	$ 0.00	$ (34,328.88)	$ 853.69	$ 0.00
17	11-Jul-12	42.73%	$ 35,182.57	$ 0.00	$ (31,422.88)	$ 3,759.69	$ 2,906.00
18	13-Nov-12	49.15%	$ 35,182.57	$ 0.00	$ (31,422.88)	$ 3,759.69	$ 0.00
20	26-Mar-13	55.98%	$ 35,182.57	$ 0.00	$ (9,881.19)	$ 25,301.38	$ 21,541.69
19	26-Mar-13	55.98%	$ 35,182.57	$ 0.00	$ 390,118.81	$ 425,301.38	$ 400,000.00
21	24-May-13	59.01%	$ 35,182.57	$ 0.00	$ 463,432.81	$ 498,615.38	$ 73,314.00
23	14-Aug-13	63.23%	$ 35,182.57	$ 0.00	$ 1,722,432.81	$ 1,757,615.38	$ 1,259,000.00
22	19-Aug-13	63.48%	$ 35,182.57	$ 0.00	$ 1,727,682.81	$ 1,762,865.38	$ 5,250.00
24	6-Sep-13	64.41%	$ 35,182.57	$ 0.00	$ 1,743,097.12	$ 1,778,279.69	$ 15,414.31
25	21-Feb-14	73.04%	$ 35,182.57	$ 0.00	$ 2,279,458.47	$ 2,314,641.04	$ 536,361.35
26	28-Apr-14	76.43%	$ 99,182.57	$ 0.00	$ 2,279,458.47	$ 2,378,641.04	$ 64,000.00

RW Block Consulting, Inc.

EXHIBIT 4 – APPROVED CHANGE ORDERS HARRY TRACY

CO #	Date of Approval	% Time	DESIGN _ CUM	SITE_CUM	OTHER_CUM	CUM_ALL	Amount
1	10-Oct-12	36.67%	$ 0.00	$ 2,231.00	$ 0.00	$ 2,231.00	$ 2,231.00
2	10-Oct-12	36.68%	$ 0.00	$ 22,628.00	$ 0.00	$ 22,628.00	$ 20,397.00
5	10-Oct-12	36.68%	$ 0.00	$ 22,628.00	$ 32,586.00	$ 55,214.00	$ 32,586.00
6	10-Oct-12	36.68%	$ 3,249.00	$ 22,628.00	$ 32,586.00	$ 58,463.00	$ 3,249.00
7	10-Oct-12	36.68%	$ 6,449.00	$ 22,628.00	$ 32,586.00	$ 61,663.00	$ 3,200.00
8	10-Oct-12	36.68%	$ 6,449.00	$ 26,243.00	$ 32,586.00	$ 65,278.00	$ 3,615.00
10	10-Oct-12	36.68%	$ 6,449.00	$ 122,875.00	$ 32,586.00	$ 161,910.00	$ 96,632.00
11	10-Oct-12	36.68%	$ 0.00	$ 122,875.00	$ 32,586.00	$ 153,684.00	$ (8,226.00)
12	10-Oct-12	36.68%	$ (1,777.00)	$ 123,315.00	$ 32,586.00	$ 154,124.00	$ 440.00
15	10-Oct-12	36.68%	$ (1,777.00)	$ 123,315.00	$ 82,422.00	$ 203,960.00	$ 49,836.00
16	10-Oct-12	36.68%	$ (1,777.00)	$ 195,878.00	$ 82,422.00	$ 276,523.00	$ 72,563.00
18	10-Oct-12	36.68%	$ (1,777.00)	$ 195,878.00	$ 77,362.00	$ 271,463.00	$ (5,060.00)
19	10-Oct-12	36.68%	$ 40,460.00	$ 195,878.00	$ 77,362.00	$ 313,700.00	$ 42,237.00
20	10-Oct-12	36.68%	$ 40,460.00	$ 195,878.00	$ 77,362.00	$ 313,700.00	$ 0.00
21	10-Oct-12	36.68%	$ 40,460.00	$ 195,878.00	$ 79,771.00	$ 316,109.00	$ 2,409.00
26	10-Oct-12	36.68%	$ 48,460.00	$ 195,878.00	$ 79,771.00	$ 324,109.00	$ 8,000.00
27	10-Oct-12	36.68%	$ 48,460.00	$ 216,876.00	$ 79,771.00	$ 345,107.00	$ 20,998.00
30	10-Oct-12	36.68%	$ 48,460.00	$ 216,876.00	$ 110,158.00	$ 375,494.00	$ 30,387.00
31	10-Oct-12	36.68%	$ 48,460.00	$ 219,226.00	$ 110,158.00	$ 377,844.00	$ 2,350.00
13	10-Oct-12	36.68%	$ 48,460.00	$ 260,282.00	$ 110,158.00	$ 418,900.00	$ 41,056.00
3	25-Oct-12	37.62%	$ 48,460.00	$ 262,898.00	$ 110,158.00	$ 421,516.00	$ 2,616.00
4	25-Oct-12	37.62%	$ 55,657.00	$ 262,898.00	$ 110,158.00	$ 428,713.00	$ 7,197.00
23	25-Oct-12	37.62%	$ 57,945.00	$ 262,898.00	$ 110,158.00	$ 431,001.00	$ 2,288.00
33	25-Oct-12	37.62%	$ 57,945.00	$ 371,018.00	$ 110,158.00	$ 539,121.00	$ 108,120.00
37	25-Oct-12	37.62%	$ 227,321.00	$ 371,018.00	$ 110,158.00	$ 708,497.00	$ 169,376.00
36	25-Oct-12	37.63%	$ 227,321.00	$ 386,630.00	$ 110,158.00	$ 724,109.00	$ 15,612.00
38	25-Oct-12	37.63%	$ 229,719.00	$ 386,630.00	$ 110,158.00	$ 726,507.00	$ 2,398.00
40	25-Oct-12	37.63%	$ 229,719.00	$ 386,630.00	$ 259,532.00	$ 875,881.00	$ 149,374.00
46	25-Jan-13	43.48%	$ 301,285.00	$ 386,630.00	$ 259,532.00	$ 947,447.00	$ 71,566.00
51	25-Jan-13	43.48%	$ 301,285.00	$ 387,075.00	$ 259,532.00	$ 947,892.00	$ 445.00
52	25-Jan-13	43.48%	$ 317,416.00	$ 387,075.00	$ 259,532.00	$ 964,023.00	$ 16,131.00
58	25-Jan-13	43.48%	$ 320,678.00	$ 387,075.00	$ 259,532.00	$ 967,285.00	$ 3,262.00
59	25-Jan-13	43.48%	$ 337,046.00	$ 387,075.00	$ 259,532.00	$ 983,653.00	$ 16,368.00
60	25-Jan-13	43.48%	$ 342,027.00	$ 387,075.00	$ 259,532.00	$ 988,634.00	$ 4,981.00
62	22-Feb-13	45.28%	$ 375,771.00	$ 387,075.00	$ 259,532.00	$ 1,022,378.00	$ 33,744.00
65	22-Feb-13	45.28%	$ 376,032.00	$ 387,075.00	$ 259,532.00	$ 1,022,639.00	$ 261.00
67	22-Feb-13	45.28%	$ 415,203.00	$ 387,075.00	$ 259,532.00	$ 1,061,810.00	$ 39,171.00
68	22-Feb-13	45.28%	$ 440,397.00	$ 387,075.00	$ 259,532.00	$ 1,087,004.00	$ 25,194.00
71	21-Mar-13	47.02%	$ 440,397.00	$ 392,493.00	$ 259,532.00	$ 1,092,422.00	$ 5,418.00
74	21-Mar-13	47.02%	$ 443,814.00	$ 392,493.00	$ 259,532.00	$ 1,095,839.00	$ 3,417.00
75	21-Mar-13	47.02%	$ 443,814.00	$ 392,493.00	$ 301,856.00	$ 1,138,163.00	$ 42,324.00
76	21-Mar-13	47.02%	$ 443,814.00	$ 394,638.00	$ 301,856.00	$ 1,140,308.00	$ 2,145.00

RW Block Consulting, Inc.

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78	21-Mar-13	47.02%	$ 443,814.00	$ 395,433.00	$ 301,856.00	$ 1,141,103.00	$ 795.00
79	21-Mar-13	47.02%	$ 443,814.00	$ 398,003.00	$ 301,856.00	$ 1,143,673.00	$ 2,570.00
80	21-Mar-13	47.02%	$ 504,825.00	$ 398,003.00	$ 301,856.00	$ 1,204,684.00	$ 61,011.00
81	21-Mar-13	47.02%	$ 491,275.00	$ 398,003.00	$ 301,856.00	$ 1,191,134.00	$ (13,550.00)
82	21-Mar-13	47.02%	$ 492,324.00	$ 398,003.00	$ 301,856.00	$ 1,192,183.00	$ 1,049.00
83	21-Mar-13	47.02%	$ 492,324.00	$ 406,057.00	$ 301,856.00	$ 1,200,237.00	$ 8,054.00
32	8-May-13	50.05%	$ 492,324.00	$ 406,057.00	$ 304,111.00	$ 1,202,492.00	$ 2,255.00
84	24-May-13	51.08%	$ 562,357.00	$ 406,057.00	$ 304,111.00	$ 1,272,525.00	$ 70,033.00
85	24-May-13	51.08%	$ 581,733.00	$ 406,057.00	$ 304,111.00	$ 1,291,901.00	$ 19,376.00
86	24-May-13	51.08%	$ 596,050.00	$ 406,057.00	$ 304,111.00	$ 1,306,218.00	$ 14,317.00
88	24-May-13	51.08%	$ 602,234.00	$ 406,057.00	$ 304,111.00	$ 1,312,402.00	$ 6,184.00
89	24-May-13	51.08%	$ 605,867.00	$ 406,057.00	$ 304,111.00	$ 1,316,035.00	$ 3,633.00
90	24-May-13	51.08%	$ 641,643.00	$ 406,057.00	$ 304,111.00	$ 1,351,811.00	$ 35,776.00
91	24-May-13	51.08%	$ 643,429.00	$ 406,057.00	$ 304,111.00	$ 1,353,597.00	$ 1,786.00
92	24-May-13	51.08%	$ 645,154.00	$ 406,057.00	$ 304,111.00	$ 1,355,322.00	$ 1,725.00
94	24-May-13	51.08%	$ 654,889.00	$ 406,057.00	$ 304,111.00	$ 1,365,057.00	$ 9,735.00
95	24-May-13	51.08%	$ 654,889.00	$ 407,149.00	$ 304,111.00	$ 1,366,149.00	$ 1,092.00
96	24-May-13	51.08%	$ 655,496.00	$ 407,149.00	$ 304,111.00	$ 1,366,756.00	$ 607.00
97	24-May-13	51.08%	$ 655,496.00	$ 414,255.00	$ 304,111.00	$ 1,373,862.00	$ 7,106.00
98	24-May-13	51.08%	$ 655,496.00	$ 418,191.00	$ 304,111.00	$ 1,377,798.00	$ 3,936.00
99	24-May-13	51.08%	$ 655,496.00	$ 423,396.00	$ 304,111.00	$ 1,383,003.00	$ 5,205.00
100	24-May-13	51.08%	$ 675,065.00	$ 423,396.00	$ 304,111.00	$ 1,402,572.00	$ 19,569.00
93	19-Jun-13	52.75%	$ 675,065.00	$ 426,127.00	$ 304,111.00	$ 1,405,303.00	$ 2,731.00
103	19-Jun-13	52.75%	$ 680,337.00	$ 426,127.00	$ 304,111.00	$ 1,410,575.00	$ 5,272.00
104	19-Jun-13	52.75%	$ 680,337.00	$ 427,952.00	$ 304,111.00	$ 1,412,400.00	$ 1,825.00
105	19-Jun-13	52.75%	$ 702,601.00	$ 427,952.00	$ 304,111.00	$ 1,434,664.00	$ 22,264.00
107	19-Jun-13	52.75%	$ 702,601.00	$ 427,952.00	$ 600,405.00	$ 1,730,958.00	$ 296,294.00
57	15-Jul-13	54.40%	$ 702,601.00	$ 430,674.00	$ 600,405.00	$ 1,733,680.00	$ 2,722.00
61	15-Jul-13	54.40%	$ 702,601.00	$ 479,387.00	$ 600,405.00	$ 1,782,393.00	$ 48,713.00
63	15-Jul-13	54.40%	$ 709,481.00	$ 479,387.00	$ 600,405.00	$ 1,789,273.00	$ 6,880.00
66	15-Jul-13	54.40%	$ 709,481.00	$ 491,509.00	$ 600,405.00	$ 1,801,395.00	$ 12,122.00
69	15-Jul-13	54.40%	$ 709,481.00	$ 497,315.00	$ 600,405.00	$ 1,807,201.00	$ 5,806.00
73	15-Jul-13	54.40%	$ 709,481.00	$ 500,787.00	$ 600,405.00	$ 1,810,673.00	$ 3,472.00
77	15-Jul-13	54.40%	$ 709,481.00	$ 508,530.00	$ 600,405.00	$ 1,818,416.00	$ 7,743.00
101	15-Jul-13	54.40%	$ 714,863.00	$ 508,530.00	$ 600,405.00	$ 1,823,798.00	$ 5,382.00
117	15-Jul-13	54.40%	$ 714,863.00	$ 516,137.00	$ 600,405.00	$ 1,831,405.00	$ 7,607.00
44	17-Jul-13	54.53%	$ 721,018.00	$ 516,137.00	$ 600,405.00	$ 1,837,560.00	$ 6,155.00
64	20-Sep-13	58.68%	$ 721,018.00	$ 517,140.00	$ 600,405.00	$ 1,838,563.00	$ 1,003.00
70	20-Sep-13	58.68%	$ 721,018.00	$ 518,313.00	$ 600,405.00	$ 1,839,736.00	$ 1,173.00
72	20-Sep-13	58.68%	$ 733,072.00	$ 518,313.00	$ 600,405.00	$ 1,851,790.00	$ 12,054.00
108	20-Sep-13	58.68%	$ 733,072.00	$ 518,313.00	$ 605,104.00	$ 1,856,489.00	$ 4,699.00
118	20-Sep-13	58.68%	$ 752,418.00	$ 518,313.00	$ 605,104.00	$ 1,875,835.00	$ 19,346.00
119	20-Sep-13	58.68%	$ 752,418.00	$ 518,313.00	$ 607,458.00	$ 1,878,189.00	$ 2,354.00
125	20-Sep-13	58.68%	$ 774,703.00	$ 518,313.00	$ 607,458.00	$ 1,900,474.00	$ 22,285.00
129	20-Sep-13	58.68%	$ 774,703.00	$ 521,659.00	$ 607,458.00	$ 1,903,820.00	$ 3,346.00

RW Block Consulting, Inc.

CO #	Date of Approval	% Time	DESIGN _ CUM	SITE_CUM	OTHER_CUM	CUM_ALL	Amount
130	20-Sep-13	58.68%	$ 781,364.00	$ 521,659.00	$ 607,458.00	$ 1,910,481.00	$ 6,661.00
133	20-Sep-13	58.68%	$ 781,364.00	$ 591,380.00	$ 607,458.00	$ 1,980,202.00	$ 69,721.00
139	20-Sep-13	58.68%	$ 790,769.00	$ 591,380.00	$ 607,458.00	$ 1,989,607.00	$ 9,405.00
140	20-Sep-13	58.68%	$ 790,769.00	$ 806,393.00	$ 607,458.00	$2,204,620.00	$ 215,013.00
142	20-Sep-13	58.68%	$ 790,769.00	$ 807,467.00	$ 607,458.00	$2,205,694.00	$ 1,074.00
143	20-Sep-13	58.68%	$ 791,773.00	$ 807,467.00	$ 607,458.00	$2,206,698.00	$ 1,004.00
150	20-Sep-13	58.68%	$ 791,773.00	$ 812,995.00	$ 607,458.00	$ 2,212,226.00	$ 5,528.00
152	20-Sep-13	58.68%	$ 791,773.00	$ 832,244.00	$ 607,458.00	$ 2,231,475.00	$ 19,249.00
160	20-Sep-13	58.68%	$ 795,361.00	$ 832,244.00	$ 607,458.00	$2,235,063.00	$ 3,588.00
167	20-Sep-13	58.68%	$ 795,361.00	$ 836,837.00	$ 607,458.00	$2,239,656.00	$ 4,593.00
175	20-Sep-13	58.68%	$ 816,350.00	$ 836,837.00	$ 607,458.00	$2,260,645.00	$ 20,989.00
39	20-Sep-13	58.69%	$ 816,350.00	$ 842,693.00	$ 607,458.00	$ 2,266,501.00	$ 5,856.00
41	20-Sep-13	58.69%	$ 827,176.00	$ 842,693.00	$ 607,458.00	$ 2,277,327.00	$ 10,826.00
42	20-Sep-13	58.69%	$ 881,117.00	$ 842,693.00	$ 607,458.00	$ 2,331,268.00	$ 53,941.00
185	12-Nov-13	62.06%	$ 881,117.00	$ 845,127.00	$ 607,458.00	$ 2,333,702.00	$ 2,434.00
186	12-Nov-13	62.06%	$ 881,117.00	$ 845,127.00	$ 897,865.00	$ 2,624,109.00	$ 290,407.00
188	12-Nov-13	62.06%	$ 882,177.00	$ 845,127.00	$ 897,865.00	$ 2,625,169.00	$ 1,060.00
190	12-Nov-13	62.06%	$ 882,177.00	$ 845,127.00	$ 917,898.00	$2,645,202.00	$ 20,033.00
191	12-Nov-13	62.06%	$ 882,177.00	$ 845,127.00	$ 947,646.00	$ 2,674,950.00	$ 29,748.00
192	12-Nov-13	62.06%	$ 886,324.00	$ 845,127.00	$ 947,646.00	$ 2,679,097.00	$ 4,147.00
194	12-Nov-13	62.06%	$ 886,324.00	$ 850,582.00	$ 947,646.00	$2,684,552.00	$ 5,455.00
110	12-Nov-13	62.06%	$ 886,324.00	$ 853,209.00	$ 947,646.00	$ 2,687,179.00	$ 2,627.00
115	12-Nov-13	62.06%	$ 886,324.00	$ 855,316.00	$ 947,646.00	$2,689,286.00	$ 2,107.00
116	12-Nov-13	62.06%	$ 886,324.00	$ 859,121.00	$ 947,646.00	$ 2,693,091.00	$ 3,805.00
145	15-Jan-14	66.14%	$ 1,088,455.00	$ 859,121.00	$ 947,646.00	$2,895,222.00	$ 202,131.00
195	15-Jan-14	66.14%	$ 1,088,455.00	$ 1,012,761.00	$ 947,646.00	$3,048,862.00	$ 153,640.00
209	15-Jan-14	66.14%	$ 1,488,086.00	$ 1,012,761.00	$ 947,646.00	$3,448,493.00	$ 399,631.00
210	15-Jan-14	66.14%	$ 1,516,367.00	$ 1,012,761.00	$ 947,646.00	$ 3,476,774.00	$ 28,281.00
213	15-Jan-14	66.14%	$ 1,516,367.00	$ 1,009,637.00	$ 947,646.00	$ 3,473,650.00	$ (3,124.00)
214	15-Jan-14	66.14%	$ 1,518,141.00	$ 1,009,637.00	$ 947,646.00	$ 3,475,424.00	$ 1,774.00
215	15-Jan-14	66.14%	$ 1,519,566.00	$ 1,009,637.00	$ 947,646.00	$ 3,476,849.00	$ 1,425.00
43	15-Jan-14	66.14%	$ 1,574,814.00	$ 1,009,637.00	$ 947,646.00	$ 3,532,097.00	$ 55,248.00
218	19-Feb-14	68.38%	$ 1,587,774.00	$ 1,009,637.00	$ 947,646.00	$ 3,545,057.00	$ 12,960.00
220	19-Feb-14	68.38%	$ 1,611,588.00	$ 1,009,637.00	$ 947,646.00	$ 3,568,871.00	$ 23,814.00
221	19-Feb-14	68.38%	$ 1,620,452.00	$ 1,009,637.00	$ 947,646.00	$ 3,577,735.00	$ 8,864.00
222	19-Feb-14	68.38%	$ 1,620,452.00	$ 1,009,637.00	$ 943,269.00	$ 3,573,358.00	$ (4,377.00)
223	19-Feb-14	68.38%	$ 1,625,840.00	$ 1,009,637.00	$ 943,269.00	$ 3,578,746.00	$ 5,388.00
224	19-Feb-14	68.38%	$ 1,626,419.00	$ 1,009,637.00	$ 943,269.00	$ 3,579,325.00	$ 579.00
225	19-Feb-14	68.38%	$ 1,626,419.00	$ 1,009,637.00	$ 944,777.00	$3,580,833.00	$ 1,508.00
226	19-Feb-14	68.38%	$ 1,626,419.00	$ 1,009,637.00	$ 959,149.00	$3,595,205.00	$ 14,372.00
227	19-Feb-14	68.38%	$ 1,648,820.00	$ 1,009,637.00	$ 959,149.00	$ 3,617,606.00	$ 22,401.00
228	19-Feb-14	68.38%	$ 1,648,820.00	$ 1,009,637.00	$ 961,344.00	$ 3,619,801.00	$ 2,195.00
229	19-Feb-14	68.38%	$ 1,691,390.00	$ 1,009,637.00	$ 961,344.00	$ 3,662,371.00	$ 42,570.00
237	19-Feb-14	68.38%	$ 1,885,649.00	$ 1,009,637.00	$ 961,344.00	$3,856,630.00	$ 194,259.00
238	19-Feb-14	68.38%	$ 1,986,924.00	$ 1,009,637.00	$ 961,344.00	$ 3,957,905.00	$ 101,275.00

RW Block Consulting, Inc.

CO #	Date of Approval	% Time	DESIGN _ CUM	SITE_CUM	OTHER_CUM	CUM_ALL	Amount
243	19-Feb-14	68.38%	$ 1,986,924.00	$ 1,389,637.00	$ 961,344.00	$ 4,337,905.00	$ 380,000.00
155	18-Mar-14	70.11%	$ 1,990,812.00	$ 1,389,637.00	$ 961,344.00	$ 4,341,793.00	$ 3,888.00
171	18-Mar-14	70.11%	$ 2,015,898.00	$ 1,389,637.00	$ 961,344.00	$ 4,366,879.00	$ 25,086.00
212	18-Mar-14	70.11%	$ 2,015,850.00	$ 1,389,637.00	$ 961,344.00	$ 4,366,831.00	$ (48.00)
230	18-Mar-14	70.11%	$ 2,017,991.00	$ 1,389,637.00	$ 961,344.00	$ 4,368,972.00	$ 2,141.00
231	18-Mar-14	70.11%	$ 2,017,991.00	$ 1,389,637.00	$ 961,034.00	$4,368,662.00	$ (310.00)
232	18-Mar-14	70.11%	$ 2,017,991.00	$ 1,429,746.00	$ 961,034.00	$ 4,408,771.00	$ 40,109.00
233	18-Mar-14	70.11%	$ 2,017,991.00	$ 1,429,746.00	$ 962,239.00	$ 4,409,976.00	$ 1,205.00
235	18-Mar-14	70.11%	$ 2,027,85.00	$ 1,429,746.00	$ 962,239.00	$ 4,419,800.00	$ 9,824.00
236	18-Mar-14	70.11%	$ 2,038,231.00	$ 1,429,746.00	$ 962,239.00	$ 4,430,216.00	$ 10,416.00
239	18-Mar-14	70.11%	$ 2,038,231.00	$ 1,429,746.00	$ 970,410.00	$ 4,438,387.00	$ 8,171.00
240	18-Mar-14	70.11%	$ 2,055,260.00	$ 1,429,746.00	$ 970,410.00	$ 4,455,416.00	$ 17,029.00
241	18-Mar-14	70.11%	$ 2,060,680.00	$ 1,429,746.00	$ 970,410.00	$4,460,836.00	$ 5,420.00
242	18-Mar-14	70.11%	$ 2,061,284.00	$ 1,429,746.00	$ 970,410.00	$ 4,461,440.00	$ 604.00
249	18-Mar-14	70.11%	$ 2,061,284.00	$ 1,471,138.00	$ 970,410.00	$4,502,832.00	$ 41,392.00
113	28-Apr-14	72.71%	$ 2,072,601.00	$ 1,471,138.00	$ 970,410.00	$ 4,514,149.00	$ 11,317.00
132	28-Apr-14	72.71%	$ 2,106,791.00	$ 1,471,138.00	$ 970,410.00	$4,548,339.00	$ 34,190.00
166	28-Apr-14	72.71%	$ 2,164,126.00	$ 1,471,138.00	$ 970,410.00	$ 4,605,674.00	$ 57,335.00
169	28-Apr-14	72.71%	$ 2,183,471.00	$ 1,471,138.00	$ 970,410.00	$ 4,625,019.00	$ 19,345.00
177	28-Apr-14	72.71%	$ 2,183,471.00	$ 1,496,913.00	$ 970,410.00	$ 4,650,794.00	$ 25,775.00
181	28-Apr-14	72.71%	$ 2,198,441.00	$ 1,496,913.00	$ 970,410.00	$ 4,665,764.00	$ 14,970.00
198	28-Apr-14	72.71%	$ 2,207,215.00	$ 1,496,913.00	$ 970,410.00	$ 4,674,538.00	$ 8,774.00
197	28-Apr-14	72.71%	$ 2,207,215.00	$ 1,496,913.00	$ 1,048,539.00	$ 4,752,667.00	$ 78,129.00
244	28-Apr-14	72.71%	$ 2,236,624.00	$ 1,496,913.00	$ 1,048,539.00	$ 4,782,076.00	$ 29,409.00
246	28-Apr-14	72.71%	$ 2,236,624.00	$ 1,496,913.00	$ 1,050,077.00	$ 4,783,614.00	$ 1,538.00
247	28-Apr-14	72.71%	$ 2,236,624.00	$ 1,496,913.00	$ 1,052,418.00	$ 4,785,955.00	$ 2,341.00
248	28-Apr-14	72.71%	$ 2,241,778.00	$ 1,496,913.00	$ 1,052,418.00	$ 4,791,109.00	$ 5,154.00
251	28-Apr-14	72.71%	$ 2,245,692.00	$ 1,496,913.00	$ 1,052,418.00	$ 4,795,023.00	$ 3,914.00
252	28-Apr-14	72.71%	$ 2,245,692.00	$ 1,516,179.00	$ 1,052,418.00	$ 4,814,289.00	$ 19,266.00
250	5-May-14	73.18%	$ 2,279,437.00	$ 1,516,179.00	$ 1,052,418.00	$4,848,034.00	$ 33,745.00
49	22-May-14	74.26%	$ 2,279,437.00	$ 1,545,891.00	$ 1,052,418.00	$ 4,877,746.00	$ 29,712.00
56	22-May-14	74.26%	$ 2,279,437.00	$ 1,545,891.00	$ 1,061,971.00	$ 4,887,299.00	$ 9,553.00
109	22-May-14	74.26%	$ 2,289,110.00	$ 1,545,891.00	$ 1,061,971.00	$ 4,896,972.00	$ 9,673.00
111	22-May-14	74.26%	$ 2,295,806.00	$ 1,545,891.00	$ 1,061,971.00	$4,903,668.00	$ 6,696.00
131	22-May-14	74.26%	$ 2,304,129.00	$ 1,545,891.00	$ 1,061,971.00	$ 4,911,991.00	$ 8,323.00
149	22-May-14	74.26%	$ 2,338,446.00	$ 1,545,891.00	$ 1,061,971.00	$4,946,308.00	$ 34,317.00
156	22-May-14	74.26%	$ 2,338,446.00	$ 1,545,891.00	$ 1,107,263.00	$ 4,991,600.00	$ 45,292.00
165	22-May-14	74.26%	$ 2,344,985.00	$ 1,545,891.00	$ 1,107,263.00	$ 4,998,139.00	$ 6,539.00
211	22-May-14	74.26%	$ 2,360,269.00	$ 1,545,891.00	$ 1,107,263.00	$ 5,013,423.00	$ 15,284.00
264	22-May-14	74.26%	$ 2,360,269.00	$1,584,534.00	$ 1,107,263.00	$5,052,066.00	$ 38,643.00
112	25-Jun-14	76.42%	$ 2,364,571.00	$1,584,534.00	$ 1,107,263.00	$5,056,368.00	$ 4,302.00
161	25-Jun-14	76.42%	$ 2,364,571.00	$1,589,983.00	$ 1,107,263.00	$ 5,061,817.00	$ 5,449.00
205	25-Jun-14	76.42%	$ 2,364,571.00	$1,598,568.00	$ 1,107,263.00	$ 5,070,402.00	$ 8,585.00
253	25-Jun-14	76.42%	$ 2,371,798.00	$1,598,568.00	$ 1,107,263.00	$ 5,077,629.00	$ 7,227.00
255	25-Jun-14	76.42%	$ 2,383,685.00	$1,598,568.00	$ 1,107,263.00	$ 5,089,516.00	$ 11,887.00

RW Block Consulting, Inc.

CO #	Date of Approval	% Time	DESIGN _ CUM	SITE_CUM	OTHER_CUM	CUM_ALL	Amount
256	25-Jun-14	76.42%	$ 2,392,157.00	$1,598,568.00	$ 1,107,263.00	$ 5,097,988.00	$ 8,472.00
257	25-Jun-14	76.42%	$ 2,393,609.00	$1,598,568.00	$ 1,107,263.00	$5,099,440.00	$ 1,452.00
258	25-Jun-14	76.42%	$ 2,394,546.00	$1,598,568.00	$ 1,107,263.00	$ 5,100,377.00	$ 937.00
259	25-Jun-14	76.42%	$ 2,394,546.00	$ 1,604,761.00	$ 1,107,263.00	$ 5,106,570.00	$ 6,193.00
260	25-Jun-14	76.42%	$ 2,394,546.00	$ 1,604,761.00	$ 1,138,348.00	$ 5,137,655.00	$ 31,085.00
261	25-Jun-14	76.42%	$ 2,403,814.00	$ 1,604,761.00	$ 1,138,348.00	$ 5,146,923.00	$ 9,268.00
263	25-Jun-14	76.42%	$ 2,409,832.00	$ 1,604,761.00	$ 1,138,348.00	$ 5,152,941.00	$ 6,018.00
265	25-Jun-14	76.42%	$ 2,412,049.00	$ 1,604,761.00	$ 1,138,348.00	$ 5,155,158.00	$ 2,217.00
266	25-Jun-14	76.42%	$ 2,412,049.00	$ 1,604,761.00	$ 1,588,348.00	$ 5,605,158.00	$ 450,000.00
267	25-Jun-14	76.42%	$ 2,412,049.00	$ 1,604,761.00	$ 1,608,348.00	$ 5,625,158.00	$ 20,000.00
268	25-Jun-14	76.42%	$ 2,414,689.00	$ 1,604,761.00	$ 1,608,348.00	$ 5,627,798.00	$ 2,640.00
269	25-Jun-14	76.42%	$ 2,414,689.00	$ 1,610,232.00	$ 1,608,348.00	$ 5,633,269.00	$ 5,471.00
271	25-Jun-14	76.42%	$ 2,432,126.00	$ 1,610,232.00	$ 1,608,348.00	$ 5,650,706.00	$ 17,437.00
272	25-Jun-14	76.42%	$ 2,439,804.00	$ 1,610,232.00	$ 1,608,348.00	$5,658,384.00	$ 7,678.00

RW Block Consulting, Inc.

EXHIBIT 5 – APPROVED CHANGE ORDERS CSSA

CO #	Date of Approval	% Time	DESIGN _ CUM	SITE_CUM	OTHER_CUM	CUM_ALL	Amount
2	4-Feb-11	4.36%	$ 0.00	$ 0.00	$ (676,938.00)	$ (676,938.00)	$ (676,938.00)
3	15-Feb-11	5.10%	$ 0.00	$ 0.00	$ 674,621.00)	$ (674,621.00)	$ 2,317.00
4	8-Mar-11	6.51%	$ 26,746.00	$ 0.00	$ (674,621.00)	$ (647,875.00)	$ 26,746.00
5	17-Mar-11	7.11%	$ 26,746.00	$ 0.00	$ (292,668.00)	$ (265,922.00)	$ 381,953.00
7	15-Jun-11	13.15%	$ 42,404.00	$ 0.00	$ (292,668.00)	$ (250,264.00)	$ 15,658.00
8	7-Jul-11	14.62%	$ 498,455.00	$ 0.00	$ (292,668.00)	$ 205,787.00	$ 456,051.00
43	31-May-12	36.72%	$ 498,455.00	$ 467,300.00	$ (292,668.00)	$ 673,087.00	$ 467,300.00
44	31-May-12	36.72%	$ 498,455.00	$ 717,300.00	$ (292,668.00)	$ 923,087.00	$ 250,000.00
47	31-May-12	36.72%	$ 498,455.00	$ 717,300.00	$ (292,668.00)	$ 923,087.00	$ 0.00
46	31-May-12	36.72%	$ 570,436.00	$ 717,300.00	$ (292,668.00)	$ 995,068.00	$ 71,981.00
41	31-May-12	36.72%	$ 570,436.00	$ 751,900.00	$ (292,668.00)	$ 1,029,668.00	$ 34,600.00
42	31-May-12	36.72%	$ 570,436.00	$ 751,900.00	$ (267,345.00)	$ 1,054,991.00	$ 25,323.00
40	31-May-12	36.72%	$ 570,436.00	$ 751,900.00	$ (236,164.00)	$ 1,086,172.00	$ 31,181.00
39	31-May-12	36.72%	$ 615,406.00	$ 751,900.00	$ (236,164.00)	$ 1,131,142.00	$ 44,970.00
38	31-May-12	36.72%	$ 615,406.00	$ 751,900.00	$ (205,739.00)	$ 1,161,567.00	$ 30,425.00
37	31-May-12	36.73%	$ 654,647.00	$ 751,900.00	$ (205,739.00)	$ 1,200,808.00	$ 39,241.00
36	31-May-12	36.73%	$ 654,647.00	$ 762,872.00	$ (205,739.00)	$ 1,211,780.00	$ 10,972.00
35	31-May-12	36.73%	$ 654,647.00	$ 849,872.00	$ (205,739.00)	$ 1,298,780.00	$ 87,000.00
34	31-May-12	36.73%	$ 654,647.00	$ 995,961.00	$ (205,739.00)	$ 1,444,869.00	$ 146,089.00
33	31-May-12	36.73%	$ 654,647.00	$ 1,015,047.00	$ (205,739.00)	$ 1,463,955.00	$ 19,086.00
32	31-May-12	36.73%	$ 665,127.00	$ 1,015,047.00	$ (205,739.00)	$ 1,474,435.00	$ 10,480.00
31	1-Jun-12	36.78%	$ 426,875.00	$ 1,015,047.00	$ (205,739.00)	$ 1,236,183.00	$ (238,252.00)
30	1-Jun-12	36.78%	$ 426,875.00	$ 1,098,185.00	$ (205,739.00)	$ 1,319,321.00	$ 83,138.00
29	1-Jun-12	36.78%	$ 430,848.73	$ 1,098,185.00	$ (205,739.00)	$ 1,323,294.73	$ 3,973.73
28	1-Jun-12	36.78%	$ 430,848.73	$ 1,146,633.00	$ (205,739.00)	$ 1,371,742.73	$ 48,448.00
27	1-Jun-12	36.78%	$ 430,848.73	$ 1,177,866.00	$ (205,739.00)	$ 1,402,975.73	$ 31,233.00
26	1-Jun-12	36.78%	$ 476,157.73	$ 1,177,866.00	$ (205,739.00)	$ 1,448,284.73	$ 45,309.00
25	1-Jun-12	36.78%	$ 1,316,157.73	$ 1,177,866.00	$ (205,739.00)	$ 2,288,284.73	$ 840,000.00
22	1-Jun-12	36.78%	$ 1,317,467.73	$ 1,177,866.00	$ (205,739.00)	$ 2,289,594.73	$ 1,310.00
21	1-Jun-12	36.78%	$ 1,329,083.73	$ 1,177,866.00	$ (205,739.00)	$ 2,301,210.73	$ 11,616.00
20	1-Jun-12	36.78%	$ 1,329,083.73	$ 1,177,866.00	$ (150,539.00)	$ 2,356,410.73	$ 55,200.00
17	1-Jun-12	36.78%	$ 1,329,083.73	$ 1,192,779.00	$ (150,539.00)	$ 2,371,323.73	$ 14,913.00
15	1-Jun-12	36.78%	$ 1,437,283.73	$ 1,192,779.00	$ (150,539.00)	$ 2,479,523.73	$ 108,200.00
11	1-Jun-12	36.78%	$ 1,448,943.73	$ 1,192,779.00	$ (150,539.00)	$ 2,491,183.73	$ 11,660.00
16	1-Jun-12	36.78%	$ 1,448,943.73	$ 1,192,779.00	$ (143,044.00)	$ 2,498,678.73	$ 7,495.00
12	1-Jun-12	36.78%	$ 1,448,943.73	$ 1,506,852.66	$ (143,044.00)	$ 2,812,752.39	$ 314,073.66
23	1-Jun-12	36.78%	$ 1,448,943.73	$ 1,513,652.66	$ (143,044.00)	$ 2,819,552.39	$ 6,800.00
10	1-Jun-12	36.78%	$ 1,448,943.73	$ 1,513,652.66	$ (129,787.00)	$ 2,832,809.39	$ 13,257.00
48	6-Jun-12	37.13%	$ 1,448,943.73	$ 1,791,117.66	$ (129,787.00)	$ 3,110,274.39	$ 277,465.00
49	6-Jun-12	37.13%	$ 1,448,943.73	$ 1,834,718.66	$ (129,787.00)	$ 3,153,875.39	$ 43,601.00
50	6-Jun-12	37.13%	$ 1,448,943.73	$ 1,897,187.66	$ (129,787.00)	$ 3,216,344.39	$ 62,469.00
52	6-Jun-12	37.13%	$ 1,448,943.73	$ 1,897,187.66	$ (110,677.00)	$ 3,235,454.39	$ 19,110.00

RW Block Consulting, Inc.

CO #	Date of Approval	% Time	DESIGN _ CUM	SITE_CUM	OTHER_CUM	CUM_ALL	Amount
45	8-Jun-12	37.26%	$ 1,448,943.73	$ 1,897,187.66	$ (302,677.00)	$ 3,043,454.39	$ (192,000.00)
54	7-Aug-12	41.27%	$ 1,448,943.73	$ 1,906,007.66	$ (302,677.00)	$ 3,052,274.39	$ 8,820.00
55	7-Aug-12	41.27%	$ 1,448,943.73	$ 1,907,398.66	$ (302,677.00)	$ 3,053,665.39	$ 1,391.00
56	7-Aug-12	41.27%	$ 1,448,943.73	$ 1,911,287.66	$ (302,677.00)	$ 3,057,554.39	$ 3,889.00
57	7-Aug-12	41.27%	$ 1,448,943.73	$ 1,913,644.66	$ (302,677.00)	$ 3,059,911.39	$ 2,357.00
58	7-Aug-12	41.27%	$ 1,451,290.73	$ 1,913,644.66	$ (302,677.00)	$ 3,062,258.39	$ 2,347.00
59	7-Aug-12	41.27%	$ 1,451,290.73	$ 1,922,058.66	$ (302,677.00)	$ 3,070,672.39	$ 8,414.00
63	7-Aug-12	41.27%	$ 1,458,438.73	$ 1,922,058.66	$ (302,677.00)	$ 3,077,820.39	$ 7,148.00
66	10-Aug-12	41.48%	$ 1,462,881.73	$ 1,922,058.66	$ (302,677.00)	$ 3,082,263.39	$ 4,443.00
65	10-Aug-12	41.48%	$ 1,466,288.73	$ 1,922,058.66	$ (302,677.00)	$ 3,085,670.39	$ 3,407.00
64	10-Aug-12	41.48%	$ 1,468,578.73	$ 1,922,058.66	$ (302,677.00)	$ 3,087,960.39	$ 2,290.00
61	10-Aug-12	41.48%	$ 1,468,578.73	$ 1,922,058.66	$ (296,162.00)	$ 3,094,475.39	$ 6,515.00
67	13-Aug-12	41.67%	$ 1,487,138.73	$ 1,922,058.66	$ (296,162.00)	$ 3,113,035.39	$ 18,560.00
60	29-Aug-12	42.75%	$ 1,494,813.73	$ 1,922,058.66	$ (296,162.00)	$ 3,120,710.39	$ 7,675.00
68	31-Aug-12	42.88%	$ 1,499,358.73	$ 1,922,058.66	$ (296,162.00)	$ 3,125,255.39	$ 4,545.00
69	31-Aug-12	42.88%	$ 1,499,358.73	$ 1,940,625.66	$ (296,162.00)	$ 3,143,822.39	$ 18,567.00
74	28-Sep-12	44.76%	$ 1,499,358.73	$ 1,940,625.66	$ (279,662.00)	$ 3,160,322.39	$ 16,500.00
75	28-Sep-12	44.76%	$ 1,499,358.73	$ 1,951,449.66	$ (279,662.00)	$ 3,171,146.39	$ 10,824.00
76	28-Sep-12	44.76%	$ 1,499,358.73	$ 1,955,922.66	$ (279,662.00)	$ 3,175,619.39	$ 4,473.00
77	28-Sep-12	44.76%	$ 1,499,358.73	$ 1,955,922.66	$ (274,283.00)	$ 3,180,998.39	$ 5,379.00
78	28-Sep-12	44.76%	$ 1,513,358.73	$ 1,955,922.66	$ (274,283.00)	$ 3,194,998.39	$ 14,000.00
73	28-Sep-12	44.76%	$ 1,641,520.73	$ 1,955,922.66	$ (274,283.00)	$ 3,323,160.39	$ 128,162.00
70	28-Sep-12	44.76%	$ 1,628,644.73	$ 1,955,922.66	$ (274,283.00)	$ 3,310,284.39	$ (12,876.00)
71	28-Sep-12	44.76%	$ 1,631,317.73	$ 1,955,922.66	$ (274,283.00)	$ 3,312,957.39	$ 2,673.00
53	28-Sep-12	44.76%	$ 1,684,505.73	$ 1,955,922.66	$ (274,283.00)	$ 3,366,145.39	$ 53,188.00
51	28-Sep-12	44.76%	$ 1,684,505.73	$ 1,955,922.66	$ (245,083.00)	$ 3,395,345.39	$ 29,200.00
72	28-Sep-12	44.77%	$ 1,693,505.73	$ 1,955,922.66	$ (245,083.00)	$ 3,404,345.39	$ 9,000.00
62	17-Oct-12	46.03%	$ 1,693,505.73	$ 1,999,414.66	$ (245,083.00)	$ 3,447,837.39	$ 43,492.00
79	17-Oct-12	46.03%	$ 1,693,505.73	$ 2,154,466.66	$ (245,083.00)	$ 3,602,889.39	$ 155,052.00
80	17-Oct-12	46.03%	$ 1,698,805.73	$ 2,154,466.66	$ (245,083.00)	$ 3,608,189.39	$ 5,300.00
81	18-Oct-12	46.11%	$ 1,698,805.73	$ 2,154,466.66	$ (243,866.00)	$ 3,609,406.39	$ 1,217.00
82	18-Oct-12	46.11%	$ 1,700,819.73	$ 2,154,466.66	$ (243,866.00)	$ 3,611,420.39	$ 2,014.00
83	18-Oct-12	46.11%	$ 1,700,819.73	$ 2,154,466.66	$ (237,128.00)	$ 3,618,158.39	$ 6,738.00
84	26-Nov-12	48.72%	$ 1,700,819.73	$ 2,184,966.66	$ (237,128.00)	$ 3,648,658.39	$ 30,500.00
86	6-Dec-12	49.39%	$ 1,700,819.73	$ 2,284,966.66	$ (237,128.00)	$ 3,748,658.39	$ 100,000.00
87	6-Dec-12	49.39%	$ 1,711,190.73	$ 2,284,966.66	$ (237,128.00)	$ 3,759,029.39	$ 10,371.00
85	6-Dec-12	49.39%	$ 1,711,190.73	$ 2,310,026.66	$ (237,128.00)	$ 3,784,089.39	$ 25,060.00
89	27-Mar-13	56.85%	$ 1,712,657.73	$ 2,310,026.66	$ (237,128.00)	$ 3,785,556.39	$ 1,467.00
90	27-Mar-13	56.85%	$ 1,712,657.73	$ 2,315,566.66	$ (237,128.00)	$ 3,791,096.39	$ 5,540.00
91	27-Mar-13	56.85%	$ 1,712,657.73	$ 2,326,566.66	$ (237,128.00)	$ 3,802,096.39	$ 11,000.00
92	27-Mar-13	56.85%	$ 1,712,657.73	$ 2,328,387.66	$ (237,128.00)	$ 3,803,917.39	$ 1,821.00
94	27-Mar-13	56.86%	$ 1,712,657.73	$ 2,330,286.66	$ (237,128.00)	$ 3,805,816.39	$ 1,899.00
95	27-Mar-13	56.86%	$ 1,712,657.73	$ 2,337,997.66	$ (237,128.00)	$ 3,813,527.39	$ 7,711.00
97	5-Apr-13	57.44%	$ 1,717,014.73	$ 2,337,997.66	$ (237,128.00)	$ 3,817,884.39	$ 4,357.00
99	5-Apr-13	57.46%	$ 1,717,014.73	$ 2,340,117.66	$ (237,128.00)	$ 3,820,004.39	$ 2,120.00

RW Block Consulting, Inc.

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100	5-Apr-13	57.46%	$ 1,603,974.73	$ 2,340,117.66	$ (237,128.00)	$ 3,706,964.39	$ (113,040.00)
98	5-Apr-13	57.46%	$ 1,652,695.73	$ 2,340,117.66	$ (237,128.00)	$ 3,755,685.39	$ 48,721.00
93	2-May-13	59.26%	$ 1,788,684.73	$ 2,340,117.66	$ (237,128.00)	$ 3,891,674.39	$ 135,989.00
88	28-May-13	61.01%	$ 1,788,684.73	$ 2,373,542.66	$ (237,128.00)	$ 3,925,099.39	$ 33,425.00
101	10-Jun-13	61.87%	$ 1,807,064.73	$ 2,373,542.66	$ (237,128.00)	$ 3,943,479.39	$ 18,380.00
114	28-Jun-13	63.07%	$ 1,807,064.73	$ 2,373,542.66	$ (237,128.00)	$ 3,943,479.39	$ 0.00
109	26-Aug-13	67.00%	$ 1,807,064.73	$ 2,387,236.66	$ (237,128.00)	$ 3,957,173.39	$ 13,694.00
102	3-Sep-13	67.56%	$ 1,807,064.73	$ 2,455,986.66	$ (237,128.00)	$ 4,025,923.39	$ 68,750.00
96	3-Sep-13	67.57%	$ 2,107,064.73	$ 2,455,986.66	$ (237,128.00)	$ 4,325,923.39	$ 300,000.00
103	16-Sep-13	68.44%	$ 2,115,041.73	$ 2,455,986.66	$ (237,128.00)	$ 4,333,900.39	$ 7,977.00
105	16-Sep-13	68.44%	$ 2,118,878.73	$ 2,455,986.66	$ (237,128.00)	$ 4,337,737.39	$ 3,837.00
106	16-Sep-13	68.44%	$ 2,124,516.73	$ 2,455,986.66	$ (237,128.00)	$ 4,343,375.39	$ 5,638.00
107	16-Sep-13	68.44%	$ 2,124,516.73	$ 2,463,410.66	$ (237,128.00)	$ 4,350,799.39	$ 7,424.00
108	16-Sep-13	68.44%	$ 2,129,813.73	$ 2,463,410.66	$ (237,128.00)	$ 4,356,096.39	$ 5,297.00
110	16-Sep-13	68.44%	$ 2,129,813.73	$ 2,529,083.66	$ (237,128.00)	$ 4,421,769.39	$ 65,673.00
111	16-Sep-13	68.44%	$ 2,129,813.73	$ 2,529,083.66	$ (247,541.00)	$ 4,411,356.39	$ (10,413.00)
116	16-Sep-13	68.44%	$ 2,129,813.73	$ 2,543,698.66	$ (247,541.00)	$ 4,425,971.39	$ 14,615.00
117	16-Sep-13	68.44%	$ 2,129,813.73	$ 2,548,709.66	$ (247,541.00)	$ 4,430,982.39	$ 5,011.00
119	16-Sep-13	68.44%	$ 2,129,813.73	$ 2,588,035.66	$ (247,541.00)	$ 4,470,308.39	$ 39,326.00
120	16-Sep-13	68.44%	$ 2,127,446.73	$ 2,588,035.66	$ (247,541.00)	$ 4,467,941.39	$ (2,367.00)
121	16-Sep-13	68.44%	$ 2,127,446.73	$ 2,590,775.66	$ (247,541.00)	$ 4,470,681.39	$ 2,740.00
122	16-Sep-13	68.44%	$ 2,127,446.73	$ 2,590,775.66	$ (240,686.00)	$ 4,477,536.39	$ 6,855.00
123	3-Oct-13	69.58%	$ 2,127,446.73	$ 2,678,530.66	$ (240,686.00)	$ 4,565,291.39	$ 87,755.00
104	6-Nov-13	71.86%	$ 2,127,446.73	$ 3,555,580.66	$ (240,686.00)	$ 5,442,341.39	$ 877,050.00
112	6-Nov-13	71.86%	$ 2,429,321.73	$ 3,555,580.66	$ (240,686.00)	$ 5,744,216.39	$ 301,875.00
125	6-Nov-13	71.86%	$ 2,429,321.73	$ 3,555,580.66	$ (205,574.00)	$ 5,779,328.39	$ 35,112.00
127	6-Nov-13	71.86%	$ 2,430,173.73	$ 3,555,580.66	$ (205,574.00)	$ 5,780,180.39	$ 852.00
129	6-Nov-13	71.86%	$ 2,709,434.73	$ 3,555,580.66	$ (205,574.00)	$ 6,059,441.39	$ 279,261.00
130	6-Nov-13	71.86%	$ 2,717,698.73	$ 3,555,580.66	$ (205,574.00)	$ 6,067,705.39	$ 8,264.00
131	6-Nov-13	71.86%	$ 2,717,698.73	$ 3,556,916.66	$ (205,574.00)	$ 6,069,041.39	$ 1,336.00
132	8-Nov-13	72.01%	$ 2,717,698.73	$ 3,556,916.66	$ 1,794,426.00	$ 8,069,041.39	$ 2,000,000.00
140	8-Nov-13	72.01%	$ 2,717,698.73	$ 5,406,610.66	$ 1,794,426.00	$ 9,918,735.39	$ 1,849,694.00
148	11-Dec-13	74.22%	$ 3,609,917.73	$ 5,406,610.66	$ 1,794,426.00	$ 10,810,954.39	$ 892,219.00
159	2-Jan-14	75.70%	$ 3,609,917.73	$ 5,406,610.66	$ 544,426.00	$ 9,560,954.39	$ (1,250,000.00)
138	2-Jan-14	75.70%	$ 3,609,917.73	$ 5,406,610.66	$ 558,810.00	$ 9,575,338.39	$ 14,384.00
141	2-Jan-14	75.70%	$ 3,653,336.73	$ 5,406,610.66	$ 558,810.00	$ 9,618,757.39	$ 43,419.00
134	2-Jan-14	75.70%	$ 3,653,336.73	$ 5,406,610.66	$ 564,383.00	$ 9,624,330.39	$ 5,573.00
136	2-Jan-14	75.70%	$ 3,653,336.73	$ 5,445,568.66	$ 564,383.00	$ 9,663,288.39	$ 38,958.00
142	2-Jan-14	75.70%	$ 3,653,336.73	$ 5,445,568.66	$ 581,102.00	$ 9,680,007.39	$ 16,719.00
143	2-Jan-14	75.70%	$ 3,654,127.73	$ 5,445,568.66	$ 581,102.00	$ 9,680,798.39	$ 791.00
144	2-Jan-14	75.70%	$ 3,654,990.73	$ 5,445,568.66	$ 581,102.00	$ 9,681,661.39	$ 863.00
145	2-Jan-14	75.70%	$ 3,656,434.73	$ 5,445,568.66	$ 581,102.00	$ 9,683,105.39	$ 1,444.00
146	2-Jan-14	75.70%	$ 3,656,434.73	$ 5,448,175.66	$ 581,102.00	$ 9,685,712.39	$ 2,607.00
151	2-Jan-14	75.70%	$ 3,670,060.73	$ 5,448,175.66	$ 581,102.00	$ 9,699,338.39	$ 13,626.00
156	2-Jan-14	75.70%	$ 3,701,082.73	$ 5,448,175.66	$ 581,102.00	$ 9,730,360.39	$ 31,022.00

RW Block Consulting, Inc.

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124	3-Jan-14	75.75%	$ 3,911,082.73	$ 5,448,175.66	$ 581,102.00	$ 9,940,360.39	$ 210,000.00
126	3-Jan-14	75.75%	$ 3,924,285.73	$ 5,448,175.66	$ 581,102.00	$ 9,953,563.39	$ 13,203.00
137	3-Jan-14	75.75%	$ 3,971,321.73	$ 5,448,175.66	$ 581,102.00	$ 10,000,599.39	$ 47,036.00
139	3-Jan-14	75.75%	$ 3,971,321.73	$ 5,548,175.66	$ 581,102.00	$ 10,100,599.39	$ 100,000.00
152	3-Jan-14	75.75%	$ 3,975,321.73	$ 5,548,175.66	$ 581,102.00	$ 10,104,599.39	$ 4,000.00
155	3-Jan-14	75.75%	$ 3,975,321.73	$ 5,553,812.66	$ 581,102.00	$ 10,110,236.39	$ 5,637.00
149	6-Jan-14	75.97%	$ 3,975,321.73	$ 5,553,812.66	$ 807,481.00	$ 10,336,615.39	$ 226,379.00
193	5-Feb-14	77.97%	$ 3,975,321.73	$ 5,553,812.66	$ 2,007,481.00	$ 11,536,615.39	$ 1,200,000.00
170	3-Mar-14	79.72%	$ 4,851,865.92	$ 5,553,812.66	$ 2,007,481.00	$ 12,413,159.58	$ 876,544.19
173	13-May-14	84.46%	$ 4,854,607.92	$ 5,553,812.66	$ 2,007,481.00	$ 12,415,901.58	$ 2,742.00
164	13-May-14	84.47%	$ 4,854,607.92	$ 5,553,812.66	$ 2,009,209.00	$ 12,417,629.58	$ 1,728.00
210	13-May-14	84.47%	$ 4,854,607.92	$ 7,462,829.66	$ 2,009,209.00	$ 14,326,646.58	$ 1,909,017.00
213	13-May-14	84.47%	$ 5,250,741.92	$ 7,462,829.66	$ 2,009,209.00	$ 14,722,780.58	$ 396,134.00
214	13-May-14	84.47%	$ 5,250,741.92	$ 8,694,332.66	$ 2,009,209.00	$ 15,954,283.58	$ 1,231,503.00
215	13-May-14	84.47%	$ 5,250,741.92	$ 8,694,332.66	$ 2,002,961.00	$ 15,948,035.58	$ (6,248.00)
209	13-May-14	84.47%	$ 5,250,741.92	$ 9,648,840.66	$ 2,002,961.00	$ 16,902,543.58	$ 954,508.00
212	13-May-14	84.47%	$ 5,250,741.92	$ 9,691,263.66	$ 2,002,961.00	$ 16,944,966.58	$ 42,423.00
220	13-May-14	84.47%	$ 5,374,341.92	$ 9,691,263.66	$ 2,002,961.00	$ 17,068,566.58	$ 123,600.00
128	4-Jun-14	85.94%	$ 5,374,341.92	$ 9,691,263.66	$ 2,004,599.40	$ 17,070,204.98	$ 1,638.40
219	4-Jun-14	85.94%	$ 5,374,341.92	$ 9,691,263.66	$ 2,268,251.40	$ 17,333,856.98	$ 263,652.00

RW Block Consulting, Inc.

EXHIBIT 6 – WSIP BID RESULTS

Project Number	Project Name	Bid Date	No. of Bidders	Engineer's Estimate1	Low Bid	% of Engineer's Estimate	2nd Low Bid		High Bid		Bid Range
CUW31101	Sunset Circulation Improvements	16-Oct-03	3	$ 2,700,000.00	$ 2,555,487.00	94.60%	$ 2,788,162.00	109.10%	$ 2,824,188.00	110.50%	$ 268,701.00
	McLaren Park Tank Outlet Modification and 24" Ductile Iron Pipe from McLaren Park Tank to McLaren Pump Station	16-Oct-03	3	$ 1,920,000.00	$ 1,701,300.00	88.60%	$ 1,773,277.00	104.20%	$ 2,254,120.00	132.50%	$ 552,820.00
CUW30701	Summit Reservoir Rehabilitation	23-Oct-03	4	$ 9,857,000.00	$ 8,046,917.00	81.60%	$ 8,887,965.00	110.50%	$ 10,190,000.00	126.60%	$ 2,143,083.00
CUW30601	Crocker Amazon Pump Station Upgrades	18-Dec-03	4	$ 2,214,200.00	$ 2,225,000.00	100.50%	$ 2,405,800.00	108.10%	$ 2,594,616.00	116.60%	$ 369,616.00
CUW31201	Lincoln Way Transmission Line	18-Mar-04	7	$ *9,285,000.00*	$ 8,461,156.00	91.10%	$ 8,644,069.00	102.20%	$ 10,953,831.00	129.50%	$ 2,492,675.00
CUW36101	Pulgas Balancing - Inlet/Outlet Work	9-Sep-04	3	$ 430,156.00	$ 694,000.00	161.30%	$ 717,300.00	103.40%	$ 771,285.00	111.10%	$ 77,285.00
	Sunset Reservoir North Basin-Embankment Stabilization Project	13-Jan-05	6	$ 9,400,000.00	$ 6,799,376.00	72.30%	$ 7,373,195.00	108.40%	$ 9,058,870.00	133.20%	$ 2,259,494.00
	Calaveras Reservoir Oxygenation	31-Mar-05	1	$ 832,444.00	$ 977,250.00	117.40%	$ 977,250.00	100.00%	$ 977,250.00	100.00%	$ 0.00
CUW31801	Forest Hill Tank Rehab & Seismic Upgrade	28-Apr-05	2	$ 1,700,000.00	$ 1,792,810.00	105.50%	$ 1,882,000.00	105.00%	$ 1,882,000.00	105.00%	$ 89,190.00
CUW32201	Lincoln Park Pump Station Upgrades	5-May-05	3	$ 3,480,000.00	$ 4,204,080.00	120.80%	$ 4,298,010.00	102.20%	$ 5,608,998.00	133.40%	$ 1,404,918.00
CUW37402	Calaveras Reservoir Upgrades	10-May-05	1	$ 832,000.00	$ 977,250.00	117.50%	$ 977,250.00	100.00%	$ 977,250.00	100.00%	$ 0.00
CUW31401	La Grande Tank Seismic Upgrade	26-May-05	3	$ 4,028,444.00	$ 4,323,075.00	107.30%	$ 4,452,000.00	103.00%	$ 4,499,797.00	104.10%	$ 176,722.00

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Project Number	Project Name	Bid Date	No. of Bidders	Engineer's Estimate1	Low Bid	% of Engineer's Estimate	2nd Low Bid	High Bid	Bid Range	Project Number	Project Name
CUW36601	HTWTP Short-term Improvements (Demo Filters)	26-May-05	1	$ 1,533,000.00	$ 1,515,700.00	98.90%	$ 1,515,700.00	100.00%	$ 1,515,700.00	100.00%	$ 0.00
CUW33501	Potrero Heights Reservoir Rehabilitation	21-Jul-05	2	$ 4,770,450.00	$ 5,094,156.00	106.80%	$ 5,242,209.00	102.90%	$ 5,242,209.00	102.90%	$ 148,053.00
CUW30801	Key Motorized and Other Critical Valves	20-Oct-05	2	$ 6,500,000.00	$ 8,324,442.00	128.10%	$ 9,822,630.00	118.00%	$ 9,822,630.00	118.00%	$ 1,498,188.00
CUW32701	Summit Pump Station Upgrades	2-Mar-06	1	$ 3,442,000.00	$ 4,720,000.00	137.10%	$ 4,720,000.00	100.00%	$ 4,720,000.00	100.00%	$ 0.00
CUW35301	BDPL Nos. 3 & 4 Crossover/Isolation Valves	6-Jul-06	4	$ *15,500,000.00*	$ 13,788,000.00	89.00%	$ 13,865,000.00	100.60%	$ 17,730,068.00	128.60%	$ 3,942,068.00
CUW35801	Sunset Reservoir - North Basin	17-Aug-06	4	$ *37,000,000.00*	$ 41,776,700.00	112.90%	$ 43,675,400.00	104.50%	$ 49,868,000.00	119.40%	$ 8,091,300.00
CUW32801	McLaren #1 Tank Rehab & Seismic Upgrade	24-Aug-06	3	$ *6,500,000.00*	$ 6,545,760.00	100.70%	$ 6,747,000.00	103.10%	$ 7,998,400.00	122.20%	$ 1,452,640.00
CUW32601	Sky View - Aqua Vista Pump Station Upgrade	31-Aug-06	4	$ *2,750,000.00*	$ 2,943,460.00	107.00%	$ 3,079,000.00	104.60%	$ 3,382,000.00	114.90%	$ 438,540.00
CUW36901	Capuchino Valve Lot Improvements	9-Nov-06	3	$ *1,400,000.00*	$ 1,425,400.00	101.80%	$ 1,562,400.00	109.60%	$ 1,614,000.00	113.20%	$ 188,600.00
CUW31501	East / West Transmission Main	16-Nov-06	3	$ *20,000,000.00*	$ 19,929,348.00	99.60%	$ 23,894,382.00	119.90%	$ 25,029,308.00	125.60%	$ 5,099,960.00
CUW31601	Fulton @ Sixth Ave - 30" Main Replacement	11-Jan-07	8	$ *3,100,000.00*	$ 2,658,065.00	85.70%	$ 2,744,290.00	103.20%	$ 4,185,340.00	157.50%	$ 1,527,275.00
CUW35701	Adit Leak Repair - Crystal Springs/Calaveras	25-Jan-07	5	$ 1,200,000.00	$ 1,431,113.00	119.30%	$ 1,547,000.00	108.10%	$ 1,862,698.00	130.20%	$ 431,585.00
CUW37001	Pipeline Repair & Readiness Improvements	3-May-07	2	$ 1,300,000.00	$ 1,047,600.00	80.60%	$ 1,399,050.00	133.50%	$ 1,399,050.00	133.50%	$ 351,450.00

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Project Number	Project Name	Bid Date	No. of Bidders	Engineer's Estimate1	Low Bid	% of Engineer's Estimate	2nd Low Bid	High Bid	Bid Range	Project Number	Project Name
CUW33401	Stanford Heights Reservoir Rehabilitation	15-May-07	2	$ *21,000,000.00*	$ 17,899,960.00	85.20%	$ 20,997,450.00	117.30%	$ 20,997,450.00	117.30%	$ 3,097,490.00
CUW32501	Palo Alto Pump Station Upgrades	21-Jun-07	3	$ *3,500,000.00*	$ 3,671,000.00	104.90%	$ 4,349,000.00	118.50%	$ 4,447,000.00	121.10%	$ 776,000.00
CUW35501	Standby Power Facilities	28-Jun-07	1	$ 5,700,000.00	$ 9,356,250.00	164.10%	$ 9,356,250.00	100.00%	$ 9,356,250.00	100.00%	$ 0.00
CUW35501	Standby Power Facilities - East Bay	9-Aug-07	3	$ 200,000.00	$ 233,917.00	117.00%	$ 267,100.00	114.20%	$ 358,000.00	153.00%	$ 124,083.00
CUW32301	Alemany Pump Station Upgrades (McLaren Park)	11-Oct-07	4	$ *20,000,000.00*	$ 21,640,000.00	108.20%	$ 23,269,000.00	107.50%	$ 28,937,000.00	133.70%	$ 7,297,000.00
CUW32101	Forest Knolls Pump Station Upgrades	18-Oct-07	3	$ *6,250,000.00*	$ 6,022,500.00	96.40%	$ 6,547,000.00	108.70%	$ 6,955,000.00	115.50%	$ 932,500.00
CUW32401	Mount Davidson Pump Station Upgrades	28-Feb-08	4	$ *4,700,000.00*	$ 3,987,800.00	84.80%	$ 4,854,000.00	121.70%	$ 6,210,000.00	155.70%	$ 2,222,200.00
CUW36602 & CUW36603	HTWTP Short-Term Improvements - Coagulation & Flocculation/ Remaining Filters	15-May-08	4	$ *16,500,000.00*	$ 13,334,000.00	80.80%	$ 13,375,000.00	100.30%	$ 13,860,000.00	103.90%	$ 526,000.00
CUW30401	North University Mound System Upgrade	31-Jul-08	6	$ *16,500,000.00*	$ 13,529,370.00	82.00%	$ 13,994,000.00	103.40%	$ 18,174,150.00	134.30%	$ 4,644,780.00
CUW38401	Tesla Treatment Facility	15-Sep-08	3	$ 88,630,787.00	$ 88,801,073.00	100.20%	$ 98,159,011.00	110.50%	$ 105,793,549.00	119.10%	$ 16,992,476.00
CUW35601	New Crystal Springs Bypass Tunnel	1-Oct-08	4	$ *60,000,000.00*	$ 55,674,000.00	92.80%	$ 59,968,200.00	107.70%	$ 64,935,100.00	116.60%	$ 9,261,100.00
CUW31301	Noe Valley Transmission Main, Phase 2	16-Oct-08	4	$ *7,000,000.00*	$ 5,724,000.00	81.80%	$ 5,741,035.00	100.30%	$ 6,935,977.00	121.20%	$ 1,211,977.00

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Project Number	Project Name	Bid Date	No. of Bidders	Engineer's Estimate1	Low Bid	% of Engineer's Estimate	2nd Low Bid	High Bid	Bid Range	Project Number	Project Name
CUW30901	Lake Merced Pump Station Essential Upgrades	18-Dec-08	10	$ *56,000,000.00*	$ 29,960,000.00	53.50%	$ 31,584,000.00	105.40%	$ 40,211,000.00	134.20%	$ 10,251,000.00
CUW39101	Baden and San Pedro Valve Lots Improvements	5-Jan-09	9	$ *16,500,000.00*	$ 11,536,500.00	69.90%	$ 11,647,000.00	101.00%	$ 17,046,750.00	147.80%	$ 5,510,250.00
CUW36102	Pulgas Balancing Reservoir - Discharge Channel Modifications	22-Jan-09	6	$ *3,750,000.00*	$ 1,366,000.00	36.40%	$ 1,479,620.00	108.30%	$ 1,767,500.00	129.40%	$ 401,500.00
CUW38001	BDPL Nos. 3 and 4 Crossovers	26-Mar-09	9	$ 21,500,000.00	$ 12,695,000.00	59.00%	$ 12,814,800.00	100.90%	$ 21,450,000.00	169.00%	$ 8,755,000.00
CUW34001	Vista Francisco Pump Station Upgrades	5-May-09	4	$ *4,250,000.00*	$ 2,770,200.00	65.20%	$ 3,047,000.00	110.00%	$ 3,187,000.00	115.00%	$ 416,800.00
CUW35902	Alameda Siphon #4	5-May-09	4	$ *40,500,000.00*	$ 30,975,870.00	76.50%	$ 31,933,695.00	103.10%	$ 36,488,675.00	117.80%	$ 5,512,805.00
CUW37201	University Mound Reservoir - North Basin	19-May-09	9	$ *49,500,000.00*	$ 29,597,000.00	59.80%	$ 32,449,491.00	109.60%	$ 42,830,379.00	144.70%	$ 13,233,379.00
CUW37901	San Andreas Pipeline No. 3 Installation	21-May-09	6	$ *22,500,000.00*	$ 16,336,350.00	72.60%	$ 17,488,000.00	107.00%	$ 26,142,950.00	160.00%	$ 9,806,600.00
CUW36401	Lawrence Livermore Water Quality Improvement	2-Jun-09	5	$ 3,500,000.00	$ 2,379,248.00	68.00%	$ 2,810,000.00	118.10%	$ 3,085,000.00	129.70%	$ 705,752.00
CUW37302	Rehabilitation of Existing San Joaquin Pipelines-Roselle Crossover	5-Jun-09	5	$ 3,050,000.00	$ 2,837,000.00	93.00%	$ 2,883,000.00	101.60%	$ 3,682,000.00	129.80%	$ 845,000.00
CUW38601	San Antonio Pump Station Upgrade	30-Jul-09	8	$ *9,000,000.00*	$ 6,991,000.00	77.70%	$ 7,067,000.00	101.10%	$ 9,190,000.00	131.50%	$ 2,199,000.00
CUW36103	Pulgas Balancing Reservoir - Structural Rehabilitation and Roof Replacement	18-Aug-09	6	$ *6,000,000.00*	$ 12,736,000.00	79.60%	$ 12,857,000.00	101.00%	$ 19,709,640.00	154.80%	$ 6,973,640.00

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Project Number	Project Name	Bid Date	No. of Bidders	Engineer's Estimate1	Low Bid	% of Engineer's Estimate	2nd Low Bid	High Bid	Bid Range	Project Number	Project Name
CUW36301	SCADA System - Phase II	27-Aug-09	4	$ 10,600,000.00	$ 3,847,250.00	36.30%	$ 3,950,000.00	102.70%	$ 6,427,600.00	167.10%	$ 2,580,350.00
CUW36802	BDPL Reliability Upgrade-Pipeline (East Bay)	17-Sep-09	8	$ *93,000,000.00*	$ 61,558,005.00	66.20%	$ 64,420,560.00	104.70%	$ 86,027,610.00	139.80%	$ 24,469,605.00
CUW36802	BDPL Reliability Upgrade-Pipeline (Peninsula)	29-Oct-09	6	$ *65,500,000.00*	$ 52,183,400.00	79.70%	$ 53,511,481.00	102.50%	$ 67,515,400.00	129.40%	$ 15,332,000.00
CUW36801	BDPL Reliability Upgrade - Tunnel	12-Nov-09	4	$ *247,500,000.00*	$ 215,294,530.00	87.00%	$ 215,391,455.00	100.00%	$ 245,630,000.00	114.10%	$ 30,335,470.00
CUW33801	La Grande Pump Station Upgrades	7-Jan-10	6	$ *3,250,000.00*	$ 1,703,565.00	52.40%	$ 2,327,400.00	136.60%	$ 2,895,000.00	169.90%	$ 1,191,435.00
CUW38101	SVWTP Expansion & Treated Water Reservoir	4-Mar-10	9	$ 109,000,000.00	$ 83,102,160.00	76.20%	$ 84,231,178.00	101.40%	$ 106,917,135.00	128.70%	$ 23,814,975.00
CUW37301	San Joaquin Pipeline System-Crossovers	11-Mar-10	7	$ 21,000,000.00	$ 11,723,817.00	55.80%	$ 11,844,817.00	101.00%	$ 18,399,547.00	156.90%	$ 6,675,730.00
CUW35901	New Irvington Tunnel	1-Apr-10	4	$ 253,202,000.00	$ 226,657,700.00	89.50%	$ 275,150,000.00	121.40%	$ 293,027,421.00	129.30%	$ 66,369,721.00
	Harding Park Recycled Water Project	22-Jun-10	8	$ 6,500,000.00	$ 5,251,100.00	80.80%	$ 5,897,447.00	112.30%	$ 7,877,575.00	150.00%	$ 2,626,475.00
CUW36105	Pulgas Balancing Reservoir - Modifications of the Existing Dechlorination Facility	8-Jul-10	3	$ *2,000,000.00*	$ 1,503,000.00	75.20%	$ 1,539,508.00	102.40%	$ 1,717,000.00	114.20%	$ 214,000.00
CUW37101	Crystal Springs/San Andreas Transmission Upgrade	12-Aug-10	4	$ *110,000,000.00*	$ 99,763,000.00	90.70%	$ 100,900,000.00	101.10%	$ 111,392,200.00	111.70%	$ 11,629,200.00
CUW31901	Hunters Point Reservoir Rehab & Seismic Upgrade	21-Oct-10	1	$ *1,500,000.00*	$ 1,747,000.00	116.50%	$ 1,747,000.00	100.00%	$ 1,747,000.00	100.00%	$ 0.00
CUW37301	San Joaquin Pipeline System-Western Segment	9-Nov-10	11	$ 63,000,000.00	$ 48,706,379.00	77.30%	$ 50,958,111.00	104.60%	$ 59,131,812.00	121.40%	$ 10,425,433.00

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Project Number	Project Name	Bid Date	No. of Bidders	Engineer's Estimate1	Low Bid	% of Engineer's Estimate	2nd Low Bid	High Bid	Bid Range	Project Number	Project Name
CUW35401	Lower Crystal Springs Dam Improvements	16-Nov-10	2	$ *20,000,000.00*	$ 17,360,400.00	86.80%	$ 18,749,749.00	108.00%	$ 18,749,749.00	108.00%	$ 1,389,349.00
CUW37801	Crystal Springs Pipeline No. 2 Replacement	9-Dec-10	8	$ *45,500,000.00*	$ 32,547,350.00	71.50%	$ 38,352,900.00	117.80%	$ 51,109,415.00	157.00%	$ 18,562,065.00
CUW36701	HTWTP Long-Term Improvements (with Alternate A-1)	16-Dec-10	5	$ 235,250,000.00	$ 174,197,000.00	74.00%	$ 183,277,000.00	105.20%	$ 203,605,000.00	116.90%	$ 29,408,000.00
CUW36302	System Security Upgrade	3-Feb-11	1	$ 2,400,000.00	$ 1,431,264.00	59.60%	$ 1,431,264.00	100.00%	$ 1,431,264.00	100.00%	$ 0.00
CUW37401	Calaveras Dam Replacement	21-Apr-11	5	$ 275,000,000.00	$ 259,571,850.00	94.40%	$ 284,141,000.00	109.50%	$ 391,878,750.00	151.00%	$132,306,900.00
CUW37301	San Joaquin Pipeline System-Eastern Segment	12-May-11	9	$ *54,500,000.00*	$ 45,329,416.00	83.20%	$ 46,751,791.00	103.10%	$ 55,660,797.00	122.80%	$ 10,331,381.00
	Bioregional Habitat Restoration, Goldfish Pond	19-May-11	3	$ 2,400,000.00	$ 3,188,000.00	132.80%	$ 3,566,245.00	111.90%	$ 3,847,327.00	120.70%	$ 659,327.00
	Habitat Reserve Program, Homestead Pond San andreas Reservoir Wetlands, Adobe Gluch Grasslands	2-Jun-11	1	$ *4,300,000.00*	$ 6,974,800.00	162.20%	$ 6,974,800.00	100.00%	$ 6,974,800.00	100.00%	$ 0.00
CUW32001	Forest Hill Pump Station Upgrades	30-Jun-11	3	$ *3,550,000.00*	$ 3,651,050.00	102.80%	$ 3,734,970.00	102.30%	$ 3,747,000.00	102.60%	$ 95,950.00
CUW36302	System Security Upgrade	11-Aug-11	2	$ 1,000,000.00	$ 1,206,030.00	120.60%	$ 1,216,742.00	100.90%	$ 1,216,742.00	100.90%	$ 10,712.00
CUW38401	Tesla Portal Protection	22-Sep-11	3	$ 2,300,000.00	$ 2,611,000.00	113.50%	$ 2,760,000.00	105.70%	$ 3,137,550.00	120.20%	$ 526,550.00
	San Antonio Creek Bioregional habita Restoration	6-Oct-11	4	$ 13,000,000.00	$ 12,947,400.00	99.60%	$ 13,601,000.00	105.00%	$ 14,198,500.00	109.70%	$ 1,251,100.00

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Project Number	Project Name	Bid Date	No. of Bidders	Engineer's Estimate1	Low Bid	% of Engineer's Estimate	2nd Low Bid	High Bid	Bid Range	Project Number	Project Name
CUW30103	Regional Groundwater Storage and Recovery	13-Oct-11	2	$ *3,900,000.00*	$ 2,998,685.00	76.90%	$ 3,932,634.00	131.10%	$ 3,932,634.00	131.10%	$ 933,949.00
CUW36802	Bay Division Pipeline No.5 Cordillearas Micro-Tunnel	3-Nov-11	5	$ 5,800,000.00	$ 5,251,100.00	90.50%	$ 5,686,050.00	108.30%	$ 6,620,050.00	126.10%	$ 1,368,950.00
	Peninsula 2011 Watershed Compensation, SASS and Upper San Mateo Creek Project	2-Feb-12	4	$ *6,300,000.00*	$ 5,591,750.00	88.80%	$ 6,087,850.00	108.90%	$ 7,558,000.00	135.20%	$ 1,966,250.00
CUW35302	Seismic Upgrade of BDPL Nos. 3 & 4	19-Apr-12	7	$ *51,500,000.00*	$ 31,320,000.00	60.80%	$ 36,680,000.00	117.10%	$ 47,439,197.00	151.50%	$ 16,119,197.00
CUW33701	Sutro Reservoir Rehab & Seismic Upgrade	17-May-12	5	$ *32,000,000.00*	$ 26,399,900.00	82.50%	$ 26,967,920.00	102.20%	$ 29,412,550.00	111.40%	$ 3,012,650.00
	Bioregional Habitat Restoration, Sheet Camp Creek Project	24-May-12	3	$ 2,700,000.00	$ 3,912,500.00	144.90%	$ 5,267,000.00	134.60%	$ 5,990,000.00	153.10%	$ 2,077,500.00
	Bioregional Habitat Restoration, Goat Rock Management Unit - Well Pumps and Cattle Troughs	28-Jun-12	5	$ 350,000.00	$ 378,210.00	108.10%	$ 419,152.00	110.80%	$ 805,000.00	212.80%	$ 426,790.00
CUW37403	San Antonio Backup Pipeline	29-Nov-12	5	$ *36,000,000.00*	$ 31,372,335.00	87.10%	$ 31,644,555.00	100.90%	$ 35,280,400.00	112.50%	$ 3,908,065.00
CUW36302	System Security Upgrade	19-Sep-13	2	$ 1,200,000.00	$ 1,187,648.00	99.00%	$ 1,531,924.00	129.00%	$ 1,531,924.00	129.00%	$ 344,276.00
CUW36702	Peninsula Pipelines Seismic Upgrade	19-Dec-13	5	$ 22,500,000.00	$ 20,613,902.00	91.60%	$ 20,736,380.00	100.60%	$ 23,951,500.00	116.20%	$ 3,337,598.00

RW Block Consulting, Inc.

Project Number	Project Name	Bid Date	No. of Bidders	Engineer's Estimate1	Low Bid	% of Engineer's Estimate	2nd Low Bid	High Bid	Bid Range	Project Number	Project Name
	San Francisco Groundwater Pipeline	7-Apr-14	5	$ *2,500,000.00*	$ 8,676,685.00	69.40%	$ 8,881,875.00	102.40%	$ 11,928,850.00	137.50%	$ 3,252,165.00
	Total		**4.39**	**$ 2,467,707,481.00**	**$ 2,065,770,664.00**	**83.70%**	**$ 2,218,189,749.00**	**107.40%**	**$ 2,637,424,277.00**	**127.70%**	

EXHIBIT 7 – LESSONS LEARNED

Reference	Project No./ Contract No. (As applicable)	Project Name	ISSUES / LESSONS LEARNED SUMMARY DESCRIPTION	ISSUES/IMPACTS	RECOMMENDATIONS	Budget	Change Management	Communication	Constructability	Construction Management	Contract	Design	Environmental		Planning	Project Delivery	QA/QC	Risk Management	Safety
1	WD-2498	New Crystal Springs Bypass Tunnel	Safety Performance. There was one recordable injury during the 223,034 man-hours worked on the project. The project also received a safety award from the contractor's insurance company for achieving 200,000 man- hours without a recordable injury.	Positive. Good cooperation in controlling risk exposures from the contractor, CM, and the program manager. The escalation ladder was effective in dealing with issues.	Making safety a priority and good cooperation among all entities (i.e., contractor, CM, Craft, Management) was critical to a safe, successful project. Although safety performance was exemplary, it was a constant effort to instill a safety culture, from the prime down through the subcontractors, particularly in regards to personal protective equipment (PPE) items (especially eye protection) and fall protection. The WSIP safety policy did not provide much leverage with the contractor, although the contractor was motivated to keep on top of safety by other, non-						x								x
2	WD-2498	New Crystal Springs Bypass Tunnel	Planning of Shutdown #1. This shutdown was planned extensively, and the new pipeline was tied into the SSPL within the desired duration.	Positive. WS&TD personnel were very responsive. There were adequate contractor personnel and equipment to complete the work. Daily updates to WS&TD, RPM, and other interested parties were well received.	Extensive planning led to the successful completion of Shutdown #1. Cooperation and open communication between WS&TD and the contractor were essential.					x									
3	WD-2498	New Crystal Springs Bypass Tunnel	Planning of Shutdown #2. This shutdown was planned extensively, and the new pipeline was tied in to the CSBPL within the desired duration.	Positive. WS&TD personnel were very responsive. The participation of senior personnel in planning and execution of the shutdowns was critical. The contractor completed the tunnel excavation and support and pipeline installation early enough to allow partial completion of surface pipeline work before the shutdown. EMB provided revised design criteria so that portions of the new pipe could be installed ahead of Shutdown #2. The CM issued a change order for nonvibratory installation of sheet piles within a 10- foot zone of the in-service pipeline. There were adequate contractor personnel and equipment to complete the shutdown work. Daily updates to WS&TD, RPM, and all interested parties were well received. Contingency planning for this Shutdown was very extensive. Neither the contractor nor WS&TD tried to "pass the buck"—they worked to a common goal	Include WS&TD personnel early in the detailed planning to schedule the crews. Cooperation and open communication between WS&TD and the contractor (via the CM) are essential.					x									
4	WD-2498	New Crystal Springs Bypass Tunnel	Acceleration of Shutdown #2. The CM issued a change order to accelerate the completion of Shutdown #2 from 30 calendar days to 4 calendar days.	The cost of the change order was $469,847.	For critical shutdowns that increase overall system risk, require a reduced duration in the contract (as long as it is feasible to perform the work in a reduced period of time) or provide an acceleration incentive in the original contract to limit cost.		x					x							
5	WD-2498	New Crystal Springs Bypass Tunnel	Disinfection of Pipeline. WS&TD was responsible for dewatering, treating discharged water, and disinfection. Unauthorized discharge was followed by a fish take in San Mateo Creek during the disinfection of the surface pipeline and tunnel prior to Shutdown #2.	WS&TD had some issues completing the disinfection of the surface pipeline and tunnel that could have potentially delayed the start of Shutdown #2. The availability of WS&TD personnel to treat and disinfect was limited. The CM supplemented WS&TD crew with biological monitors that alerted WS&TD when problems with the discharges occurred, limiting the damage.	Include WS&TD personnel in the detailed planning to schedule the crews. Tailgate crews extensively on the project environmental permit requirements.								x		x				
6	WD-2498	New Crystal Springs Bypass Tunnel	Time Available to Perform Prestartup and Startup Testing. This testing was not well coordinated with other City projects and WS&TD.	Prestartup testing was delayed because the valves were locked out for the CSSA project.	Coordinate startup similarly to how shutdowns are coordinated.					x									
7	WD-2498	New Crystal Springs Bypass Tunnel	Startup and Testing Coordination. Startup and Testing Coordination Meetings. These meetings were essential to completing the work and testing the systems. Including WS&TD Operations and the SCADA group in planning meetings was critical to the integration of the new control strategy with the in-service control strategy.	The control strategies were integrated without any operational incidents.	Empower a Startup and Testing Coordinator to facilitate the planning and execution of the startup and testing plan. Require the regular participation of the WS&TD Operations and the SCADA in the planning. Begin the startup and testing coordination meetings early.					x					x				

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8	WD-2498	New Crystal Springs Bypass Tunnel	Contact Configuration for the Auma Actuators. This was not properly explained to the contractor's subcontractor, KBL.	There was confusion between Auma and KBL on how the contacts worked in the programming. During the contractor's proposal/bid phase for subcontractors, the drawings Auma provided showed the contact position when the valve was in transition. KBL used the information to program the Human Machine Interface (HMI). KBL then had to reprogram to fit what the actuators' as-built contact	Auma should revise its documentation to present the contact position correctly.												x		
9	WD-2498	New Crystal Springs Bypass Tunnel	Expected Maximum Flow Rate. This changed from 200 MGD to 250 MGD.	A change order was issued to revise the Local Operator Interface (LOI) programming to accommodate 250 MGD.	Coordinate the contract range for the flow rate with WS&TD needs.							x							
10	WD-2498	New Crystal Springs Bypass Tunnel	SCADA Design Changes. Eleven Change Order items were required to address City-requested SCADA design changes.	Although the cost of the changes was not significant, the number of changes and the amount of time required to define the scope of work, program the changes, and test the changes was extensive and added approximately 3 weeks to the project (prior to Substantial Completion; there was no contract extension or overall delay).	Include an allowance item in the Bid Item list for SCADA programming, configuring, and testing. Coordinate programming requirements with City stakeholders during the design phase.							x				x			
11	WD-2498	New Crystal Springs Bypass Tunnel	SCADA Equipment Bill of Materials. This was incomplete, and the specification requirement that the contractor provide "all equipment and materials necessary to make the system operational" was unspecific. If the City does not know if the equipment is required, one option would be to require the contractor to purchase the equipment, and if it is not used, ask for the credit. Phrases such as "if required" as shown on Drawing E37 result in the contractor not knowing if the items should be included in its bid.	A change order was issued for some equipment, because the contract requirements were unclear.	Include a complete single line diagram and equipment bill of material in the contract documents.							x							
12	WD-2498	New Crystal Springs Bypass Tunnel	SCADA issues.	The City disagreed with the contractor's notice of delay. There was an initial delay in the beginning of startup and testing due to delays from the City's disinfection of the CSSA project. The remaining delays were due to the inability of the contractor's subcontractor to complete the original programming in a timely fashion. The contractor also had difficulty directing the subcontractor to complete the City changes to the programming in a timely fashion. The contractor did not effectively coordinate the work since the contractor's startup and testing coordinator was no longer with the company. The CM had to perform additional coordination with the contractor's subcontractor and WS&TD to complete the startup and testing. There was no claim at the end of the project since there was sufficient float in the schedule to offset both the City's and the contractor's delays.	Allow sufficient time for SCADA programming and prestartup testing.		x					x							
13	WD-2498	New Crystal Springs Bypass Tunnel	CMB Decision to Use an Integrated Team of Specialty Consultants and City Staff Proved Beneficial.	Successful completion of a complicated tunnel project within schedule and budget. Using an integrated team from the City, Jacobs Associates, and specialty subconsultants allowed the City to leverage all parties' experience and expertise to successfully manage this complex project. The group functioned very well as a team.	The use of an integrated CM team can be very effective.											x			

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14	WD-2498	New Crystal Springs Bypass Tunnel	Coordination of Division 0 and Division 1 Specifications with Division 2+ Specifications.	There were some conflicts between contract terms and the technical design intent. Some change orders could have been avoided.	Take extra time before bidding project to ensure the "front end" contract documents do not conflict with construction specifications. Allow for CM review of complete contract documents, and allow enough time for modification prior to bid advertisement. Bring on the CM team sufficiently early to allow for a proper review of the contract documents prior to bidding.				x			x								
15	WD-2498	New Crystal Springs Bypass Tunnel	Resource Loaded Schedule. Contractor was allowed not to submit a resource loaded schedule at the beginning of the project in favor of the promise to use the escrow bid documents to evaluate contract changes if needed.	Changes had to be quantified using other methods. During the negotiation of the shutdown acceleration schedule, for example, the CM had to rely on the contractor's estimate of its original cost to complete the shutdown, instead of being able to use the resource loaded schedule for an estimate.	Do not grant exemption for providing a resource loaded schedule at the start of the project.		x			x										
16	WD-2498	New Crystal Springs Bypass Tunnel	Thirty-day Time Limit between Substantial Completion and Final Completion.	Contractor was reluctant to issue Substantial Completion as soon as possible. Punch list coordination with EMB and contractor-provided documentation were difficult to complete in 30 days.	Additional time between Substantial Completion and Final Completion is preferable.						x									
17	WD-2498	New Crystal Springs Bypass Tunnel	Final Inspection Conducted after Notice of Substantial Completion Received from Contractor, in Accordance with Contract Specifications.	The CM and EMB had very little time to resolve items on the Punch List / Final Completion. If any punch list items had been required to be completed prior to granting Substantial Completion, substantial completion would have been delayed. Due in part to the CM's early preparation of an incomplete work items list, this was not the case.	Require all interested parties to participate in an early inspection well in advance of Substantial Completion. Begin compiling a punch list early, and as the work is completed.					x	x									
18	WD-2498	New Crystal Springs Bypass Tunnel	HRC Sign Off. Contractor reported being directed by HRC to list only LBE subcontractors on HRC Forms 7 and 9. The contractor initially refused to list its other subcontractors on HRC Forms 7 and 9 when HRC requested the information for closeout.	Delay to the issuance of final payment and closeout of the contract.	Require that the contractor fill out all the information required on the HRC forms for the duration of construction.						x									
19	WD-2498	New Crystal Springs Bypass Tunnel	Partnering. Contractor's senior management did not participate.	The CM managed partnering by incorporating quarterly progress meetings (with attendance from senior City management) into the regular construction progress meeting schedule. The contractor was committed to completing the work. The CM had a good working relationship with the contractor's on-site management. The close proximity of the contractor's offices and the CM's office facilitated communication and coordination of work. Informal partnering worked for this project.	Use informal partnering where formal partnering is not going to be effective.					x	x									
20	WD-2498	New Crystal Springs Bypass Tunnel	Amount of Information Shared with DRB.	The contractor and the City originally disagreed on the amount of information/issues shared with the DRB. The program limited the information shared with the other DRBs.	Be flexible in the amount of information provided to the DRB. Summarized information can be effective and cost efficient.		x				x									
21	WD-2498	New Crystal Springs Bypass Tunnel	Hydro Testing of Tunnel and Shafts Pipelines (HFT). The hydrostatic testing requirements were not well defined in the contract. Test procedures and test zones were not specifically identified in the specifications or drawings. Temporary pressure test head requirements were not included in the specification and were not communicated to the contractor in a timely manner. The acceptance criteria for hydrostatic testing were not clearly defined. The mitigation/repair method if the hydrostatic testing did not meet acceptance criteria was not specified in the contract.	The contractor challenged the contract requirement to hydrotest the tunnel and protested the timeliness of the hydrostatic field test acceptance criteria. The contractor also identified the potential operating risks related to the test pressure. The City issued a change order to install temporary pressure test heads after the pipeline was fabricated and installed. The original, required test pressure was incompatible with the pressure rating of the Venturi meter. The acceptance test criteria and results still have not been formally accepted by EMB.	Convene the hydrostatic testing committee during the design phase. Perform a review if hydrostatic testing is appropriate for the specific project before incorporating the requirement in the bid documents. Define the boundaries and acceptance criteria, and identity potential consequences and remedies during design. Include requirements in the contract documents.		x					x								

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22	WD-2498	New Crystal Springs Bypass Tunnel	Additional 60-inch BFV Purchase for Kiewit. Kiewit purchased bolts for the butterfly valve (BFV) based on the shop drawings without measuring the actual flange thickness. The AWWA standard to which the BFV was cast does not specify the maximum flange thickness, so the bolt length may vary.	The contractor did not measure the thickness of the flange prior to ordering the bolts. The ordered bolts were short. The bolts are fabricated on a per order basis. The City issued a change order for the correct bolts.	The valve specification should include the back facing of the bolt flange and the maximum thickness (and tolerance) for the flange, or the contract documents should require that contractor as-built the BFV prior to ordering the bolts.		X					X					X		
23	WD-2498	New Crystal Springs Bypass Tunnel	Welding Quality Control Requirements Incomplete. The design of the pipeline and specials was required to be performed in accordance with the ASME Boiler and Pressure Vessel Code, whereas the fabrication and QC were to be performed in accordance with AWWA C200 and C206.	Contract requirements for weld inspection of the specials (wye branches, tees, elbows, and manholes) were inconsistent with industry standard practice. A change order was approved to add volumetric weld examination to shop-welded specials.	Require the contractor-supplied pressure vessel (pipeline and specials) design and fabrication to be performed in conformance with the same design code. The ASME Boiler and Pressure Vessel Code is the recommended design code.		X					X					X		
24	WD-2498	New Crystal Springs Bypass Tunnel	Protection of Permanent Structures at the North Shaft. The CM recommended additional protection of the structures at the North Shaft. Direction to perform the change was provided too late for this contract to implement. Details and San Mateo County approval are still pending.	The protection of the structures at the North Shaft could not be performed in this contract. WS&TD will need to perform the work on its own or perform the additional work under another contract.	Provide timely direction to perform change order work. The CM should push the issue with San Mateo County (or other municipality), even when met with initial resistance, to require additional protection be approved and added to the construction contract.		X					X							
25	WD-2498	New Crystal Springs Bypass Tunnel	Electrical Drawing AutoCAD Requirement. This requirement was found in the general electrical specification, not in the closeout section.	The CM did not automatically transmit the AutoCAD files to EMB. They were included in a submittal and not with the as-built drawings and had to be transmitted separately to EMB.	Include as-built drawing requirements in one (closeout) specification section.						X	X							
26	WD-2498	New Crystal Springs Bypass Tunnel	Additional Environmental Permits. Additional environmental permits were needed to begin work. The Fuels Permit, which was for treatment and discharge of groundwater, was not initiated prior to NTP because responsibility to obtain the permit had not been assigned to either BEM or CMB. The hydrocarbon contamination was identified during design during the installation of the early	The start of shaft construction was delayed.	Responsibilities for ALL project construction permits should be tracked by the RPM/CM and secured in advance of NTP.							X	X						
27	WD-2498	New Crystal Springs Bypass Tunnel	Conflicting Contract and Permit Requirements. Various deadline requirements existed as follows: field office delivery of 14 days after NTP; noise and vibration plan submittal required 28 days prior to work; and storm water pollution prevention plan (SWPPP) submittal required 60 days prior to work. While the City stated that all permits had been previously furnished—except NPDES Fuel-Clean- up (NPDES) to be issued by RWQCB upon approval of SWPPP—work could not start without the SWPPP approval by RWQCB.	The start of ground mobilization and groundbreaking activities was delayed.	Permit requirements and timeline should be clearly delineated in the contract. Clarify other details such as the height of the environmental exclusion fence prior to the bid.						X	X							
28	WD-2498	New Crystal Springs Bypass Tunnel	Storm Water Pollution Regulation Interpretation.	A noncompliance notification (NCN) was issued for noncompliance with turbidity limits in the Basin Plan, required by the General Construction Permit (NPDES for storm water). S/BB contended that water quality objectives, not numerical turbidity limits, applied to storm water runoff. The contractor also maintained that storm water discharges had been in compliance with both the NPDES General Permit and the Basin Plan by implementation of BMPs. The City wished for the contractor to implement proactive measures to stay below certain turbidity levels in order to preserve the City's good relationship with the RWQCB for future contracts. Work was tracked on a force account basis, and contractor costs to procure and install erosion control blankets were paid under the contract environmental allowance.	Include specific requirements in the contract environmental specifications regarding turbidity limits. Coordinate the permit requirements with the environmental specifications. Provide a draft SWPPP in the contract documents.							X	X						
29	WD-2498	New Crystal Springs Bypass Tunnel	Temporary Substation Minor Project Modification (MPM).	The CM pursued an MPM because the location of the temporary substation's power line conflicted with the location of the South Shaft. This delayed the construction of the temporary electrical substation.	Perform a detailed and multidisciplinary constructability review of the bid documents.				X			X							

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30	WD-2498	New Crystal Springs Bypass Tunnel	Improper Snake Handling. Handling of unknown snake species was not in conformance with specifications and SDFG Code. Worker training does not constitute expertise for wildlife identification; training instructed workers to back away from wildlife, leave it alone, and inform environmental inspectors.	USFWS or CDFG can stop or restrict work. Potential work shutdown was avoided by response of CM. BEM and responsible agencies were immediately notified in accordance with permits. The contractor's personnel were retrained on proper procedures. The CM issued a noncompliance notification to the	Refresh environmental training periodically (monthly or quarterly) with the contractor's crew at the tailgate meetings.					x			x						
31	WD-2498	New Crystal Springs Bypass Tunnel	Traffic Control at North Shaft. EIR allowed "temporary" (up to 3 weeks) closure of one lane of Crystal Springs Road; however, the contractor desired narrowing of both lanes and elimination of the bike lane for a significantly longer duration (i.e., for more than 1 year).	An MPM was required to accommodate the contractor's work plan.	During the design phase, prepare a construction staging drawing and construction sequence plan, which can serve as the basis for the environmental permitting.				x			x							
32	WD-2498	New Crystal Springs Bypass Tunnel	Permit Requirements. These requirements were not written in such a way that they could be directly converted into contractual requirements. Accordingly, the contractor interpreted the permit requirements and proceeded with the work. The City's and the contractor's interpretations did not always agree.	The CM was required to hire a full-time environmental manager.	Integrate permit requirements into the specifications and drawings.		x					x							
33	WD-2498	New Crystal Springs Bypass Tunnel	Specification Requirements for Topsoil, Seed, Seed Placement Timing, Maintenance, and Warranty. These requirements were not well integrated.	Refer to subparts a through e below.	Refer to subparts a through e below.							x							
34	WD-2498	New Crystal Springs Bypass Tunnel	Timing Requirements for the Reseeding. These requirements were incompatible with the work schedule and required planting either prior to the completion of ground-disturbing site work or after the Final Completion deadline.	Removal of the seeding work from the contract was required, as well as issuance of a JOC contract to complete the reseeding and maintenance work.	Involve Natural Resources and a landscaping designer in the development of the EIR and contractual requirements for revegetation, and specifically define revegetation success in contractually enforceable terms.				x			x				x			
35	WD-2498	New Crystal Springs Bypass Tunnel	Bid Items for Revegetation and Environmental Allowance. These bid items should be more specific. Bid items for site revegetation did not include the cost for the top soil.	There were arguments regarding the topsoil cost. The installation of the top soil for areas other than the muck disposal area was compensated using the environmental allowance.	Integrate technical and environmental requirements into bid items.						x	x				x			
36	WD-2498	New Crystal Springs Bypass Tunnel	Site revegetation Seed Requirements. Non-native invasive plant species were required. However, these were prohibited by the environmental permits and were not desirable to Natural Resources.	The seed mix had to be redesigned through significant coordination efforts of Natural Resources, BEM, and the CM team. The redesigned mix resulted in additional cost, and put the City in a difficult position with respect to the warranty and maintenance requirements in the contract. The native seeds are more tenuous and typically have a lower success rate than the non-native seeds that were originally included in the contract.	Involve Natural Resources in the development of the EIR and contractual requirements for revegetation.		x					x	x						
37	WD-2498	New Crystal Springs Bypass Tunnel	Specification Requirements for Effective Revegetation. These required that grasses be "in good health and thriving condition." This is not an easily measurable success rate.	We expect it to be difficult to enforce contract compliance and the need for warranty work.	Involve Natural Resources and a landscaping designer in the development of the EIR and contractual requirements for revegetation, and specifically define revegetation success in contractually enforceable terms.							x							
38	WD-2498	New Crystal Springs Bypass Tunnel	Specification Requirements for Revegetation Monitoring in Section 01060 Regulatory Permits. These required 5 years of monitoring, whereas Section 02270 only requires monitoring for 1 year.	Revision to Specification Section 02770 Revegetation was made to specify who would be performing the monitoring to include of the seeding work from the contract; and a JOC contractor will complete the reseeding and maintenance work.	Involve Natural Resources in the development of the EIR and contractual requirements for revegetation. Include the regulatory permit requirements for monitoring in the contract specification. Specify who is responsible for the monitoring for 1 year and 5 years.							x							
39	WD-2498	New Crystal Springs Bypass Tunnel	Proactive and Informative Public Outreach Program. This program included mailers, door-hangers, blogs, community coffees, and site tours in advance of each stage of heavy construction. Regular meetings with and transmission of information to San Mateo County kept them informed on project activities and mitigations.	Positive. There were no significant impacts from community complaints. The County appreciated being apprised of project happenings.	Continue best practices. Set expectations with the community early on in the project. Continue good communication with San Mateo County.			x											

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40	WD-2498	New Crystal Springs Bypass Tunnel	Property Damage Claim Responsiveness. Through preconstruction surveys and outreach, residents adjacent to the construction site were able to contact the City regarding potential 3rd party construction related damage to their property. The lead QA was responsible for responding to all damage notices, and inspections were scheduled in a timely manner. Once the inspection was completed and damage validated, the CM notified the contractor of each claim for handling.	Positive. There were five 3rd party damage claims forwarded to the contractor. The contractor's insurer followed up with the residents. No damage claims were assigned to the City.	Continue best practices.					x	x	x							
41	WD-2498	New Crystal Springs Bypass Tunnel	Establishing a Baseline Risk Register during the Design Phase. The project risk register was developed during design and updated by the CM during construction. The monthly risk register was tracked at the project level using action plans in CMIS.	The risk register was a useful tool to manage risk.	Continue best practices.													x	
42	WD-2498	New Crystal Springs Bypass Tunnel	NCSBT was first major project in the Water System Improvement Program (WSIP).	The project was the first major project to implement Primavera Contract Manager (CMIS) and was the first major CM contract in WSIP. The NCSBT experience allowed the City to optimize the WSIP CM plan and WSIP CM procedures for other contracts. NCSBT had a lot of support from the program managers regarding implementation of WSIP procedures.	The team provided valuable input on implementation of CMIS. Lessons learned on NCSBT are already being implemented on other WSIP projects.														
43	WD-2498	New Crystal Springs Bypass Tunnel	Requested Substitution of Venturi Meter.	The City paid additional costs for the contractor to install the specified venturi meter through a change order request (COR) after rejecting a Request for Substitution	If a specific item is required in the design, use the sole source option in the contract. Otherwise, ensure it is possible for more than one product to meet the specified acceptance criteria.		x				x	x							
44	WD-2498	New Crystal Springs Bypass Tunnel	"Work by Others." The City was responsible for installing selected inclinometers prior to the start of shaft excavation. The inclinometers were not installed by the City.	Shaft excavation was not delayed but was very close to being delayed, and was the subject of an argument with the contractor due to the lateness of direction to the project team on this issue. Change orders were issued for $192,965 to perform the inclinometer installation and	Contractual "Work by Others" (outside this contract) should be included in the master project schedule and coordinated by the RPM/CM. Tracking of "Work by Others" should be closely monitored by the CM and RPM.		x			x									
45	WD-2498	New Crystal Springs Bypass Tunnel	Unclear Temporary and Permanent Power Responsibilities. The Contract required the contractor to coordinate all temporary and permanent power with PG&E. However, PG&E would only coordinate with the SFPUC. The SFPUC attempted to impose requirements on the contractor beyond those included in PG&E standards.	The CM was required to referee among the SFPUC, PG&E, and the contractor to maintain the project schedule.	Revise the requirements for temporary and permanent power coordination to acknowledge the SFPUC's role as the coordinator and make reference to the appropriate PG&E standards. Strictly adhere to the contract submittal requirements, and require submittals be provided at least 21 days in advance of the work.					x		x							
46	WD-2498	New Crystal Springs Bypass Tunnel	PG&E Invoices. The City and the contractor disagree on who was responsible for paying PG&E invoices. This issue came up related to both temporary and permanent power invoices.	For permanent power invoices ultimately paid by the contractor, the CM team spent significant time with the contract documents and in discussion with EMB identifying costs that could be attributed to contractor responsibility. For temporary power invoices, the drawings stated that the temporary power facility would be provided by PG&E and paid for by the City. The City paid the $10,766 PG&E	Clearly specify and indicate who is responsible for the cost for temporary and permanent facilities. Work with PG&E to obtain detailed invoices wherever possible.						x	x							
47	WD-2498	New Crystal Springs Bypass Tunnel	Differing Site Conditions at the North Shaft. The report describing the anticipated ground conditions for the G36/G38 vault was not the Geotechnical Baseline Report (GBR), which is a contract document. It was a reference document. The baseline for anticipated shaft conditions was summarized in the GBR Table 3, but was not	The City reimbursed the contractor $144,393 for costs associated with additional exploration and drilling through isolated zones of rock not clearly included in the GBR.	Separate and distinct baselines should be included in the Geotechnical Baseline Report for the subterranean vaults (G36/G38, G32, G34, Venturi Vault).		x					x							

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48	WD-2498	New Crystal Springs Bypass Tunnel	Managing Differing Site Conditions. Underground construction is vulnerable to differing site conditions, even when appropriate subsurface investigation and preconstruction potholing are performed. The GBR and change order processes are tools for resolving potential cost and schedule impacts of differing site conditions.	Several vault foundation and pipeline locations required additional excavation or treatment before the engineer would accept the structural foundations. The additional work was paid for through the change order process. In two situations, the contractor submitted claims for additional work and potential schedule delay. The claims were settled onsite without going to the Dispute Review Board.	Continue to use the GBR, and the change order and Dispute Review Board processes.		x					x							
49	WD-2498	New Crystal Springs Bypass Tunnel	Muck Disposal Site. The quantity of muck removed from the shaft and tunnel excavation was not sufficient to achieve the design grade of the muck disposal area. Additionally, when the wildlife exclusion fence was installed in accordance with contract requirements, the installed fencing line did not allow for proper drainage of the muck	Perimeter site drainage was redesigned to address localized ponding and the reduced embankment footprint. The CM had to obtain an MPM to allow for the increased muck disposal area.	Indicate variable footprint for the muck disposal site based on theoretical minimum and maximum volumes. Consider the entire basin hydraulics for site drainage design. One suggestion would be to require the contractor to slope to drain in the muck disposal site design.		x					x							
50	WD-2498	New Crystal Springs Bypass Tunnel	Delayed demobilization of the City's Field Offices. The City notified the contractor of its need to occupy the field offices beyond the date when the contractor wished to demobilize them and directed the contractor to repair the sanitary sewer service and provide potable water service to the offices. Although it was stated in the contract that the City office was required to be in place for the duration of construction, the location of the City field office had to be relocated to complete final grading.	The contractor could not complete the grading and drainage work associated with the field office location until CM personnel relocated. The City issued an NCN in response to the contractor's noncompliance of providing the City with the specified field office and refused to pay for sewer line repair associated with reestablishing the office.	The location of the City's field offices should be incorporated into the plan for final grading and demobilizing the project.					x		x							
51	WD-2498	New Crystal Springs Bypass Tunnel	Request for Deviation for Pipeline Lining. The contractor proposed revising the polyurethane lining to cement mortar lining (CML). Revision was accepted by the City.	The revision to the pipeline lining resulted in a cost savings of $228,359. The use of CML also allowed the contractor to complete Shutdown #2 earlier than if polyurethane lining had been used. This is because of the cure time requirement for lining applied at	The design phase evaluation of the pipeline lining should also consider the time to complete construction activities.				x			x				x			
52	WD-2498	New Crystal Springs Bypass Tunnel	Punch List Generation and Resolution. This is the CM's responsibility, not the engineer-of- record's responsibility.	There were misunderstandings between EMB and the CM regarding punch list item disposition and closeout	Include EMB in WSIP training and distribution. Have the CM and the PE meet prior to initiating closeout to review the expectations and responsibilities of each party.					x	x	x							
53	WD-2498	New Crystal Springs Bypass Tunnel	Incentives. Two incentives were offered to the contractor—an incentive to minimize 24-hour work during tunneling, and an added incentive to reduce the duration of Shutdown #2. The requirements for the achievement of the 24-hour incentive were difficult to understand in the contract documents. In addition, whereas the Shutdown #2 duration and window were clearly defined in the contract, Liquidated Damages were linked to a specific Shutdown #2 calendar date and were not a deterrent to the contractor. Accordingly, the Shutdown #2 incentive included a combination of incentive and reverse incentive.	Both incentives achieved the desired results.	Financial incentives can be effective if the criteria are clearly defined for acceptance or rejection.						x	x				x			
54	WD-2498	New Crystal Springs Bypass Tunnel	Liquidated Damages (L/D). L/Ds were not assessed on this project.	The threat of L/Ds achieved the desired results.	Continuing to include L/Ds can be effective if the trigger dates or criteria are clearly defined.						x								
55	WD-2498	New Crystal Springs Bypass Tunnel	Weekly Construction Progress Meetings. These meetings were extremely effective because of the standard agenda, which routinely recognized key elements of the project on a weekly basis. SFPUC Communications was routinely at the table and able to identify construction activities with potential community impacts.	Positive. The meetings were routinely kept to a 60-minute duration, with follow-on meetings as appropriate.	Continue best practices.					x	x								
56	WD-2498	New Crystal Springs Bypass Tunnel	Weekly CM Staff Meetings. These meetings were effective at managing CM tasks, balancing workload, discussing project related issues, and maintaining high morale.	Positive. The weekly meetings helped CM staff coordinate activities and provided an opportunity to brief staff on outstanding issues/activities. They also provided good cross training for staff in other areas of expertise. The meetings were routinely kept to a	Weekly CM staff meetings are valuable.					x									

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57	WD-2498	New Crystal Springs Bypass Tunnel	Supplier Quality Surveillance (SQS) Coordination. SQS monitored the fabrication of the tunneling steel pipeline and the fabrication of the butterfly valves and appurtenances.	Positive. SQS monitoring was very good. The CM Team had good access to the SQS inspectors to discuss any potential deficiencies identified in the SQS report. SQS reports were well written and detailed.	Continue best practices.												X		
58	WD-2566	San Antonio Pump Station Upgrades	Drawing Coordination Between Design Disciplines - Contract drawings contained Civil, Structural, Architectural, Electrical, Cathodic Protection, and Security design drawings. During the project, differences between drawings of different design disciplines were noted. RFIs were prepared and minor Change Orders resulted as a result of these inconsistencies. Project examples include:	1. Schedule Impact: There was no schedule impact as a result of this Lesson Learned. 2. Cost Impact: CO #28 (new gate), CO #22 (Miscellaneous Electrical), CO #4 (added shotcrete wall), CO #18 (Tank Pit Handrail), CO #9 (West to South Wall Transition).	EMB should perform additional review and coordination between design disciplines.		X					X							
59	WD-2566	San Antonio Pump Station Upgrades	A. Both the Civil (C1.1) and Security drawings (SE-3.0) showed perimeter fencing around the new engine generator and fuel storage equipment yard. However, details of the fencing varied between the Civil and Security drawings. Civil drawings showed more standard gates while the Security Drawings showed specific details geared around security related latches and future security provisions. Also, locations of vehicle entrance gates and personnel gates varied between the Civil and Structural drawings. Contractor noted the discrepancies, and the location of the entrance gates was finalized based on the Security Drawings. This resulted in a Change Order to run additional conduit to the location of the entrance gates based on the Security Drawings. Finally, on the Civil Drawings, the limits of new fencing were shown to be around the perimeter of the new equipment yard.	1. Schedule Impact: There was no schedule impact as a result of this Lesson Learned. 2. Cost Impact: CO #28 (new gate), CO #22 (Miscellaneous Electrical), CO #4 (added shotcrete wall), CO #18 (Tank Pit Handrail), CO #9 (West to South Wall Transition).	EMB should perform additional review and coordination between design disciplines.		X					X							
60	WD-2566	San Antonio Pump Station Upgrades	B. Coordination between the Architectural and Structural Design Drawings also contained some minor inconsistencies. Contractor raised questions via RFI on construction of the architectural reveals and other architectural details as they related to the seismic retrofit scope of work (W10 columns, shotcrete walls, micropile caps). Ultimately, minor Change Orders were issued during the construction	1. Schedule Impact: There was no schedule impact as a result of this Lesson Learned. 2. Cost Impact: CO #28 (new gate), CO #22 (Miscellaneous Electrical), CO #4 (added shotcrete wall), CO #18 (Tank Pit Handrail), CO #9 (West to South Wall Transition).	EMB should perform additional review and coordination between design disciplines.		X					X							
61	WD-2566	San Antonio Pump Station Upgrades	Civil Design Needs for the Engine Generator and Fuel Storage Pad Area - SAPS Contract drawings called for the construction of two foundation slabs to support 1) the two new standby engine generators and 2) the new diesel fuel storage equipment. Together, during the construction phase, this area came to be referred as the "Equipment Yard". During the construction project, it became apparent that civil design specific to the Equipment Yard was missing, and that design changes and additions were needed. The required changes are below:	1. Schedule Impact: There was no schedule impact as a result of this Lesson Learned. 2. Cost Impact: CO #23 (Gen Pad Site Improvements), CO #25 (Equipment Yard Outdoor Lighting), CO #13 (Generator Pad Drainage).	EMB should perform additional review and coordination between design disciplines.		X					X							

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62	WD-2566	San Antonio Pump Station Upgrades	A. The existing grade at the Equipment Yard sloped from Calaveras Road (east side) down to the west (Chloramines Building) side. Contract drawings called for the new engine generator and fuel storage concrete foundations to be constructed with a similar 2% slope from E-W to follow the existing contours and also provide natural draining. However, during the construction phase, Contractor and CM noted that typically, large pieces of equipment (engine generators and fuel storage tanks) are mounted flat, and the concrete foundation is typically flat in nature, with slight elevation changes on the concrete foundation to provide drainage of water off the slab. Mounting two large 1500 kw Generators other than perfectly level created questions from the Contractor. Several design options (including adding steel members under the frames of the engine generators) was discussed. Ultimately, Contractor and CM Team developed a design together in the field which was later approved by the Design Engineer. The final design and construction called for the engine generator pad to be constructed for the most part level. Floor drains and drain piping within the slab to remove standing water were incorporated. Sloping of concrete to the floor drains was incorporated.	1. Schedule Impact: There was no schedule impact as a result of this Lesson Learned. 2. Cost Impact: CO #23 (Gen Pad Site Improvements), CO #25 (Equipment Yard Outdoor Lighting), CO #13 (Generator Pad Drainage).	EMB should perform additional review and coordination between design disciplines.		x		x			x							
63	WD-2566	San Antonio Pump Station Upgrades	B. The new "Equipment Yard" for the SAPS project called for the entire area to be enclosed with new security fencing. Vehicle and personnel entrance gates into the Equipment Yard were required in the Contract Documents. However, there were no Civil Design provisions for access within the perimeter fenced area. SAPS Operations noted that they must have clear access for Operation and Maintenance while working within the fenced area. As a result, the CM Team took the initiative to add new site/civil design features within the Equipment Yard. This included a new concrete sidewalk from the North Entrance gate down to the central area between the Engine Generator and Fuel Storage Tank Pads. A new sidewalk was also added between these two pads such that Operations would have a flat/clean working space when performing maintenance and Operation on the fuel supply/return pumps as well as working around the new Panel M in the equipment yard. Also, CM Team designed a gravel road from the vehicle entrance gate, up to the Engine Generator Pad, so that an all weather road surface for	1. Schedule Impact: There was no schedule impact as a result of this Lesson Learned. 2. Cost Impact: CO #23 (Gen Pad Site Improvements), CO #25 (Equipment Yard Outdoor Lighting), CO #13 (Generator Pad Drainage).	EMB should perform additional review and coordination between design disciplines.		x		x			x							
64	WD-2566	San Antonio Pump Station Upgrades	C. During the construction phase, SAPS Operations and CM Team noted that lighting around the Equipment Yard needed to be increased. While the two engine generators had wall mounted light fixtures, Operations requested additional lighting around the Fuel Storage Tank area and other areas of the Equipment Yard that they would be accessing during the off-hours. CM Team and Electrical Design Team developed design additions for a new standing light pole, and additional wall mounted light fixtures to the engine	1. Schedule Impact: There was no schedule impact as a result of this Lesson Learned. 2. Cost Impact: CO #23 (Gen Pad Site Improvements), CO #25 (Equipment Yard Outdoor Lighting), CO #13 (Generator Pad Drainage).	EMB should perform additional review and coordination between design disciplines.		x		x			x							

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65	WD-2566	San Antonio Pump Station Upgrades	Cooperation with other SFPUC Divisions - The San Antonio Pump Station Project (WD-2566) is a forty year old facility that is critical to the Sunol Region and SFPUC Water System. When the project began, both Contractor and CM Team were unfamiliar with the different Operating Divisions within the SFPUC. These operating divisions have their own areas of responsibility, and bring their own areas of expertise and familiarity with both the SAPS Facility and operation within the SFPUC structure. The Contractor and CM Team came to understand the importance of engaging these different working groups within the SFPUC. Not only was becoming familiar with the Operating Procedures within the SFPUC important, it was critical to getting input and acceptance of construction related work during the project. The project team notes the following SFPUC Operating Divisions that the team came to develop strong relationships that were critical to the success of the	Schedule Impact: None. Cost Impact: Non-definable.	CMB recognizes those individuals mentioned above and again highly recommends on future SFPUC projects that the CMB team establishes points of contact with those entities involved with their perspective project. Developing communication and trust with the various Operating Divisions is critical to working within the SFPUC. It is critical to the success of SFPUC Projects.			x		x										
66	WD-2566	San Antonio Pump Station Upgrades	A. SAPS Operations: Parveen Joshii, Frank Calvo, Gary Williams, Steve Shaw. All of these individuals were key members of the project team. All of their knowledge sharing of how the SAPS facility operates within the Sunol Valley was critical. They all shared critical information on how the existing generators operate, allowed access within the SAPS Project, showed a willingness to help and assist during the construction phase, were available during startup, and available to answer questions on the existing facility.	Schedule Impact: None. Cost Impact: Non-definable.	CMB recognizes those individuals mentioned above and again highly recommends on future SFPUC projects that the CMB team establishes points of contact with those entities involved with their perspective project. Developing communication and trust with the various Operating Divisions is critical to working within the SFPUC. It is critical to the success of SFPUC Projects.			x		x										
67	WD-2566	San Antonio Pump Station Upgrades	B. WST&D Machinsts: Pete Woolery, Prem ???. The SAPS Upgrade project involved the replacement of three existing 1000 hp Horizontal Split Case Pumps. During the installation of the new pumps, CM Team engaged WST&D Machinists such that they were involved during the replacement work, offered assistance, and became comfortable with the installation. Pete Woolery and the machinists participated in checking horizontal and vertical alignment of the pump installation, participated in additional pinning of the pumps, and assisted with trouble-shooting the motor operated valves related to the discharge of the existing engine generators.	Schedule Impact: None. Cost Impact: Non-definable.	CMB recognizes those individuals mentioned above and again highly recommends on future SFPUC projects that the CMB team establishes points of contact with those entities involved with their perspective project. Developing communication and trust with the various Operating Divisions is critical to working within the SFPUC. It is critical to the success of SFPUC Projects.			x		x										
68	WD-2566	San Antonio Pump Station Upgrades	C. SFPUC SCADA Group: Ron Roses, Fonda Davidis, Mostafa Dastgheib. The SAPS Project was designed by the SFPUC. Early in the project, it was noted that while each of the two new systems (Cummins Standby Generator and Simplex Fuel Storage System) contained their own programming specific to the operation of their equipment, ultimately these two new systems would need to be programmed into the PLC operation of the SAPS facility, and ultimately programmed into to the overall Operator work stations (HMI, wonderware). Project team engaged the SFPUC, and became familiar with their management in Millbrae and Market Street, and their programmers and technicians local to the Sunol Region. Ron Roses was valuable in performing the programming of the existing PLC to incorporate two new systems. Ron also developed the HMI screens and associated programming needed for control from the Operator work stations. This programming was done in advance of final start-up and testing. Detailed instrumentation and wiring diagrams were prepared by Ron Roses and given to the contractor.	Schedule Impact: None. Cost Impact: Non-definable.	CMB recognizes those individuals mentioned above and again highly recommends on future SFPUC projects that the CMB team establishes points of contact with those entities involved with their perspective project. Developing communication and trust with the various Operating Divisions is critical to working within the SFPUC. It is critical to the success of SFPUC Projects.			x		x		x								

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69	WD-2566	San Antonio Pump Station Upgrades	D. Electrical Maintenance Technicians (EMT): Shawn McEntire and Sparky. CM Team engaged the Sunol Region EMT's during the project. Communication with Shawn McEntire and Sparky proved to be beneficial to the project. Sparky assisted with answering questions related to the many existing conduit and circuits that needed to be cut during the structural retrofit work. Shawn was helpful in staying close to the project as new SEL relays were brought on line and new electrical instruments were made operational.	Schedule Impact: None. Cost Impact: Non-definable.	CMB recognizes those individuals mentioned above and again highly recommends on future SFPUC projects that the CMB team establishes points of contact with those entities involved with their perspective project. Developing communication and trust with the various Operating Divisions is critical to working within the SFPUC. It is critical to the success of SFPUC Projects.			x		x										
70	WD-2566	San Antonio Pump Station Upgrades	Need to Research As-builts During Design and Resolution of Embedded Electrical Conduit - Contract documents called for the seismic retrofit and structural upgrades to the existing San Antonio Pump Station facility. This work included drilling and installing twenty-six (26) micropiles, installation of new W10x49 columns and installation of a new shotcrete wall. Within the engine pump room of the pump station, contract documents called for the demolition of the existing foundation slab at both the north and south ends of the pump room. Additionally, along the east wall of the pump station, contract documents called for the demolition of sections of existing foundation slab along the east interior wall. Prior to beginning slab demolition activities, Contractor performed Non-Destructive Testing in accordance with the Contract Requirements of Specification 01045. During NDT investigation, a large number of live electrical conduits running from the existing MCC and Control Rooms, out to various pieces of equipment within the pump room, were identified in areas requiring slab demolition. The CM Team took an active role in researching As-Built drawings from the original SAPS Construction built in 1966, and drawings from other upgrades performed over the past 40 years. CM identified the electrical feed from the equipment back to its power source, and the instrumentation/control from the equipment to ultimately the SAPS Control equipment. These live electrical feed provided power and instrumentation control to the existing diesel engine pumps, existing motor operated valves, existing 100 kW generator, existing lights, heaters, receptacles, roll-up doors, existing diesel pumps, and existing air compressor equipment. It was	1. Schedule Impact: None. 2. Cost Impact: CO #10 – Electrical Conduit Replacement.	EMB should confirm the presence of existing utilities in areas of requiring structural demolition. The inclusion of the Non-Destructive Testing (NDT) requirement in the contract documents, and the contractor performing this NDT work, enabled these electrical utilities to be identified prior to demolition. This allowed the project team to research the extent of the electrical utilities and develop a plan to work around the utilities in order for the structural work to proceed.				x		x								

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71	WD-2566	San Antonio Pump Station Upgrades	Added items to the Supplier Quality Surveillance (SQS) Plan - The SAPS Project Upgrades Project called for the installation of three new 1000 hp horizontal split case pumps, and new standby power equipment (new medium voltage switchgear and new standby engine generators). The SFPUC's Supplier Quality Surveillance Program was not defined or referenced in the Contract Drawings or Specifications. The only requirement for Owner Representation in the Contract Documents was Factory Witness Testing of the Horizontal Split Case Pumps. While the Drawings and Specifications were silent on the SQS Program, internally, SFPUC had written a Project Specific SQS Plan for the SAPS Project. The three new horizontal split case pumps were included in the original SQS Plan. During the project, the CM Team notified the Contractor of the City's SQS Program, and their desire to perform additional factory inspections of the SQS Program beyond the Factory Witness Testing of the pumps. The Contractor complied with this without issue. In addition to the SQS of the horizontal split case pumps, the CM Team and Senior Management from CMB noted the importance of performing SQS on the new Cummins' Standby Generators and Medium Voltage Switchgear. The CM Team worked with PMB, Parsons, and the Program Management Quality Assurance Manager, on adding the Cummin's equipment to the SQS Program for the SAPS Project. Contractor also believed that performing SQS on the Cummins' equipment was a benefit to both schedule and quality for the SAPS Project, and they worked with their supplier (Cummins) on seeing that SQS was performed in conjunction with the City's SQS Team.	1. Schedule Impact: None. 2. Cost Impact: None	EMB should either add all items that will required SQS into specific areas of the Contract Specifications, or contain more general provisions in the contract specifications that all items within the Contract Documents are eligible work that are subject to the SFPUC's SQS Program, and that if the City desires to perform SQS, on any items of work, that the City will be responsible for the inspection and travel. However, there will no cost forwarded to the SFPUC for any perceived impact from the City desiring to perform SQS..					x					x		
72	WD-2566	San Antonio Pump Station Upgrades	Successful Coordination Between Sunol Region Projects - The SAPS Project Upgrades Project was one of four construction projects (AS #4, Irvington Tunnel, and SVWTP Expansion) on-going concurrently in the Sunol Valley Region. All four projects were located in close proximity to each other and all projects were accessible from the same road (Calaveras Rd.). In addition, all four projects have either transmission, pumping, or treatment facilities that are necessary for each other's Operation. Coordinating the new construction within each of individual Construction Contacts, as well its impact on the other projects within the Sunol Region, was critical. Solid relationships between the different CM Project Teams, different contractors, and common Sunol Operations staff were critical to successfully executing the SAPS contract work. Several examples of successful Regional coordination are noted below: 1. Temporary Power to the SAPS Field Trailers was coordinated/routed through the Alameda Siphon #4 Contractor's temporary utilities. 2. Alameda Siphon #4 conference room used for all SAPS Meetings. 3. Office Space from the SAPS field office utilized for the CM Team on the Calaveras Dam project during Calaveras Dam Pre-construction phase activities. 4. Outages and shutdowns on Alameda Siphons 1, 2, and 3 during the Alameda Siphon #4 construction contract needed to be coordinated with pump shutdowns for the SAPS Project. 5. Starting and Testing of the three horizontal split case pumps needed to be coordinated with levels in the San Antonio Reservoir,	1. Schedule Impact: None. 2. Cost Impact: None	Continue to emphasize communication and coordination between all project participants from the Regional Construction contracts.				x	x	x								

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73	WD-2566	San Antonio Pump Station Upgrades	Safety Culture Shared By Project Team Leads to Zero Lost Time and Zero Incident Record - The SAPS Project Upgrades Project was completed with Zero Lost Time and Zero Incidents with respect to Safety. All project team members worked together to emphasize the importance of project safety, implemented safe measures in the field, and maintained an open communication with respect to Safety that was important to the safety culture observed at the project. As mentioned, the Project had zero lost time accidents and zero incident accidents during construction. Communication and planning for work involving Job Hazards, and implementing safety measures in the field for these job hazards, was successful. The following work involved safety measures implemented during the construction phase: 1. Execution of LOTO and other electrical shutdowns for the work involved with modifications to existing MCC Equipment, electrical tie-ins to existing Breaker 52L in the Switchgear Room, shutdowns and coordination with Hetch Hetchy Power group needed on Breaker 52L. 2. Scaffolding Erection during Shotcrete Placement 3. Lifelines and Leading Edge safety related to work on the SAPS roof. 4. Mitigation and Safety Awareness associated with potential Lead Based Paint (later determined to not be an issue) during paint	1. Schedule Impact: None. 2. Cost Impact: None	Continue to emphasize communication and coordination between all project participants from the Regional Construction contracts.				x								x
74	WD-2566	San Antonio Pump Station Upgrades	Relocation of Seismic Detection Unit from SAPS Facility to Chloramines Facility Reduces Costs to SFPUC - The SAPS Project Upgrades Project called for the supply and installation of a new Seismic Detection Unit (SDU). This unit was originally designed to be located in the south end interior of the SAPS Pump station. Electrical and instrumentation conduit/wire to the unit was required, and alarm horns/strobes triggered from the SDU was shown in the Contract documents. During the SAPS Construction Phase, the nearby Alameda Siphon #4 contract was also under construction. The Alameda Siphon #4 contract also contained requirements for installation of Seismic Detection Units. In addition, the SFPUC SCADA and WST&D groups were looking into a Regional Plan for installing Seismic Detection units, and having alarms generated from the SD Units close/open various systems within the Sunol Region in the event of a seismic trigger. During discussion between the SAPS CM Team and Sunol Regional SCADA staff (Transydyn) working on the Regional Seismic Detection Unit plan, a plan for consolidating the amount of Seismic Detection Units needed at the SAPS Facility and Chloramines Facility was developed. Ultimately, the plan resulted in the elimination of 1-2 seismic detection units needed in the Sunol Region. Instead, the SDU being installed under the SAPS project could provide seismic alarms needed to control other systems in the Sunol Region. CM Team, Contractor, Electrical Subcontractor, and Transdyn worked together to relocate the SAPS Seismic Detection Unit from the south	1. Schedule Impact: None. 2. Cost Impact: CO #11 – Seismic Detection Relocation	Continue to look at scope of work between various construction projects within a Region to determine if there are opportunities to save cost.					x		x						
75	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Submit timely SOR with resource loaded day-by-day schedule with extra detail for tie-in work					x							x				x
76	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	When scheduling, plan for 3-day cure PLUS touchup cure time																

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77	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Include Contingency Plan in SOR and have required parts and equipment							x					x				
78	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Prepare a list of all materials / equipment jointly with CM. Verify onsite before starting							x					x				
79	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Shutdown plan submittal should include site plan with location of all temp facilities.												x				
80	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Thoroughly investigate pipe and survey location/ orientation									x							
81	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Verify all bolts, washers etc against specs to avoid issues with bolt lengths and washer sizes														x		
82	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Welding: Investigate pipe steel, request coupons and verify weldability before shutdown									x					x		
83	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Welding: Approved WPS, PQR and all welding equipment (air arc welder, etc)							x							x		
84	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	QA/QC Precon conferences to ensure meeting of the minds							x							x		
85	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Complete all Safety planning (Confined space training, rescue equipment, etc)																x
86	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Arrange backup for CWI and NACE QC Inspectors in case of vacation/ illness, etc							x							x		
87	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Have all sizes of spare NSF61 gaskets onsite or available in 1 day or less								x	x							
88	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Know in advance where you can get a spare for all salvage material (ARV, AVV, etc)							x		x							
89	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Consider ordering Inflatable plugs and pumps. Determine pump discharge points								x	x							
90	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Have a plan in advance for water discharge									x							
91	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Verify fitup of actuators and stems before shutdown							x							x		
92	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Have spare tools, equipment , etc like impact wrench, welding machine, etc							x	x	x							
93	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Determine thickness & weight of demo pipe in advance so correct crane is available.						x	x		x							
94	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Coordinate with SQS – QC at shop critical														x		
95	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Shop hydrotest of fittings will minimize risk of steel/weld defects														x		
96	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Verify factory coating on all onsite material before shutdown (DJs, spools, etc)							x							x		

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97	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Demo welding with both CWIs onsite prior to first day of production work							x							x		
98	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Test 1st weld to identify problems								x	x					x		
99	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Use professional coatings firm with plural spray equipment								x	x							
100	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Have Level 3 NACE inspector onsite at all times when surface prep & coating performed.							x							x		
101	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Have dehumidifiers onsite								x	x							
102	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Use bulkheads to avoid drying out existing mortar lining during cure						x			x							
103	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Have Aquatapoxy available for emergency repairs							x	x	x							
104	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Communication of all changes in plans, new workers, etc.							x									
105	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Verify critical Sub arrival time and which jobsites the day before							x									
106	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Get a COMMITMENT from Subs & Specialty Inspectors as to equipment and manpower							x	x								
107	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Bring in new workers day or two earlier to get drug testing, environmental training, etc.							x	x								
108	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	If extended days, consider 2 shifts rather than one crew 12 hours+						x	x	x								
109	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	If work done at night have environmental QA on site or on standby							x							x		
110	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	If work done at night make sure batteries are available for flashlights.																
111	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Check electrical continuity when pipes disassembled before reassembly														x		
112	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Use DCDE "Dairyland" decoupler when stray current hazards																x
113	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Lining AFTER welding / Heat shrink wrap, not before						x			x					x		
114	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Do not cover up any work before inspected by QA								x	x					x		
115	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Use only experienced installers for coatings, linings, wraps and CP								x	x							
116	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Have manufacturer reps present at beginning of work to train on actual pipes								x	x							

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117	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Film pipeline walkthrough before turnover. Look for blasting grit														X		
118	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	Fabrication of Steel Pipe Welding Procedure Specification (WPS) test requirements - Specification section 05505 paragraph 1.05.C incorporated a new SFPUC requirement to perform WPS / PQR's (Procedure Qualification Records) qualified by testing for EACH HEAT of steel provided. This requirement was new to the SFPUC specification for fabrication of steel pipe and the Contractor / Fabricator argued that they did not interpret the literal requirements for providing WPS / PQR's for each heat of steel. The Contractor stated that this was not industry standard and had never been performed on any orders for steel pipe, especially on the magnitude of this order for over 35,000 lf of pipe. As a result of this requirement, the Contractor / Fabricator performed approximately 364 PQR's (91 Heats x 4 PQR's / Heat) to meet the intent of the specifications.	Dispute resolution procedures were necessary to resolve this item. After numerous meetings over the course of 12 months, a mutual agreement was reached by the parties resulting in a net cost to the SFPUC of $315k to the Construction Contract. Soft costs for EMB, CMB, PMB, and other consultants are not included in the $315k settlement cost. In addition, the prolonged merit determination and eventual dispute resolution procedures created underlying animosity between the contractor, SFPUC, and pipe supplier (Ameron International). Cost Impact: Original submitted cost of $807k ($702k direct + 105k). Settlement of dispute = $315k. Schedule Impact: None. Additional time required to	Changes to specifications that have major cost impacts (in excess of $250k) should be highlighted and clearly explained to potential bidders so that they understand the implications of the new requirements. Suggest changes like this be discussed at the pre-construction meeting and documented in minutes distributed to all bidders.		X				X					X		
119	HH-935C	San Joaquin Pipeline System - Eastern Segment and Other Facilities	The Contract documents did not include provisions to prevent rodents from entering outdoor equipment (generators and PV solar array's) and electrical pullboxes. It was discovered after facilities were installed that rodents had infiltrated some electrical pullboxes and conduits and that other equipment was similarly vulnerable to rodent intrusion. Once the rodents had gained access into the electrical pullboxes, they damaged wires by gnawing on the wire insulation thereby causing electrical shorts and loss of signal / power.	Resolution: 1. EMB prepared design details for fabrication of rodent proof enclosure around exterior generator and PV array's. JOC contractor hired to perform work. 2. Conduit penetrations were re-sealed inside pullboxes by Contractor 3. Security wiring re-tested and damaged components replaced Cost Impact: 1. Additional PMB / EBM / CMB staff costs to prepare design and administer JOC Contract (Not quantified) 2. JOC direct costs of approximately $32,000 to fabricate and install rodent screens around equipment. 3. Phase B security contractor potential impact costs Schedule Impact: 1. No impact to Job Order Contractor. Work was performed outside of East segment Contract at a later date. 2. Potential schedule impact to Phase B Security	EMB – Consider the following items on future Contracts 1. Perform review of all outside equipment / enclosures to determine if vulnerable to rodent intrusion and include details in construction bid documents CMB – Perform the following on future Contracts: 2. Closely inspect all installed work to insure that all conduit penetrations are adequately sealed and that electrical equipment installation is protected from rodents		X		X			X				X	X		
120	WD-2573	Pulgas Roof and Rehab Project	Site Safety Representative		1) A role dedicated to individuals whose sole focus is safety, 2) Independent of other roles on the project, 3) Alternate SSRs should also be independent of other roles on the project						X								X
121	WD-2573	Pulgas Roof and Rehab Project	Rain Day Allowance		1) Don't remove it from the Contract, 2) Increase allowance for work required to be performed within the wet weather season, 3) Expand on mitigation efforts beyond General Condition language				X		X								
122	WD-2573	Pulgas Roof and Rehab Project	Qualified Companies at Bid Time		1) Qualifications for specialty work need to be clearly highlighted and verified at Bid Time so that qualified Bids are accepted and awarded, 2) Replacement of unqualified companies during construction risks delay to the work											X			
123	WD-2573	Pulgas Roof and Rehab Project	Quality Control		1) The qualifications for the QC Manager need to be appropriate to suit the project scope, 2) QC should include specialty inspection for structural steel, welding, etc. in both shop and field, 3) Look Ahead Schedules should identify "hold points" for QC						X	X					X		

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124	WD-2573	Pulgas Roof and Rehab Project	Shutdown-specific Requirements	Window Establishment	1) Original planning involved 2 shorter shutdowns over consecutive wet weather seasons - not feasible, 2) When a shutdown is limited to an undesirable window that is not ideal for construction, consider construction of a redundant system				x			x							
125	WD-2573	Pulgas Roof and Rehab Project	Shutdown-specific Requirements	Normal Work Days & Hours	Normal Working Hours within Shutdown periods should be defined such that the Contractor is required to maximize the entire Shutdown period, including weekends, holidays & overtime					x	x								
126	WD-2573	Pulgas Roof and Rehab Project	Shutdown-specific Requirements	Submittal Deadlines	1) A single deadline: A) Results in a flood of submittals, B) Increases the likelihood of no or little QC, C) Increases the likelihood of multiple review cycles, D) Increases the overall turnaround time, E) Incurs unnecessary pressure on all parties, F) Increases the likelihood that items will be missed during review. 2) No single deadline. 3) Should be based on material					x	x								
127	WD-2573	Pulgas Roof and Rehab Project	Shutdown-specific Requirements	Material Procurement	1) Shutdown approval constraints should not include blanket statements for all materials to be used in the shutdown, A) Stock items and other easily procured items, B) tems that can be quickly manufactured/fabricated based on actual field conditions, C) Shelf-life, D) Risk of damage during storage, E) Risk that fabricated items do not fit field dimensions. 2) Long-lead items - Require proof of manufacture and delivery schedules following submittal approval, but prior to shutdown commencement						x								
128	WD-2573	Pulgas Roof and Rehab Project	Shutdown-specific Requirements	Field Verification	1) Plan and conduct separate brief shutdowns for field verification during both design phase and early part of construction. 2) Utilize surveyor services for areas that are not readily accessible without a shutdown				x			x							
129	WD-2573	Pulgas Roof and Rehab Project	Product Substitutions		1) Do not allow the use of unfamiliar products even though they are appealing in terms of potentially quick installation and under wet weather conditions. 2) Reject if the Contractor/subcontractor lacks experience in application of the materials. 3) Reject if there is no evidence ofthe product's performance history					x	x	x							
130	WD-2573	Pulgas Roof and Rehab Project	NSF-61 Certification		Consider specifying acceptable alternatives when NSF-certified products are not readily available or limited to one or two sources							x							
131	WD-2573	Pulgas Roof and Rehab Project	Weather & Thermal Effects		1) Stipulate requirements in the technical specifications for Contractor to develop workaround plans for installations that are dependent on moisture and/or temperature conditions (i.e. tenting, heaters, etc.). 2) Identify guidelines for construction sequencing to facilitate proper layout & minimize issues related to				x			x							
132	WD-2573	Pulgas Roof and Rehab Project	Slotted Connections		1) Incorrectly interpreted by Contractor as erection tolerance. 2) Prevent use of counterfeit nuts, bolts, and washers through submittal requirements for supplier, materials. 3) Specify testing for nuts, bolts, and washers							x					x		
133	WD-2573	Pulgas Roof and Rehab Project	Re-use of Existing Infrastructure		1) If the condition of existing infrastructure is unknown, require new infrastructure to be installed. 2) Verify existing operation status and desire for reuse with Operations. 3) Allow for spare provisions for future modifications/ improvements. 4) Verify physical compatibility with new equipment/infrastructure				x			x							
134	WD-2573	Pulgas Roof and Rehab Project	Mobilizing on Site		1) Non-residential & less populated areas require planning and implementation of communication services well in advance of NTP, even before the Contract is Bid. 2) Direct City Network and Phone Services				x	x	x								

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135	WD-2573	Pulgas Roof and Rehab Project	Pre-Submittal Meetings		1) Helped to clarify submittal requirements with Contractor. 2) Reduced multiple review cycles 3) Follow-up meetings to clarify and/or confirm review comments before material is procured or installation commences					X	X								
136	WD-2573	Pulgas Roof and Rehab Project	SQS (Supplier Quality Surviallence)		1) Good resource for specialty inspection (i.e. welding, coating) at off-site fabrication. 2) Surface prep deficiencies caught during fabrication. 3) Monitor progress for long-lead items. 4) Provide Submittals and RFIs pertaining to inspection items in a timely manner						X	X					X		
137	WD-2573	Pulgas Roof and Rehab Project	QC/QA Meetings		1) Only beneficial if both parties contribute sincere effort and acknowledge responsibilities. 2) Review QC hold points. 3) Review opportunities for QA inspection. 4) Informal, daily communication vs. weekly/monthly					X	X	X					X		
138	WD-2573	Pulgas Roof and Rehab Project	Working Punchlists		1) Highlighted quality concerns to reduce noncompliant work. 2) Minimized major punchlist items at completion. 3) Issued weekly. 4) Encouraged Contractor to avoid recurring items by taking prompt action					X	X	X					X		
139	WD-2573	Pulgas Roof and Rehab Project	LDs for as-builts		Are contract provisions for LDs for as-built drawinsg stromg enough						X					X			
140	WD-2513	San Andreas Pipeline No. 3 Installation	CalOSHA surprise site visit.	Due to the uncovering of asbestos conduits, CalOSHA was called by another City agency to perform inspection. Fortunately no violations cited; hover work was stopped while CalOSHA searched for possible violations.	All city agencies to check-in with Project Construction Manager prior to accessing the job site. No site access without CMB Rep. Coordination with other City agencies and Contractor. Other City agencies should check with project CM if they have							X							X
141	WD-2513	San Andreas Pipeline No. 3 Installation	Shoring Requirements	Contractor installed shoring only between joints, which caused street undermining and required additional street backfill and paving	Engineer should clearly identify the requirements for shoring in the contract specification if continuous shoring is desired.				X		X	X							X
142	WD-2513	San Andreas Pipeline No. 3 Installation	LOTO process	Near miss incident at San Pedro Valve Lot during shutdown #1. Contractor almost cut into an active 60" pipe.	Incorporate requirements into the shutdown specification that the Contractor is required to perform a LOTO walkthrough with the City "X" amount of days or weeks prior to the start of the shutdown window. Incorporate requirements into the shutdown specification that the Contractor is required to have sufficient quantity of locks prepared and to use a separate lock for the lockout box. All keys for locks on equipment are to be kept in the lockout box. Contractor's schedule should allow for a LOTO walkthrough prior to the shutdown, and removal of LOTO afterwards.					X		X							X
143	WD-2513	San Andreas Pipeline No. 3 Installation	Operation Liaison Coordination	Lack of coordination lead to multiple visits to various vault locations which delayed the project and stretched CDD resources.	Need to initiate I&C coordination, meetings as early as possible and hold them regularly throughout the construction phase. Also need to involve the correct individuals from operations, SCADA, ITS, etc. for their input. Need a good Lead Test Coordinator from the Contractor's side, as well as a good Testing & Startup Engineer from the City's side who is well-versed with the design intent, the system, the system constraints, and the operations staff. These individuals should be carefully selected and consistent throughout the project. A designated individual who is familiar with operation of the facility should be assigned to the project to support project needs and communicate feedback for the project duration. Some overlap of personnel may be necessary to insure continuity. Having a full-time liaison for the project would alleviate the burden placed on Operations staff whose primary responsibility is to focus on keeping the Plant functioning on a day-to-day basis. The liaison would effectively interface with the Project CM Team to identify operational issues/items that may impact construction.			X		X									

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144	WD-2513	San Andreas Pipeline No. 3 Installation	Utility Drawings	Lack of underground utilities shown on plans and incorrect location information lead to stoppages in work as well as numerous Change Orders.	Incorporate results of the pothole surveys into the final contract documents. Perform a comprehensive utility potholing program during the design phase. Check the elevations of (E) utilities							X							
145	WD-2513	San Andreas Pipeline No. 3 Installation	Traffic rated Hatch Covers	Specified hatch-covers did not hold up to traffic loadings.	Better research on the product data prior to stating in the contract document. More manufacturer and model options for contractor							X							
146	WD-2513	San Andreas Pipeline No. 3 Installation	Transite conduits	The encountering of unforeseen Transite conduits led to stoppages in work and additional work as crews need to dispose of the hazardous material and replace with new conduits	Incorporate Transmit conduits into the contract drawings. Add a Bid Item to replace conduits and include the work in the project budget.		X					X				X			X
147	WD-2513	San Andreas Pipeline No. 3 Installation	DPW excavation permit	Lack of required permit lead to confusion between City agencies.	Clearly specify the requirements for the permit in the Contract Documents. Coordinate with DPW to make sure that they are in agreement with the permit requirements prior to construction phase.						X	X							
148	WD-2513	San Andreas Pipeline No. 3 Installation	SFGC agreement	Clauses in the agreement caused the Contractor to request additional access easements from the local home owners	Clearly specify the access to the SFGC. Make sure time restraints are practical. Require the contractor to complete the work on time				X		X	X							
149	WD-2513	San Andreas Pipeline No. 3 Installation	Daily City MOU	Lack of clarity with the Daly City MOU lead Daly City request addition work by the Contractor that was not in the Contract Specifications	Assure the MOU is complete and agreed to prior to NTP.						X	X							
150	WD-2513	San Andreas Pipeline No. 3 Installation	Support and work- around of known utilities in Daly City.	City paid for the Contactor to support and work around known underground utilities in Daly City.	Specifications unclear about who will pay for utility crossings and conflicts outside SF. Recommend payment for utility crossings outside SF be included in the contract		X				X	X							
151	WD-2513	San Andreas Pipeline No. 3 Installation	Staging Areas	Additional time needed to obtain approval and to process minor project deviations when adding Staging Areas to the project	Specify more staging areas in the contract.				X										
152	WD-2513	San Andreas Pipeline No. 3 Installation	Welding Issues	Ambiguity in the Specifications allowed the Contractor to use welding methods not preferred by the City. Contractor was also able to back-charge for additional costs while forced to use the preferred	Clearly specify the required welding technique to be used. Review the specifications during the design phase.		X					X					X		
153	WD-2513	San Andreas Pipeline No. 3 Installation	Special quality control	Additional cost incurred due to having to add Specialty Quality Control to the Contract.	Clearly specify the QC requirements in the contract documents. Review the specifications during the design phase.		X					X					X		
154	WD-2513	San Andreas Pipeline No. 3 Installation	Lack of continuity with Quality Assurance Inspectors.	Numerous inspectors were assigned to the project (some of them only staying with the project 1 or 2 months). Lack of continuity hurt overall quality assurance and lead to some confusion between	HDR to be proactive in staffing adequate QA Inspectors. Provide adequate QA inspection staffing early in the project.					X							X		
155	WD-2513	San Andreas Pipeline No. 3 Installation	Noise Control	Lack of noise control at various times lead to public and governmental complaints.	Strictly enforce all noise control measures, such as mufflers on load equipment. Make sure QA Inspectors are educated on the required noise constraints					X									
156	WD-2513	San Andreas Pipeline No. 3 Installation	SWPPP	Lack of BMP's by the Contractor early in the project lead to several Noncompliance notifications from the Environmental Inspectors.	Push for early re-vegetation of the staging areas. Enforce adequate street sweeping. QA Inspectors assist with checking that the Contractor is maintaining BMP's prior to environmental inspectors on site					X									
157	WD-2513	San Andreas Pipeline No. 3 Installation	Minor Project Deviations	Minor project deviations cannot always be issued on short notice, which can delay the project schedule.	Perform a detailed constructability review of the bid documents to minimize the amount of MPD's during the construction phase. Construction Management and Contractors need to identify potential deviations early and provide information for the MPDs as early as possible. Include specific requirements and time frames for MPD's.		X		X										

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158	WD-2513	San Andreas Pipeline No. 3 Installation	Agreements	Home owner filed a claim against to the Contractor regarding the quantity of plants restored in their yard.	All agreements between Home Owners or other agencies should be documented and issued to the Contractor prior to Bid time.						x	x							
159	WD-2513	San Andreas Pipeline No. 3 Installation	OLSE Issue	Chapman welding short paid their subcontractors, which delayed the final completion and closeout of the contract.	Request OLSE to verify the certified payroll as early as possible in the project.					x	x								
160	WD-2513	San Andreas Pipeline No. 3 Installation	Substantial / Final Completion	Some closeout items could not be complete in 30 days.	Minimize the amount of Change Orders issued late in the project or after substantial completion.		x		x		x								
161	WD-2513	San Andreas Pipeline No. 3 Installation	Daly City Alignment Issues	Lack of accurate and complete utility drawings, delayed the project and increased construction costs.	Recommend to comprehensively pothole all areas of the alignment during the design phase.							x							
162	WD-2513	San Andreas Pipeline No. 3 Installation	Turn around time for O&M manuals.	Delay the final completion	Recommend a quicker turn around for the O&M manuals. Specify the O&M to submit in specific time frame.						x	x							
163	WD-2591	Lower Crystal Springs Dam Improvement	One recordable case (Poison Oak)	Contractor did not notify City Representative in a timely manner	City shall remind Contractor to immediately report all incidents to the PUC Safety Representative and to the Project Construction Manager. The Contractor's supervisors shall communicate employee risks regarding Poison Oak – pre task meetings – tool box meetings. The Contractor shall ensure all employees are familiar with procedures for reporting work related illness correctly every time. Contractor shall ensure all supervisors are familiar with the requirements in the Contractor Case Management procedures. Contractor personnel shall coordinate with their safety manager after discovering symptoms of Poison Oak or other potential work related illnesses.					x								x
164	WD-2591	Lower Crystal Springs Dam Improvement	Shutdown #1 Sampling Station 5	Contractor had to work two weekends due to poor coordination with its Subs in order to complete the shutdown schedule on time.	Continued cooperation and open communication between WSTD and the Contractor is essential. Continue to perform field walk-thrus to streamline the LOTO process.			x		x									x
165	WD-2591	Lower Crystal Springs Dam Improvement	Unforeseen Conditions	Various unforeseen conditions during construction caused additional costs and schedule impacts: Concrete blocks discovered at the toe of dam, Unknown water infiltration at the Stilling Basin, Hazardous Soils discovered during excavation of the stilling basin, Contaminated Soils encountered during excavation, Core holes collapsed when drilling to place parapet wall reinforcing rods	Conduct additional exploration and soil sampling prior to design. Provide more specific direction in the Contract Documents as to how disposal of contaminates soils will be paid. Curtail assumed optimism during the design phase – acknowledge there will unknowns. Perform additional test bores during the design phase.		x					x					x		
166	WD-2591	Lower Crystal Springs Dam Improvement	Redesign Work	Additional costs incurred due to having to redesign work during construction. Sampling Station #5, CalTrans Pipe Reroute, Additional Soil Nails, Ogee Crest Joints, Thicken Parapet Walls, Extend Drainage Trenches, Ladder and Fence Revisions	More interaction is needed with Caltrans during the design phase. Work closely with other agencies regarding what is needed prior to design completion. Review all design documents with other agencies during the design phase. Conduct thorough field explorations during design phase. Check interagency agreements to make sure there are no schedule conflicts between projects.				x			x							
167	WD-2591	Lower Crystal Springs Dam Improvement	Incomplete information during design phase	Compressed construction schedule and rigid completion date created acceleration CO's whenever unforeseen conditions on designed changes occurred.	Extend time commitment needed from design team. Make sure construction documents are complete. Conduct constructability reviews.				x			x							
168	WD-2591	Lower Crystal Springs Dam Improvement	Internal Communication	Direct communication and agreements between EMB and the Contractor created CO issues.	Keep the PCM in the loop of any and all revisions. Reconsider performing two projects concurrently at the same site in order to avoid coordination/scheduling conflicts.				x	x									
169	WD-2591	Lower Crystal Springs Dam Improvement	San Mateo Country delayed their work	Separation of building components between projects, such as the construction of a future catwalk by San Mateo County, was required.	Coordination between the stakeholders of individual projects is critical.														

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170	WD-2591	Lower Crystal Springs Dam Improvement	Schedule	Due to Operations and permitting constraints, the project had to finish prior to the next rain season. Additional cost incurred due to having to accelerate the Contract in order to meet that requirement. Acceleration: Top of dam, Stilling Basin Slab, Stilling Basin Walls/Rock Anchors, Soil Nail Walls	Extend the contract schedule, or clearly specify the acceleration requirements in the Specifications. Enforce the contractor to have adequate forces to perform the work on time. Consider separating the top of dam activities and the stilling basin work into two projects.				X		X	X							
171	WD-2591	Lower Crystal Springs Dam Improvement	Quality Assurance issues	Various quality issues and questions arose during construction. Shotcrete special inspection, Adding water to concrete trucks, Early formwork removal, QC inspection for all core drilling – especially during structural work.	Contractor to ensure adequate QC at all times. Remind contractor that altering concrete mix w/out authorization is prohibited. Solidify Specifications regarding the timelines for form removal. Reconsider QC requirements for all core drilling.					X		X					X		
172	WD-2591	Lower Crystal Springs Dam Improvement	Quality Assurance Positives	Positives	Inspection was proactive in looking for issues or problems before they arose. Very good cooperation and open discussion between the QA Inspectors, the QC Manager and the Apex Inspectors. Field issues were brought to the attention of the project engineer and construction manager in a timely manner.					X							X		
173	WD-2591	Lower Crystal Springs Dam Improvement	Unforeseen Operations issues	High water elevations at top of dam Water releases untimely Staging at Polhemus	Better coordination between CMB and WSTD is required to ensure construction and operations needs are accounted for. Always be sure to coordinate with WNR prior to using new areas.			X											
174	WD-2591	Lower Crystal Springs Dam Improvement	Fish Relocation Permit	Fish Relocation could not start per schedule thereby delaying the start of the Contractor's work in San Mateo Creek	Make sure all permits are in place prior to NTP.							X	X						
175	WD-2591	Lower Crystal Springs Dam Improvement	Re-vegetation Plan	Additional vegetation was required at the end of the project.	Finalize the approved re-vegetation plan prior to bid.							X							
176	WD-2591	Lower Crystal Springs Dam Improvement	Minor Project Deviations	Minor project deviations cannot always be issued on short notice, which can delay the project schedule.	Perform a detailed constructability review of the bid documents to minimize the amount of MPD's during the construction phase. Construction Management and Contractors need to identify potential deviations early and provide information for the MPDs as early as possible. Include specific requirements and time frames for MPD's in the Contract Documents.		X		X	X	X								
177	WD-2591	Lower Crystal Springs Dam Improvement	OLSE Issue	Third tier subcontractor (SWIM) did not follow the prevailing wage requirements.	Request OLSE to verify the certified payroll as early as possible in the project.						X					X			
178	WD-2591	Lower Crystal Springs Dam Improvement	Schedule vs. Contract	Modifications were made to the Specifications during the construction phase in order to accelerate the schedule: • Elimination of construction joints at the battered walls. • Burning vs. cutting of rebar at various locations. • Reduction of the time required prior to the removal of formwork at various locations. • Placement of concrete adjacent to fresh concrete permitted. • Grinding of trenches at the top of the dam permitted after the placement of fresh concrete. • Allowed placement of rock anchor spoils under the rip rap area. • Allowing Contractor to keep unauthorized expansion of soil nail walls led to various redesigns	Make sure EMB approves all modifications and that CMB is kept in the loop at all times..				X	X		X							
179	WD-2591	Lower Crystal Springs Dam Improvement	Adjacent project	Sharing site access with other WSIP project	Verify that the Contractor is coordinating with the Contractor on the other project on a regular basis.				X	X									

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180	WD-2591	Lower Crystal Springs Dam Improvement	Coordination w/ Other Agencies:	DSOD, WSTD, and WNR were proactive in providing support.	Keep other agencies such as DSOD, Caltrans, and San Mateo County informed of any changes with which they may be concerned.			X											
181	WD-2591	Lower Crystal Springs Dam Improvement	Force Account Work	Contractor proceeded with force account work without proper authorization. Subcontractor Force Account Reports were not submitted to QA inspectors for verification. Lack of detailed work descriptions and work locations listed in the FAR's.	Enforce Contractor to notify City prior to working on Force Account work, and remind them to turn in FAR's to the QA inspectors by 12pm the next day. Enforce Contractor and their Subcontractors to complete and submit their FAR's. Specify what data should be included in the FAR's in the Contract		X			X	X								
182	WD-2591	Lower Crystal Springs Dam Improvement	COR's and PCO's	Lack of narratives and work descriptions in the Contractors' proposals.	Specify that the Contractor must include narratives and detailed work descriptions in the Contract Specifications and reject data dumping.		X				X								
183	WD-2591	Lower Crystal Springs Dam Improvement	Time Frame for COR submittals	Contractor did not submit COR's in a timely manner. Contractor did not follow the Specifications to notify the City of pending change orders.	Remind and enforce the Contractor to submit COR's as soon as possible. Solidify Specifications regarding the COR submittal requirements		X			X	X								
184	WD-2591	Lower Crystal Springs Dam Improvement	Contingency	Contingency was exceeded due to stringent time restraints and renovations to an aged structure.	Increase the contingency for these types of projects prior to NTP. Increase allowances on short duration projects.	X	X												
185	WD-2591	Lower Crystal Springs Dam Improvement	RFI's	Contractor deviated from the Specifications prior to receiving RFI responses and approved submittal reviews.	Remind Contractor to submit RFI's prior to changing the work, and to not perform work without approved submittals.					X									
186	WD-2591	Lower Crystal Springs Dam Improvement	Field Staff	Contractor was understaffed to handle the work load and Change Order negotiations.	Put the Contractor on notice when it appears their staffing (field and office personnel) is not sufficient.					X	X								
187	WD-2591	Lower Crystal Springs Dam Improvement	Sign-in sheets	Contractor and their Subcontractors did not sign in and out on a regular basis.	Require the Contractor to adhere to the sign-in requirement in the Specifications, and to submit the documentation to the City in a timely manner. Separate the sign-in requirements and OLSE's requirements in the Specifications. Separate the sign-in sheets for the two adjacent KIWC projects.					X	X								
188	WD-2591	Lower Crystal Springs Dam Improvement	Final Completion	Contractor failed to settle all outstanding COR's, PCO's and NPC's, and submit all required closeout documentation by the scheduled final completion date.	Increase the final completion duration by at least one month.		X				X					X			
189	WD-2542	Division Pipeline Reliability Upgrade Project – Peninsula Reaches	Soil assessment for disposal at standard landfill	The soil in numerous parts of the Peninsula has naturally occurring Nickel, such that normal landfills cannot accept it, and it must be disposed in a special landfill. While the soil was not dangerous or contaminated per se, the metal levels were more than landfills accept. Cost Impact: $300k	Aside from Phase 1 and Phase 2 evaluations of contamination for a project, take a soil sample and send to lab to evaluate for heavy metals such as nickel. Then compare these results with the standards used by local landfills. If soil can't be disposed at local landfill, find a facility that will		X					X	X						

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190	HH-935A	San Joaquin Pipeline System Crossover	Contractor Project Team - In the proposal and on the Experience Statement Form 00492, required as a condition of award of the construction contract, the Contractor listed a Project Manager. He had many years of directly relevant pipeline experience and as a Project Manager. After the contact was awarded, a very junior-level Project Manager with no pipeline experience showed up as the original person identified as an Area Manager. Early on, the CM Team and SFPUC had numerous discussions with the Contractor regarding the fact that the substituted person did not meet the qualifications and requested a full time replacement. After many discussions, as a group and in the spirit of moving the project forward, the SFPUC determined that the substituted person could continue as the PM. In the future, based on lessons learned, the Contract requirements for experience levels should be strictly adhered to. In addition to not having the proposed Project Manager on this project, the Contractor's CQC Manager was also serving as the Start-up and Testing Coordinator. In trying to handle both roles, neither job was handled well. This contributed to problems with not installing the upstream cross at the Pelican site. The inability to provide effective and efficient direction to the workers when needed added to the cost and schedule of the project. There were also issues with having an experienced Safety Manager. The Contractor tried to use the supervisor and foreman as the Site Safety Representative because of	Cost Impact: Ineffective management contributed to many of the changes, which totaled approximately 33% of the original Contract value, and in most cases interfered with effective resolution. Schedule Impact: Hard to determine, since ineffective management contributed to some of the time delays, in addition to continuing to contribute to not yet having Final Completion. The project was Substantially Complete 66 days late and Final Completion has been delayed by many disputes that a more experienced PM may have avoided.	Hold firmly to the Contract regarding the specific Key Personnel as listed in the Proposal or allow a replacement with an individual with like experience. Hold firmly to the Contract language regarding rejection of a contractor's employee. Tighten the Specifications that require full-time, onsite, dedicated positions.				x	x									
191	HH-935B	San Joaquin Pipeline System – Western Segment	Importance of Pre-Construction Geotechnical Studies and Planning for Ground Water Disposal - When installing the new SJPL#4 pipeline between River Road and McCracken Road, the Contractor encountered groundwater less than 12 below the surface and within the pipe zone. The Geotechnical Report stated that groundwater could be expected anywhere from 18 to 30 feet below the ground surface. The SFPUC determined that there was a conflict in the Contract Documents and agreed to accept responsibility for the cost of managing the groundwater. To mitigate the cost, SFPUC directed the Contractor to re-sequence their planned pipe laying to skip over area with excessive groundwater (1,576 feet). The Contractor thereafter returned to finish the work during a drier time period. Nonetheless, the Contractor still had a substantial amount of dewatering work to do to complete the pipe installation. We believe that much of the water encountered was "perched water" resulting from farm irrigation activity in the adjacent agricultural areas. Beyond extracting the water and stabilizing the pipe subgrade, the problem was compounded because the water contained contaminants and could not be discharged to waters of the state. Irrigation districts didn't want the water either so there was no practical place to dispose of the water except within the SFPUC right of way via water trucks that sprayed water along the pipeline route on a 24 hour per day basis. It was very fortunate that the area experienced an unseasonably dry year or disposal on the right of way would not	Cost Impact: $566,000 plus $65,000 +/- for Remobilization and Pipe Fabrication. Schedule Impact: 3-Weeks to allow Ameron to fabricate pipe for re-sequenced work.	Lesson #1. -When doing a subsurface project such as a pipeline, the Geotechnical Report is exceedingly important and must be thorough, accurate, and consistent. - The results of the geotechnical investigation must be clearly communicated in the Contract Documents to preclude differing site condition claims by Contractors. - Money spent on additional borings and piezometers will help avoid large claims. - Since groundwater is seasonal and varies from year to year, it would be beneficial to provide updated geotechnical data to include borings taken during the most recent wet weather season immediately prior to bidding. Lesson #2. - Employ environmental consultants to provide guidance regarding how to dispose of groundwater. Don't assume you will be able to discharge to irrigation ditches or on adjacent fields. We were not allowed to discharge to either according to our environmental permits. - Make provisions for disposing of the ground water and communicate them to bidders in theContract Documents.		x					x								

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192	WD-2541	Bay Division Pipeline Reliability Upgrade Project – East Bay Reaches	Pilot hole boring, rail and freeway crossings - During boring of microtunnelling under the UPRR railroad tracks in Newark, the MTBM hit a previously unknown soldier pile for a recently installed railroad culvert. This halted the tunnel, and required extraction and realignment of the pipeline. This problem could have been avoided by drilling pilot bores before launching the MTBM. On subsequent project microtunnels this procedure was successfully applied.	Cost Impact: $5M Schedule Impact: None	Include pilot boring as part of the contract prior to launching an MTBM, particularly in locations where rescue of a stuck MTBM would be impossible or highly impractical (under rivers, freeways and railroad tracks. The additional expense is justified by the high cost of potentially retrieving and realigning a tunnel.		X		X			X							
193	WD-2541	Bay Division Pipeline Reliability Upgrade Project – East Bay Reaches	For the WSIP BDPL5 East Bay contract in 2011, Ranger Pipeline questioned SFPUC's safety policy regarding working in confined spaces subject to potential inundation. Following several months of correspondence and meetings with CalOSHA, a cumbersome protocol was worked out for SFPUC facilities requiring single block and bleed. CalOSHA has an issue with single block and bleed shutdowns for cases with butterfly valves on either end of the confined space work. CalOSHA does not have an issue with single block and bleed with gate valves on either end of the confined space work. In early 2012, Paul Mazza from the WSTD suggested that the SFPUC look into double block and bleed considerations of pipelines during the planning and design phases . This could entail doing nothing, installing gate valves instead of butterfly valves, or installing more butterfly valves to accommodate safer construction shutdowns as well as operational shutdowns. This is a regulatory matter.		The consideration of double block and bleed in pipelines needs to be addressed during the CIP Planning and Design Phases. EMB should incorporate double block and bleed in SFPUC transmission mains (>2 feet in diameter) in the alternatives analysis, conceptual engineering, and design review checklists in Procedure PD 3.05 and Procedure PM 2.01. Also, the CM Teams need to vigilant that the contractors submit an Incidenetal Water Management Plan for shutdowns with single block and bleed for which workers are subject to potenatial inundation. This is required by CalOSHA.				X										X
194	WD-2555	CRYSTAL SPRINGS PIPELINE NO. 2 REPLACEMENT PROJECT	Coordination/ Turnover of Site 13, 14/15, and 16 pipeline - Ranger was not ready to turnover the pipeline on the day they had previously indicated they were ready to do so. Ranger should have informed the CM that their work progress did not accommodated WST disinfection schedule and changes needed to be performed. The CM worked with Ranger to install the required air valves required for disinfection and allowed Ranger to perform the air venting for the air valves after the disinfection of this portion of CS2 was complete. The air valves that required to be moved had to be locally disinfected with bacti testing.	Cost Impact: Actual cost still not determined. Schedule Impact: Additional time to complete the work after turnover.	Perform an independent assessment of Ranger's progress in the field and challenge Ranger to their actual work progress. Perform the walkthrough of the site to determine if Ranger was ready to turnover the site earlier than the day of disinfection. Complete all work prior to Ranger turning over the site to WST.					X									
195	WD-2555	CRYSTAL SPRINGS PIPELINE NO. 2 REPLACEMENT PROJECT	Coordination and communication regarding the installation of bulkhead for Shutdown 5 (K20 to K30) - Ranger's approved SOR indicates that Ranger would install a bulkhead at the end of Site 11. Ranger decided not to install the bulkhead per plan but did not inform the PUC in writing of the change to the approved SOR. Leak water began entering to Site 11 at that location and Ranger was unable to keep up with dewatering. Upon discovery that Ranger did not install the bulkhead per plan, the CM directed Ranger to install the required bulkhead and issued NCN 004 for failure to follow the approved SOR. WS&T was also required to assist Ranger during dewatering to helpRanger install and removal of the bulkhead	Cost Impact: Actual cost still not determined. Schedule Impact: No additional time extension required.	Perform additional inspection of Ranger's work to ensure the work is in accordance to the approved SOR. Field changes that require changes in the approved SOR must be submitted in writing by Ranger. More extensive research was performed on the location and means Ranger performs their dewatering to ensure Ranger has the means to control leak water in future shutdowns.					X									X

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196	WD-2568	Bay Division Pipelines Nos. 3 and 4 Crossovers Facilities	Valve Leakage Estimates Included in Contract and Residual Water in Pipeline at Turnover to Contractor - The valve leakage estimate included in Specification 01012-1.6.C was 100 gpm, and there were 3 contract sections discussing (differently) residual water remaining in the pipelines was included in Specs 01012, 01565, and 01650. At Barron Creek BDPL4 and Bear Gulch BDPL3, there were valve leakage rates of 400 gpm and 150 gpm, respectively, which were not known until 2 days prior to pipe turnover. In each case, the contractor had to mobilize larger pumps, fittings, hoses, piping, tees, etc. to accommodate the additional valve leakage with only limited time. This resulted in a last minute scramble to find acceptable discharge locations for the greater volume of valve leakage, with the proper permits, dechlorination equipment, and additional materials to access the discharge locations, etc., which could have created a significant problem if other locations weren't found. The Contractor also claimed that the larger hoses, pipes, i etc., impacted the other work (ie welding) occurring around it, which made it less efficient. This had a significant cost impact on the project, and the contractor used this as a potential reason as leverage if the shut-down milestone was missed. For all shut-downs, the pipelines were turned over to the contractor with some residual water, and not completely empty. However, the contractor argued that since there were references in 3 different specification sections with different descriptions of the pipe turnover condition, the contractor could not expect other than an empty pipe at turnover and could not be expected to bid and plan for residual water if it wasn't clear how	Cost Impact: $123,000	For the valve leakage estimate, recommend including a minimum of 500 gpm in the contract (in one Spec section only). This will have minimal impact on the bids, and will ensure that the contractor has sufficient time to plan resources and discharge locations. From the experience with the BDPL4 90" diameter and BDPL3 72" diameter pipes, 500 gpm was the upper limit (except during draining of BDPL4 at Barron Creek), For the residual water in the pipelines at turnover, clearly state in the contract (one section only) that the contractor should anticipate some residual water in the pipeline at turnover. Include an estimate in the contract of how much so the contractor has something to bid to. Consider basing the estimate on the diameter of the pipes and the distance to the upstream and downstream closed valves, assuming ¼ the distance with a full pipe.							x							
197	WD-2581	New Irvington Tunnel Project	Potential Gassy to Gassy Tunnel Classification - Cal-Osha classified NIT in early 2009 based on a draft Geotechnical Baseline Report as "Potentially Gassy". SFPUC decided to include language in the specifications requiring all tunnel equipment during excavation to be permissible. In June, 201, only 40 ft from Vargas shaft, methane gas was encountered and ignited causing Cal-Osha to re-classify the entire NIT tunnel alignment as a "Gassy Tunnel with Special Conditions" on June 16, 2011. Upon further review, if was noticed that the final GBR language on gas to be encountered in the excavation of the new tunnel was revised in the bid documents that we believe would have made difference in Cal- Osha classifying the tunnel as Gassy. The classification change to Gassy by Cal-Osha required SFPUC to issue a Change Order to the Contractor for the downtime and the change of ventilation and gas monitoring as well as operating the tunnel excavation in all headings under Gassy Tunnel classification. The installation of the WSP in the section of IP to Vargas also was performed under the Gassy Tunnel Classification.	Cost Impact: Approx. $15 million Schedule Impact: 60 WD	The PCM believes, based on the final GBR data and information (existing tunnel records and well as what was encountered in several exploratory boreholes during the geotechnical design of NIT, that the NIT Project should have been classified by Cal-Osha as Gassy Tunnel Classification. This would have required the bidding Contractors to bid the project as a Gassy Tunnel. We believe this would have added to the cost of performing the excavation of the tunnel but we would have probably kept the contract time duration the same in the contract. If the NIT would have been classified as Gassy in the bid, the additional ventilation and monitoring requirements would have prevented the ignition of methane gas in June 2010. I believe Cal-Osha should have made their classification findings on the Final GBR and not the Draft GBR, however we do not know if Cal-Osha was ever given the Final GBR to review.							x							x

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198	HH-935B	San Joaquin Pipeline System West Segment	During draining at a constant rate of hydrostatic test water from 8 miles of sealed San Joaquin Pipeline 4 (SJPL4), a 150' unburied section of the pipeline collapsed. Although the entire pipeline was designed with vacuum protection by the inclusion of air relief valves at the high points, the reach of pipe at the Tesla Valve Vault was not yet tied-in and thus did not have the benefit of the uppermost ARV. SJPL4 is generally constructed of 78 inch diameter welded steel pipe with approximate 50 feet lengths that are joined by field welding of double fillet welded lap joints. The collapsed or buckled portion of the pipeline included a section of 90-inch pipe and a transition to the 78-inch pipe. The pipe wall thickness in this area is 3/8 inch. An investigation by pipeline experts on Aug 16, 2012 revealed that proper vacuum protection of pipeline at high point of profile (piece #1107) was missing from Contractor's hydrostatic testing equipment set-up. Plan No. P0-6 shows a test bulkhead detail with a 2" nozzle and a 6" drain line. The Contractor developed its own hydrostatic test plan submittal and chose to reduce the 2-inch nozzle to ¾". The submittal stated "...flows will be recorded via calibrated in line flow meter to ensure no more than 2,000 GPM" discharge. This 2,000 gpm flow rate was simply a restatement of the discharge rate ceiling negotiated with the El Solyo Irrigation District. EMB reviewed this submittal for general conformance per 01300.1.4.I since hydrostatic testing is a Contractor responsibility under 02610.1.05.C.1and the City	Cost Impact: The City has incurred City, Consultant & CM labor costs associated with additional inspections, investigations and delayed completion that it will seek recovery of. Schedule Impact: It took approximately 3 months to remove the damaged pipe, get a repair plan approved, reinstall the new pipe, and hydrostatically test the repaired section.	The contractor should have sized and installed specialty air-vacuum valves to protect the large diameter thin wall pipeline from collapse.					x		x								
199	WD-2551	CDRP	Last summer an asbestos air monitoring station located in the clean exit zone began to show chronic exceedances of trigger levels. Using a new technique called asbestos speciation, we fingerprinted the asbestos mix and identified two potential sources: Disposal Site 3 (DS-3) downwind from the station, and water from the vehicle wheel wash. We eliminated DS-3 as a source by setting up an array of monitoring stations downwind from the station, and documenting that asbestos concentrations actually increased within the clean area. We then sampled water from the wheel wash, dust from a vehicle, and silt from the clean road cap, and showed that asbestos was progressively moved down the road by contaminated water (more than 5 billion fibers per liter) dripping from vehicles as they left the wheel wash and drove down the exit road. This asbestos		Standard decontamination systems were installed as specified that were designed for storm watercompliance, but without consideration of the unusual requirements of Naturally Occurring Asbestos (NOA). On this project we learned that special circumstances (in this case, NOA), may require creative solutions, and one must be very careful not to become complacent and accept designs based solely on past performance and standard of practice. The CM Team and Contractor redesigned the wheel wash as a single pass system. Instead of water remaining in the wash basin and periodically discharged into a permitted leach system, water now flushes at each pass, preventing buildup of asbestos. The concentration of asbestos in water in the wash is now similar to the source water.						x								x

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200	WD-2601	Crystal Springs /San Andreas Transmission Upgrade Project and Other Peninsula Region Projects (HTWTP, CSPL # 2, and BHR sites)	Stormwater Permit Compliance - Contractor has inconsistent, sporadic, and reactive (as opposed to proactive) efforts to maintain BMPs at the construction sites. As a result, few close calls and some minor violations occurred where higher than expected turbidity levels were released. In addition, there has been some confusion on the sampling requirements for Risk Level 2 sites.	Cost Impact: Not specifically defined Schedule Impact: Minor	Keep a close eye on the weather forecast and send out reminders to the Contractor when inclement weather is predicted, especially when adverse weather warnings are predicted. Register for "StormPOP.com" which will send you a daily email with the precipitation percentages for your projects' zip codes…it's an easy way to stay on top of the weather. Don't rely on the Contractor to check the forecast. Continue to remind contractor of their obligations to install and maintain the BMPs per the contract and General Construction Stormwater Permit (CGP). Identify their key permit and contract requirements and key risks at their project sites, and provide recommendations for buttoning up the sites (reiterating what the EIs communicate in the field). Ensure their paperwork is in place (e.g. Rain Event Action Plans need to be prepared 48 hours prior to a rain event) and monitor during and after rain events to confirm contractors are sampling stormwater where required (e.g.. Risk Level 2 sites) and follow through on implementation recommendations. As a proactive approach for the current rain event, the RECM issued the attached memo outlining the requirements and provided a summary of the sampling and inspection requirements as a "tool box" topic. In addition, EIs were dispatched to each location to confirm compliance and monitorperformance. For future rain events, the RECM, EIs or SFPUC's QSD will develop additional "tool box" topics on stormwater compliance focusing on other aspects of the CGP.					x			x						
201	WD-2541	Bay Division Pipeline 5 Reliability Upgrade – East Bay Reaches	Design/Environmental and Other Agency Coordination - The Memorandums of Agreement (MOUs) between the SFUC and both the City of Newark and Fremont were not finalized prior to bid. The City of Newark restoration plans were not provided as part of the draft MOUs included in the bid documents. As a consequence, the final MOUs provided after the project bid included more extensive restoration for Ash Street Park than included in the construction contract.	The contractor restored the City of Newark and Fremont areas, per the details included in the final MOUs, under change order. Cost Impact: $150,000 (approx.) Schedule Impact: None.	Negotiate and memorialize in the agency MOUs what theexact scope of the restoration will be prior to completing the design. Include an itemized list of items to be restored with dimensions, as well as photos of the existing conditions, as part of the MOU attachments. Ensure that the design standards include an item in the checklist for no certification of the final design for bid without the final MOUs. The final design bid documents should be checked for consistency between the specifications/drawings and the MOU requirements.		x					x						
202	WD-2582	Sunol Valley Water Treatment Plant Expansion and Treated Water Reservoir Project	Temporary Generator/Temporary Power During Plant Outage - Contract Documents require the existing transformer (Hetch Hetchy Utility Power) to the Plant to be removed and replaced with an upgraded transformer. This swap out requires that Hetch Hetchy Utility Power be disconnected and the Plant to utilize generators for power during this shut-down period. Contract Documents indicate that the existing 600 kW generator can be utilized for temporary power. However, during the Project, Plant Operations indicated that the existing 600 kW generator is only permitted to be in operation for a defined amount of hours each year. The duration for completing the Transformer swap-out work would exceed the agency- permitted hours the existing 600 kW Generator can be utilized each year. Additionally, the permit for the 600 kW generator specifies that this generator can only be used for emergency purposes. A contractual scope of work to replace the existing transformer is work that is known in advance, can be scheduled, and is not considered an emergency condition. With this as the background, it became apparent that finding an alternative temporary power source (temporary generator) would be required to complete the Transformer replacement work.	CM Team worked with Plant Operations on defining the electrical loads that a temporary generator would need to provide power during this Shutdown. Ultimately, a 400 kW temporary generator was sized, and a Contract Change Order negotiated with the Contractor to provide a temporary 400 kW generator for a two-week duration. A lump sum change order for the electrical work needed to hook up the temporary generator was negotiated. The cost for diesel fuel for the generator was agreed to be compensated on as as-consumed basis since the CM Team was not willing to accept the Contractor's very conservative estimate of fuel consumption. Cost Impact: $50K Schedule Impact: Potentially significant to the achievement of a shutdown milestone, but successfully avoided as the issue was resolved with Contractor	Contract Documents should be clear that existing emergency generators are not available to the Construction Contractor to support construction related activity requiring the Plant to have back-up power. The City's existing emergency generators are not permitted to support these types of construction shut-downs and activities.		x		x			x						

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203	WD-2596	Harry Tracy Water Treatment Plant – Long Term Improvements	Contract Requirements / Supplementary Conditions - General Site - Record Aerial Photos - Early in the project it was felt that aerial photos taken on a monthly basis would contribute to project records and would capture multi-locations at the jobsite from a higher elevation. The aerial photos would be a general record of progress and to support on-the-ground conditions for the monthly payment request as inspector photos tended to be very focused on a particular area. In addition, the photographs have supported public relations through display at various public meetings and have been used for describing progress at management meetings. Since the aerial photo program has been run at Harry Tracy WTP on the LTI project, Sunol and CSSATU has also initiated aerial photos for their construction projects. With the ongoing work at 22 multi-locations, the aerial photos will continue to capture the progress of the contract	Cost Impact: Current cost is $600/month including approximately 30 high resolution (6 MB) JPEG files and the same low resolution (2 MB) JPEG files for e-mail. Included in the pricing is a 20"x30" "poster" photo reproduction used for progress payment negotiations and for display.	1) Provide for aerial photos on future plant and multi-site projects in the contract. 2) Provide time-lapse photography to capture 15 minute increment of the contractor's progress at key locations to document contract progress and compliance.				x								
204	WD-2601	Crystal Springs /San Andreas Transmission Upgrade Project and Other Peninsula Region Projects (HTWTP, CSPL # 2, and BHR sites)	Seasonal limitations are often over-looked and can have significant consequences on the project's schedule if windows are missed. The CM Team should track contract/permit seeding and planting windows carefully because oftentimes the contractors are not planning their work with these windows in mind and leave theproject in jeopardy of missing critical seasonal opportunities for planting, seeding, and plant/seed collection.		Require in the contract that contractors to put these seasonal planting/seeding milestones on their schedules just like any other contract milestone. Consult with a qualified revegetation specialist because certain years can be drier or wetter and the most favorable conditions might fall outside the typical windows of a typical year. Negotiate with agencies if the given year is atypical to hopefully extend your planting windows if conditions are favorable following consultation with a reveg specialist. This may help keep the				x			x						
205	HH-953	Tesla Portal Protection	Constructability of the Barrel Portion of the Security Structure - The security structure is in two portions, the vestibule and the barrel. The vestibule is made up of solid and straight concrete floor, walls and roof, a relatively standard structure. The barrels is made up of rolled I-beams and rolled 7/8" plate, all welded together. The barrel is very difficult to construct, and has been the secondary critical path throughout the entire project. If the barrel had been designed as similarly to the vestibule, as a concrete structure with flat component, this project may have been completed on time, September 16, 1012. As designed, the completion of the rolled and welded steel portion of the structure is projected to be complete by the end of January 2013	Cost Impact: Both of the costs related to this issue are still in negotiation. The contractor has requested a change order of $42k claiming that the structural detail 10 on drawing S1-7 is not constructible. The design is unique; the engineer is not able to provide an example of a built structure with a similar detail. The quoted cost seemed high, so the work is being tracked via force account. The other cost is a $400k delay claim which the Contractor has not dropped yet. It is the City's position that the claim has no merit. So far the Contractor's claim is based on the procurement of the jib crane, as that is the primary critical path. However, the work on the barrel portion of the security structure is right behind the jib crane procurement. Schedule Impact: As it turns out, the primary critical path is the procurement of the explosion proof jib crane, and not the barrel portion of the security structure. However, if the barrel portion was completed earlier, the Contractor could have demobilized, and returned to the site when the jib crane was built to install it. The delay of the jib crane does not impact operations. This might have made a huge difference in dealing with the $400k extended overhead claim we are currently facing from the Contractor.	1) Constructability review needs to happen early in the project to review the larger design concepts, as well as towards the end of design. 2) The Project Engineer needs to be appraised of all information relevant to the design of a City facility. This was a homeland security project with technical information restricted based on the "need to know". Therefore, considerations such as how big of a blast the structure is intended to withstand, failure mechanisms of the structure, weak points and how they are compensated for, were all restricted to the safety consultant (Hinman) and the designer (MWH). The SFPUC reviewers did not have a "need to know". Therefore when the design was being reviewed there was a tendency to not question the structural choices made by the designers: it was assumed that it had to be that way because of security considerations. If the project was presented as just a normal building, there probably would have been more comments/suggestions such as "provide more clearance here" and "wouldn't reinforced concrete be less expensive and easier to construct than welded steel?" etc. 3) The duration for this project was 6 months, which was a pretty accelerated duration. The project had no impact on Operations, whereas a time extension can have quite a financial impact on a project, and is a common claim. As it turns out, there is one safety related limitation on the duration of this project, but it came months after the original substantial completion date of September 16, 2012. The safety related schedule impact is that it is				x			x						

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206	WD-2581	New Irvington Tunnel	Bid Item for Environmental Allowance Work - A Bid Item was established in the NIT Contract to pay for specific additional environmental compliance and mitigation measures directed by the City Representative that may arise during the course of construction and are not identified in the Contract Documents. This Bid Item 26 is also being used to compensate for supplemental groundwater inflow control measures and the groundwater management plan for supplying potable water to residents that are affected by groundwater reductions along the alignment. Because not all environmental permits were issued prior to bid, there were certain environmental and SWPPP issues that were considered additional work. Just after NTP, we had to add thousands of feet of wildlife exclusion fencing around the perimeters of the spoil areas that were not identified on the drawings as well as pay for labor and equipment to assist the biological specialist in checking gopher holes for snakes and other species. We also used this bid item for other directed work such as additional soundwall required at Irvington Portal and dozens of directed work orders for the Groundwater management and mitigation work in Sheridan Valley and the local residents along the	Cost Impact: Because there was a $5 million allowance set up in the contract, there were no additional change orders needed to pay for all the directed work to date on environmental issues. This made the payment, typically T&M, much easier to manage and account for in the monthly payment request. We have currently used less than $2 million of the $5 million to date. Schedule Impact: There are no schedule impacts to date regarding the use of this bid item	This Bid Item has been effective in paying for the many City directives regarding environmental compliance and mitigation as well as the groundwater management program implementation that was not identified in the Contract Documents. We believe that this type of Environmental Allowance item should be discussed on every project during the design phase and a bid item allowance added since the environmental issues that arise during construction are not always addressed in the contract specifications or drawings and need immediate direction to the Contractor.							X	X			X		X	
207	WD-2601	Crystal Springs/San Andreas Transmission System Upgrade	Revised RFI Responses - Numerous RFI responses have been finalized, sent back to the Contractor, then modified and re-issued.	This has been problematic in the field because when RFI responses are modified and re-issued changes are missed or the work has already been completed. Cost Impact: TBD Schedule Impact: TBD	Make sure the responses are final before returning them. To accomplish this make sure all parties involved have reviewed the response and are agreeable with the response. For complicated RFIs a meeting might be necessary. It might also be beneficial to let the CM review the response before issuing.					X		X							
208	WD-2541	Bay Division Pipeline 5 Reliability Upgrade – East Bay Reaches	Design and Safety – Newark Contamination - Contaminated groundwater was encountered at Newark during installation of the pipeline. There was significant additional cost to the project for stoppage of work to address the contaminated groundwater and not affect the adjacent contaminant plumes, as well as designing and installing sheet pile cut-off walls to minimize the seepage, a limited pumping system, and a sophisticated treatment system (VOCs, metals, turbidity, etc.) to meet the local USD permitted discharge limits. Inflow and outflow discharge sampling and testing was also required over several weeks to ensure compliance with the discharge limits, as well as documentation of no impact on the area contamination. The BDPLs 1, 2 and 5 at Newark were also raised to a higher elevation, in order to limit the extent of the excavation and the groundwater pumping. Contaminated soil was also encountered in Newark. The BI 2A allowance was not adequate for the quantity of contaminated soil required to be disposed of.	The contractor installed a field team designed cut-off wall/treatment system in order to safely continue with the pipe/valve installation. Cost Impact: $1,313,000 (approx.) Schedule Impact: 40 days including work stoppage, design and installation of cut-off and treatment system (RPI was able to integrate this work in their schedule, so no impact to overall Substantial Completion milestone).	Recommend that thorough Phase I and Phase II site assessments be performed prior to completion of intermediate and final designs, and the design completion checklist include these before the design can proceed. If areas adjacent to the project site are suspected to have possible contamination, include this information in the contract documents, as well as a bid item allowance sufficient to cover handling and disposal of material up to 50% within the suspected area. If areas adjacent to the project site are known to have possible contamination, include a plume map in the contract documents, as well as a bid item allowance to obtain permits, design and install a pumping and treatment system which will not impact the plumes, as well as produce the required sampling and testing reports for project documentation. Alternate contract strategy: Having knowledge of the contaminant plume in the nearby properties, GBR could have stated that dewatering beyond the trench is not allowed so Contractor will be forced install a type of cut-off wall system.		X		X			X				X			

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209	WD-2629	Seismic Upgrades of BDPL 3 & 4 at the Hayward Fault	BDPL 3X Slip Joint - As part of the mechanism to allow the BDPL 3X to survive a large magnitude quake on the Hayward faultwith up to 6 feet of elongation a72" slip joint is to be installed on BDPL 3X along with two 72" ball joints and an articulated vault with sliding members to facilitate the necessary movement. The ball joints were pre-ordered and fabricated and stored at a local site for use by the construction contractor. The sliding mechanism is to be fabricated by the Construction contractor from readily available parts. However the conceptual design of the slip joint and subsequent final design and fabrication and delivery were included in the construction contract to be managed by the construction contractor. However, the contractor could not reach an agreement with the designer/ manufacturer of the joint. The City has since taken over the agreement with the designer/ manufacturer. The joint may not be delivered on time (Jan 2014) to meet shutdown dates in the current contract.	To try and avoid delaying the project due to late delivery of the joint, the City is issuing a PCO to install 4 new 72" butterfly valves and appurtenant piping and plumbing. These were originally in the contract,but removed due to change in shutdown sequence. The valves will allow more flexibility with transitioning from the section of BDPL 3 that is be abandoned and replaced with BDPL 3x Cost Impact: unknown (in excess of $2 million) Schedule Impact: unknown (potentially a few months at best)	Don't put a project out to bid until you have all the special parts on hand. Don't rely on the contractor to come to terms with a third party on a critical piece of equipment that needs to be designed and manufactured.				x	x		x								
210	WD-2629	Seismic Upgrades of BDPL 3 & 4 at the Hayward Fault	Overexcavation at Vault Base - At all 3 sites, over-excavation of the vault base subgrade was required with replacement with filter fabric and ¾" drain rock due to wetter than expected soil conditions. Although Specification 02200-2.01 discusses replacement of unsuitable material at the bottom of the foundation excavation with Caltrans Class II aggregate base, a specific volume of material to be over-excavated was not included in the drawings and is difficult for the contractor to bid. After review by the geotechnical engineer, directed the contractor to over-excavate the vault foundation base by one foot and replace with filter fabric and ¾" drain rock to the vault slab elevation. The Guadalupe site over-excavation work was done by change order, but the Barron Creek and Bear Gulch sites overexcavation work was tracked on force	Cost Impact: $115,000 (approx.) Schedule Impact: None.	If a structure is designed below the water table, include over-excavation and installation of filter fabric and ¾" drain rock to subgrade in the contract documents.				x			x				x				
211	WD-2601	CSSATUP	Wet Excavation Quantity Overrun & Not accounting for San Andreas reservoir standard operating water elevations for unit price bid quantities. - Change Order 170 wet excavation (Dredging) was issued because quantities increased by about 215% above what was specified in the contract Bid item 7.3 SAOS3 Wet excavation because the water level was 10 to 12 feet higher during construction than what the engineer assumed in the original bid item quantity calculation. The total material amount did not increase, just the portion that was wet versus dry. Theoriginal contract had Bid Item 7.2 dry excavation at 9,700 CY and 7.3 Wet Excavation at 6,900 CY which is equal to a total of 16,600 CY excavations. Bathymetric survey analysis during construction shows revised excavation amounts for 7.2 Dry excavations is about 1,960 CY and 7.3 Wet Excavation is about 14,620 CY which total 16,580 CY	Cost Impact: Approx. $1.3 million over the original contract value or 1.3% of the original contract value Schedule Impact: Total impact is not fully realized as the contractor has not submitted completed claims for this portion of work.	Confirm quantity overruns using 3rd party bathymetric survey analysis, renegotiate the unit price for Bid item 7.3 and issue corresponding change orders for overages. Put more effort into considering the standard operating water elevations of a reservoir before calculating wet excavation bid quantities and/or avoid all risk of water level issues by not breaking the excavation bid quantities into separate wet and dry excavation volumes.				x	x		x				x				

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212	WD-2666	Bioregional Habitat Restoration, Sheep Camp Creek	Well Drilling - The project has two components, erosion control which involves planting, and irrigation of those plants over a long term plant establishment period, and providing water for cattle. The water for both of these purposes was to come from two wells drilled as part of the project. After NTP was issued, it was brought to the CM team's attention that the neighbors had drilled many wells, and the boron levels in all of their wells was too high for both their consumption, and for landscaping. The CM team deleted the well closest to those neighbors, but drilled the other well in the contract. This led to a change order. The well had excessive boron, and cannot be used for irrigation or cattle watering. This is leading to a few more change orders.	Cost Impact: Undetermined as of yet; $75k for a test bore. If the test bore yields an adequate quantity and quality of water, estimated $125 for a new well, $120k for additional piping, $40k for additional cost to solar system, as new location has no room for the solar array, so it will have to be located at a distance. (This also includes redesign for the Contractor, as the water system is a performance specification.) This has increased soft costs as well, as the proposed new well location has involve a minor project modification from environmental agencies, a Caltrans permit to go under 680, and a permit to go under a county road. Schedule Impact: If one of the next two planned test borings are successful, no delay. If they are not successful, the planting will be removed from the contract and done another time.	Well drilling is a big unknown. Next time a large project is so dependent on a well, the well should be drilled first, before the rest of the work is designed. Also, Zone 7 keeps a map of wells drilled, and well completion permits. Before drilling a well in this area again, as much research should be done as possible to find any existing knowledge of groundwater quality and quantity.					x		x							
213	WD-2582	Sunol Valley Water Treatment Plant and Treated Water Reservoir Project	Evacuation of an existing Lessee took more time than envisioned. Lessee wanted to continue Nursery Operations.	Almost threatened the NTP date. Debris left over by previous lessee will cost SFPUC several hundred thousand dollars	Confirm Acquisition of Land with Real Estate before Bid and Award						x	x								
214	WD-2582	Sunol Valley Water Treatment Plant and Treated Water Reservoir Project	SVWTP and TWR – Civil Design (Spoils Disposal) - Prepared Hydrology Study at RWQCB's request to address drainage east of Calaveras Road	RWQCB Certification and SWPPP compliance at Site 1 was challenging	Getting Agency Involved Early help							x								
215	WD-2582	Sunol Valley Water Treatment Plant and Treated Water Reservoir Project	Site 1- Spoils Disposal Design - Site 1 Spoils Disposal Need more Refinement. Civil Details inadequate in the following areas: A) 10-inch Discharge from Site 1 to Alameda Creek B) Pond Outlet Design C) Coordination with existing Utilities (44-inch pipe and details)									x								
216	WD-2582	Sunol Valley Water Treatment Plant and Treated Water Reservoir Project	Design - CER was confirmed by several Tech Memorandums during Design, Over 600 Drawings, 3 Volumes of Specifications, $110 Million Engineers Construction Cost Estimate. Better definition of Roles and Responsibilities for PM and PE early in the project to assist in managing the Consultant better. SCADA was well coordinated with IT and Controls		Better coordination and monitoring of consultants in following areas: A) Project Mgmt B) QA/QC Procedures C) Schedule					x										
217	WD-2582	Sunol Valley Water Treatment Plant and Treated Water Reservoir Project	Preparation of Bid Documents - Coordination with Contracts. In spite of close working relationship, a few items not included in the final specs; specifically the start of the first shutdown was incorrect in Division 1. Finalizing Division 0 and Division 1 was challenging: A) Too many last minute revisions B) Lack of Good Communication									x								
218	WD-2582	Sunol Valley Water Treatment Plant and Treated Water Reservoir Project	BID AND AWARD-Addition of Scope Items - Addition of Chemical Tank Replacement ($1.3M a major component). Add approx. 100 new drawings and changes to several drawings	Created too much work which took away time from sharpening the original bid documents.	Do not add major scope changes after start of design							x								
219	WD-2582	Sunol Valley Water Treatment Plant and Treated Water Reservoir Project	BID AND AWARD - Scope Creep caused Quality to suffer. 600 QBDs. Many due to last minute addition of a major scope item during Bid and Award. Be Aware of your primary Bid Items before you announce the apparent low bidder		Better Coordination with Operations on Project Scope before start Design and a better job with Review of final bid set. Get upper mgmt involved early in the process							x								
220	WD-2582	Sunol Valley Water Treatment Plant and Treated Water Reservoir Project	BID AND AWARD – Additional Scope Items added after NTP. Replacement of Boiler ($1.0 M). Replacement of Elect Panels and MCC ($1.0 M). Replacement of Chemical Feed Lines ($1.2 M)									x								

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221	WD-2582	Sunol Valley Water Treatment Plant and Treated Water Reservoir Project	ENVIRONMENTAL PERMITTING - Project Description: Detailed civil design most important; EIR analyze a larger area; Permits fine tune; Some project changes are good, even if schedule is delayed; Include MEA in decision making when there are options * Saved ~ $11 MILLION by relocating spoils disposal area * •Project Objectives: Be specific on what the project needs to achieve. Good alternatives analysis is energy well spent. Collaboration of PMB, EMB, and BEM Key: Accurate project description; Elimination of impacts or reduction in severity; Implementable mitigation measures								X								
222	WD-2582	Sunol Valley Water Treatment Plant and Treated Water Reservoir Project	ENVIRONMENTAL PERMITTING - Inter Agency Task Force is a Resource; Explore their Ideas.		Environmental requirements on construction drawings to facilitate compliance							X							
223	WD-2501	Alemany Pump Station Upgrades (McLaren Park)	The installation for a typical blow-off assembly per the standard detail does not require the vertical spool piece to be restrained with rods to the 90-deg elbow fitting below. Make sure the vertical spool is restrained when adding temporary piping above ground to a drain for the purpose of flushing. Another option would be to monitor and restrict the flow so that the pressure buildup at the blow-off assembly		The blowoff assembly would have been modified							X							
224	WD-2501	Alemany Pump Station Upgrades (McLaren Park)	The only other issue regarding the shutdown is that when the project started, the contractor had to use a sump pump to pump some remaining water that was in the pipe before demolition. The isolation gate valve was a mile away so after the line was isolated, CDD helped blow off the remaining water in the pipe and the contractor pumped the remaining standing water, which took a day or two. But everything else went pretty smoothly, CDD came in, isolated the station and once we got the ok from CDD, we were ready for		provisions for de-watering pipes would have been worked out in advance				X			X							
225	WD-2552	Alameda Siphon #4	S.P. Rados' portion of Shutdown AS4/1 could not start prior to 11/15/10 due to Ameron pipe procurement issues; however, S.P. Rados was not late. The original shutdown date for S.P. Rados was 11/15/10. Ameron's pipe delivery schedule was based on this date. We asked if Ameron could accelerate pipe fabrication so S.P. Rados could start their work earlier, but Ameron could not. S. P. Rados could not have anticipated SFPUC starting this shutdown early.	The SOR generally should arrive 60 days prior to the start of the shutdown. S. P. Rados could not have anticipated that the SFPUC was going to start the shutdown a month earlier than planed.	The Contractor needs to carefully monitor pipe procurement from its supplier					X									X
226	WD-2552	Alameda Siphon #4	The OCR and LOTO plans should arrive 21 calendar days before the start of the shutdown rather than after the start of the shutdown. The Shutdown Coordinator now has the authority to cancel a shutdown for which a written LOTO plan is not in place prior to the start of the shutdown		The SFPUC should not start shutdowns without a written LOTO plan.														X
227	WD-2552	Alameda Siphon #4	The first version of the SOR was received on 1/27/10. The Operational Change Request (OCR) was approved by WSTD after the start of this shutdown which is unacceptable for several reasons including safety.		The System Outage Request (SOR) needs to be sent to the Shutdown Delivery Team 60 days prior to the start of the shutdown.														X
228	WD-2552	Alameda Siphon #4	The AS4/2 shutdown was lengthened by about 2 weeks due to congested pipe conditions and the need for 2 back-to-back shutdowns (pipelines AS3 followed by AS2) instead of just AS2. Temporary pipe bends in AS3 had to be installed in order to make this shutdown work		The design team needs to field verify the field conditions such as pipe separation prior to advertising the contract so that the construction team does not have to scramble at the last moment with a change order to address the situation.							X							
229	WD-2552	Alameda Siphon #4	On 3/30/10, WSTD requested a 2 week delay for this shutdown. The start of the shutdown was further delayed due to late arrival of the necessary Ameron pipe. The System Outage Request (SOR) was received on 5/13/10 and the revised SOR was received on 6/16/10. The Operational Change Request was signed on 7/2/10.		The pipe was purchased by Rados so they should have done a better job tracking the fabrication schedule. The SFPUC has been sending people to the fabrication facilities as part of the SQS program, but they are typically only tasked with verifying quality. For a small additional fee , I'm sure we can also have them do					X							X		
230	WD-2552	Alameda Siphon #4	There is no record of a lock out tag out (LOTO) plan for this shutdown.		All shutdowns should have a LOTO plan														X

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231	WD-2552	Alameda Siphon #4	The schedule for this shutdown was changed 3 times. The first System Outage Request (SOR) arrived on 12/7/10, the second on 1/20/11, and the third on 2/25/11.							X									
232	WD-2552	Alameda Siphon #4	Although the water system was cut off, the shutdown was planned such that there would be no service interruptions. The four Town of Sunol tanks were topped off before the shutdown. No service interruptions occurred; however, WSTD had to truck water (20 truck loads) to the Town of Sunol water storage tanks over a two day period. The original plan to use a jumper hose on the Corral Hollow Pipeline could not be implemented. Due to the risk of a water outage, the City of Pleasanton was notified of the potential use of the emergency intertie on upper Kilkare Road in the Town of Sunol. The City of Pleasanton was having problems with their water system/tank at this time and it is not clear if Pleasanton could have held up the Town of Sunol water system if the intertie had been activated.		The residents in the Town of Sunol should have received some type of advance notification (U.S. mail or community bulletin boards) by the SFPUC that there water system was going to be cut off for a few days. G238			X										
233	WD-2552	Alameda Siphon #4	The disinfection of the Coral Hollow 36-inch pipeline took longer than planned due to low flows. The original plan was to use sanitary work practices for this pipeline, but since a large portion of the Coral Hollow Pipeline was depressurized, the method was switched to slug disinfection.																
234	WD-2552	Alameda Siphon #4	S.P. Rados used the wrong sized flange for the 36-inch to 12-inch connection which caused a minor delay.														X		
235	WD-2552	Alameda Siphon #4	Water discharge locations.		Water discharge locations need to be made know in advance of a shutdown and future WSTD discharges into the silt ponds need advance notification to CEMEX.				X	X		X							
236	WD-2552	Alameda Siphon #4	There was lack of planning on WSTD's part that lead to delays including the unexpected water truck hauling to replenish the water storage tanks. There was a lack of fire protection for the Town of Sunol during the shutdown, and the unanticipated need for 24/7 WSTD operations support.		CalFire, the fire service provider, should have been notified that there was a limited water supply from the fire hydrants during this shutdown.			X											X
237	WD-2442	Bay Division Pipeline Reliability Upgrade - Pipeline	The dewatering plan called for monitoring and dewatering from sites remote from the work site at Redwood City in order to safely control the risk of valve leak water engulfment. When the pipeline was turned over to MCI, one of the dewatering control points had been locked and could not be accessed. Control was returned to the City, who dewatered the pipeline again before turning it back over to MCI. SFPUC inadvertently put a lock on that point, so MCI was unable to access the manhole until the weekend was over. Over a weekend) the pipeline re-filled with water, and had to be dewatered again by the SFPUC on Monday.	By the time the lock was removed the pipeline had filled back up with water, and the work had to be aborted.	Access point requirements for dewatering and engulfment hazard could have been better clarified between all involved City forces and the contractor before the start of the shutdown. 1. Confirm that all access points needed for valve leak dewatering are available to the Contractor when the pipeline is turned over to them. 2. Turnover to contractor on a Friday can be problematic if the contractor cannot install the dewatering system until the following Monday.				X	X		X							
238	WD-2442	Bay Division Pipeline Reliability Upgrade - Pipeline	This shutdown lasted 7 days longer than planned. The issue of groundwater contamination in Newark (FMC site near NVH) caused Ranger Pipelines to request a 2-week extension in order to build a 600-feet long coffer dam to control the contaminated water intrusion. This 2-week shutdown extension caused Ranger Pipelines to compress their shutdown duration for the subsequent shutdown BDPL5P/4. The amount of planning for this shutdown was much more than for most shutdowns and involved interaction with CalOSHA to address worker engulfment concerns.	The extra planning, involving CalOSHA oversight for work inside the pipe, was unexpected.	The pre-construction investigations of the contaminated FMC site should have been more extensive. As a result of this shutdown, the SFPUC Health and Safety Group produced guidelines on 3/15/11 for working inside pipe confined spaces and avoiding potential engulfment. These procedural and policy changes will be incorporated, by the Health and Safety Group, into the SFPUC's LOTO and Confined Space Entry Policy and a revised P022 System Shutdown procedure.							X							X

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239	WD-2442	Bay Division Pipeline Reliability Upgrade - Pipeline	The initial date for the hot tap could not be met on 4/1/11 due to installation of a non-conforming steel collar and the hot tap ended up being delayed for over a year. During MCI's initial hot tap preparations on 3/29/11, the collar weld cracked during the 100 psi pneumatic testing and the hot tap was put on hold. The collar of the non-conforming material was removed and the bulkhead tested for damage. No damage was reported. Due to 1) the Contractor's performance of non-conforming work and 2) concerns that welding a new collar in the same area where the original collar had been installed may cause damage to the existing bulkhead, SPUC EMB issued a revised design for the installation of a dished head that encapsulated the existing bulkhead.	The unilateral change order for the cold ring and dished head cost the SFPUC $44,835 due to the Contractor's non-conformance. The SFPUC is not paying for the Contractor's non-conformance but is paying the differential cost for manufacturing (material cost) of the new dished head versus the original design.	If large diameter hot taps are performed, a weld procedure specification (WPS) is needed to ensure the materials to be installed and welded are compatible. • If possible, manifold metallurgy should be performed prior to the hot tap. • Increase design safety factors for tunnel manifolds with hot taps. • Use thicker steel plates for the collar to account for field uncertainties if collars are used. • Extend the collar or saddle over and around the existing pipe or use a cold ring and dished head. • When welding in the rain, provide proper shelter, keep the workspace dry, and test for condensation on the steel. • Use the proper electrodes when welding.				x			x					x		
240	WD-2442	Bay Division Pipeline Reliability Upgrade - Pipeline	There was a contracting issue with the original hot tap subcontractor FlowTech having to do with hiring local workers. TapMaster, a local Bay Area firm, was able to hire locals for the hot tap work.		Ideally, the contracting issues should have been worked out before the time of bid award					x	x								
241	WD-2442	Bay Division Pipeline Reliability Upgrade - Pipeline	At the last minute, the start of this shutdown was delayed 3 days due to procurement issues with switches for SCADA communications to the new Control Building							x									
242	WD-2442	Bay Division Pipeline Reliability Upgrade - Pipeline	The Contractor's electrician was on site on 5/5/12 near the RIOU without the control system integrator.		This should not have occurred.					x									
243	WD-2442	Bay Division Pipeline Reliability Upgrade - Pipeline	There was a LOTO issue on 5/8/12 with multiple valves needing to be in local mode rather than remote mode.		This should have been anticipated in advance.					x									x
244	WD-2442	Bay Division Pipeline Reliability Upgrade - Pipeline	This electrical shutdown was not in the construction contract and was introduced in July 2011 with an anticipated date of October 2011.		Ideally, this minor shutdown should have been anticipated and incorporated into the construction contract.				x			x							
245	WD-2442	Bay Division Pipeline Reliability Upgrade - Pipeline	In March 2012, the shutdown date was moved to 4/16/12. The draft System Outage Request (SOR) arrived on 7/22/12, the SOR arrived on 8/31/11, the SOR Revision 1 arrived on 3/9/12, and the SOR was signed on 3/26/12. The null Operational Change Request (OCR) was authorized on 4/12/12. All the SOR signatures were received on 4/16/12, the same day as the start of the shutdown		As a procedural matter, the SOR authorization needs to be done 21 days before the shutdown starts not on the same day as the shutdown														x
246	WD-2442	Bay Division Pipeline Reliability Upgrade - Pipeline	This shutdown was not in the contract but was introduced on 7/27/11 as a 1- day-long shutdown scheduled for some time in November 2011. On 10/28/11 this shutdown was changed to a 1-day-long shutdown scheduled sometime in February 2012. On 12/23/11, the shutdown dates were changed to 1/24/12- 4/10/12 and the duration		Ideally, this electrical shutdown should have been included in the construction contract.				x			x							
247	WD-2442	Bay Division Pipeline Reliability Upgrade - Pipeline	MCI altered the work plan and issued a revised SOR nearly a month after the start of the shutdown.																x
248	WD-2442	Bay Division Pipeline Reliability Upgrade - Pipeline	The draft System Outage Request (SOR) arrived on 10/19/11, the SOR Revision 1 arrived on 12/14/11, and a null OCR was authorized on 1/25/12. The SOR Revision 2 arrived on 2/23/12 and a corrected shutdown schedule arrived on 3/8/12		The null OCR was verbally approved prior to the start of this shutdown. The actual null OCR for this shutdown arrived the day after the start of this shutdown and it should have been in place prior to the start														x
249	WD-2568	Bay Division Pipeline Nos. 3 and 4 Crossovers	The shutdown duration was 14 days longer than expected.																
250	WD-2568	Bay Division Pipeline Nos. 3 and 4 Crossovers	This project required that SFPUC pre-purchase butterfly valves and pipes in order to meet shutdown schedule dates. One of the butterfly valves failed a factory hydrostatic test during the manufacturing process and the project team had to borrow a 90-inch butterfly valve from the Alameda Siphon 4 project. The replacement valve was not delivered to the site until December 10, as opposed to the original valve that would have been delivered in late October. This delivery date severely compressed the contractor's construction time. Earlier pre-purchase of valves could have avoided this problem but overall project schedule and the shutdown dates		When pre-purchasing equipment and materials, try to leave adequate time for problems in the testing and delivery of these items.					x						x	x		

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251	WD-2568	Bay Division Pipeline Nos. 3 and 4 Crossovers	The contract had a conflict between specified valve gasket materials and the NSF-61 requirements. This necessitated a change in valve gasket materials and bolt materials after the shutdown had commenced. Different gasket materials were specified for insulated and non-insulated joints. Shimmick Construction Company Incorporated (SCCI) experienced difficulties in making a leak tight connection using the new non-insulated gasket material and resolving that problem extended the shutdown		Contract documents should be coordinated to ensure that specified materials and equipment meet all other requirements of the contract and regulatory agencies. PUC Operations can make decisions and changes to their work on the project rapidly. It is construction management's responsibility to see that these conform to the construction contract. Improved communications are needed between Operations and the project construction manager to avoid problems with the construction contractor.					x		x							
252	WD-2568	Bay Division Pipeline Nos. 3 and 4 Crossovers	After all of the 72-inch pipe and valves had been installed, the east insulated flanged joint was found to be faulty. Cause of the fault has tentatively been established as a gasket imperfection not detectable by visual inspection. SCCI removed the pipe section and installed a new gasket														x		
253	WD-2568	Bay Division Pipeline Nos. 3 and 4 Crossovers	The OCR was received by the Shutdown Coordinator on 2/2/10, after the start of the shutdown.		The Operation Change Request (OCR) needs to be distributed in a timelier manner for review by the Shutdown Delivery Team. E-mail, rather than Inter-office mail, should be used for distributing the OCR			x											x
254	WD-2568	Bay Division Pipeline Nos. 3 and 4 Crossovers	During connection of BDPL3 to the intertie valve, the intertie valve leaked. This caused some difficulty in completing the construction. The valve manufacturer representative stated that butterfly valves need to be exercised under pressure before all of the packing seats up properly. This is not possible with this type of construction.						x			x					x		
255	WD-2568	Bay Division Pipeline Nos. 3 and 4 Crossovers	There was a poorly coordinated transfer from WSTD dewatering operations to Shimmick dewatering operations. Turnover was late in the day with the pipe more than half full and the high rate of valve leakage; this almost overwhelmed the contractor's ability to dewater. The high rate of valve leakage had been communicated to Shimmick a couple of days before.		Better communication is needed between the WSTD field operations and the contractor regarding turnover of the pipeline to or from WSTD. Transfers to contractors on Fridays place a burden on the contractor that may or may be reflected in the contract documents. On the other hand, transfers to contractors on Mondays place a burden on WSTD. The turnover date to the Contractor needs to be determined in advance to the extent					x									
256	WD-2568	Bay Division Pipeline Nos. 3 and 4 Crossovers	There was a mistake in the contract regarding the expected valve leakage/intrusion into BDPL4. The contract specified 100 gpm whereas it should have been 500 gpm	SCCI was aware of this mistake in the contract prior to the start of this shutdown so a potential change order should not have been a surprise								x							
257	WD-2568	Bay Division Pipeline Nos. 3 and 4 Crossovers	There were problems accessing the new crossover section for monitoring		The contractor should provide ladder access for disinfection monitoring crews to get down to the vaults for flushing and sampling; especially when a 1-inch whip is not allowed to lay on ground blocking traffic					x	x								
258	WD-2568	Bay Division Pipeline Nos. 3 and 4 Crossovers	With Barron Creek and Bear Gulch vault wall construction proceeding during SFPUC tapping and sampling during disinfection, safe access for WSTD crews to the BDPLs taps was a challenge due to open rebar and concrete trucks	At the Bear Gulch site, the CM team directed SCCI to utilize a crane as a means of fall protection (harness attached to crane hook) for WSTD crew.	Coordinate with the contractor for WSTD site access for water sampling during a disinfection at the end of a shutdown.					x	x								x
259	WD-2568	Bay Division Pipeline Nos. 3 and 4 Crossovers	The valve leakage information was provided by WSTD to the design team, but it was not included in shutdown section 01650 but rather in section 1020	The BDPL34C higher-than-contract valve leakage cost the project almost $120,000 in change orders.	Assume and include a higher than expected valve leakage in the contract. It won't affect the bid that much, and will save a lot of money in change orders after bid							x							
260	WD-2568	Bay Division Pipeline Nos. 3 and 4 Crossovers	Due to the >300 gpm for BDPL34C/3, the CM team directed the contractor to install a contingency discharge system to Barron Creek (bypassing the limited capacity of the swale) in case extra capacity was needed then and for BDPL34C/5		Always have a contingency plan for handling valve leakage (to another location if the current location backs-up, etc.), and put it in place.				x		x	x							
261	WD-2568	Bay Division Pipeline Nos. 3 and 4 Crossovers	Contingency for power outage		Require the contractor to provide back-up power, not only for the valve leakage discharge pumps, but also for the sodium bisulfite pumps, the monitoring devices, and other smaller equipment, in the event of a power outage				x		x	x							
262	WD-2568	Bay Division Pipeline Nos. 3 and 4 Crossovers	On Wednesday, 2/8/12, 2 days before pipe turnover to SCCI, the CM team was notified that the valve leakage was 700 gpm, which required the CM team and SCCI to scramble and attempt to find larger pumps and larger diameter discharge piping a valves to re-route the discharge		The WSTD plumbers did a lot of research on the expected valve leakage prior to the advertising of the BDPL34C contract. However, this valve leakage information, provided to the design team, was not included in the contract in shutdown Section 01650 but rather in Section 01020							x							

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263	WD-2568	Bay Division Pipeline Nos. 3 and 4 Crossovers	WSTD discovered a pipe situation due to a concrete riser and an 8-inch bottom blowoff valve buried about 25 feet below grade just north of the BDPL3 connection point. The weight of the concrete riser created a weak point at the welded connection of the blow off next to the invert of BDPL3. At this depth it would be very expense for WSTD to excavate and repair this blow off if it was left as it was.The contractor had already excavated the blow off and riser was asked to fix this on a time a materials basis. WSTD wanted this blow off valve and the concrete riser removed.		This last-minute request should have been relayed to the contractor on a more timely basis. This work was done during the last week of this shutdown.		x			x		x							
264	WD-2568	Bay Division Pipeline Nos. 3 and 4 Crossovers	Prior to cutting into the RCP section of BDPL3, a problem was noted regarding damaged pipe upstream of the attachment point. The CM team worked closely with WSTD in getting this section of pipe repaired. The north and south tie-in points required additional work to make a quality connection to the existing BDPL3 pipe, due to the condition of the existing pipe. This was done in conjunction with		Existing pipe condition should be assessed as soon as possible during the shut-down to ensure that there is sufficient time for the repairs prior to connection with the new pipe.					x		x							
265	WD-2556	Baden and San Pedro Valve Lot Improvements	A 29-year-old cross-connect Valve T56R (at BPS) was leaking in excess of 300 gpm, which slowed down the turnover of SAPL3 to the Contractor. WSTD initially inserted an inflatable bladder into SAPL3 to control the water; however, this method was only partially effective since the bladder could not be properly secured inside the pipe due to the upstream pressure against it. Ultimately, WSTD used pumps to discharge the water into the adjacent 12" drainage line leading to		Better safety planning is necessary for insertion and removal of inflatable bladders														x
266	WD-2556	Baden and San Pedro Valve Lot Improvements	The point-of-connection for the SAPL3 tie-in was a 60" steel pipe sliplined inside the existing 66" reinforced concrete pipeline. The Contractor incorrectly measured (and subsequently fabricated) a tee section that did not accommodate the field conditions at the tie-in location, thus necessitating the fabrication of 66" x 60" transition reducers to complete the tie-in. This resulted in additional fabrication time and corrective work in the field, which in turn, extended the shutdown duration.		The Contractor should have reconfirmed their field measurements for the SAPL3 tie-in location with the City. Also, Operations should have been consulted regarding the dimensions of the concrete lining.							x					x		
267	WD-2556	Baden and San Pedro Valve Lot Improvements	Generally the Shutdown Delivery Team needs the System Outage Request (SOR) 60 calendar days in advance. The System Outage Request (SOR) was posted on the shutdown common drive on 3/25/10 although the CM team submitted this SOR on 02/11/10. The signed Operation Change Request (OCR) was posted on the shutdown common drive on 5/12/10, 9 days after the start of this		More attention needs to be paid on getting the approved OCRs circulated and posted on the shutdown common drive prior to the start of the shutdown as the OCR is the official approval for the Contractor to perform the shutdown.			x											x
268	WD-2556	Baden and San Pedro Valve Lot Improvements	For one set of sub-shutdowns (i.e. BSP/5D, BSP/5E, and BSP/5F) the LOTO plan delivery to the Shutdown Delivery Team was delayed 2 months.		Due to coordination issues on other projects, procedural changes were made such that the Shutdown Coordinator now has the authority to cancel a sub-shutdown if the written LOTO plan is not in place prior to the start of a sub-shutdown.														x
269	WD-2556	Baden and San Pedro Valve Lot Improvements	Planning and execution of shutdown from an operational standpoint should have been done differently. The System Outage Request should have been approved weeks prior to the shutdown rather than a week in advance; however, this delay was due to Operations' need to test valve leakage and confirm whether or not the shutdown																x
270	WD-2556	Baden and San Pedro Valve Lot Improvements	Prior to the recent EMB directive to use a NSF-61 approved gasket, a Garlock 3760 Multi-Swell gasket was used for Valve G14 per the specifications									x							
271	WD-2556	Baden and San Pedro Valve Lot Improvements	Coordination with previous improvements contract would have avoided the electrical conflict under the WD-2556 Contract		Field visits to be prioritized during the design phase to identify facilities requiring relocation and/or interruption of service.							x							
272	WD-2556	Baden and San Pedro Valve Lot Improvements	The System Outage Request (SOR) should have been approved weeks prior to the shutdown instead of the day before the shutdown.																x

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273	WD-2556	Baden and San Pedro Valve Lot Improvements	Electrical trade personnel was not available to support the SOR so that the approval of the SOR was delayed.																
274	WD-2556	Baden and San Pedro Valve Lot Improvements	Shut-down resulted in limited redundancy in the system. At one point during the shutdown, events caused a contingency plan to be implemented.		The events during this shutdown demonstrate the need for careful shutdown planning even for a seemingly insignificant shutdown subject to improbable system failures.				x			x							
275	WD-2556	Baden and San Pedro Valve Lot Improvements	Timing of SOR		For future shutdowns of this nature, the System Outage Request (SOR) needs to be submitted weeks in advance of the shutdown. Additional effort is needed between Operations and the Contractor to facilitate future outage requests and accommodate additional contingency plans and operational constraints.														x
276	WD-2556	Baden and San Pedro Valve Lot Improvements	Outage coordination		The Project team has implemented monthly outage coordination meetings with Jim Bennington, Dee Cutino, and Leland Fong as it pertains to the BPS outages.			x											
277	WD-2551	Calaveras Dam Replacement	This new shutdown was introduced into the WSIP shutdown schedule on 1/13/12 to give the SFPUC more operational flexibility. This shutdown was originally scheduled for 7/1/12 - 10/15/12 but was moved a week earlier. The System Outage Requests (SOR) arrived on 4/6/12 and the SOR Revision 1 arrived on 4/25/12. The signed Operational Change Request (OCR) arrived on 6/19/12. Contractor's work dates were originally scheduled for 6/26/12 - 10/9/12. DFSJV requested a shutdown extension to 10/31/12 which was approved in late August 2012.									x							x
278	WD-2551	Calaveras Dam Replacement	This shutdown took 22 days longer than planned. Initially, WSTD had issues with a flooded shaft and a broken pump which resulted in a slightly late turnover to the Contractor (approximately one week). This initial delay was further compounded with the initial dewatering of the 72-inch pipeline. There was some confusion as to the responsible party for dewatering operations.								x	x	x						
279	WD-2551	Calaveras Dam Replacement	Furthermore, at the end of the shutdown, there was an additional delay when WSTD attempted to re-establish flows to SVWTP through the existing 44-inch pipeline. A leak was discovered at two sampling lines teeing off of the 44-inch pipeline, just downstream of the existing Vault V34. The sample lines were not shown in the Contract Drawings, resulting in DFSJV demolishing them. They were directed to plug the sample lines.								x		x					x	
280	WD-2551	Calaveras Dam Replacement	On a separate note, corrosion (pitting) damage was discovered inside the 72-inch pipeline (approximately 1,000-foot section remaining) as it was being relined. The pitting was localized to four sections of the pipeline, and could be described as a "shotgun" pattern which ranged in size from pinholes to the size of a dime. Initial nondestructive (ultrasonic) testing (UT) at the sections of concern was conducted and showed that the residual pipe wall thickness was less than the original design thickness, and in some cases, approximately half. As a temporary fix to get the outlet works back into service prior to the end of the shutdown period, DFSJV was directed to weld steel patches on the inside of the pipe and reline the pipe.										x					x	
281	WD-2551	Calaveras Dam Replacement	It was agreed upon that during the next shutdown, a comprehensive scan can be done to verify the full extent of the 72-inch pipeline defects. It is important to note that at this time, the extent of pitting in the pipeline cannot be ascertained. There is some evidence that the soils and/or groundwater adjacent to the pipeline may be sulfuric in nature, which may be attributing to the corrosion. However, no tests have been done to date. A cathodic protection system can be installed to potentially minimize corrosion effects.										x						

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282	WD-2551	Calaveras Dam Replacement	There was confusion regarding the EBRPD Sunol Regional Park fire hydrant fed off of the Calaveras Outlet Pipe. WSTD handled this hydrant situation well by periodically checking the hydrant pressure and then communicated the hydrant situation to the East Bay Regional Park District.							X		X							
283	HH-914R	Rehabilitation of Existing San Joaquin Pipelines	Work and issue status communication		The daily CRT status e-mails to the CRT Shutdown Team were useful in providing a general big-picture of the shutdown. However, the CRT Shutdown Team members were unaware of many of the details and incidents taking place during the shutdown. Perhaps another more detailed tier of daily status e-mails, for select CRT Shutdown Team members, would be useful			X											
284	HH-914R	Rehabilitation of Existing San Joaquin Pipelines	Shut-down provisions.		The contract provisions, related to shutdowns, need to be reviewed by the Shutdown Coordinator prior to advertising the contract.						X	X							X
285	HH-914R	Rehabilitation of Existing San Joaquin Pipelines	On January 10, 2010 when the AEP Contractor S.P. Rados was working near the 126-inch temporary bulkhead there was a near miss incident involving three Contractor employees who were bumped as the bulkhead blew out in one piece. Fortunately, these workers were uninjured.		The lesson learned is thatthe Contractor cannot design the bulkhead assuming only frictional restraint. The bulkhead design needs to account for both pressure and live loads. Needed specific performance requirements for temporary ulkhead built by Rados at Alameda East. Temporary ulkhead at Alameda East needed to withstand pressure in both directions.					X		X					X		
286	HH-914R	Rehabilitation of Existing San Joaquin Pipelines	At Tesla Portal the Contractor PCL had to deal with gassy conditions during the bladder installation in the three San Joaquin Pipelines. The upstream isolation valves were insufficient in keeping methane out of the work area. The contract did not include this condition and a proposed change order (PCO) was necessary.		Contract should have included provisions for the Contractor to deal with gassy conditions so as to have avoided a PCO		X					X				X			
287	HH-914R	Rehabilitation of Existing San Joaquin Pipelines	At Tesla Portal, there was a minor issue with the contract shutdown dates. The shutdown dates were different in contract sections 01650, 0802, and Q2. The PCL contract pre-dated the procedure which requires the sections of the contract, related to shutdowns/startup, to be reviewed by the Shutdown Coordinator before the contract is authorized.		The shutdowns/startup dates should be reviewed by the Shutdown Coordinator before the contract is authorized.						X	X							
288	HH-914R	Rehabilitation of Existing San Joaquin Pipelines	The lesson learned is that improbably events, such as lightning strikes, can occur during shutdowns which can jeopardize the shutdown. Had the HTWTP remained down longer than 8 hours, major steps would have been necessary to maintain the water supply. WSIP Construction Management Procedure No. 022, Attachment 5 Had JMB been working during at BPS during the lightning strike, it would have taken slightly longer to have activated the BPS pumps to feed		This illustrates the importance of taking necessary steps to ensure that the water treatment plants have contingency plans for lightening strikes and scrutinizing the synergistic effects of multiple shutdowns				X			X							
289	HH-914R	Rehabilitation of Existing San Joaquin Pipelines	During the CRT Shutdown, work was being performed on the Moccasin tailrace by a fourth contractor. In order for this work to commence, Moccasin Reservoir needed to be drained. This is accomplished by opening Gate #3. While trying to open Gate #3, it was inadvertently closed. This caused the 40 foot stem to bend and		The lesson learned is that a qualified gate operator needs to be on site and verify direction of gate movement, especially when it comes to gates that a very seldom used. Also the correct wiring of all motors should be double checked after it has been re-installed					X									X
290	HH-914R	Rehabilitation of Existing San Joaquin Pipelines	Contractor S.P. Rados did not follow the AEP disinfection plan regarding placing calcium hypochlorite tablets in the tunnel at the end of the job and relied on localized disinfection instead.		Better communication with the contractor may have helped.					X							X		
291	HH-914R	Rehabilitation of Existing San Joaquin Pipelines	LOTO – some locks didn't have tags, resulting in ownership questions.																X

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292	HH-914R	Rehabilitation of Existing San Joaquin Pipelines	The number of unclassified electrical installations at the Tesla Portal site justified removing power from the site during the shutdown to isolate ignition sources.		For similar future outages, the overhead PG&E incoming power lines should be replaced with underground lines terminating in an explosion proof transformer and main breaker. This would allow SFPUC to shut off the power to the site at will without PG&E's assistance, and would remove the ignition hazard posed by the overhead lines (from transformer malfunction or line-to-line arcing aused by a falling branch). The valve operators on the San Joaquin pipelines and associated electrical gear should be replaced with electrical gear rated for hazardous atmospheres (Class 1).				x		x							x
293	HH-914R	Rehabilitation of Existing San Joaquin Pipelines	All electrical installations that can potentially come into contact with the CRT atmosphere should be suitably rated for hazardous locations. This includes installations at Tesla, Thomas Vent Shaft, Thomas Construction Shaft and Mocho Shaft. This recommendation has been made several times in the past and was the subject of a report by Weiss and Associates, but improperly rated electrical installations are still present outside the CRT. While it is possible to isolate these installations during a planned shutdown, the possibility of neglecting to do so in an emergency situation coupled with the loss of operational flexibility or capacity with these installations deenergized, present risks that could be avoided with proper installations.		All electrical installations that can potentially come into contact with the CRT atmosphere should be suitably rated for hazardous locations				x		x							x
294	HH-914R	Rehabilitation of Existing San Joaquin Pipelines	Bulkhead design		SFPUC should design any future ventilation bulkheads in the CRT and that design should include a positive connection to the tunnel liner capable of sustaining ventilation loads, and impact from men and machinery operating in the area.				x		x	x							
295	WD-2555	Crystal Springs Pipeline No. 2 Replacement	Per 01650, the Contractor was required to submit a SOR for each shutdown on each pipe segment. For this particular shutdown, the CM Team submitted the SOR on the Contractor's behalf because the deadline for the submittal would have been before the NTP date. As a consequence, the CM Team had to write a SOR on behalf of the								x	x							x
296	WD-2555	Crystal Springs Pipeline No. 2 Replacement	This shutdown should have had an Incidental Water Management Plan since the Burlingame end of the pipe at Valve K30 was singled blocked.																x
297	WD-2555	Crystal Springs Pipeline No. 2 Replacement	Ranger Pipeline should have managed their staffing better for this shutdown. Also, Ranger Pipeline should have been more proactive with Burlingame regarding permit issues.							x									
298	WD-2555	Crystal Springs Pipeline No. 2 Replacement	Ranger Pipeline should have followed the contract requirements more closely for the nozzle and air valves. There was an issue with a nozzle too close to the ground and there was a need to change a mis-installed air valve.							x							x		
299	WD-2555	Crystal Springs Pipeline No. 2 Replacement	Ranger's subcontractor had a grout over pressurization incident will working on the sliplined pipe thereby causing 400 to 700-feet of out-of-round pipe. A damage report was produced. About 40 feet of pipe (5 sticks) was in very bad shape and had to be replaced. Northwest Pipe supplied 620 feet of the replacement pipe.		The contractor needed better quality control/oversight of the grouting subcontractor					x							x		

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300	WD-2555	Crystal Springs Pipeline No. 2 Replacement	Ranger requested options to deal with the leaking water that was potentially entering CSPL2 from Service Connection 82 in Hillsborough. WSTD suggested that Ranger replace the Service 82 valve. The CM made arrangements the previous week with WSTD to have the service shutdown on June 21 to perform this valve replacement. On June 21; WSTD, the Lead QA, and Ranger removed the LOTO off Service 82. The Lead QA confirmed with Hillsborough that their pumps were off line and proceeded to allow Ranger to begin replacing the existing valve off the main CSPL2 line. At around noon, Ranger cut a small slit in the valve line and discovered the line was still live. The Lead QA informed WSTD of the situation immediately and requested WSTD close the valves at the meter.															x
301	WD-2555	Crystal Springs Pipeline No. 2 Replacement	A 210 feet long pipe section in Hillsborough had to be sliplined due to a wooly sunflower found on the right of way						x			x							
302	WD-2555	Crystal Springs Pipeline No. 2 Replacement	This shutdown took 101 days longer than anticipated with 67 days of delay were due to Ranger Pipelines and 34 days were due to WSTD.																
303	WD-2555	Crystal Springs Pipeline No. 2 Replacement	OCR/LOTO plan timing		The signed OCR/LOTO plan should have arrived 15 days prior to the shutdown rather than 1 day after the shutdown's out of service date														x
304	WD-2555	Crystal Springs Pipeline No. 2 Replacement	There was a near miss at the PG&E Yard on 4/5/12 when unexpectedly the pipe partially refilled with water.		WSTD should have checked the status of the air valve over the creek prior to turnover to Ranger. Both WSTD and the contractor need to verify the air valve status during the LOTO walkthrough prior to the start of the shutdown, in order to avoid potential working in water issues														x
305	WD-2555	Crystal Springs Pipeline No. 2 Replacement	This shutdown originally was scheduled from 7/18/11 – 10/28/11 for a duration of 103 calendar days. This shutdown was advanced a month and lengthened by 23 calendar days on 1/4/11 to accommodate a request from the CSPL2 Project Team. During this shutdown, Ranger Pipeline encountered numerous underground utilities which were unanticipated field conditions. As a consequence, this shutdown was completed 21 days ahead behind schedule.									x							
306	WD-2555	Crystal Springs Pipeline No. 2 Replacement	After CSPL2 was repressurized at the end of the shutdown, a leak was identified immediately adjacent to the tie-in location at Site 16. Other areas of deterioration were identified during the shutdown and repaired by Ranger at SFPUC's direction									x					x		
307	WD-2555	Crystal Springs Pipeline No. 2 Replacement	On November 25, 2011 (almost a month after return to service), the Elm Court service connection number 115 in South San Francisco failed, requiring shutting the section down again for repairs. A third-party preliminary investigation, in December 2011, indicated that the most likely failure cause was insufficient restraint on the 12-inch-nominal-size Smith-Blair Type 411 bolted coupling at this service connection. In addition, the incident coupling was improperly restrained against axial movement; it had not been buried and the manifold thrust blocks had not been restored. Furthermore, the elbow downstream of the coupling had an angle of installation that was 70 degrees instead of the design angle of 37 degrees.		During shutdowns the pipeline sections adjacent to tie-ins should be inspected and the condition assessed. Repairs should be contemplated as a risk mitigation measure prior to return to service, as leaks or breaks may occur following repressurization. Pipeline repairs are more efficient if performed during shutdowns, rather than after return to service (requiring another shutdown, or work on a live pipeline).					x		x						x		

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308	WD-2555	Crystal Springs Pipeline No. 2 Replacement	LOTO Issues		Furthermore, once the Contractor turns the pipe back over (returns key) to SFPUC Operations, under no circumstances should the Contractor or Operations go back into or work in a zone not under full LOTO control. This includes confined spaces at SFPUC service connections. Established LOTO procedures must be followed by all parties working in LOTO zones including areas subject to potential inundation. In any event, LOTO communication among all parties needs improvement including awareness of all current, upcoming, and proposed tasks that may affect the prosecution of LOTO. SFPUC Operations and the CM Team can re-define the LOTO zone by modifying the LOTO plan if one element of the zone (like a service connection) still needs work while the rest of the system is handled back to SFPUC Operations and energized. Previously shutdown documentation has focused on main line outages. Outages of services are														x
309	WD-2555	Crystal Springs Pipeline No. 2 Replacement	Ranger was not ready to turn over the pipeline on the day they had previously indicated that they would be ready to do so. Ranger should have informed the Project Construction Manager that their work progress did not accommodate the WSTD disinfection schedule and changes needed to be performed. The Project CM worked with Ranger to install the required air valves needed for the disinfection and allowed Ranger to perform the air venting for the air valves after the disinfection of this portion of CSPL2 was completed. The air valves that required movement had to be locally disinfected with bacteriological testing.		The lesson learned is that an independent assessment of the contractor's progress in the field is necessary. A site walkthrough to determine if the contractor is ready for turn over must be done earlier than the day of the scheduled disinfection. All the air valve work must be completed prior to the contractor turning over the pipe to WSTD.					x								
310	WD-2555	Crystal Springs Pipeline No. 2 Replacement	This shutdown was completed 25 days behind schedule because of artifact issues and a longer-than-anticipated disinfection. The Contractor dug up what looked like a Native American hearth on 10/14/11. On 11/10/11, the archeological site had been cleared.		A more extensive investigation of potentially archeological area should have been performed prior to the start of the shutdown.							x							
311	WD-2555	Crystal Springs Pipeline No. 2 Replacement	In the future, Ranger Pipeline needs to install all bulkheads advertised in the SOR. Because one bulkhead was missing, Ranger Pipeline and had to install a plate which resulted in a Notice of Noncompliance. This was also is a confined space/engulfment safety issue		Ranger Pipeline needs to convey changes to the SOR in writing prior to starting the shutdown, especially if the changes involve decisions not to install the bulkhead at Site 11.														x
312	WD-2601	Crystal Springs/San Andreas Transmission System Upgrade (CSSATU) Project	This was an unanticipated shutdown which was added to the shutdown schedule on 5/26/10 per a WSTD request.						x			x							
313	WD-2601	Crystal Springs/San Andreas Transmission System Upgrade (CSSATU) Project	Overall, this first Kiewit shutdown accomplished its purpose but it did not go well since Kiewit was not well prepared		Kiewit's SOR work plan should have had a detailed material/equipment/tools list. The pre-shutdown meeting should have addressed whether all the necessary materials were on site. Proper shutdown preparation is vital.					x	x	x							
314	WD-2601	Crystal Springs/San Andreas Transmission System Upgrade (CSSATU) Project	There was a mismatch with outer diameter of new versus old pipe, the joint shrink wrap arrived late, and the bolts and washers were the wrong type.		Kiewit should have inventoried their flange bolts and should have had shrink wrap on hand prior to this shutdown.							x					x		
315	WD-2601	Crystal Springs/San Andreas Transmission System Upgrade (CSSATU) Project	This shutdown lasted 3 weeks longer than planed. Kiewit's work activities caused an initial delay; subsequent delays were caused by heavy rain and the high level of Crystal Springs Reservoir.																

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316	WD-2601	Crystal Springs/San Andreas Transmission System Upgrade (CSSATU) Project	SCHEDULED DURATION: 398 calendar days ACTUAL DURATION: 772 calendar days Ideally, Kiewit should have used better means and methods in the execution of the work associated with this shutdown. In general, Kiewit needed better planning and coordination. Specifically, Kiewit should have had a startup and testing plan. Also, Kiewit and the subcontractors had generally poor production and lack of quality control	• Concrete placement (2 month delay) • Fish screen issues • Additional dowels were required because the existing CSOS2 tower concrete was too hard • The tower liner rebar installation took longer than planned compounded by Kiewit's quality control issues with the rebar • The CSOS2 tower was not perfectly round • Valve actuator issues • Tower lid corrective work • Tower cap epoxy repairs to the seating area • Problems with the high-pressure stainless steel hydraulic lines (316 versus 304 stainless steel) • Problem with the lower adit valve. • Testing interference due to Shutdown CSSATU/8 (Force Main and Crystal Springs Pump Station). WSTD tested the control of the valves, the hydraulic pumps, etc. with the Force Main out and with HTWTP shutdown • Shutdown CSSATU/3 System Outage Request submittals (Section 01650) • Start-up and testing submittals (Section 01660) • CSOS2 tower concrete placement drawings • CSOS2 tower liner rebar production, lack of quality control and rework • CSOS2 additional Division of Safety of Dams					x	x		x								
317	WD-2601	Crystal Springs/San Andreas Transmission System Upgrade (CSSATU) Project	During construction it was decided that a cathodic protection system (temporary sacrificial anodes and long term impressed current) was needed									x							
318	WD-2601	Crystal Springs/San Andreas Transmission System Upgrade (CSSATU) Project	Kiewit's fabrication of the tower cap included some warping which required modifications to the seating surfaces.														x		
319	WD-2601	Crystal Springs/San Andreas Transmission System Upgrade (CSSATU) Project	While opening the valves around the fall of 2012, Kiewit flooded the CSOS2 tower using the middle adit in about 2 minutes. As a result, three magnesium anodes and a part of the old fish screen were found at the bottom of the tower. Overall, an inspection showed no obvious structural damage but it did blast off some debris from the tunnel and tower walls which needed cleanup.							x									x
320	WD-2601	Crystal Springs/San Andreas Transmission System Upgrade (CSSATU) Project	The contract requires Kiewit to operate and maintain water quality monitors during construction activities, but these requirements were not adequately met by Kiewit as frequent issues with the monitors were observed. It took Kiewit about a year to maintain an inventory of spare parts for these monitors. Kiewit should have ensured that the water quality monitors were consistently functional (operational with data communication) during construction phase and should have taken preventive and contingency measures.							x	x						x		
321	WD-2601	Crystal Springs/San Andreas Transmission System Upgrade (CSSATU) Project	The OCR/LOTO plan had Operations Manager approval but lacked the approval of the Division Manager. This procedural oversight should have been noticed by the Shutdown Coordinator. The Division Manager was aware of this shutdown																x
322	WD-2601	Crystal Springs/San Andreas Transmission System Upgrade (CSSATU) Project	Kiewit should not have furnished several appurtenances lacking NSF 61 documentation contrary to the contractual requirements.							x							x		

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323	WD-2601	Crystal Springs/San Andreas Transmission System Upgrade (CSSATU) Project	This shutdown took 284 days longer than planed due to Kiewit's slow production, inefficient means and methods for dredging, lack of quality control, and rework required at SAOS2. Kiewit's position was that the delay was primarily to changed field conditions associated with hard rock outcroppings discovered near the adit, but the City disagrees. Hard rock was to be expected per the contract and borings taken in the reservoir indicate site conditions materially similar to those indicated in the Contract and reference drawings	Shutdown acceleration letters were sent to Kiewit on 4/30/12 and 5/8/12 and schedule recovery meetings with Kiewit and SFPUC were held thereafter.	Ideally, the geotechnical exploration should have found the 5 hard rock outcroppings by the SAOS2 tower during the Planning or Design Phases. In hindsight, this shutdown should have had liquidated damages in the contract for late completion. WSTD Operations did not realize in 2009/10 that they needed the full 140 MGD from HTWTP instead of 120 MGD and the Shutdown Delivery Team did not fully realize the interdependence/sequence of the key shutdowns from the other WSIP projects. The critical nature of this shutdown was not realized fully when the contract was written especially given the numerous other WSIP shutdowns going on during the timeframe of this shutdown.				x		x	x				x				
324	WD-2601	Crystal Springs/San Andreas Transmission System Upgrade (CSSATU) Project	Dredging subcontractor Cooper Crane hit large areas of solid rock where a dredging barge and pneumatic breakers/splitters were necessary. The underwater work was slow and included multiple rework. In addition, contractor delays were experienced from lower-expansion joint fabrication issues and material delivery issues. Kiewit/Veolia used double shift for stopping schedule slip near the									x							
325	WD-2601	Crystal Springs/San Andreas Transmission System Upgrade (CSSATU) Project	This shutdown work scope was not completed and required a revised shutdown CSSATU/4a to fix some incomplete items. The delay in Shutdown CSSATU/4 and the follow up Shutdown CSSATU/4a (now underway) have delayed the subsequent shutdown Kiewit CSSATU/6 (SAOS2)							x									
326	WD-2601	Crystal Springs/San Andreas Transmission System Upgrade (CSSATU) Project	The valve leakages associated with this shutdown should have been specified in section 01650 of the contract.									x							
327	WD-2601	Crystal Springs/San Andreas Transmission System Upgrade (CSSATU) Project	This shutdown took 17 days longer than planed due the inadequacy of Kiewit's attempted means and methods.	Ideally, Kiewit should have completed all the work during the original shutdown CSSATU/4 so that this follow shutdown would not have been necessary.						x									
328	WD-2601	Crystal Springs/San Andreas Transmission System Upgrade (CSSATU) Project	The shutdowns for the CSSATU, SVWTP, and HTWTP projects were interconnected and furthermore the shutdowns at SVWTP and HTWTP were staggered. The shutdown of SAOS2 affected the HTWTP capacity needed to support the water system during the full SVWTP SCADA shutdown in October 2012. Kiewit was behind schedule for Shutdown CSSATU/4 and had to bring SAOS2 back on line, in a partially completed state, in order to support the SVWTP		This demonstrates the importance of coordinating the various WSIP shutdowns in order to avoid system risks and delays to other WSIP shutdowns				x			x							
329	WD-2601	Crystal Springs/San Andreas Transmission System Upgrade (CSSATU) Project	DSOD changed the pressure ratings of the valves and piping which delayed the order for these components but did not delay the shutdown									x							
330	WD-2601	Crystal Springs/San Andreas Transmission System Upgrade (CSSATU) Project	There was a 6 foot bust in the horizontal and vertical dimension for the makeup pipe received from the pipe fabricator Ameron. The Contractor had a custom joint fabricated for this makeup pipe.									x					x		
331	WD-2601	Crystal Springs/San Andreas Transmission System Upgrade (CSSATU) Project	A 42-inch diameter manway was installed in the pipe on a slope above Crystal Springs Road which was fabricated to be horizontal; so, a miter cut/weld was required to install this manway as vertical.														x		
332	WD-2601	Crystal Springs/San Andreas Transmission System Upgrade (CSSATU) Project	This was one of the key CSSATU Project shutdowns and was originally scheduled for 4/4/11 - 5/5/11 for a duration of 32 calendar days. In April this shutdown was delayed to 4/20/11 - 5/21/11. The System Outage Request (SOR) arrived on 1/26/11, SOR Revision 1 arrived on 2/16/11, and SOR Revision 2 arrived on 4/8/11 and was approved on 4/12/11. Part of the reason for the multiple SORs was that the scope of work for this shutdown changed as described below. The approved/signed Operational Change Request (OCR)/LOTO arrived on 4/20/11, the same day that the shutdown started		The WSTD OCR/LOTO plans should have arrived much sooner than they did. Per the Shutdown Procedure 022, the approved OCR/LOTO plan from WSTD was due 21 days in advance of a shutdown. In this case, the OCR/LOTO plan arrived 21 days late.														x

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333	WD-2601	Crystal Springs/San Andreas Transmission System Upgrade (CSSATU) Project	LOTO		A more thorough LOTO was enacted for this shutdown than for the pre-2011 WISP shutdowns. This safety review was due to CalOSHA concerns (12/22/10 letter to SFPUC) regarding work inside pipes (double block and bleed and potential engulfment). A review of the valving was performed by WSTD prior to writing the LOTO plan and prior to the start of this shutdown. The referenced 2010 CalOSHA letter was triggered by an earlier shutdown associated with the Bay Division Pipeline 5 Project.															x
334	WD-2601	Crystal Springs/San Andreas Transmission System Upgrade (CSSATU) Project	SOR/LOTO timing		SORs need to arrive 60 days prior to the start of the shutdown. The signed lock out/tag out plan needs to be received prior to the start of the shutdown not after the start of a shutdown for safety reasons															x
335	WD-2601	Crystal Springs/San Andreas Transmission System Upgrade (CSSATU) Project	The pending Kiewit work had to be stopped until the signed WSTD OCR/LOTO plan was in place.		The shutdown procedure needs to be followed in order to have a safe, effective shutdown.															x
336	WD-2601	Crystal Springs/San Andreas Transmission System Upgrade (CSSATU) Project	An unexpected offset was discovered in the Force Main which required Kiewit to order and install specials									x							
337	WD-2601	Crystal Springs/San Andreas Transmission System Upgrade (CSSATU) Project	The second dive (Shutdown CSSATU/15) was an unexpected shutdown due to an unanticipated field condition, namely the discovery of 5 rock outcroppings near the UCSR outlet structure. At the 8/16/11 Shutdown Coordination Meeting, WSTD stated that 1-week's notice for this dive inspection was sufficient. The System Outage Request (SOR) arrived and was signed on 8/22/11. The Shutdown was stopped by the Shutdown Coordinator on 8/23/11 due to lack of shutdown approvals. The Operational Change Request/LOTO was signed on 8/24/11. The SOR Revision 1, for a re-scheduled dive inspection, was signed on 8/29/11.	Shutdown CSSATU/15 had to be rescheduled since the shutdown approval could not be processed fast enough.	The Shutdown Delivery Team needs more than a few days notice to process an Operational Change Request and Lockout/Tagout (LOTO) Plan. WSTD could not deliver on a 1-week turnaround time for the shutdown paperwork which caused Kiewit to reschedule their dive inspection.					x									x
338	WD-2601	Crystal Springs/San Andreas Transmission System Upgrade (CSSATU) Project	There was confusion and a difference of opinion as to whether the dive inspections should be handled via a System Outage Request (SOR) or an Access Request Form (ARF). Ultimately, the CSSATU/15 outage request was submitted via a SOR form. There was confusion as to whether the LOTO at CSPS had to be electrical only or both electrical and mechanical. Ultimately, the CSSATU/15 LOTO plan included only pump electrical disconnects as this was deemed								x	x								x
339	WD-2601	Crystal Springs/San Andreas Transmission System Upgrade (CSSATU) Project	The SORs should be signed by the Contractor not the subcontractor. The Contractor should have had their locks on the electrical disconnects in the CSPS																	x
340	WD-2601	Crystal Springs/San Andreas Transmission System Upgrade (CSSATU) Project	The dive inspection demonstrated the different anchors are needed for the hydraulic and air lines									x							
341	WD-2596	Harry Tracy Water Treatment Plant Long Term Improvements	WSTD should have had a written and distributed the LOTO plan prior to the out of service date instead of 2 days after the out of service date																	x
342	WD-2596	Harry Tracy Water Treatment Plant Long Term Improvements	The Project Team should have made an extra effort to complete everything scheduled during this shutdown, whether deemed important or unimportant, so as to reduce future risk to the project.		By postponing work elements intended for this 2012 shutdown into 2013, the chance of completing the HTWTPLT contract on time was lessened.					x										
343	WD-2596	Harry Tracy Water Treatment Plant Long Term Improvements	Overall, this was a successful shutdown with many work elements.		Kiewit prepared a detailed SOR that was thoroughly reviewed and modified. The CM Team conducted several weekly pre-shutdown planning meetings, including review of the SOR, which helped make this shutdown a success															x
344	WD-2596	Harry Tracy Water Treatment Plant Long Term Improvements	The Construction Management Team was extremely organized for this shutdown and was checking every aspect of the shutdown's progress which helped make this shutdown a success.		The construction management team and the Contractor had multiple shutdown breakout meetings			x		x										

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345	WD-2596	Harry Tracy Water Treatment Plant Long Term Improvements	LOTO Plans should be prepared and available well in advance of the shutdown commencement to ensure proper coordination and planning for the safety of all personnel																x
346	WD-2596	Harry Tracy Water Treatment Plant Long Term Improvements	Isolation		Many of the isolation and supply problems were identified prior to the shutdown and planned for in advance							x							
347	WD-2596	Harry Tracy Water Treatment Plant Long Term Improvements	Valve leakage		Verify leakage rates and existing conditions of piping & valve connections during design phase to avoid additional work scope dependent on a shutdown							x							
348	WD-2596	Harry Tracy Water Treatment Plant Long Term Improvements	During preparation work in advance of Shutdown HTWTPLT/5, the Valve T11 bottom flange bolts and valve body were found by the Contractor to be rusted and the flange had to be cut off thereby creating this new shutdown. Also, an unexpected 2-inch elbow was found on the bottom of the valve. Fortunately, a new 78-inch butterfly valve and actuator was available from the City as it was previously procured under the HTWTP Short-Term Improvements project.		Ideally there should have been a valve condition assessment performed during the Planning or Design Phases to incorporate the work within the first project shutdown. Exercising equipment and condition assessment of connections at critical valves within the system should be performed as part of routine preventative maintenance so that operational support, shutdowns, design, and installation can be planned and completed within budgeted resources and scheduled before major risks to the system become apparent.				x			x					x		
349	WD-2596	Harry Tracy Water Treatment Plant Long Term Improvements	This shutdown was deferred several times as negotiations with the Contractor were finalized, material was procured, and a favorable shutdown window was identified																
350	WD-2564	HTWTP Short-Term Improvements - Remaining Filters	Contract allowed multiple full plant shutdowns of 5 days in duration and partial shutdowns; An unplanned contract electrical shutdown was also scheduled and completed from 12/16/08 to 12/17/08. Due to system constraints and material/equipment procurement, Contractor (NTK) and Ops had to reshuffle proposed contract shutdowns.		A more thorough review of the Contract could have prevented the shutdown confusion; however, the initial construction sequencing assumed a certain sequencing of construction work and thus the numbers of shutdowns were identified. In practice, given the Operational constraints, the need for operational flexibility/reliability, and the variable contract delivery method, there will be reshuffling of some contract work. In this case, the Contract allowed the Contractor to ask for other non-contract scheduled shutdowns, subject to the approval of Ops. Review Contract shutdown provision more thoroughly prior to advertisement				x		x	x							
351	WD-2564	HTWTP Short-Term Improvements - Remaining Filters	Unable to complete valve replacement due to existing conditions. Additional time was required to re-install the existing valves to allow filters to return to service.		New valves should have been tested at least manually after each installation. This would have allowed Operations to terminate the shutdown early or provided the opportunity to use the remaining window to perform further field verification of existing conditions at each filter while the Full Plant Shutdown remained in effect. It is not good design practice to place a butterfly valve directly adjacent to a Venturi meter – this does not ensure that the butterfly valve disc will have enough clearance to fully open. Additionally, construction projects to upgrade existing facilities own an inherent risk that existing equipment may not be completely compatible with replacement equipment in regard to physical dimension. As-built drawings often do not reflect whether existing equipment or facilities have been modified improperly. Therefore, it is beneficial to schedule shutdowns for the purposes of field verification so that adequate preparation can be implemented for assurance that work will be completed as				x			x					x		
352	WD-2564	HTWTP Short-Term Improvements - Remaining Filters	Additional request for a Full Plant Shutdown was not anticipated in order to complete replacement of the 24-inch effluent flow control valves at Filter No.'s 1-6						x			x							
353	WD-2564	HTWTP Short-Term Improvements - Remaining Filters	Repair of an unforeseen leak on existing piping		Building contingency time in the requested shutdown window allows an opportunity to address unforeseen issues in a timely manner while minimizing the planned impact to Operations				x		x	x							

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354	WD-2564	HTWTP Short-Term Improvements - Remaining Filters	This Partial Plant Shutdown was not part of the original WSIP System Shutdown Matrix, and was necessary to incorporate design errors and omissions realized during the first Flocculation Basin No. 1 & Upper Inlet Channel Shutdown HTWTPST/3.		Verification of existing facility conditions through site visits and more careful review of Contract Drawings by all designers during the design phase. Shutdowns of facilities during the design phase would be beneficial in verifying existing facility conditions to ensure that all issues are addressed and Contract Documents are				x			x								
355	WD-2564	HTWTP Short-Term Improvements - Remaining Filters	Vertical wall expansion joints at the gullet walls were added to the scope of work for Filter No. 8 when designers on the Long-Term project realized that a fault line existed across the filter and it would be more cost-effective to address the issue during this project than at a later time.									x							
356	WD-2564	HTWTP Short-Term Improvements - Remaining Filters	The shutdown windows should be consistent with the shutdown constraints disclosed in the Contract Documents.		Shutdown constraints written into the Contract Documents should take into consideration schedules that work best with expected Plant rates and availability of staffing for support, including during City holidays.				x		x	x							
357	WD-2564	HTWTP Short-Term Improvements - Remaining Filters	Safety of personnel working inside the filters needs to be considered when evaluating the shutdown duration of the related Applied Channel.						x			x							x
358	WD-2591	Lower Crystal Springs Dam Improvements	Kiewit needed a higher-quality System Outage Request and better shutdown planning, especially on the equipment needed to move SS#5 (lift versus crane) and their in-channel worker safety plan. Four revisions of the SOR were excessive.						x			x							x
359	WD-2591	Lower Crystal Springs Dam Improvements	The shutdown SOR mentioned raising SS#5 but there was nothing in the Kiewit work plan or in the Shutdown Matrix concerning moving SS#5 upstream by 20 to 30 feet. This change was due to an unknown pipe which conflicted with the footing of the SS#5. Furthermore, the WSTD Operations Analyst, in charge of the Channel flow instrumentation, was unaware that SS#5 was being moved upstream. (A meeting was scheduled on 9/7/11, and Operations Representative was on site but not the Operations Analyst.)						x	x		x							
360	WD-2591	Lower Crystal Springs Dam Improvements	On the day that this shutdown was completed, a hydraulic issue regarding the Isco 4250 level probe was discovered. Prior to Shutdown LCSDI/1; this Isco level probe, located immediately downstream of the vehicle bridge, was functioning. The Isco meter was disconnected during this shutdown, it is scheduled to be reinstalled by WSTD but the reconnection is not part of this contract. The raising of SS#5 did not affect the Isco probe; it was the upstream repositioning of the SS#5 sample pump intake that caused the hydraulic disturbance (possibly a hydraulic jump) at the Isco probe. It is not clear if new vanes were installed by Kiewit or if the old vanes							x						x			
361	WD-2548	Lake Merced Pump Station Essential Upgrades	Originally, both shutdowns were scheduled for January 2010. In July 2009, Shutdowns LMPS1/1 and LMPS1/2 were modified to occur simultaneously in April 2010 and the duration of the combined shutdown was increased from 11 to 21 days Shortly before the shutdown, 14 additional days were added as a contingency for the CDD disinfection activities. The System Outage Request (SOR) was received with plenty of lead time for review and approval. The Operation Change Request (OCR) was not received by the Shutdown Coordinator until the day prior to the start of the shutdown.		The OCR needs to be distributed in a timelier manner for review by the Shutdown Delivery Team.			x											x
362	WD-2548	Lake Merced Pump Station Essential Upgrades	The contract was somewhat clear on the scope of work for the shutdowns and did not clearly define the durations for the CDD and contractor activities associated with these 2 shutdowns.		The contract predated the shutdown procedure and lacked review by the Shutdown Coordinator. The Contract shutdown provisions should have been more clearly defined.				x		x	x							
363	WD-2548	Lake Merced Pump Station Essential Upgrades	Valves outside of facility buildings were not identified to turn counterclockwise to close in contract documents. All valve operators turn directions were revised at the factory or in the field due to delivery constrains.		Contract documents needs to identify SFWD's unique valve operator turn procedure to prevent confusion.							x							

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364	WD-2548	Lake Merced Pump Station Essential Upgrades	Original interior lining material specified in the Contract requires seven (7) days curing time which would have been impossible to meet the shutdown schedule. An alternate lining material manufacturer were identified and approved prior to the shutdown which required only two (2) hours cure time.		Contract documents needs to identify a short cure time lining material for numerous reasons. (1) Shutdown duration can be minimized and have less disruption to the system. (2) Work can be performed in shorter duration resulting in labor cost savings (3) Shorter cure time will result in cost savings on special				x			x							
365	WD-2548	Lake Merced Pump Station Essential Upgrades	This shutdown took 69 days longer than planned. The Sutro Discharge Pipe was found to have an asbestos wrap which caused a 2-week delay in this shutdown. The Contractor was 3 weeks behind schedule due to compaction grouting issues. Also, there were minor shutdown delays due to work in the Pulgas Channel on the Peninsula and due to the Charles Schwab golf tournament									x							
366	WD-2548	Lake Merced Pump Station Essential Upgrades	The LOTO Plan Part C arrived 4 days after the start of the LOTO. Part C should have been shared with the Shutdown Delivery Team prior to the start of the LOTO. It is not clear if LOTO Part C was shared in advance with the Contractor																x
367	WD-2548	Lake Merced Pump Station Essential Upgrades	The Contractor should not have substituted gearboxes for the Sutro Pumps which created some problems. The Sutro Pumps 4 and 5 required extensive troubleshooting following installation and the issues for these pumps are still being resolved as of 2/27/12. The Sutro Pumps worked intermittently. The pumps had motor starter protection system issues which did not allow the motor to start so the Contractor had to arrange re-programming of this protection. The J&S gearbox squeaked and needs to be replaced with an Alma gearbox. Although, the Sutro Pumps are usable, the 7-day pump testing has been delayed until the contract-specified gearbox is installed								x						x		
368	WD-2498	New Crystal Springs Bypass Tunnel	The Operational Change Request (OCR) form was approved at a very late date. This was primarily because contract requirements for submittal of the Systems Outage Request (SOR) were different from that of the current WSIP CM Plan; the Crystal Springs contract required the SOR to be submitted only 21 days in advance of the shutdown. The SOR was submitted 45 days in advance, but went through a review lasting 20 days before being returned with comments, then was re-submitted 22 days in advance of the shutdown, and approved 18 days in advance. Preparation of the OCR did not start until after the SOR was approved. The Shutdown Coordinator did not receive the OCR for review until the day after the shutdown started		This could have been avoided by sending a scanned copy of the OCR by e-mail instead of by inter-office mail.				x										x
369	WD-2498	New Crystal Springs Bypass Tunnel	WS&TD crews attempted to locate the blow-off during the summer prior to the shutdown, but did not complete the dewatering appurtenance survey until November 2009, when it was confirmed that as-builts for the Sunset Supply blow-offs were incorrect. If the dewatering appurtenances (vacuum valves, blow-offs, and discharge locations) had been surveyed much earlier, then there would have been adequate time to pursue a MPD without putting the project schedule at risk.		1. For each future dewatering operation a dewatering plan should be developed and an appurtenance survey be performed of all equipment which will be used during the dewatering operation. The dewatering plan should list all equipment which will be used for the dewatering, and all proposed discharge points. The survey should include: • Field verification of blow-offs, both to confirm existence of a useable blowoff, and compatibility of the blowoff with dechlorination activities (some of the older blowoffs drain directly to creeks). • Operability of vacuum valves. This should be performed as far in advance of the shutdown as possible, in case modifications are required. Any environmental approvals required should be identified and pursued far in advance of the shutdown				x			x							x

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370	WD-2498	New Crystal Springs Bypass Tunnel	Normally leaking water from a valve flows downhill and collects at low points in the pipeline, which is the contractor's responsibility for pump out. The empty volume of the pipeline is used as storage for leakage water, so that the contractor can limit pumping to allowed project work hours. During times when work is not allowed, water would collect in the empty pipeline, with the contractor operating pumps as needed to keep the water level at a lower elevation than the work site.		The contractor's dewatering plan should include a comparison of allowable project work hours against available storage time in the pipeline. If storage is limited, pumping over the weekend, and/or at night may be required. For NCSBT/1, storage time was forecasted to be only 16.5 hours, so the project had to ask permission to pump extended hours, 7-days a week. If required, extended work hours may require environmental approval, and should be pursued far in advance of the shutdown.				x	x	x	x								
371	WD-2498	New Crystal Springs Bypass Tunnel	Pre-shutdown inspection		The pre-shutdown inspection was very useful					x		x							
372	WD-2498	New Crystal Springs Bypass Tunnel	Intense planning leads to exceptional results.		The primary lesson learned was intense planning leads to exceptional results. The coordination between the SFPUC, CM team, and a responsible contractor was the primary reason for the completion of this project on time.					x									
373	WD-2498	New Crystal Springs Bypass Tunnel	Bi-weekly coordination meetings.		Bi-weekly coordination meetings with CM team, Operations and Communications headed off issues before the shutdown					x									
374	WD-2498	New Crystal Springs Bypass Tunnel	Internal Operational communication.		Internal Operational communication with-in the SFPUC can always be improved with daily updates and progress reports to the whole organization.					x									
375	WD-2498	New Crystal Springs Bypass Tunnel	Community relations.		• Tell the neighbors what to expect - noise, light, 24 hour work. • Provide the neighbors with the longest time frame for completing work and then finish early!			x											
376	WD-2498	New Crystal Springs Bypass Tunnel	During this shutdown, the HTWTP staff was augmented for the swing and graveyard shifts using operators from SVWTP. The extra staffing was a contingency in case something went wrong at HTWTP during this shutdown.		The SVWTP operators should have been trained at the HTWTP well in advance of Shutdown NCSBT/2. The augmented staff should have been handled using overtime with existing HTWTP operators instead of borrowing SVWTP operators. As such, the trained staffing at HTWTP was inadequate for the swing and graveyard shifts during this shutdown.														x
377	WD-2498	New Crystal Springs Bypass Tunnel	Overlap of CM Team shifts.		The CM Team worked two 12-hour shifts per work day and held meetings at the start and end of each shift with all personnel overlapping (as is customary when running multiple shifts). These meetings were very effective in keeping staff up-to-the-minute in the midst of a fast paced operation					x									
378	WD-2498	New Crystal Springs Bypass Tunnel	Much of the surface pipeline was installed prior to the shutdown, which enabled the shutdown work activities to be reduced. However, it also required installation of excavation support in close proximity to the in-service pipeline. In order to reduce risk, the City chose to bear the cost of special non-vibratory sheet pile installation for piles within 10 feet of the existing pipeline.		Design criteria should be developed, and contractor proposed means and methods should be evaluated, with potential changes to construction timing in mind.				x			x						x	
379	WD-2498	New Crystal Springs Bypass Tunnel	Also related to construction timing, the early completion of the tunnel and surface pipeline enabled them to be disinfected early and made possible a contingency plan wherein only a portion (the east end) of the shutdown work had to be completed to be ready for an emergency return to service.		If this had been recognized earlier and if WSTD so desired, the financial incentive for the contractor could have been structured to include only the east end.				x			x				x			
380	WD-2498	New Crystal Springs Bypass Tunnel	Quality control during the shutdown had to be carefully monitored. Because the work was significantly accelerated, the CM Team's quality assurance responsibilities were stretched a bit to fill in for some of the contractor's quality control.		In the future it might be appropriate for the specifications to require a shutdown-specific quality control submittal from the contractor.					x	x						x		
381	WD-2498	New Crystal Springs Bypass Tunnel	Field issues needed to be resolved quickly. Details that had not been included in the contractor's submittals and had not been discussed at the pre-construction meetings had to be evaluated very quickly because the consequences of delay were greater than at other times during the project.		This meant that EMB needed to be available around the clock and that the CM Team had to resolve non-design issues quickly.					x		x							

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382	WD-2498	New Crystal Springs Bypass Tunnel	Better ways to motivate the Contractor to work faster could reduce cost and risk to the SFPUC.		The liquidated damages specified in the contract needed to be tied to the end of the shutdown rather than to the end of the shutdown window.						X					X		X	
383	WD-2498	New Crystal Springs Bypass Tunnel	Plan for 24 hr a day operations.		The project team needs to plan for potential 24 hour per day construction prior to construction so that a Minor Project Modification is unnecessary.					X									
384	WD-2498	New Crystal Springs Bypass Tunnel	The shutdown duration was 2 days longer than originally planned in part due to the long time required to manually operate the valve. Valve G20 had not been used in 40 years	• G20 had to be operated manually, and it was a very slow process. The CDD machinist estimate a 1000 turns = 1" of lift. • The G20 actuator motor was pulled by the CDD machinists and sent to Dahl-Beck to be rebuilt. • G20 Electrical control compartment is extremely corroded including holes in the bottom and several latches gone. • Electrical components, circuit breaker, reversing contactors, push buttons, term strip, and heater are all frozen and/or corroded (inoperable). • The motor & limit switch compartment are also corroded.							X							
385	WD-2498	New Crystal Springs Bypass Tunnel	This activity was added to the shutdown schedule in July 2010. This shutdown was done concurrently with an operational shutdown to re-test valve G20 in preparation for the upcoming NCSBT/2 shutdown in January 2011. Closing valve G20 cut the Peninsula water system in half for a brief period.	There were some issues with the simultaneous WSTD testing of Valve G20 which occurred during the NCSBT/5 actuator motor replacement. On 11/30/10 during the G20 testing, HTWTP was running at a low rate and Baden Pump Station was running at the same time while the Baden Contractor was working on instrumentation and control issues. The water pressure sagged on the Peninsula due to these simultaneous events causing one Hillsborough neighborhood to go dry and causing cavitation of the Hillsborough pump. Hillsborough filed a claim with the City for pump damage. Cal Water also complained about low system pressure. Had the HTWTP operators known in advance of the valve testing and simultaneous BPS operation, the plant could have increased their rate thereby eliminating the low pressure condition.	The HTWTP operators should have been informed of the G20 valve testing			X											
386	WD-2498	New Crystal Springs Bypass Tunnel	The NCSBT/5 System Outage Request arrived on 11/12/10. The Operational Change Request and Lockout/Tagout Plan arrived on 11/18/10.		Ideally, the SOR should arrive 60 days prior to the shutdown.														X
387	WD-2498	New Crystal Springs Bypass Tunnel	One other observation is that the actuator work on the G41 and G42 butterfly valves required a flow curtailment to perform the work safely. This coordination requirement should have been included in the SFPUC/ShankRR contract.						X			X							
388	WD-2581	New Irvington Tunnel	The need for one of the necessary sampling taps was identified late (after Pipe installation and backfill was completed and this delayed the shutdown return to service. This was located adjacent to the 60-inch butterfly valve B-9. By the time WQD visited the site, it was backfilled and it was not possible to verify the appurtenances and sample taps. This site visit could not have been done until all appurtenance information was received by the WQD engineers. Information provided on drawings usually takes time to review, extract, and verify through communications with WSTD and/or Construction Management before it can be confirmed through site	STP was demobilizing at the time of the tap change order and charged $34K for this sampling tap which involved excavation of the a ten -foot section BDPL 1 pipe, installation of the 2-inch tap and corporation stop, backfill and then restoration of the area including re-installation of best management practices. This tap could have cost approximately $2K to $5K if it was originally shown on the drawings or identified before the pipe was backfilled.	The Water Quality Division should have done their site visit earlier to identify a 2-inch sampling tap necessary for the disinfection adjacent to Valve B-9.					X		X							
389	WD-2581	New Irvington Tunnel	STP had a high quality SOR which helped make this shutdown a success.																X

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390	WD-2581	New Irvington Tunnel	As-built information.		The Construction Management Team should be more vigilant and be aware that the as-built drawings together with a comprehensive list of all new appurtenances with location and station number information should be submitted to WSTD and WQP timely and circulated					x										
391	WD-2581	New Irvington Tunnel	During the excavation and removal of the existing BDPL2, the pipe was found to be located deeper than shown on the drawings and required additional sand backfill bedding at additional costs.									x								
392	WD-2581	New Irvington Tunnel	Additionally, due to the Northwest Pipe shop drawings referencing elevations at the top of the pipeline instead of at flow line (invert), BDPL2's wye connection to the manifold retained approximately 6 inches of water along the bottom, as was observed after the hydrostatic test. URS designed this section to not retain any water when the pipeline is emptied, yet because of the differences in elevation as surveyed at the top of the pipe versus at the flow line (invert), a small amount (puddle) of water was retained in the invert								x							x		
393	WD-2581	New Irvington Tunnel	Shut-down planning.		STP held a couple breakout meetings with the SFPUC to plan this shutdown which were useful. STP was highly efficient in performing this shutdown, had a high quality SOR					x										
394	WD-2581	New Irvington Tunnel	There was also a slight delay demolishing and removing and massive thrust block that was encountered on the north side of the existing BDPL 3 when being excavated. This was not anticipated or shown as large massive block and was more than twice as much as shown on the Contract Drawings									x								
395	WD-2581	New Irvington Tunnel	WSTD had one critical issue (item 1. below) that was not identified and communicated to the STP until the pipeline was ready to be turned over to the Contractor. BDPL3 was dewatered by WSTD/Operations and the overall leakage was measured at 130 gpm. The contractor, STP was prepared to control leaking water from Valve C10 which was approx. 35 gpm. However the leakage from the services and isolation valves on lower portion of BDPL3 was approximately 95 gpm and the pipeline was filling below the contractor's job site. WSTD dewatered the lower portion of BDPL3 an additional three days until STP was able to mobilize a sub-contractor. The sub-contractor set up dewatering operations at the Cal Trans storm drain at Mission Blvd south of Lima Terrace and assumed the dewatering from WSTD. Dewatering was required every other day by the Contractor for the duration of this		The leakage could have been communicated earlier to the Contractor and the contractor should be prepared for leakage on both sides of the job site. All projects should be prepared for leakage and have a plan to control water entering both sides of a connection site. However, WSTD did not realize that approximately 95 gpm would be leaking downstream and how fast it would fill up the pipe just below the excavation.					x		x								
396	WD-2581	New Irvington Tunnel	After the BDP 3 was put back in operation, WSTD and the Designer, URS, realized that an air release was needed just below the 78-inch valve (C9) to bleed off the trapped air. This will require a future change order and it will be installed during the BDPL 4 shutdown in November 2012				x			x		x								
397	WD-2581	New Irvington Tunnel	Work on the 96-inch manifold pipe was added during the shutdown that reduced the dynamic thrust on the connections during hydrotesting				x					x								
398	WD-2581	New Irvington Tunnel	Overflows from adjacent pipes or vent stacks can occur during shutdowns. A previous WSIP Shutdown AS4/3 also experienced an overflow on 2/17/10 at Alameda East Portal while construction workers were present. For Shutdown NIT/3, the overflow occurred above the STP job-site excavation and flowed into it at night without					x				x								x

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399	WD-2581	New Irvington Tunnel	Field tests by System 3 discovered inconsistencies in the new transformer readings compared with factory tests. The project team recommended reconnecting the existing old transformer while the project team is resolving the technical issues. The substation power using the old transformer was restored on 3/24/10. Another Shutdown NIT/6 needs to be scheduled to disconnect the old transformer and re-install a new or repaired transformer once the technical issues are resolved.	Based on the problems that have been encountered during the final assembly and testing of the WEG transformer, the SFPUC and consultant MWH had some concerns regarding placing this transformer into permanent service. During field testing the following problems requiring corrective action were encountered: • A test of the transformer oil revealed that it did not meet specifications. • Ratio testing readings between H2-H3 and X3-X0 were high, and H2-H3 resistance was high indicating high side connection problems at Phase C. The transformer was opened up and after inspection it was found that the Phase C tap connection had broken. The other connections were checked and the Phase C weld connection was replaced with compression fitting. • Insulation testing of all six of the high side CT's resulted in very low readings. It was found that the CT lead conduit was filled with water. It is unclear at what point the water entered the conduits and if water is present at other conduit	The factory inspection for the WEG transformer was performed by a highly-qualified electrical engineer. The transformer inspection was adequate and the transformed met performance specifications at the factory. The pre-purchase contract for sensitive equipment such as transformers must include packaging/crating and shipping specifications. There must be a requirement that during shipping the equipment must be protected from precipitation and dust. Also, the contract needs to provide requirements for fabrication, material specification, and welding details. It is recommended that more thorough investigation of the vendors and their product quality be done before they get into the SFPUC approved list of providers.							x					x		
400	WD-2581	New Irvington Tunnel	This shutdown covered the electrical switchover of the transformer and involved pre-purchasing of equipment. This shutdown was aborted due to defective equipment. Shutdown NIT/5, which preceded NIT/6, was also aborted due to this defective transformer.		In the future, more stringent transformer specifications are needed as well as actual performance data for similar transformers sold by the manufacturer.							x							
401	WD-2581	New Irvington Tunnel	When the Calaveras Substation was down, the SFPUC facilities in the Sunol Valley ran off their emergency generators. Emergency generators cannot be used to support construction activities for durations greater than about 30 hours per year. The SFPUC received a notice of violation for the Bay Area Air Quality Management District		Either a variance request from the BAAQMD needs to be approved prior to using emergency generators to support construction activities or portable backup generators must be rented from an already permitted company.				x			x							
402	WD-2581	New Irvington Tunnel	This shutdown took 105 days longer than planned due to WSTD staffing resource issues/priorities unrelated to STP and due to a break in Hayward's portion of the 24-inch pipe (unrelated to STP). About 5 days of delay were due to late Northwest Pipe delivery; however, the there was a floating shutdown start date. STP could not start their		STP should have provided more notice to Northwest Pipe for the pipe order					x									
403	WD-2581	New Irvington Tunnel	OCR/LOTO plan timing		The signed OCR/LOTO plan should have arrived before the shutdown rather than 2 days after the out of service date.														x
404	WD-2581	New Irvington Tunnel	STP's geotechnical drilling contractor accidentally core drilled through the 24-inch service line and then had to reroute the service connection using ductile cast iron pipe to accommodate future STP construction in the area. STP restored the service connection to its original location during this shutdown. This was a simple shutdown		The drilling subcontractor needs to pay attention to marked underground pipes so as to not drill through a water service to a major SFPUC wholesale customer.					x							x		x
405	WD-2563	Pulgas Discharge Channel	Shut-down coordination.		The key to the success of completing the project within the scheduled shutdown was close coordination, well thought out planning, proper safety tools on-hand, and continuous monitoring between project team and operations staff.					x									

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406	WD-2573	Pulgas Balancing Reservoir	The end of this shutdown was delayed by 41 calendar days due to a combination of rain delays and Contractor-caused delays. The overall delay pushed this shutdown into the high water demand period making system operation more difficult for WS&TD. The delay of this shutdown completion also delayed the start of another WSIP shutdown in the Pulgas Discharge Channel.		The rain day allowance that is typically provided for in the Contract General Conditions should never be removed. This allowance would have reduced the non-compensable days entitled to the Contractor. For work that is required to be completed within a wet weather season, the rain day allowance should be substantially increased beyond normal rainfall duration for added measure. The Contractor should have taken a conservative approach in planning for material procurement and						x	x				x		x	
407	WD-2573	Pulgas Balancing Reservoir	The warranty inspection for Valve G-14, which was installed under the Baden & San Pedro Valve Lot Improvements Project (Contract No. WD-2556), was scheduled for September 7, 2011, but was not performed.		The warranty inspection for Valve G-14 could have been coordinated to coincide with the actual shutdown period of the Pulgas Balancing Reservoir to allow the opportunity for a required inspection and eliminate the need for a separate shutdown for the inspection. Work that is outside the Contract scope or related to other projects that requires a shutdown of the same facility should be coordinated well in advance of the shutdown completion to avoid the need for additional shutdowns.					x								
408	WD-2573	Pulgas Balancing Reservoir	Shut-down window planning.		Shutdown windows that are convenient to ensure smooth operation of the water supply and distribution system are not necessarily feasible construction windows. The roof replacement could not have been completed within the originally conceived shutdown windows. Phasing of the roof replacement over two wet weather seasons would not have guaranteed a complete and				x			x							
409	WD-2573	Pulgas Balancing Reservoir	Material substitution.		Alternative products without a supported history of performance and application experience by the installing contractor should not be permitted. The Contractor's lack of quality control was a major factor as was the subcontractor F. Rodgers' performance.					x		x					x		
410	WD-2607	Pulgas Balancing Reservoir	The only suggestion would be to start the shutdown at 6:00AM instead of 7:00 AM which would provide enough time inside the channel, cause less arguments with the Contractor, and avoid having to pay the Contractor for not giving them a total of 8 hours per day		The Contract should not promise the Contractor 8 hours a day for a Channel Shutdown to avoid a claim since the Contractor may have to get out of the Channel at 2 PM.				x		x								
411	WD-2607	Pulgas Balancing Reservoir	This shutdown originally was not recognized as a shutdown by the designers and was not in the contract. This shutdown was added to the WSIP shutdown schedule in April 2011. The contractor NCCI defaulted towards the end of this contract (on 4/16/11) and Trinet took over for the CO2 tank portion of the work. This shutdown took 19 days longer than planned due to the default of the NCCI.		This shutdown was not identified in the Contract and there was no liquidated damage leverage over the Contractor.				x		x	x						x	
412	WD-2607	Pulgas Balancing Reservoir	The official request for this work, although signed by the Operations Representative on the date the work started,		should have been submitted earlier than it was and shared with the Shutdown Delivery Team. The Access Request Form (ARF) should have arrived prior to the start of the work. This work should have been submitted as a System Outage Request (SOR) 60 days prior to the start of this shutdown.														x
413	WD-2575	San Antonio Backup Pipeline	This shutdown was complicated due to the failed pipeline disinfection and multiple pipe leaks. When it came time to put the transmission main back into service, multiple leaks were discovered which had to be repaired by WSTD. WSTD, over a period of several days, placed clamps over the leaking pipe sections. No sooner than WSTD fixed one leak, then another leak appeared and WSTD run out of repair clamps. Eventually, a total of 17 leaks had to be repaired by WSTD.		In the future, Ranger needs to be more diligent with their pipeline sanitary work practices and more thoroughly flush the newly laid pipe so that the pipe is more likely to have a successful disinfection.					x							x		

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414	WD-2575	San Antonio Backup Pipeline	This shutdown was not in the Contract and was introduced into the shutdown schedule on 9/21/12.		WSTD did not ask to put any shutdown restrictions on this work during the Design Phase. In retrospect, this shutdown should have been scheduled in the construction contract.				x			x							
415	WD-2575	San Antonio Backup Pipeline	Another thing that could be done better on almost all of these shutdowns was to make sure that valves or other appurtenances for disinfections are put into the design. We had to have the contractor install line valves (provided by WSTD but still a change order for labor) in order for the shutdown to work. On SABPL/4 we had to have extra taps put in for the sodium hypochlorite injection and						x			x							
416	WD-2575	San Antonio Backup Pipeline	The SOR arrived with short notice. The SOR was not signed by the Regional Construction Manager and the Operations Representative. WSTD struggled with producing an OCR and LOTO plan due to the new personnel changes. Never-the-less shutdowns are supposed to have Operational Change Requests signed by the WSTD Operations Manager. Furthermore, shutdowns are supposed to have written LOTO plans. On 9/5/13, WSTD's pluming supervisor stated that there was no Lotto plan for this job. The valves where locked out but the 12-inch raw water shutdown valves did not have identification numbers. All other protocol was followed including a tailgate and walk thru with the contactor.		The SOR was supposed to have been submitted by the Contractor 60 days prior to the start of the shutdown and be signed by the Regional Construction Manager and the Operations Representative but was not. In the future, all shutdowns will have a LOTO plan attached to the OCR. The Resident Engineer shall stop all shutdowns lacking written pre-approval from the WSTD Division Manager.												x
417	WD-2513	San Andreas Pipeline 3 Installation	Overall this shutdown failed due to lack of a lockout/tagout (LOTO) plan, the Contractor starting work with authorization from the WSTD Division Manager, lack of the Contractor verifying that valves were closed before starting work on the pipe, confusion as to whether this was a shutdown or a tie in, and miscommunication between the SFPUC and the Contractor. The shutdown should have had minimal impact on the water system due to isolation valve T64M. The shutdown was stopped on 10/26/10 as the Contractor was chipping into a live pipeline, an obvious safety issue.		All shutdowns need OCRs so that official shutdown approval is provided by the Operations Division Manager. All shutdowns need LOTO plans coordinated with WSTD, the CM Team, and the contractor per the Shutdown Procedure P022 and the SFPUC Lockout/Tagout Program (Attachment 7 to Shutdown Procedure). There will be a training session soon for RCMs, PCMs, RPMs, Operatiaons Representatives, and Operations staff on LOTO procedures.												x
418	WD-2513	San Andreas Pipeline 3 Installation	The shutdown was rushed due to the congested WSIP shutdown schedule in late 2010. Normally the System Outage Request (SOR) is due 60 days in advance of the shutdown. The Shutdown Delivery Team tried to accommodate a quicker turnaround of the SOR. The first SOR arrived on 10/5/10; but, the shutdown dates were inconsistent in the SOR. The dates were later corrected. The contractor's work plan did not provide a site plan and there was no WSTD Operational Change Request (OCR). A sketch of the tie-in and nearby valves was never provided.		It does not always pay to accelerate a shutdown to try to accommodate the Contractor. The Shutdown Delivery Team needs time to carefully evaluate any shutdown including SAPL3/1.					x							x
419	WD-2513	San Andreas Pipeline 3 Installation	This shutdown was mistakenly scheduled to occur after the contract final completion date; but, the error was corrected in late 2010 when Mountain Cascade's first SOR arrived.		The shutdown dates should be compared to the contract final completion date to make sure the shutdown can be accommodated. Neither the Shutdown Delivery Team nor the scheduler (PCE) noticed this scheduling discrepancy.						x	x							
420	WD-2513	San Andreas Pipeline 3 Installation	The awkward, almost vertical orientation of the gate valve (different from the Contract plans) was a result of the City's insistence that the Contractor avoid tapping into the horizontal lockbar.						x			x							
421	WD-2513	San Andreas Pipeline 3 Installation	The main lesson learned is that this piping intertie was not designed properly. All interties need isolation valves.		The design of the intertie should have included two isolation valves to make the intertie usable.				x			x							
422	WD-2513	San Andreas Pipeline 3 Installation	The System Outage Request (SOR) arrived on 11/1/10. The Operational Change Request (OCR) and LOTO plan arrived on 11/4/10.		Generally, the SOR should arrive 60 days in advance of the shutdown at the shutdown should not start unless there is a written circulated LOTO plan.														x
423	WD-2513	San Andreas Pipeline 3 Installation	The Pratt butterfly valve delivery, necessary for the shutdown, was delayed.		The Contractor needs to carefully track valves necessary for shutdowns.					x							x		
424	WD-2566	San Antonio Pump Station Upgrade	The SOR arrived on 5/14/10		Usually, SORs are needed 60 days prior to the shutdown														x

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425	WD-2566	San Antonio Pump Station Upgrade	The SOR mentions lockout/tagout (LOTO) for the main breaker; however, there was no WSTD LOTO (MAXIMO) plan. A LOTO plan should have been in place for sub-shutdowns SAPS/1a and SAPS/1b for safety reasons. There was a retroactive WSTD Operational Change Request (OCR) memo dated 10/5/10		All shutdowns need LOTO plans coordinated with WSTD, the CM Team, and the contractor per the Shutdown Procedure P022 and the SFPUC Lockout/Tagout Program (Attachment 7 to Shutdown Procedure).														x
426	WD-2566	San Antonio Pump Station Upgrade	The machinists originally did not want the pumps pinned. At a later date, the machinists changed their minds after some field work was done. This detail was added during the installation phase.		It would have been best if the pinning details could have been worked out during the Design Phase; however, in field decisions are hard to anticipate during the Design Phase.				x			x							
427	WD-2566	San Antonio Pump Station Upgrade	The contract documents called for this shutdown to be a 46-day outage to Breaker 52L, which would result in electric Pumps 8, 9, and 10 to be off-line the entire duration. The 46-day scheduled duration for this shutdown was excessive, as the contractor indicated that they could complete the electrical modifications to Breaker 52L within 3 days. Additionally, the SAPS could not lose use of the three 1000 hp electric pumps for 46 days.						x			x							
428	WD-2566	San Antonio Pump Station Upgrade	Modifications to Breaker 52L required that Hetch Hetchy Power be shutdown and the SAPS facility to run on standby power available through the existing 100 kW generator. However, during the project, Operations expressed concern over using their existing 100 kW generator due to potential permitting issues associated with the existing 100 kW generator. As a result, MCI provided a temporary generator to provide electrical power and SCADA power to the SAPS facility during the SAPS/3 shutdown.		Future contract document preparations should consider such potential limitations from Operations or include clear direction within the shutdown descriptions themselves to have the contractor provide temporary power				x			x							
429	WD-2566	San Antonio Pump Station Upgrade	The phasing in the original contract documents for the three SAPS shutdowns resulted in some downtime of construction activity, which was avoided by accelerating the SAPS/3 shutdown.		Further analysis of shutdowns, phasing, and how it relates to construction activity could be performed in future contract document preparations.				x			x							
430	HH-935A	San Joaquin Pipeline System	In this case, the OCR/LOTO plan arrived 22 days late as it arrived on the day after the shutdown out of service date		Per the Shutdown Procedure 022, the approved OCR/LOTO plan from HHWP is due 21 days in advance of a shutdown.															x
431	HH-935A	San Joaquin Pipeline System	The duration was three times longer than expected due to a mix of owner and contractor issues. The Contractor had painting problems; the SFPUC misaligned the valve flanges and changed the mortar transition detail at the tie in; and problems were discovered after turnover on 12/27/11 with defective metallurgy on two tee crotch plates and use of unspecified steel for pipe fabrication that delayed		This shutdown should have been classified as a "most critical" shutdown and it should have had a Work Around Plan. T				x			x						x	
432	HH-935A	San Joaquin Pipeline System	Two tee crotch plates (both from Oregon Steel) crackeddeformed when the pipeline was pressurized. Some of the cracks extended into the weld areas. One tee was designed by the SFPUC and one tee was designed by WBB's fabricator Jifco.		The contract documents should have required that the pipe tees have had a PE-stamped/signed design package and PE-stamped shop drawings. All fittings/specials should have been hydrotested at the shop.							x					x			
433	HH-935A	San Joaquin Pipeline System	The crotch plate steel was defective.		For future contract material specifications, the specification should read "The steel shall be ASTM A572, Gr. 42" instead of "the steel shall conform to ASTM A572, Gr. 42"							x					x			
434	HH-935A	San Joaquin Pipeline System	The tee crotch plates were mis-designed with an inadequate plate thickness. The AWWA design formula was unclear. The project team contacted Ameron to see how they interpreted this design formula and then contacted AWWA		As a result of this conversation, the AWWA is considering clarifying their tee design formula. Subsequently, the crotch plate thickness was increased (design change) by 1/8 of an inch							x					x			
435	HH-935A	San Joaquin Pipeline System	Qualified subcontractors.		Bring in a qualified coatings firm with plural component spray equipment (more than a week of the shutdown was lost trying to correct coating defects)					x	x	x								
436	HH-935A	San Joaquin Pipeline System	Work planning.		Labor - Working two 10-hour shifts per day rather than one crew working from 10-18 hours, Hiring seasoned piping laborers					x	x									
437	HH-935A	San Joaquin Pipeline System	Work planning and inspections.		WBB providing earlier notice of new workers and planned work requiring special inspections					x							x			

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438	HH-935A	San Joaquin Pipeline System	Work submittals.		Having all welding procedures in place. Submitting certification for all possible welders and coating applicators before starting work. This needs to be done for welders added as well as planned welders					X							X		
439	HH-935A	San Joaquin Pipeline System	Inspecting the work.		Documenting all work, before covering it up, with extensive, up-close photos that clearly identify the joint					X							X		
440	HH-935A	San Joaquin Pipeline System	The duration of this shutdown was four times longer than planed due to the issues with the failed tees at Emery/Pelican and the leaking valves at Roselle														X		
441	HH-935A	San Joaquin Pipeline System	One valve was damaged in shipment at a New York dock. This valve was repaired but not re-tested with water and this valve subsequently leaked														X		
442	HH-935A	San Joaquin Pipeline System	The SOR had a contingency plan but this shutdown did not have a Work Around Plan.		In retrospect, this shutdown should have been classified as a "most critical" shutdown and it should have had a Work Around Plan				X			X						X	
443	HH-935A	San Joaquin Pipeline System	The SFPUC should not have dealt directly with Olsen and Contractor should have been better informed on what was happening. The work and plan had been in discussion since at least 3/14/11 (over three weeks) and the work plan from Olsen has apparently been in hand since 3/30/11. The SFPUC delayed the Olsen work involving SFPUC's leaky valves and at the last minute on 4/7/11 the SFPUC requesting things that can not be done in time and the SFPUC ran		The coordination effort with Olsen to adjust the valves at Roselle could have been better coordinated					X									
444	HH-914R	San Joaquin Pipeline System	The owner-furnished valve testing was poorly coordinated and not well understood. All triple offset valves should be tested bi-directionally while it is still possible to do so		For pre-purchased valves, the Contractor needs to accept the valves. If at all possible, pre-requisitioned equipment should not be part of a construction contract						X					X	X		
445	HH-914R	San Joaquin Pipeline System	Thise shutdown took four times longer than planed due to crackdeformed tees at Pelican and Emery and leaking valves at Roselle														X		
446	HH-914R	San Joaquin Pipeline System	During the Design Phase the project team was told that the electric actuator did not require a shutdown; but, in the end the installation required a shutdown..	During the actuator testing it was discovered that the motor was not operational and a replacement motor was installed while a new motor was being obtained. The valve supplier also changed their minds on what was needed	The design team should have identified a need for a shutdown for the electric actuator.				X			X							
447	HH-935C	San Joaquin Pipeline System	This shutdown lasted 8 days longer than planed due to failure of the slide gate actuator at Red Mountain Bar and difficulties in restarting the chlorinator at Tesla Portal as the Hetch Hetchy Aqueduct was coming back on line																
448	HH-935C	San Joaquin Pipeline System	The delivery of 85 feet of pipe required for the replacement of SJPL1 was delayed by the pipe manufacturer (Ameron) until 12/17/11; however, Contri was able to adjust their schedule in order to meet their commitment to turn over the completed facilities to HHWP by the required completion date of 12/23/2011.							X									
449	HH-935C	San Joaquin Pipeline System	Another deviation from the plan was that the blowoff valves at Cashman Creek could not be replaced during the planned shutdown window as a required environmental permit had not been obtained. The blowoff valve for SJPL3 at Cashman Creek was the only valve that was ultimately replaced during this shutdown. A future shutdown will be required to replace the blowoff valves on SJPL1 and SJPL2 at a									X							

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450	HH-935C	San Joaquin Pipeline System	There was a disconnect in the contract between the Sanitary Specification 01565 and the valve specifications 015101 and 015103 regarding NSF 61 requirements. Specification 01565 mentions compliance with NSF 61 for components in contact with drinking water but it does not specifically mention valves. On the other hand, the gate valve specification 015101 and the butterfly valve specification 015103 do not reference Specification 01565 and they do not specifically state that valves must be NSF 61 compliant. These requirements are specified in Waterworks Standards under Title 22 of the California Code of Regulations		The contract specifications need to be revised to eliminate ambiguities regarding NSF 61 compliance						X							
451	HH-935C	San Joaquin Pipeline System	This shutdown took 48 days longer than planned. The majority of this delay was due to waiting for the EMB/CMB letter stating SJPL3 was ready to operate and waiting for a letter from the HHWP consultant verifying that the valves installed were adequate for single valve isolation		There needs to clearer communication between HHWP and EMB regarding expectations regarding operational certification letters.			X											
452	HH-935C	San Joaquin Pipeline System	Also, this shutdown window was delayed due to late pipe deliveries from Ameron in part, as a result of late design changes to accommodate a fiber optic acoustic cable that needed to be rerouted around the new isolation and throttling valves for SJPL3.		The pipe manufacturer Ameron was overloaded with work and could not deliver pipe pieces on schedule. Late design changes impacted the submittal process and pipe was not released for fabrication with sufficient time to meet the original scheduled outage dates in December, 2011. Ameron provided only a 1-week notice that the pipe delivery was going to be late. Construction Management staff needs to track pipe deliveries well in advance to avoid delivery surprises. However, for this shutdown delivery tracking would not have helped since too many Ameron workers were leaving for the Christmas holidays and it was not possible for Ameron to run three shifts. The lesson learned is that critical pipe deliveries should not be scheduled during holidays.					X		X				X				
453	HH-914R	San Joaquin Pipeline System	This shutdown took four times longer than expected due to deformed tees at Pelican and Emery and leaking valves at Roselle.		More shop and field hydrotesting and leak testing of specials and valves is necessary. Also, hydrotesting is necessary after manholes are installed							X					X			
454	HH-914R	San Joaquin Pipeline System	This shutdown required a shutdown of the overhead power lines for crane safety.	The HHWP power users Modesto/Turlock prefer as much advance notice on power outages as possible. These power end users complained when the shutdown dates were changed as they have to make preparations on their end for alternate power				X	X										X
455	HH-914R	San Joaquin Pipeline System	Valve leak testing.		All valves need to be leak field tested at their final destination after the actuators are installed per AWWA requirements.							X					X		
456	HH-935A	San Joaquin Pipeline System	Per the Shutdown Procedure 022, the approved OCR/LOTO plan from HHWP was due 21 days in advance of a shutdown. In this case, the OCR/LOTO plan arrived 22 days late		In a perfect world, the OCR/LOTO plans should have arrived much sooner than they did.														X
457	HH-935A	San Joaquin Pipeline System	This shutdown was not in the Contract but was added at a later date.						X			X							
458	HH-935A	San Joaquin Pipeline System	Mary Wells reported on 10/14/11 that the 54-inch spool piece (see photo) intended to be installed by WBB was not installed due to pipe fit up issues on the section between SJPL3 and 4 (upstream) at the Pelican site. This work will be moved to a separate contract to be installed at a future date		WBB should have performed more detailed Quality Control in the field to assure fit-up so this work could have been accomplished during the shutdown					X	X	X					X		
459	HH-935A	San Joaquin Pipeline System	Some of the dismantling joints had a coating issue where the coating needed to be replaced		The CM team, QA inspectors and the Contractor were able to remove the dismantling joints and take them to a facility to be recoated and then reinstalled at the sites in short order.														

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460	HH-935A	San Joaquin Pipeline System	This shutdown on SJPL3 was one of the most unusual and complicated shutdowns that HHWP has experienced since it involved pressure testing valves, performance and functional testing valves, testing pressure transducers, removing blind flanges, and installing dismantling joints to complete the crossover connections from SJPL2 to SJPL3. To perform these tasks communication with the CM team, Contractor, testing administrator, and HHWP Operations was critical. Central Dispatch, insuring that all personnel were in place, did a wonderful job. The QA inspectors were in-place to perform testing and sign-off as items that were installed. The Contractor actually had workers and materials necessary to complete the work.		As you know these shutdowns are time critical and require all mangers to have step-by-step planning in place to be able to finish in the time allowed. The CM team did a wonderful job organizing this work, HHWP Operations personnel set up and operated equipment for the performance and function testing and led a critical role in achieving the results for the testing. Again the Contractors field personnel worked long hours to meet the shutdown schedule and expedited materials to complete the work.					X									
461	HH-935A	San Joaquin Pipeline System	The OCR/Switching Orders(LOTO) should have been signed prior to the start of this shutdown.		Both WBB and MCI should have submitted their SORs sooner, especially MCI.														X
462	HH-935A	San Joaquin Pipeline System	3-week schedule preparation.		WBB and MCI need to include power outage shutdowns in their 3-week look-ahead schedules.					X									X
463	HH-935A	San Joaquin Pipeline System	Communications.		SFPUC staff is inundated with e-mail, so the MCI SOR sent by e-mail was missed (misplaced). For a shutdown this important, a phone call needs to made by the Project CM to the Operations Representative alerting him/her to the fact that the SOR has been sent.			X		X									
464	HH-935A	San Joaquin Pipeline System	Communications.		The Pelican Project CM confirmed that LOTO was in place by e-mail which was good practice. It would have been better to have also confirmed this verbally to the Operations Representative. There is no record that the Tesla Project CM confirmed that LOTO was in place.			X											X
465	HH-914R	San Joaquin Pipeline System	This shutdown was not in the Contract but was added in October 2011.						X			X							
466	HH-914R	San Joaquin Pipeline System	Shut-down planning.		This shutdown was planned and closely coordinated with the Construction Management Team, HHWP Operations, and MCI which helped make this shutdown run smoothly.					X									
467	HH-935B	San Joaquin Pipeline System	This shutdown was not in the contract		Ideally this shutdown should have been included in the construction contract.				X			X							
468	HH-935B	San Joaquin Pipeline System	This shutdown took 91 days longer than planed mainly due to Azul Works (MCI's subcontractor) taking much longer than expected to complete their work. There were some engineering issues concerning whether the new drain line would require interior lining. Also, there were some material procurement issues (3 weeks) and		The out of service date should have followed the date of the approved SOR and OCR plans.					X		X							
469	HH-935B	San Joaquin Pipeline System	SOR vs. Access Request		The lesson learned is that this SOR should have been an Acesss Request since it did not impact any operational SFPUC systems or equipment.						X								
470	JOC 34-30	San Joaquin Pipeline System	This shutdown took 16 days longer than planned because the fabrication of the spool piece took longer due to the complexity of the fit up.																
471	JOC 34-30	San Joaquin Pipeline System	The conventional SFPUC construction contracts are set with a detailed shutdown procedure requiring the contractor to provide a System Outage Request, a shutdown work plan, a resource-loaded shutdown schedule, NSF 61 documentation, and an Incidental Water Management Plan. JOCs need to have shutdown provisions added to the contract. Power Engineering was cooperative in providing these documents even though they were not in the contract.		The Job Order Contract (JOC) should have had detailed shutdown provisions.						X					X		X	

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472	JOC 34-30	San Joaquin Pipeline System	SJPL3 had to be isolated at Tesla Portal with some of the ultraviolet (UV) reactors being locked open for surge protection while workers were inside SJPL3. . Locking open the reactors provides an open path for flow; but, 1) wastes energy, 2) increases the risk of serving noncompliant water, and 3) defeats the automatic response capability of the UV system that would automatically close the reactor valves in the event of an emergency condition while placing a replacement UV reactor into service. Furthermore, the lockout/tagout (LOTO) necessary for locking open the reactors is extremely cumbersome involving over 100 lockout points		Eventually, a system fix is needed so that the UV reactors will not have to be locked open				x		x							x
473	HH-935C	San Joaquin Pipeline System	This shutdown was the result of a differing site condition in that it was determined that the existing standpipe was not structurally adequate and needed to be replaced so that a temporary guy-wire bracing system could be installed to allow construction of the Oakdale Portal Protection Structure to commence. The existing guy wires on the Stand Pipe did not have adequate clearance for construction drill rigs and excavators to work around.		Ideally this shutdown should have been identified in the HH-935C contract.				x		x							
474	HH-935C	San Joaquin Pipeline System	The System Outage Request (SOR) arrived on 4/5/12 and the SOR Revision 1 arrived on 4/12/12 and was signed on 4/16/12. The final signed OCR/LOTO plan was received on 4/16/12. The LOTO clearance was signed on 4/17/12		Ideally the SOR should be completed 21 days prior to the start of the shutdown														x
475	HH-935C	San Joaquin Pipeline System	This was a new shutdown introduced to the WSIP shutdown schedule in April 2012 as a result of not having an environmental permit for the federally protected California Tiger Salamander, this work could not occur during the shutdown window originally contemplated		Ideally this shutdown should have been in the HH-935C contract							x							
476	HH-935C	San Joaquin Pipeline System	In April 2012 this shutdown had a 164-day long shutdown window which was narrowed down to 4 days immediately prior to the start of this shutdown						x			x							
477	HH-935C	San Joaquin Pipeline System	The System Outage Request (SOR) arrived on 5/2/12 and the SOR Revision 1 arrived on 5/4/12 and was signed on 5/2/12. The signed OCR/LOTO plan was received on 5/4/12		Ideally the SOR should have been completed 21 days prior to the start of the shutdown.														x
478	HH-935B	San Joaquin Pipeline System	This shutdown was not in the contract but was added to the shutdown schedule in May 2012		Ideally, this activity should have been specified in the Contract as shutdown.				x			x							
479	HH-935B	San Joaquin Pipeline System	The System Outage Request (SOR) and the signed Operational Change Request (OCR) and Lockout/Tagout Plan arrived on 4/26/12 at 4:25 PM. The shutdown started half a day later before the Project Construction Manager, Regional Construction Manager or the Shutdown Coordinator could sign the SOR. This shutdown was not stopped due to its minor nature		Also, this shutdown could have been handled by an Access Request instead of the more paper- intensive SOR. The Access Request option was not in the contract for this project. The SOR needs to arrive in a timely fashion 60 days prior to the start of the shutdown. Similarly, the OCR/LOTO plan needs to arrive 21 days prior to the start of the shutdown						x							x
480	HH-935B	San Joaquin Pipeline System	This shutdown was not in the contract and was added, along with Shutdown SJPL/18, to the shutdown schedule in May 2012						x			x							
481	HH-935B	San Joaquin Pipeline System	The System Outage Request (SOR) arrived on 5/15/12. The signed Operational Change Request (OCR) and Lockout/Tagout Plan arrived on 6/12/12. The SOR was signed on 6/13/12, the same day as the start of the shutdown		This shutdown could have been handled by an Access Request instead of the more paper- intensive System Outage Request. The Access Request option was not in the contract for this project but neither was this shutdown							x								x
482	HH-935B	San Joaquin Pipeline System	The hydrostatic test plan was included in the SOR. The hydrotesting took place on 8/7/12. The hydrotesting was delayed nearly 2 months after the connection (SJPL/17) due to the bolt alignment issues at the California Aqueduct														x		
483	HH-935B	San Joaquin Pipeline System	This shutdown was delayed about a month due to skewed/misaligned bolts at the California Aqueduct Crossing.														x		

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484	HH-935B	San Joaquin Pipeline System	A portion of SJPL4 at Tesla Portal collapsed on 8/7/12 during the draining following the hydrostatic testing (Figures 1 and 2). The collapsed section of pipe is being replaced by MCI		The subsequent MCI hydrotest plan should have included air intake calculations for the post-hydrotest draining. More care is necessary during hydrostatic testing and provisions for adequate pressure relief via the air release valves and nozzles are necessary. Water discharge calculations (in this case at El Solyo Canal) and air inlet flow calculations at the air valves/nozzles at the high points are necessary before the hydrotesting takes place. A sufficiently sized air relief valve or nozzle is necessary at the highest point on a pipeline (in this case at Tesla Portal) during draining. The Contractor QC staff needed a checklist to verify that the guard valves and air valves at all high points are open before the pipe is drained.				x	x		x					x		
485	HH-935A	San Joaquin Pipeline System	This was a new shutdown introduced into the shutdown schedule on 7/11/12						x			x							
486	HH-935A	San Joaquin Pipeline System	This shutdown took 25 day longer than planned since SD Electric (a Minority Business Enterprise firm) had difficulty in ordering parts in addition to not having a full time electrician on site every day working on the punchlist items		The Subcontractor should have planned ahead and scheduled the correct staffing to complete the punchlist work items in a timelier manner.					x									
487	HH-935A	San Joaquin Pipeline System	Access Request not part of contract		Due to the minor nature of this shutdown, it could have been handled as an Access Request. However, the Access Request option was not in the contract						x								x
488	HH-935A	San Joaquin Pipeline System	The Substantial Completion Date for this project was 6 January 2012 and these punchlist items were known to the contractor at that time. There were many months of disagreement and discussion with the Contractor regarding this required punchlist work and it was finally accepted by the Contractor that this work would be required prior to the Final Completion. There were also numerous in-house discussions as to what conduit would be acceptable in order to		Ideally, the parts should be on site or scheduled for delivery before the shutdown is authorized.					x									
489	HH-935A	San Joaquin Pipeline System	This new shutdown was introduced into the WSIP shutdown schedule on 7/11/12		Due to the minor nature of this shutdown, it could have been handled as an Access Request. However, the Access Request option was not in the contract						x								x
490	HH-935A	San Joaquin Pipeline System	The start of this shutdown was delayed 23 days because the Subcontractor SD Electric (a Minority Business Enterprise firm) was still working at the Emery site completing the punchlist work. SDE is a small 3-person business and they had work scheduled at various other sites and there were many days where there was no work taking place at the Emery site. This shutdown took 5 days longer than scheduled since SD Electric had difficulty ordering material in addition to not having a full time electrician on site every day working on the punchlist items		Ideally, the parts (such as flexible conduit) should be on site or scheduled for delivery before the shutdown is authorized. The Subcontractor should have planned ahead and scheduled the correct staffing to complete the punchlist work items and wire pulling in a timelier manner.					x									
491	HH-935A	San Joaquin Pipeline System	The Substantial Completion Date for this project was 6 January 2012 and these punchlist items were known to the contractor at that time. There were many months of disagreement and discussion with the Contractor regarding this required punchlist work and it was finally accepted by the Contractor that this work would be required prior to the Final Completion. There were also numerous in-house discussions before this shutdown as to what conduit would be acceptable in order to provide seismic protection.		Ideally, the parts (such as flexible conduit) should be on site or scheduled for delivery before the shutdown is authorized. The Subcontractor should have planned ahead and scheduled the correct staffing to complete the punchlist work items and wire pulling in a timelier manner.					x									
492	HH-935C	San Joaquin Pipeline System	This pair of shutdowns was not in the contract and was added to the Shutdown Matrix on 10/12/12. Both shutdowns were required for the completion of San Joaquin Pipeline 4 (SJPL4)		Ideally, this pair of shutdowns should have been anticipated and included in the contract.				x			x							

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493	HH-935C	San Joaquin Pipeline System	The System Outage Requests (SORs) were received on 10/9/12. The SORs Revision 1 arrived on 11/6/12 and the signed Operational Change Request (OCR)/Switching Orders and Lock Out Tag Out (LOTO) plan arrived on 11/16/12. The SOR was signed by most parties on 11/26/12 with the Contractor's signature lagging until		The SOR should have been approved prior to the start of this shutdown.															X
494	HH-935C	San Joaquin Pipeline System	The installation of the PIT's was deferred to a later shutdown. Installation of PIT's was issued as additional work via change order. Contractor should have performed and submitted welding procedures in advance of the work being scheduled. The PIT's were eventually installed in a later shutdown (SJPL/25) in January, 2013.		Pre-requisite welding procedures for installation of PIT's should have been submitted / approved prior to finalizing dates for SOR.					X	X	X					X		
495	HH-935C	San Joaquin Pipeline System	This shutdown was not in the contract and was added to the Shutdown Matrix on 11/6/12.		Ideally, this shutdown should have been anticipated and included in the contract.				X			X							
496	HH-935C	San Joaquin Pipeline System	This was a simple shutdown in terms of the contractor work needing to be done. The LOTO plan and Switching Order were very time consuming and complicated and hence planning had to be performed well in advance of this shutdown.																X
497	HH-935B	San Joaquin Pipeline System	This shutdown was not in the contract but was added to the shutdown schedule on 2/1/13 for repair work																
498	HH-935B	San Joaquin Pipeline System	This shutdown took 102 days longer than planed mainly due to about 5 MCI shutdown extension requests. The pipe coating was damaged when MCI took the restrained couplings apart and this took several days to repair; then, the saddle placement on the east side of the California Aqueduct had to be revised to include a work plan to bring the pipeline back into alignment. MCI had to perform oxy coating																
499	HH-935B	San Joaquin Pipeline System	The System Outage Request (SOR) arrived on 2/1/13 with specified shutdown dates of 2/6/13 - 2/28/13. The SOR was signed on 2/6/13. A HHWP Safe Clearance was received on 2/7/13. The Lockout/Tagout plan and a revised LOTO plan arrived on 2/19/13. There was HHWP confirmation of the double block status on 2/6/13. This Shutdown was approved in writing by the HHWP Division Manager's designee on		Ideally the SOR should have arrived 60 days prior to the start of this shutdown. The written LOTO plan should have been sent prior to the out of service date; however, there was written HHWP verification of safe clearance at the start of the shutdown.															X
500	HH-935B	San Joaquin Pipeline System	SJPL3 had to be isolated at Tesla Portal and some of the ultraviolet (UV) reactors had to be locked open for surge protection while workers were inside SJPL3. Locking open the reactors provides an open path for flow; but, 1) wastes energy, 2) increases the risk of serving noncompliant water, and 3) defeats the automatic response capability of the UV system that would automatically close the reactor valves in the event of an emergency condition while placing a replacement UV reactor into service. Furthermore, the lockout/tagout (LOTO) necessary for locking open the reactors is extremely cumbersome involving over 100 lockout points		Eventually, a system fix is needed so that the UV reactors will not have to be locked open					X		X							X
501	WD-2511	Standby Power Various Locations	The Standby Power contract predated the WSIP shutdown requirements per specification 01650 System Outage Request and the WD-2511 contract only specified 14 calendar days in advance of shutdown to coordinate with WSTD Operations for the shutdown work. Shutdowns of this nature require coordination and approval with the Shutdown Delivery Team in advance.									X								X
502	WD-2511	Standby Power Various Locations	On 12/17/09, this shutdown was supposed to start at 8:10 AM; but the test did not start until 10:30 AM caused by Serra Systems, a non-WSIP SCADA consultant, working on updating and testing the plant Wonderware screen		In the future, it is important to ensure that all parties, including other interface non-WSIP projects, are on the same page and that any preparation tasks must be completed in advance of the test					X										

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503	WD-2511	Standby Power Various Locations	Another issue was encountered in the afternoon when the CB-9 breaker supplying power to the ozone building tripped after a second ozone generator was started. It was found that the turns ratio (ratio) of existing current transformers at CB-9 disagreed with the switchgear record drawings of 1991. The test could not proceed until the current transformers were replaced later that evening. The test								x		x					x		
504	HH-914R	Rehabilitation of Existing San Joaquin Pipelines	On 2/12/10, leakage of about 30 gpm was observed coming from the 36-inch Adams bi-directional triple-offset valve. Although HHWP was asked to shutdown part of SJPL2 to accommodate the inspection of this newly installed leaking triple offset valve on 2/17/10, the shutdown was not required. HHWP had started to reduce the water flow through the pipe in anticipation of having to dewater the line. A representative from Limitorque went to the site on 2/17/10, adjusted the set screw in the gear box, and the valve seated completely and the leak stopped.		In order to avoid the potential delay caused by the leaky valve, the valves could have been hydrotested again after the gear boxes were installed. The inaccurate setting on the set screws would have been discovered and set correctly.						x					x		
505	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	This shutdown was completed 61 days later than planned because of unknown as built conditions discovered during the upgrade of these filters which required about 2 months.		The lessons learned is that proper as-built drawings should be made available to the Project Team during design for many reasons including for determining the durations of the shutdowns							x							
506	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	The System Outage Request (SOR) for SVWTP/1 arrived on 7/31/12 and the SOR was signed on 8/6/12. The draft Operational Change Request (OCR) arrived on 7/31/12. The signed OCR arrived on 8/7/12. Additional SOR NSF 61 documentation for the valves arrived on 9/4/12. SCCI got the filters on 8/6/12 but started their portion of the work on 8/9/12. SCCI finished their work on 1/18/13 but the plant was offline; punchlist work was continuing.		The OCR is supposed to be signed 21 days prior to the start of the shutdown rather than the day after the start of the shutdown.													x
507	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	The SOR is supposed to contain all NSF 61 documentation. WSTD was at risk since the NSF 61 documentation arrived a month after the start of the shutdown.							x	x	x							
508	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	The shutdown lasted 34 days longer than planed due to due to water leaks in the newly constructed flow distribution chamber.							x							x		
509	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	Contract Specifications describing the Shutdown (SVWTP/2) were written such that the scope of the Shutdown was to primarily complete the installation of the slide gate itself. So basically, the language describing the Shutdown scope dealt with the demolition work and installation of the gate itself. Contractor completed the demolition work and installed the gate, however the electrical work to energize the make the gate operational was not performed since the language in the Specifications was not specific. Energizing the gate actuator and testing the gate may involve another partial Shutdown.		This could have been avoided had the language in the Specifications been more specific.				x			x							
510	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	Material supply tracking.		The procurement of steel isolation slide gates must be carefully tracked so that schedule delays do not occur.					x									
511	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	Engineering support.		It is important to get the design engineer in the field as soon as possible to observe the actual conditions such as the gate thimbles					x		x							
512	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	This was a contractual shutdown. At the time the Contract was written, the Access Request Form did not exist.		If the Contract was being written today, the sludge line work request could have been made using the Access Request Form instead of the System Outage Request form						x									x

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513	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	The contract dates for this shutdown were 8/1/11 - 11/20/11 with a Contractor's work duration of 90 days. A year prior to this shutdown the shutdown dates were 3/11/12 - 5/21/12 for a 92 day shutdown duration. The draft System Outage Request (SOR) arrived on 1/25/12, the SOR arrived on 3/20/12 and was signed 3/21/12, and a signed LOTO plan arrived on 3/21/12. Both the SOR and OCR were signed a day after this shutdown started.		Ideally the SOR should have arrived 60 days prior to the start of the shutdown and the OCR should have arrived 21 days prior to the start of the shutdown. Both documents arrived late and were signed one day after the start of the shutdown.													x
514	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	This shutdown took 57 days longer than planned because of demolition work and lead paint abatement work which extended this shutdown 30 days. A leaking valve slowed down the abatement work. The abatement work was completed in early May.		The lead paint was identified before this shutdown but it turned out to be a non-issue after the fact. This paint issue was much to do about nothing and was very expensive and delayed the shutdown completion.				x			x						x	x
515	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	The System Outage Request (SOR) draft was received on 4/13/11. The SOR was received on 4/21/11. The SOR Revision 1 was received on 5/27/11 and was signed on 5/31/11. The out of service date for Filters 1 - 6 was 6/3/11. The signed Operational Change Request (OCR) form was received on 6/7/11 and the signed Lock Out /Tag		Shutdowns are not supposed to start until the OCR/LOTO plan is approved by the Water Supply and Treatment Division (WSTD) manager. The OCR and LOTO followed the out of service date by 4 and 5 days, respectively.														x
516	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	Shut-down work scope - contractor vs. SFPUC		The Contract needs to clearly spell out what portions of the shutdown including filter soaking, pre-washing, filter testing, disinfection, and start-up are included in the Contractor's portion as well as the SFPUC's portion of the shutdown window.					x							x		
517	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	During the washing and skimming of filters, the Contract Specifications need to be followed since this was not the case while washing and skimming Filters 1-6. Proper washing and skimming will definitely help in disinfection. Disinfection was delayed in Filters 1-6 because of inadequate washing and skimming which resulted in a		The depths of filter media placement and washing should follow the contract specifications – 3 layers minimum and 3 washing minimum.					x							x		
518	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	LOTO		The LOTO plan needs to include installation of stop logs to obtain access to the applied channels.														x
519	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	Safe access to the work.		Contractor to provide a plan for staging, access, crane location, SFPUC staff parking locations for work in Filters 7-12. SCCI agreed to do a better job of providing safe access to SFPUC staff.					x									
520	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	Submittal approvals.		The concrete mix design submittals should be approved well ahead of the work. Changes to approved submittals should be submitted ahead of the work. Confirmation in writing is necessary if new submittals or test panels are needed.					x	x						x		
521	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	The clear well work was not a contractual shutdown in the original bid documents but was added during construction.						x			x							
522	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	At the time the pre-purchased valves were ordered by the SFPUC, the Project Team should have requested that the WQD submit a waiver request to the California Department of Health Services for non-NSF 61 valves. The waiver request was initiated after the									x							
523	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	The System Outage Request (SOR) for SVWTP/8a and SVWTP/8b arrived on 11/13/12 and the SOR Revision 1 was received on 12/5/12. The SOR for SVWTP/11 was received on 11/14/12, SOR Revision 1 was received on 12/6/12, and SOR Revision 2 was received on 12/12/12. The SORs for SVWTP/8a, /8b, and /17 were signed on 12/10/12. The draft Operational Change Request (OCR) for all 4 shutdowns arrived on 12/5/12. The SOR was signed on 12/10/12. The signed OCR for all 4 shutdowns arrived on 12/14/12.		The OCR is supposed to be signed 15 days prior to the start of the shutdown rather than the day after the start of the shutdown														x

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524	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	It was a challenge for SCCI to perform the clearwell work since the clearwell opening was only 4-feet length by 4-feet width with limited access. This was one of the factors which extended the planned shutdown duration from 25 days to 54 days.						X			X							
525	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	Staff in both PMB and EMB need refresher training on NSF 61 compliance for wetted plumbing components so that conforming components are installed or that CDPH provides a waiver in the event that no NSF 61 certified components exist.									X							
526	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	This unexpected complete plant shutdown was introduced on 2/28/11. It was discussed at the 3/1/11 Shutdown Coordination Meeting. The System Outage Request (SOR) arrived on 3/10/11, the SOR Revision 1 arrived and was signed on 3/17/11, and the signed Operational Change Request (OCR) and Lockout Tagout (LOTO) plans arrived on 3/18/11. As this was an unexpected shutdown, the Shutdown Delivery Team worked fast in a coordinated fashion to make this shutdown happen despite the short notice		Normally, a SOR are submitted 60 days in advance of a shutdown and the OCR/LOTO plan is completed 21 days in advance of a shutdown.												X
527	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	Verify field conditions.		The design team needs to check for clearances between pipes and retaining walls prior to contract advertisement.				X			X							
528	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	There were some coordination issues regarding operations support for the CM Team during shutdowns. WSTD agreed to provide adequate support, including authorized overtime, with proper prior notification of upcoming shutdown activities from the CM Team.							X									
529	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	This was a new full-plant shutdown added to the WSIP shutdown schedule in early May 2011. The System Outage Request (SOR) arrived on 5/6/11, the SOR Revision 1 arrived and was signed on 5/25/11, and the SOR Revision 2 arrived on 6/8/11. It was known by the WSIP Shutdown Coordinator on 6/6/11 that the Operational Change Request (OCR) had not been signed; but, it was unknown whether or not this shutdown had started. On 6/7/11 at the WSTD Operations Meeting, Joe Guerra announced that this shutdown had started on the prior day 6/6/11 at 9:00 AM. A telephone message was left by the Shutdown Coordinator to the Project CM at 6:45 AM on 6/8/11 announcing that this shutdown lacked an approved Operational Change Request (OCR). The signed Operational Change Request arrived on 6/8/11 at 3:49 PM.		The official approval for this shutdown arrived 2 days after the start of this shutdown. Shutdowns cannot proceed unless the Operational Change Request (OCR) is signed by the Operations Manager (Dave Briggs) prior to the shutdown out of service date. This shutdown violated the Shutdown procedure P022 System Shutdowns. The WSIP Shutdown Coordinator should have tried harder to stop this shutdown as it was unapproved in the beginning. System Outage Requests (SORs) from the contractor are due 60 days prior to the start of a shutdown. The signed Operational Change Request/LOTO plan from WSTD is due 21 days prior to the start of a shutdown. Neither of these deadlines were met. This shutdown, commencing without an approved OCR in place, was a fatal defect. This can not be allowed to happen again. The problem was the delay in the signoff of the OCR and lack of definition of who can approve the start of a shutdown. Currently a shutdown can be stopped from starting by the Shutdown Coordinator but he is far enough removed to things controlling the actual start that there must be a back up for assuring that the OCR (and LOTO if applicable) are in place. This authority needs to address the fact that some of these shutdowns are in plant and not transmission system shutdowns. The timing of these needs to be relooked at and fixed. The authority to commence a shutdown needs to be revisited and revised.													X
530	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	This shutdown did not require a lockout/tagout (LOTO) plan for the PLC work because there were no electrical hazards, engulfment hazards, or other hazards that needed to be isolated in order to complete the work associated with this shutdown.		The official approval for this shutdown arrived 2 days after the start of this shutdown. Shutdowns cannot proceed unless the Operational Change Request (OCR) is signed by the Operations Manager (Dave Briggs) prior to the shutdown out of service date. This shutdown violated the Shutdown procedure P022 System														X

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531	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	This shutdown was not one of the 12 defined shutdowns in the construction contract Specification 01650. This shutdown involved contract work that required SVWTP to go off line in order for the work to be performed. The SOR arrived one month before the shutdown started. It was important to get this shutdown work done since it will allow future SVWTP upgrades to the various other new PLC panels and the associated programming to be completed.						X			X							
532	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	During the Shutdown, the presence of lead paint was discovered in sections of the pipe that had to be cut and tied-into. SCCI and CM Team quickly worked together to perform lead abatement with a hazardous materials firm to resolve this issue.		During the Design Phase, investigations need to be performed on existing pipe sections that are to be cut into to determine the presence of hazardous materials such as lead.				X			X							X
533	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	This shutdown was unspecified in the Contract.		Ideally, this shutdown should have been anticipated and specified in the Contract.				X			X							
534	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	This was a new (not in contract) shutdown introduced on 7/29/11 for tie in to common Washwater Recovery Basin (WWRB) yard piping.						X			X							
535	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	OT for critical shut-downs.		Due to the critical nature of this shutdown, Regional Project Manager Dan Wade on 9/28/12 authorized overtime for this shutdown as necessary for both the CM Team and SCCI.					X									
536	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	This shutdown was unspecified in the Contract and was introduced into the shutdown schedule in August 2011. The panel work was missed in the design.		This shutdown was unspecified in the Contract and was introduced into the shutdown schedule in August 2011. The panel work was missed in the design.				X			X							
537	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	The System Outage Request (SOR) arrived on 8/18/11. The SOR Revision 1 arrived on 9/7/11. The SOR was signed on 9/19/11 and a null OCR/LOTO was approved/waived on 9/19/11. The SVWTP was already down at the time that this shutdown was conducted.		the SOR received 60 days prior to the shutdown														X
538	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	Road closures in general need System Outage Requests (SORs) at least at the time the SVWTP contract was written. This shutdown was unspecified in the Contract and was introduced into the shutdown schedule on 8/19/11.		Ideally this shutdown should have been listed in the Contract Section 01650 Shutdowns and introduced into the Shutdown Schedule in early 2010.				X			X							X
539	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	This shutdown took 13 days longer than planned because of normal construction work activities.																
540	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	The System Outage Request (SOR) arrived on 8/18/11 and the SOR Revision 1 arrived on 11/4/11. There was a null Operational Change Request/Lockout Tagout for this shutdown as of 8/30/11 due to the minor nature of this shutdown. The SOR Revision 1 was signed on 11/4/11.		The contract did not require specifically a SOR for this activity. This work could have been handled with an Access Request Form (ARF). However, the access request process was developed in early 2011 after the Notice to Proceed for this Contract		X				X								X
541	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	This shutdown was unspecified in the Contract and was introduced into the shutdown schedule on 5/30/13.		Ideally this shutdown should have been listed in the Contract Section 01650.				X			X							
542	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	The System Outage Request (SOR) arrived on 5/31/13 and was signed on the same day. HHWTP de-energized transformer TX-7410 prior to the start of this shutdown. The Project Team has no written record of the switching order (LOTO). The electrical Lockout Tagout (LOTO) for this shutdown was handled by the electrical sub-contractors. There was no Operational Change Request (OCR) for this shutdown.		The SOR should have been submitted 60 days prior to the start of this shutdown. There should have been official approval for this shutdown with an OCR signed by the WSTD Operations Manager. Lastly, there should have been a written LOTO plan on the Operations end. Overall, this short shutdown accomplished its goal other than the procedural lapse of proceeding with an unauthorized shutdown. The Shutdown Procedure CM 022 System Shutdowns needs to be reviewed by the Project Team so that unauthorized shutdowns are less likely to occur in the future													X
543	WD-2582	Sunol Valley Water Treatment Plant (SVWTP) Expansion and Treated Water Reservoir	For this shutdown, SCCI had to bring in a backup generator to power the critical Plant facilities during this shutdown.						X			X							

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544	WD-2406R	Sunset Reservoir North Basin Seismic Retrofit	The North Basin refilling was delayed by contractor mobilization (25 days approx.), concrete spall repair work (45 days approx.), stainless steel diagonal brace weld defects (41 days approx.), and fiber reinforced polymer (FRP) application on then interior perimeter walls (28 days approx).		The mobilization delay was related to a premature SFPUC-requested mobilization by the Contractor related to a bid protest. The Contractor could have organized the concrete soffit spall repair work in a more efficient manner thereby accelerating the completion of the work inside the North Basin. The stainless steel fabrication lacked good QA/QC on both the fabricator's end and the independent welding inspection agency retained by the SFPUC for shop welding at the Texas site. The QC Procedures were approved by design) Better shop inspection of the welding at plant would have speeded up the completion of the work inside the North Basin.												x		
545	WD-2406R	Sunset Reservoir North Basin Seismic Retrofit	A design omission, related to lack of thermal stress analysis, resulted in the need to apply FRP on the interior perimeter walls.		Both internal design review and a third-party design review failed to pick up this design omission.				x			x							
546	WD-2609	Tesla Treatment Facility, DB-116	This was a minor last-minute shutdown with the System Outage Request (SOR) submitted on 7/13/11 and the SOR was signed/approved by HHWP on 7/14/11. A lockout/tagout plan was not required since the valves already were locked out and there was no system impact. An OCR was unnecessary for this shutdown		This work was not identified as a shutdown in the Contract. Normally, the SOR should be submitted 60 days prior to a shutdown rather than 2 days prior to the start of the shutdown. The HHWP-signed SOR was sent to the Shutdown Delivery Team on 7/20/11. It should have been either e-mailed to the Shutdown Delivery Team on the day it was signed or the Shutdown Delivery Team should have been notified that it had been posted on the Shutdown common drive. The request for this work could have been handled using an Access Request Form (ARF) instead of an SOR.				x			x							x
547	WD-2609	Tesla Treatment Facility, DB-116	This shutdown took 2 days longer than expected due to coordination issues with the factory representative. However, this shutdown was not time critical work, did not impact operations, and no corrective action was needed							x									
548	WD-2539	University Mound Reservoir –North Basin	For reservoirs, a shutdown System Outage Request (SOR) is not required; however, a lockout/tagout plan is required. The written CDD Lockout/ Tagout plan for the North Basin is unavailable; however, in September 2009 CDD showed the Contractor on a map the locked valves and assured the Contractor that appropriate valve																x
549	WD-2539	University Mound Reservoir –North Basin	This shutdown took 73 days longer than anticipated in the Shutdown Schedule with nearly 8 weeks of delay due to weather impact associated with wet and cold conditions; about two weeks of delay between Substantial Completion and the start of the North Basin refilling associated with the ribbon-cutting ceremony and final walk-through inspections; and a week of delay due to the unanticipated need to apply a rooftop waterproofing fog coat.						x			x							
550	WD-2539	University Mound Reservoir –North Basin	There was a significant change in re-sequencing of the shear wall connections to the roof. This change not only added to the cost but impacted the schedule for other tasks.		The SFPUC generally does not specify major sequencing for the contract and typically leaves this for the contractor. If the SFPUC does need to specify any sequencing, the SFPUC needs to have very clear instructions to the contractor for it. The SFPUC should ask the contractor to submit a sequencing plan separate from the schedule to determine their understanding of the work. The contract specification for the rooftop coating should have clearly stated the allowed durations between the various steps to avoid change orders related to application of remedial fog coats. In addition, the contract specifications need to clearly advise the Contractor about the impact of applying the reflective coating when they are setting up their construction sequencing since the final connections of the shear walls and the diagonal braces were impacted by the cooler conditions inside the North Basin associated with early application of the reflective coating.				x			x							

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551	WD-2539	University Mound Reservoir –North Basin	There were major changes during construction associated with modifying the outlet pipe, removing asbestos from the outlet pipe, drilling through holes at girders for the new collectors, and a large change in the quantities of concrete spall repair; however, these changes did not impact the shutdown duration. The DeZurik 48-inch outlet butterfly valve was defective; but, the replacement valve was ready for installation as of 1/14/11 and this did not delay this		The Contract specifications for the temperatures necessary for the Contractor to make the final shear wall and diagonal brace connections to the roof structure were not clear. This was the basis for a significant change order. In regard to spall repair, it always pays to spend more time to research concrete conditions upfront and add some contingencies to the Contract bid item quantities.				x		x	x				x			
552	WD-2539	University Mound Reservoir –North Basin	NSF-61 materials		The SFPUC survey crews should be instructed to use NSF 61-approved spray paint inside reservoirs. This transgression lead to an $8,000 change order to remove the unapproved survey marking paint					x	x	x							
553	WD-2539	University Mound Reservoir –North Basin	A shutdown System Outage Request (SOR) was not required by contract. In lieu of a SOR, the Contractor submitted a work plan on 9/28/12. Also, the Contractor submitted a couple designs for the repair of the outlet valve stem/key																x
554	WD-2539	University Mound Reservoir –North Basin	Shut-down communications.		The communications between the Shutdown Delivery Team and CDD Operations should have been better for this shutdown. The Operations Representative should have been more proactive in providing updates on this shutdown to the Shutdown Delivery Team			x		x									
555	WD-2539	University Mound Reservoir –North Basin	Amoroso was not given a written copy of the LOTO by the Construction Project Manager. However, the Operations Representative, 2 CDD plumbers, and the Construction Project Manager walked through the entire LOTO plan on 11/16/12 with S.J. Amoroso. It was very thorough review and S. J. Amoroso put their		There should have been a written Lockout/Tagout (LOTO) plan as a safety matter														x
556		Safety Lessons Learned Document	Safety observations.		Shutdown safety coordination requires special, detailed planning														x
557		Safety Lessons Learned Document	Safety observations.		Detailed advance planning and total cooperation among all concerned parties is essential														x
558		Safety Lessons Learned Document	Safety observations.		Facility and construction safety plans must mesh														x
559		Safety Lessons Learned Document	Safety observations.		Communication is the most important success factor														x
560		Safety Lessons Learned Document	Safety observations.		LOTO protocols must be thorough, agreed and clear														x
561		Safety Lessons Learned Document	Safety observations.		Detailed review of means and methods by all parties is required														x
562		Safety Lessons Learned Document	Safety observations.		Always require Contractors and Operators to jointly physically verify and sign off on system configurations before work														x
563		Safety Lessons Learned Document	Safety observations.		Smaller contracts (< $5 M) do not allow for dual role SSR														x
564		Safety Lessons Learned Document	Safety observations.		Difficult to find good SSR candidates having minimum 5 year safety experience in like past projects														x
565		Safety Lessons Learned Document	Safety observations.		Difficult to find good SSR candidates having minimum 5 year safety experience in like past projects														x
566		Safety Lessons Learned Document	Safety observations.		No specifics in spec for approval of alternate SSR's														x
567		Safety Lessons Learned Document	Safety observations.		Safety NCNs process needs refinement														x
568		Safety Lessons Learned Document	Safety observations.		CMs and PCM not named as indemnified parties														x
569		Safety Lessons Learned Document	Safety observations.		Existing SFPUC Specifications are adequate but not yet tied to a SSIP or HSIP Safety Approach														x

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570		Safety Lessons Learned Document	Safety observations.		Start Risk Analysis for new programs now														x
571		Safety Lessons Learned Document	Safety observations.		OCIP approach														x
572		CMIS	Reconciliation of project expenditures is manually intensive given City's core financial system interface and CMIS technology platform		Consider alternative middleware or different program management platform that can automate integration of expenditures between a program management system and the City's financial system			x											
573		Project delivery metrics	Consider identification of project delivery performance metrics that are more targeted in nature such as for departmental charges, program management, and construction management. Identification and use of metrics allows the program management team to more accurately convey performance information and externally, such metrics provide external entities and general public with more easily understood information pertaining to project delivery.													x			
574		Project contingency	Consider utilization of project-specific contingency levels based on the specific work to be accomplished rather than standardized percentages across all program projects. This approach would recognize that higher level of contingency (15%-20%, for example) are warranted on projects with higher performance, financial, and			x													
575		Owner design reviews	Consider earlier (<65%) reviews by SFPUC applicable departments to reflect O&M requirements, constructability etc. in addition to existing review at 65% design submittal									x							
576		Contract Specifications	Many areas of interpretation stemmed from unclear or undefined specifications regarding measurement of quantities, especially on unit driven projects such as tunnels								x								
577		Construction Management	Consider bringing (key) CM staff earlier in the design process so that they have a deeper understanding of design development.							x									
578		Bidding	Although hard bid pricing is often cited as issues, the WSIP staff found that this delivery method worked well and realized favorable pricing. Even on projects with significant realized differing site conditions, the proejct team worked well to resolved potentially litigious issues in a timely manner (e.g. Calaveras Dam Replacement)													x			
579		CMIS	Project level staff expressed that CMIS, although a very powerful system, could at times be a non-intuitive system to enter information; that only the program controls staff were really versed in the utilization and modification of information					x											
580		Bidding	The WSIP realized $401M in bid savings in a very favorable bidding environment that may not be present moving forward. Consider evaluating impact of construction price escalation and pricing impacts on the SSIP given realized changes to the WSIP to test budget exposure. Akin to a 'stress test' for approved budgets.				x												
581		Change Management	Program and project management staff performed extensive cost and schedule validation of construction change orders.																
582		Dispute Resolution	Project management staff approved changes orders in a timely manner and, in general, proactively management disputed costs															x	
583		Construction Management	Consider negotiation of project specific staffing tasks for consultants working on specific projects. This will align contracting with payment of services													x			
584			Lessons learned process contains a great deal of good information yet it is not applied consistently across projects. Enhanced formalization could generate additional valuable data given presence of strong technical project and program specialists.											x					

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585		Project Delivery	Unit rates for construction management costs for time extensions are higher than for original durations.													x			