

WSIP Schedule Compression Analysis

February 2, 2011

Water System Improvement Program (WSIP) Management requested Parsons evaluate schedule compression and execution concerns and address questions raised by the Commission and the Bay Area Water Supply and Conservation Agency (BAWSCA) resulting from project schedules extended into the last year of the Program. BAWSCA's concerns relate to their review of the SFPUC Fiscal Year 2009-10 Annual Report on the WSIP, dated September 1, 2010. The Annual Report was based on data as of July 1, 2010 for the Regional Program (June 2009 Revised Program). In order to address a complete resource analysis and the potential implications of the projects now scheduled to complete in the last year of the Program, this analysis includes both the Local and Regional Programs and is based on data as of October 3, 2010 (September 2010 Forecasted Program). In parallel with this analysis, a Third Party Construction Management Review Team convened in November 2010 and evaluated the SFPUC's ability to manage the program throughout the Construction Phase.

The Commission approved June 2009 Revised Program included two (2) projects scheduled to complete in 2015. These projects were CUW37401: Calaveras Dam Replacement (12/04/15) and CUW36801: Bay Division Reliability Upgrade – Tunnel (8/14/15). Currently, there are eleven (11) projects scheduled to complete in 2015:

	<u>Current* Forecasted</u>	<u>Current* Phase</u>
	<u>Completion</u>	
Regional Program		
• CUW35201: Upper Alameda Creek Filter Gallery	06/04/15	Design
• CUW36801: Bay Division Reliability Upgrade – Tunnel**	08/14/15	Construction
• CUW36302: System Security Upgrades	08/31/15	Multiple
• CUW36702: Peninsula Pipelines Seismic Upgrade**	08/31/15	Planning
• CUW36701: HTWTP Long-Term Improvements**	11/20/15	Bid and Award
• CUW 30103: Regional Groundwater Storage and Recovery	11/30/15	Environmental/Design
• CUW38802: Habitat Reserve Program	12/04/15	Multiple
• CUW37401: Calaveras Dam Replacement**	12/04/15	Environmental/Design

Local Program (Water Supply Projects)

- | | | |
|---|----------|----------------------|
| • CUW30102: San Francisco Groundwater Supply | 04/14/15 | Environmental/Design |
| • CUW30101: Lake Merced Water Level Restoration | 07/06/15 | Design |
| • CUW30201: San Francisco Westside Recycled Water | 11/17/15 | Environmental/Design |

* The term “Current” reflects data as of October 3, 2010

**Seismic Reliability Projects

Based on BAWSCA’s letter to SFPUC dated October 13, 2010 and discussions with BAWSCA and Commissioner Moran, Parsons focused the evaluation on answering seven (7) key questions:

- Is the schedule compressed?
- Do the projects projected to complete in 2015 present additional risks or challenges to overall program completion?
- Are processes and systems in place to address construction issues in a timely and effective manner and being executed?
- Has the SFPUC planned for adequate resources to address the project schedule for construction and closeout?
- Can the SFPUC manage the cash flow to meet the project schedules?
- Can the SFPUC maintain system operations throughout construction and during the last year of the program?
- Can SFPUC retain the right people and resources necessary to complete the program?

Methodology

Parsons reviewed the schedules of the above-mentioned eleven (11) projects, resource loaded forecasts, and CM processes. We also reviewed overall WSIP spending comparisons and construction schedule comparisons between the June 2009 Revised Program and the September 2010 Forecasted Program. This comparison was similar to the analysis of the 2007 Revised Program and the June 2009 Revised Program reported to the Commission on December 14, 2009. In addition, discussions were held with Finance and Water Enterprise operations staff. We want to acknowledge the support and responsiveness of Mojgan Yousefkhani (WSIP Controls Manager) and the Program Controls staff in answering requests for data and information.

Is the schedule compressed?

Figure 1 is a comparison of cash flow by fiscal year for the June 2009 Revised Program Spending Plan and the September 2010 Forecasted Spending Plan for construction and construction contingency costs for Fiscal Year FY 10-11 thru FY 15-16. The peak spending year remains FY 12-13; however, the peak year spending has decreased by \$66 million (from \$819 million to \$753 million). Spending for the last calendar year of the Program (2015) increased by \$29 million (from \$8 million to \$37 million). The increase in construction spending for 2015 is relatively small considering the magnitude of the WSIP. To put the \$37 million for all of 2015 in perspective, twenty-four (24) construction projects were active in November 2010 and an average of \$31 million has been invoiced for the past 5 months.

Figure 1

**WSIP (Regional & Local)
June 2009 Revised WSIP vs. September 2010 Forecasted Construction Spending Plan**

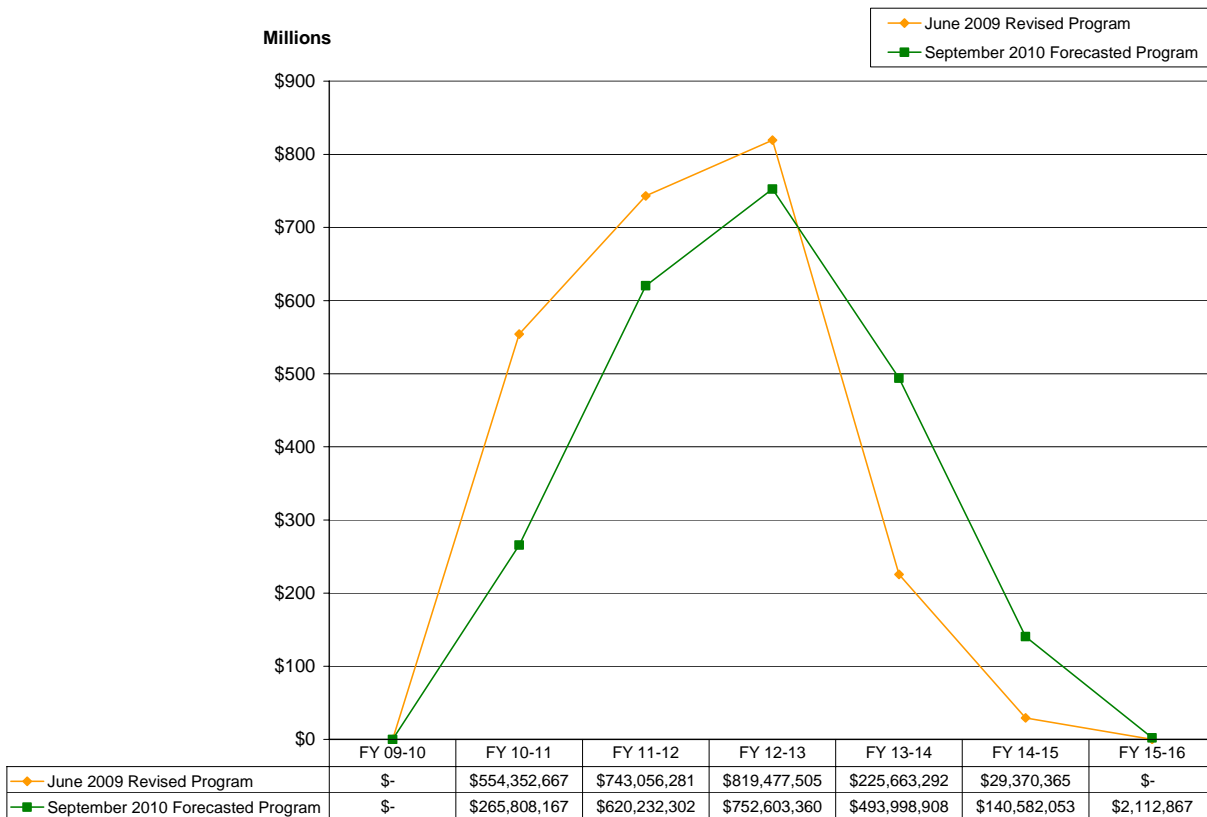


Table 1 compares the number of projects in construction, the cumulative planned construction expenditures, and planned percent complete of construction at 6-month intervals for the last five years of the June 2009 Revised and September 2010 Forecasted Programs. The peak number of projects in construction at one time is twenty-three (23) for the September 2010 Forecasted Program compared to

twenty-six (26) for the June 2009 Revised Program. The amount of construction completed prior to FY10-11 is essentially the same and the planned completion level 2 years before completion is higher (91% vs. 77%) for the June 2009 Revised Program.

Table 2 compares construction spending from FY 10-11 through FY15-16. For FY10-11 through FY12-13, spending for the September 2010 Forecasted Program is \$479 million less. For FY13-14 through FY15-16, spending increased \$382 million (from \$254 million to \$636 million). Of interest is that the total projected spending for FY10-11 thru FY15-16 has decreased by \$97 million (from \$2.370 billion for the June 2009 Revised Program to \$2.273 billion for the September 2010 Forecasted Program). This is primarily due to the competitive bidding environment of the past 18 months, which has lowered the overall forecasted cost for construction.

Table 3 illustrates there is little difference between the two programs in time (in months) to achieve two pre-determined progress levels, from 30% to 60%, and from 60% to 100%.

WSIP (Regional and Local)
TABLE 1: No. of Projects and Planned % Complete *

# of Years Before Program Completion	June 2009 Revised Program				September 2010 Forecasted Program			
	Time	# of Projects	Planned Exp. (\$)	Planned % Comp.	Time	# of Projects	Planned Exp. (\$)	Planned % Comp.
5 years	Jul 1, 2010	24	\$544	18.7%	Jul 1, 2010	22	\$530	18.9%
4.5 years	Jan 1, 2011	25	\$800	27.4%	Jan 1, 2011	23	\$633	22.6%
4 years	Jul 1, 2011	26	\$1,098	37.7%	Jul 1, 2011	23	\$795	28.4%
3.5 years	Jan 1, 2012	20	\$1,387	47.6%	Jan 1, 2012	20	\$1,055	37.6%
3 years	Jul 1, 2012	21	\$1,841	63.2%	Jul 1, 2012	17	\$1,414	50.4%
2.5 years	Jan 1, 2013	17	\$2,338	80.2%	Jan 1, 2013	18	\$1,782	63.6%
2 years	Jul 1, 2013	14	\$2,660	91.3%	Jul 1, 2013	15	\$2,167	77.3%
1.5 years	Jan 1, 2014	7	\$2,823	96.9%	Jan 1, 2014	14	\$2,454	87.5%
1 year	Jul 1, 2014	3	\$2,885	99.0%	Jul 1, 2014	11	\$2,661	94.9%
0.5 year	Jan 1, 2015	2	\$2,906	99.7%	Jan 1, 2015	8	\$2,766	98.7%
	Jul 1, 2015	0	\$2,914	100.0%	Jul 1, 2015	3	\$2,801	99.9%
Construction Complete					Sep 30, 2015	0	\$2,803	100.0%

TABLE 2: Construction Spending During Final Years of WSIP *

# of Years Before Program Completion	June 2009 Revised Program		September 2010 Forecasted Program		Delta (2010 - 2009)	Variance %
	Period	Planned Exp. (\$ M)	Period	Planned Exp. (\$ M)		
		A		B	C	C/A
5	FY10-11	\$554	FY10-11	\$265	(\$289)	-52.2%
4	FY11-12	\$743	FY11-12	\$619	(\$124)	-16.7%
3	FY12-13	\$819	FY12-13	\$753	(\$66)	-8.1%
2	FY13-14	\$225	FY13-14	\$494	\$269	119.1%
1	FY14-15	\$29	FY14-15	\$140	\$111	382.8%
1	FY15-16	\$0	FY15-16	\$2	\$2	
Total Expenditure for last 5 years before Program Completion		\$2,370		\$2,273	(\$97)	
Total prior expenditure as of 5 years before Program Completion		\$544		\$530	(\$14)	
Grand Total		\$2,914		\$2,803	(\$111)	

* - Includes Construction Contingency, but excludes Environmental Mitigation Costs.

TABLE 3: Planned % Complete

Planned % Complete	June 2009 Revised Program		Duration (Months)
	30% - 60%	Feb 2011	
30% - 100%	Feb 2011	Mar 2015	48
Planned % Complete	September 2010 Forecasted Program		Duration (Months)
	30% - 60%	Aug 2011	
30% - 100%	Aug 2011	Sep 2015	49

Analyzing project schedule comparisons, we find that the number of projects now forecasted to complete in calendar 2015 increased from two (2) to eleven (11) while the Program completion date remains unchanged. Eight (8) of these projects are part of the Regional Program, and three (3) are Water Supply projects that are part of the Local Program. The construction of twenty-nine (29) projects is delayed (i.e., completion date now closer to WSIP overall completion date of December 2015) in

comparison to the approved June 2009 Revised WSIP Program. Eight (8) of these projects are part of the group of eleven (11) projects now forecasted to complete in 2015.

The schedule for CUW38802: Habitat Reserve Program includes 3-year monitoring periods after completing construction at each site. Construction is not a factor in 2015 and resources needed for monitoring should be minimal. The Water Supply projects require more intensive public and stakeholder involvement during pre-construction, which have contributed to their delay. One of these projects, CUW30101: Lake Merced Water Level Restoration is currently on hold while various options are being considered and negotiated with Daly City. These discussions have contributed to its schedule delay.

Thirteen (13) construction schedules have been shortened. These reduced construction schedules are for three (3) of the eleven (11) projects now forecasted for completed in 2015.

It is important to understand that the forecasted completion dates of these projects include scheduled time, after construction is complete, for project closeout. When considering construction completion, there are seven (7) projects now projected to complete construction in 2015, compared to two (2) in the June 2009 Revised Program.

Based on the above analysis, it is our opinion that the overall construction and closeout schedule is compressed compared to the June 2009 Revised Program. More projects will be completed in the last year of the Program (2015), spending will be greater the last three years, and a greater percentage of construction must be completed the last three years. In addition, twenty-nine (29) construction schedules will complete closer to the Program completion date and thirteen (13) construction schedules have reduced durations. Furthermore, several projects in 2015 have reduced time for the Closeout Phase. All of this is somewhat offset by \$97 million less spending required over the last five years of the Program, a slightly more gradual ramp up to peak spending, and a slightly more gradual ramp down in spending. A more gradual ramp up enables construction management (CM) teams to mobilize and learn procedures and systems at a more measured pace. A more gradual ramp down should benefit staff transition at the end of the program.

Do the projects projected to complete in 2015 present additional risks or challenges to program completion?

The eleven (11) projects forecasted to complete in 2015 are not related in ways that pose significant additional risks because of when they are now projected to be in construction. CUW36302: System Security Upgrades relies on the schedule of the last project in WSIP before it can be closed out. This requires close coordination to ensure the security components are integrated with the construction projects so as not to cause delays. With the exception of CUW37401: Calaveras Dam Replacement, which has construction completion in July 2015, the remaining project schedules show the heavy construction activities completing before 2015.

A risk with more projects finishing in the last year of the program is there are more opportunities for schedule delays. A common adage when managing programs is that the last 5% is the hardest to

complete. We are seeing several current construction schedules extended to deal with project completion issues. In addition, the ideal duration for the project Closeout Phase is 6 months, but the average actual time, excluding projects in litigation or for events outside of the SFPUC's control, has been 7 months. With several of the projects completing in 2015 having less than 6 months for closeout, schedule extensions to complete construction and delayed project closeout of those projects pose a greater risk for overall Program completion by December 2015.

Seven (7) of these projects are in pre-construction. Pre-construction issues can pose significant risks to the schedule. The three (3) Water Supply projects involve intensive, and often more lengthy, public and stakeholder input during pre-construction. With respect to these seven projects, any efforts to accelerate the completion of pre-construction and construction earlier could add time to the Closeout Phase of these projects. The largest project in pre-construction, CUW37401: Calaveras Dam Replacement advertised for bidding January 31, which is a significant milestone for the Program and moves this major project closer to completing pre-construction.

Are processes and systems in place to address construction issues in a timely and effective manner and being executed?

The current processes and systems for managing construction were well planned and thorough. They are being tested as construction under contract has exceeded \$1 billion and more than twenty (20) active contracts. These same processes and systems will serve the Program through completion in 2015. Significant issues, such as the archeological sites, contaminated groundwater, and tunnel boring machine (TBM) extraction on CUW36802: Bay Division Reliability Upgrade – Pipeline and the TBM extraction on CUW35902: Alameda Siphon No. 4, are being elevated in a timely manner and WSIP Management has demonstrated prompt decision-making and resolution. Further, the bi-weekly Issues Meeting established by the Deputy Director for Construction provides a venue to elevate issues to management's attention.

However, while the current number of projects in construction is as high as it will be for WSIP, the value of construction taking place will more than double for the next two years and average monthly spending will exceed \$60 million. More dollars spent can mean more issues. The increase in spending over the next two years is primarily due to four (4) projects. These four projects, CUW35901: New Irvington Tunnel, CUW36701: HTWTP Long-Term Improvements, CUW37401: Calaveras Dam Replacement and CUW37301: San Joaquin Pipeline System total \$1 billion in construction. It is incumbent on the entire WSIP organization to maintain the diligence they have demonstrated in identifying, elevating and resolving construction issues.

Has the SFPUC planned for adequate resources to address the project schedules of construction and project closeout?

Resources for construction and project closeout are categorized as project management, design support, construction management and program management. City staff resources and consultant contracts are generally adequate to handle the current construction workload that has now reached the

peak for the number of projects in construction. We see nothing that should interfere with that continuing through the completion of the Program. Certainly, from time to time, staff may need to reach out for additional resources through existing contracts but the resource and contracting infrastructure is in place and the Commission has shown support for consultant support when needed.

We looked closer at the resources planned for the eleven projects completing in 2015. Seven of these projects are currently in pre-construction, one is being bid for construction, one is in construction, and two have pre-construction and construction occurring simultaneously. While we would expect resource plans for project phases underway to be more refined than for future phases, the resources for project management, design support and construction management are generally reflected in current work plans.

We did find a wide range of hours planned for Project Management during Construction and for the Closeout Phase between projects. Project Management resources during construction range from a low of 23 hours per month to a high of 451. Resources for Closeout range from a low of 44 hours per month to a high of 575. While one would expect some variation based on the project, it would be helpful to re-evaluate future resource forecasts based on actual experience for completed projects. This would confirm sufficient resources for Closeout are planned for, while avoiding over-planning which increases cost projections. The program revision effort planned for later this year would be a good opportunity to re-visit these resource plans.

Can the SFPUC manage the cash flow to meet the schedules?

Discussions with SFPUC Finance staff indicate the capital funding activities have been well coordinated with the WSIP's cash needs. The monthly program cost and schedule forecasting process ensures cash flow projections are timely and up to date. The WSIP Program Team communicates these updates to Finance, including the monthly cash flow obligations and the encumbrance amount Finance needs at the time of construction contract approval. For example, the current cash flow forecast shows \$300 million needed in August 2011 for the encumbrance of the Calaveras Dam Replacement construction contract. SFPUC will have cash on hand, or available commercial paper capability, at the beginning of each construction contract to fund the total construction cost. This mitigates the risk of the SFPUC not having funds available in 2015 to fund the completion of the program's last eleven projects.

Funding for WSIP through the sale of revenue bonds has been smooth and timely, and beneficial to ratepayers with low generational borrowing rates. SFPUC sold approximately \$2.7 billion of bonds in eight individual placements since 2006. SFPUC makes contract payments in a timely manner and we see no reason, absent a capital market collapse, that WSIP cash management requirements will not be met. Decisions related to the timing and amount of a bond sale or use of commercial paper is dependent on many factors in addition to the program cash needs (i.e., interest rate projections, debt coverage ratios, water rate analyses).

Can the SFPUC maintain system operations throughout construction and during the last year of the program?

Two projects will have the greatest impact on maintaining system operations in 2014 and 2015.

CUW36701: HTWTP Long-Term Improvements will have one partial and two full plant shutdowns in 2014 and 2015 and CUW36801: Bay Division Reliability Upgrade - Tunnel will require the commissioning and shutdowns of Bay Division Pipelines (BDPLs) #1 and 2. Discussions with Mr. David Briggs, Director of Water Supply and Treatment Operations, confirmed that advance planning is underway to manage the shutdowns and commissioning activities for these projects. Although the HTWTP and BDPL shutdowns are not inter-related, the nature of these facilities poses risks to achieving these shutdowns as planned and the regional system's overall reliability.

CUW36701: HTWTP Long-Term Improvements is a major and complex upgrade to an existing operating facility. With five (5) partial and six (6) full plants shutdowns needed during construction, delays during construction could cascade through the schedule and push the last shutdowns past the winter 2014/2015 low demand period. Should that occur, the project completion could extend past the current Program completion date of December 2015.

CUW36801: Bay Division Reliability Upgrade - Tunnel must be commissioned before BDPL #1 and #2 can be taken out of service in the winter of 2014/2015. Tunnel construction is susceptible to increased risks associated with geological conditions. Certainly, many tunnel projects complete with no delays.

CUW37201: New Crystal Springs Bypass Tunnel is an example of a tunneling project that has gone extremely well and is on schedule. But unforeseen geological or groundwater risks are high for tunnel projects as recently experienced in Seattle and Las Vegas where extensive delays occurred.

What is noteworthy, however, is the impressive level of planning for project shutdowns, and the communication and documentation ongoing between WSIP Management, designers, construction contractors and SFPUC operations staff. System shutdown planning began in 2007 and remains a high priority for the WSIP team. The ongoing coordination of shutdown planning that addresses changes in schedules in "real time" is a model for how to do it right. This effort has largely been under the radar because it has been so successful. To date, forty (40) system shutdowns have been completed successfully. This level of planning and communication reduces operations risk throughout construction and for the last years of the Program.

Twenty-four (24) shutdowns are planned over the next six months, which will further test the SFPUC shutdown planning and execution efforts. However, it should be noted that calendar years 2010 and 2011 are the peak years for the number of system shutdowns. Midway through this peak period, Water Supply and Treatment Operations, through detailed resource planning to support system have, to date, have met every challenge. Mr. Briggs mitigated concerns regarding the retirements of several Operations Liaisons in 2010 through effective management and staff re-assignments. In addition, Water Enterprise staff has become more efficient through repeated success of as shutdown processes. It will be important to maintain a high priority for staffing system shutdowns through completion of WSIP.

With six (6) shutdowns planned for 2014 and one (1) for 2015, compared to over sixty (60) for 2010 and 2011, absent unforeseen schedule delays, the September 2010 Forecasted Program poses no additional concerns for maintaining system operations during the last year of the Program.

Can SFPUC retain the right people and resources necessary to complete the program?

As the program efforts wind down in 2014 and 2015, a legitimate concern is retaining the resources necessary to complete the program on time. The consultant resources should not be a concern, as the consultants have the ability to provide sufficient resources if contract authority is in place. With respect to City staff, the overlap of resource needs for the Sewer System Improvement Program with WSIP requires special attention to balance resources and ensure WSIP retains staff needed for closing out the projects in 2015. With both Capital Programs under the authority of the Assistant General Manager of Infrastructure, we are confident WSIP will receive the priority it needs.

In summary, while the current forecasted schedule is compressed compared to the June 2009 Revised WSIP Program, resources overall appear to be adequate to address the workload. Procedures and systems are in place for construction, issues are identified and elevated in a timely manner, and cash flow management processes are in place and functioning well.

The primary risks are that with more projects now scheduled to complete in 2015, there are more opportunities for schedule delays that could affect the Program's overall completion date of December 4, 2015, and there is, in some cases, less time for Project Closeout than has historically been required. Additionally, although CM procedures, systems and resources are proving adequate to deal with the current workload, the average monthly and annual spending will increase significantly for the next 3 years, potentially stressing the organization's ability to deal with more issues.