

SEWER AUTHORITY MID-COASTSIDE
Staff Report

Subject / Title

Review and Possibly Provide Direction to Staff on Recycled Water Project

Staff Recommendation:

Review and Possibly Provide Direction to Staff on Recycled Water Project

Fiscal Impact:

None.

Discussion/Report:

The purpose of this report is to provide the Committee with summary and additional information on the Recycled Water Project (Project), to allow discussion on several critical issues associated with the Project and to allow the Committee to provide direction to staff on next and perhaps new steps.

Over the past several weeks, several aspects of the Project have been identified for a more detailed discussion. These aspects are presented in this staff report. They are the timeline of the Project including cash flow, detailed capital cost estimates, Project management and a review of treatment technologies.

1. Timeline of the Project Including Cost Estimates

In response to the Board request at its October 26, 2009 meeting, staff developed the following two timelines for the Board review and comments:

- a) The apparent shortest timeline, including a Mitigated Negative Declaration (MND)-level of review under CEQA, an Environmental Assessment (EA) and a Finding of No Significant Impact (FONSI) under NEPA, and implementing a fast-track Turnkey (Design/Build) approach to Project implementation
- b) The apparent longest timeline, including an Environmental Impact Report (EIR)-level of review under the California Environmental Quality Act (CEQA), Environmental Impact Statement (EIS) under the National Environmental Policy Act (NEPA), and implementing a traditional Design/Bid/Build approach to Project implementation

These timelines assume that SAM is Lead Agency for the permitting, design, and construction of the tertiary treatment facility on SAM's property within the existing Wastewater Treatment Plant boundaries. Any distribution and delivery of recycled water to end users is the responsibility of others. Any improvements to the timeline would be to allow quicker development of the project description, including technology choice, footprint, and various responsibilities of the participating agencies.

Key elements to be noted from the timelines include:

- a) MND/FONSI and Design/Build yield the shortest timeline;
- b) EIR/EIS and traditional design and bidding yield the longest timeline.
- c) Most sensitive areas are permitting challenges in the EIR/EIS process; which could cause an up to two-year delay in Project completion
- d) Significant short-term actions by the SAM Board are assumed to take place at the November 23, 2009 meeting and the first meeting of 2010 for both of the timelines
- e) Some actions may require Member Agency pre-approval before proceeding.
- f) Both timelines include conducting the environmental review under CEQA/NEPA and Local Coastal Program concurrently with the design and equipment vendor procurement, which represents some risk, however, greatly expedites the schedule.

Opportunities for Project Acceleration and Cost Reduction

- Consider a fast-track turn-key implementation method – Design/Build
- Consider developing a Design/Builder Request for Proposals from both Sand Filtration and Membrane Filtration manufacturers to have them compete based on the following key requirements:
 - Required Footprint
 - Future Expandability
 - Price
 - Delivery Schedule
- The following is required to start CEQA/NEPA review process:
 - Tertiary Facility capacity
 - Tertiary Facility footprint
- Consider Reformatting the Recycled Water Facilities Study into a Feasibility Study as required by Title XVI Federal guidelines for Federal funding

Other potential options for Project schedule acceleration include:

- Vendor pre-qualification
- Start working with the City of Half Moon Bay Planning now to identify ways to expedite the Coastal Development Permit (CDP) review and approval timeline

The Committee may wish to provide direction to staff or recommendation to the Board on these timelines. Specifically, the following are the key issues for Committee direction:

- a) The Recycled Project Timeline is highly dependent on the Board's and Member Agencies' desires and preparedness to make significant policy decisions and commit to advance funds (over \$300,000 this fiscal year) to ensure that the Project progresses in expeditious manner.
- b) The Recycled Project Timeline is highly dependent on the ability to quickly reach agreement with CCWD and/or OCP.
- c) The policy and funding decisions included in the timelines include assumptions that initial policy decisions will be made as soon as at the November 23, 2009 meeting and January 25, 2010 meeting.
- d) The timelines also assume that SAM will be Lead Agency for the treatment facility only, leaving the responsibility for the creek crossing to other parties as discussed on the Principles of Agreement with the Coastside County Water District.

- e) Funding of this project may entail grants and/or loans. SAM has been acting as the Lead Agency for near-term activities. Clarity is needed on which agency shall be the Lead Agency for overall Project financing, including State and Federal funding.

Note: The timelines currently do not specifically list negotiations with customer(s) as a specific line item. These negotiations are assumed under legal and administrative tasks. However, this activity is critical to the Project schedule and progress.

2. Detailed Capital Cost Estimates

In response to the Board request at the October 26, 2009 meeting, staff is providing the underlying detailed capital cost estimates for the following treatment options currently under consideration:

- a) 0.8-million-gallons-per-day (MGD) membrane treatment facility
- b) 0.8 MGD sand filtration treatment facility

No grant funding was included in the estimates. In addition, all costs are for treatment and related on-site facilities, no recycled water delivery costs are included and are assumed to be responsibility of others.

Please note that the cost per acre-foot on annual basis is listed in the cost summary for illustration purpose ONLY. The actual cost per acre-foot of water sold to customer will depend on specific agreements made with customer(s).

3. Project Management

In response to the Board request, staff reviewed the issue of Project Management required to bring the Project to successful and timely completion to satisfy the needs of end users.

Currently the Project is being managed by SAM staff with the assistance of SRT Consultants in some areas. SRT Consultants is authorized to complete a Facilities Planning Study and produce a Study report at a fixed fee of \$149,610. As part of the work on the Facilities Planning Study, Board authorized SRT Consultants to assist SAM staff in developing the Pilot Study Engineering Report and Permit Application, which was successfully procured. Management of the Project would be greatly enhanced if Project management were provided by a consultant rather than by in-house staff.

The Committee may wish to consider the benefits of adding project management at this time. For your consideration, SRT Consultants has provided their qualifications (attached). No funds have been budgeted for this addition.

4. Review of Treatment Technologies

In response to the Board request at the October 26, 2009 meeting, staff included a review of three most viable and feasible technologies considered for the Project.

The attached alternative comparison sheet shows two alternative technologies. This information was originally provided to the board in October 2008.

The Committee may want to consider making recommendations to the Board on the issue of the technology selection. There are two basic options under consideration:

- a) Consider and select a specific technology to move forward now.
- b) Consider an option of developing a Design/Build RFP that allows for both technologies to complete on a cost-benefit basis and select the Design/Build firm based on the best combination of cost, guarantees, etc.

Attachments:

- Timeline for Completion of the Recycled Water Project (short)
- Timeline for Completion of the Recycled Water Project (long)
- Engineer Opinion of Probable Project Cost Table
- Estimated Project Cash Flow (short) – Two Charts
- SRT Consultants' Qualifications
- Technology Comparison Matrix

SAM Recycled Water Project Schedule
Mitigated Negative Declaration & Turnkey Project Implementation Approach

ID	Name	Duration ¹	Start	Finish	Predecessors	Timeline																											
						2009	Half 1, 2010					Half 2, 2010				Half 1, 2011			Half 2, 2011														
						N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A						
1	Project Management, Administrative & Legal Activities	440 days	11/23/09	8/4/11		[Gantt bar spanning from 11/23/09 to 8/4/11]																											
2	SAM Board Approves Project Management Contract	1 day	11/23/09	11/23/09		[Vertical bar at 11/23/09]																											
3	Task 1 Recycled Water Project Alternative Selection	1 day	1/25/10	1/25/10		[Vertical bar at 1/25/10]																											
4	Subtask 1.1 SAM Board Selects RW Project Alternative for Implementation	1 day	1/25/10	1/25/10		[Vertical bar at 1/25/10]																											
5	Task 2 Environmental Review	131 days	1/25/10	7/26/10		[Gantt bar from 1/25/10 to 7/26/10]																											
6	Subtask 2.1 SAM Board Approval of CEQA/NEPA Consultant Contract	1 day	1/25/10	1/25/10	4SS	[Vertical bar at 1/25/10]																											
7	Subtask 2.2 CEQA/NEPA Review	120 days	1/26/10	7/12/10	6	[Gantt bar from 1/26/10 to 7/12/10]																											
8	Subtask 2.3 SAM Board Certifies CEQA/NEPA Document ²	1 day	7/26/10	7/26/10	7	[Vertical bar at 7/26/10]																											
9	Task 3 Coastal Development Permit²	100 days	4/1/10	8/18/10		[Gantt bar from 4/1/10 to 8/18/10]																											
10	Subtask 3.1 Prepare CDP Application	20 days	4/1/10	4/28/10		[Gantt bar from 4/1/10 to 4/28/10]																											
11	Subtask 3.2 CDP Application to City of Half Moon Bay	80 days	4/29/10	8/18/10	10	[Gantt bar from 4/29/10 to 8/18/10]																											
12	Task 4 Recycled Water Project Funding	131 days	2/22/10	8/23/10		[Gantt bar from 2/22/10 to 8/23/10]																											
13	Subtask 4.1 State Funding	131 days	2/22/10	8/23/10		[Gantt bar from 2/22/10 to 8/23/10]																											
14	Subtask 4.1.1 SAM Board Resolution to Apply for SRF Loan	1 day	2/22/10	2/22/10		[Vertical bar at 2/22/10]																											
15	Subtask 4.1.2 SAM Board Approves Consultant to Develop SRF Application	1 day	2/22/10	2/22/10		[Vertical bar at 2/22/10]																											
16	Subtask 4.1.3 State Loan Funding Application Development and Review	120 days	2/23/10	8/9/10	15	[Gantt bar from 2/23/10 to 8/9/10]																											
17	Subtask 4.1.4 SAM Board Approves State Funding Agreement	1 day	8/23/10	8/23/10	11	[Vertical bar at 8/23/10]																											
18	Subtask 4.2 Federal Funding	41 days	2/22/10	4/20/10		[Gantt bar from 2/22/10 to 4/20/10]																											
19	Subtask 4.2.1 SAM Board Approves Contract to Develop Title XVI Study	1 day	2/22/10	2/23/10		[Vertical bar at 2/22/10]																											
20	Subtask 4.2.2 Title XVI Study Development for Federal Funding	40 days	2/23/10	4/20/10	19	[Gantt bar from 2/23/10 to 4/20/10]																											
21	Task 5 Design and Construction of Recycled Water Facility: Turnkey (accelerated)	399 days	1/25/10	8/4/11		[Gantt bar from 1/25/10 to 8/4/11]																											
22	Subtask 5.1 SAM Board Approves Consultant to Develop Fast-Track RFP	1 day	1/25/10	1/25/10	4SS	[Vertical bar at 1/25/10]																											
23	Subtask 5.2 Develop RFP for Design/Build Contractor	39 days	1/26/10	3/19/10	22	[Gantt bar from 1/26/10 to 3/19/10]																											
24	Subtask 5.3 SAM Board Approves RFP Package	1 day	3/22/10	3/22/10	23	[Vertical bar at 3/22/10]																											
25	Subtask 5.4 Receive Design/Build Proposals	1 day	5/24/10	5/24/10	24	[Vertical bar at 5/24/10]																											
26	Subtask 5.5 Design/Build Contractor Selection Process	40 days	5/25/10	7/19/10	25	[Gantt bar from 5/25/10 to 7/19/10]																											
27	Subtask 5.6 SAM Board Approves Design/Build Contractor	1 day	7/26/10	7/26/10	26	[Vertical bar at 7/26/10]																											
28	Subtask 5.7 Notice to Proceed to Design/Build Contractor	1 day	8/23/10	8/23/10	27	[Vertical bar at 8/23/10]																											
29	Subtask 5.8 Design/Build Contractor 50% Design Submittal	1 day	10/25/10	10/25/10	28	[Vertical bar at 10/25/10]																											
30	Subtask 5.9 SAM Staff Review of 50% Design Submittal	20 days	10/26/10	11/22/10	29	[Gantt bar from 10/26/10 to 11/22/10]																											
31	Subtask 5.10 SAM Staff Approval of 50% Design Submittal	1 day	11/23/10	11/23/10	30	[Vertical bar at 11/23/10]																											
32	Subtask 5.11 Equipment Fabrication and Delivery	80 days	11/24/10	3/15/11	31	[Gantt bar from 11/24/10 to 3/15/11]																											
33	Subtask 5.12 Notice to Proceed with Construction	1 day	3/16/11	3/16/11	32	[Vertical bar at 3/16/11]																											
34	Subtask 5.13 Construction and Construction Management	80 days	3/17/11	7/6/11	33	[Gantt bar from 3/17/11 to 7/6/11]																											
35	Subtask 5.14 Tertiary Treatment Facility Startup	20 days	7/7/11	8/3/11	34	[Gantt bar from 7/7/11 to 8/3/11]																											
36	Subtask 5.15 Project Complete	1 day	8/4/11	8/4/11	35	[Vertical bar at 8/4/11]																											

¹ Duration based on Working Days
² Assuming NO appeals to CEQA and/or CDP

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SAM Recycled Water Project Schedule
Environmental Impact Report & Design/Build/Bid Project Implementation Approach

ID	Name	Duration ¹	Start	Finish	Predecessors	2010				2011				2012				2013			
						Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	Project Management, Administrative & Legal Activities	1,026 days	11/23/09	10/28/13																	
2	SAM Board Approves Project Management Contract	1 day	11/23/09	11/23/09																	
3	Task 1 Recycled Water Project Alternative Selection	1 day	1/25/10	1/25/10																	
4	Subtask 1.1 SAM Board Selects RW Project Alternative for Implementation	1 day	1/25/10	1/25/10																	
5	Task 2 Environmental Review	261 days	1/25/10	1/24/11																	
6	Subtask 2.1 SAM Board Approval of CEQA/NEPA Consultant Contract	1 day	1/25/10	1/25/10	4SS																
7	Subtask 2.2 CEQA/NEPA Review	240 days	1/26/10	12/27/10	6																
8	Subtask 2.3 SAM Board Certifies CEQA/NEPA Document ²	1 day	1/24/11	1/24/11	7																
9	Task 3 Coast Development Permit ²	100 days	1/25/11	6/13/11																	
10	Subtask 3.1 Prepare CDP Application	20 days	1/25/11	2/21/11	8																
11	Subtask 3.2 CDP Application to City of Half Moon Bay	80 days	2/22/11	6/13/11	10																
12	Task 4 Recycled Water Project Funding	342 days	2/22/10	6/14/11																	
13	Subtask 4.1 State Funding	342 days	2/22/10	6/14/11																	
14	Subtask 4.1.1 SAM Board Resolution to Apply for SRF Loan	1 day	2/22/10	2/22/10																	
15	Subtask 4.1.2 SAM Board Approves Consultant to Develop SRF Application	1 day	2/22/10	2/22/10	14SS																
16	Subtask 4.1.3 State Loan Funding Application Development and Review	120 days	2/23/10	8/9/10	15																
17	Subtask 4.1.4 SAM Board Approves State Funding Agreement	1 day	6/14/11	6/14/11	11																
18	Subtask 4.2 Federal Funding	41 days	2/22/10	4/19/10																	
19	Subtask 4.2.1 SAM Board Approves Contract to Develop Title XVI Study	1 day	2/22/10	2/22/10	14SS																
20	Subtask 4.2.2 Title XVI Study Development for Federal Funding	40 days	2/23/10	4/19/10	19																
21	Task 5 Design of Recycled Water Facility: Design/Bid/Build (traditional)	227 days	6/14/11	4/25/12																	
22	Subtask 5.1 SAM Board Approval of Design Consultant	1 day	6/14/11	6/14/11	17SS																
23	Subtask 5.2 10% Design Submittal	40 days	6/15/11	8/9/11	22																
24	Subtask 5.3 SAM Staff Review of 10% Design Submittal	15 days	8/10/11	8/30/11	23																
25	Subtask 5.4 50% Design Submittal	60 days	8/31/11	11/22/11	24																
26	Subtask 5.5 SAM Staff Review of 50% Design Submittal	15 days	11/23/11	12/13/11	25																
27	Subtask 5.6 90% Design Submittal	60 days	12/14/11	3/6/12	26																
28	Subtask 5.7 SAM Staff Review of 90% Design Submittal	15 days	3/7/12	3/27/12	27																
29	Subtask 5.8 Final Design Submittal	20 days	3/28/12	4/24/12	28																
30	Subtask 5.9 SAM Board Approval of Bid Documents	1 day	4/25/12	4/25/12	29																
31	Task 6 Bidding	61 days	4/26/12	7/19/12																	
32	Subtask 6.1 Advertise Bids	60 days	4/26/12	7/18/12	30																
33	Subtask 6.2 SAM Board Approval of Construction Contractor	1 day	7/19/12	7/19/12	32																
34	Task 7 Construction of Recycled Water Facility	301 days	9/3/12	10/28/13																	
35	Subtask 7.1 Notice to Proceed to Contractor	1 day	9/3/12	9/3/12	33																
36	Subtask 7.2 Substantial Completion	180 days	9/4/12	5/13/13	35																
37	Subtask 7.3 Construction Completion	120 days	5/14/13	10/28/13	36																

¹ Duration based on Working Days

² Assuming NO appeals to CEQA and/or CDP

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0.8 MGD Tertiary Treatment Facility at SAM WWTP Cost Summary

Description	Cost, dollars		Comments
	Sand Filtration	Membrane Filtration	
Modifications to existing WWTP facilities	\$195,000	\$195,000	
Secondary Effluent Pump Station	\$102,000	\$136,000	
WWTP Yard Piping, Valving, and Sitework	\$520,000	\$192,000	
Tertiary Effluent Pump Station	\$100,000	\$100,000	
UV Disinfection	\$450,000	\$450,000	
Coagulation/Flocculation/Filtration/Chemical Addition	\$1,200,000	-	incl. Gypsum for OCP
Membrane Filtration	-	\$2,350,000	incl. Gypsum for OCP
Subtotal	\$2,567,000	\$3,423,000	
<i>Estimating Contingency @ 25%</i>	\$641,750	\$855,750	
<i>Total Probable Construction Cost</i>	\$3,208,750	\$4,278,750	
<i>Administrative, Legal, Planning, Design, Project and Construction Management @ 40%</i>	\$1,283,500	\$1,711,500	
Total Probable Project Cost (Present Worth)	\$4,492,250	\$5,990,250	
<i>Annualized Project Costs</i>	\$292,464	\$389,990	
<i>Estimated Operations & Maintenance Annual Costs</i>	\$178,232	\$192,837	
Total Annual Costs	\$470,696	\$582,827	
<i>OCP Reported Annual Demand, acre-feet per year</i>	300	300	reported by OCP
<i>Dollars per Acre-Foot Produced on Annual Basis – Treatment Only</i>	<i>\$1,569</i>	<i>\$1,943</i>	<i>based on 300 ac-ft/yr for OCP only</i>

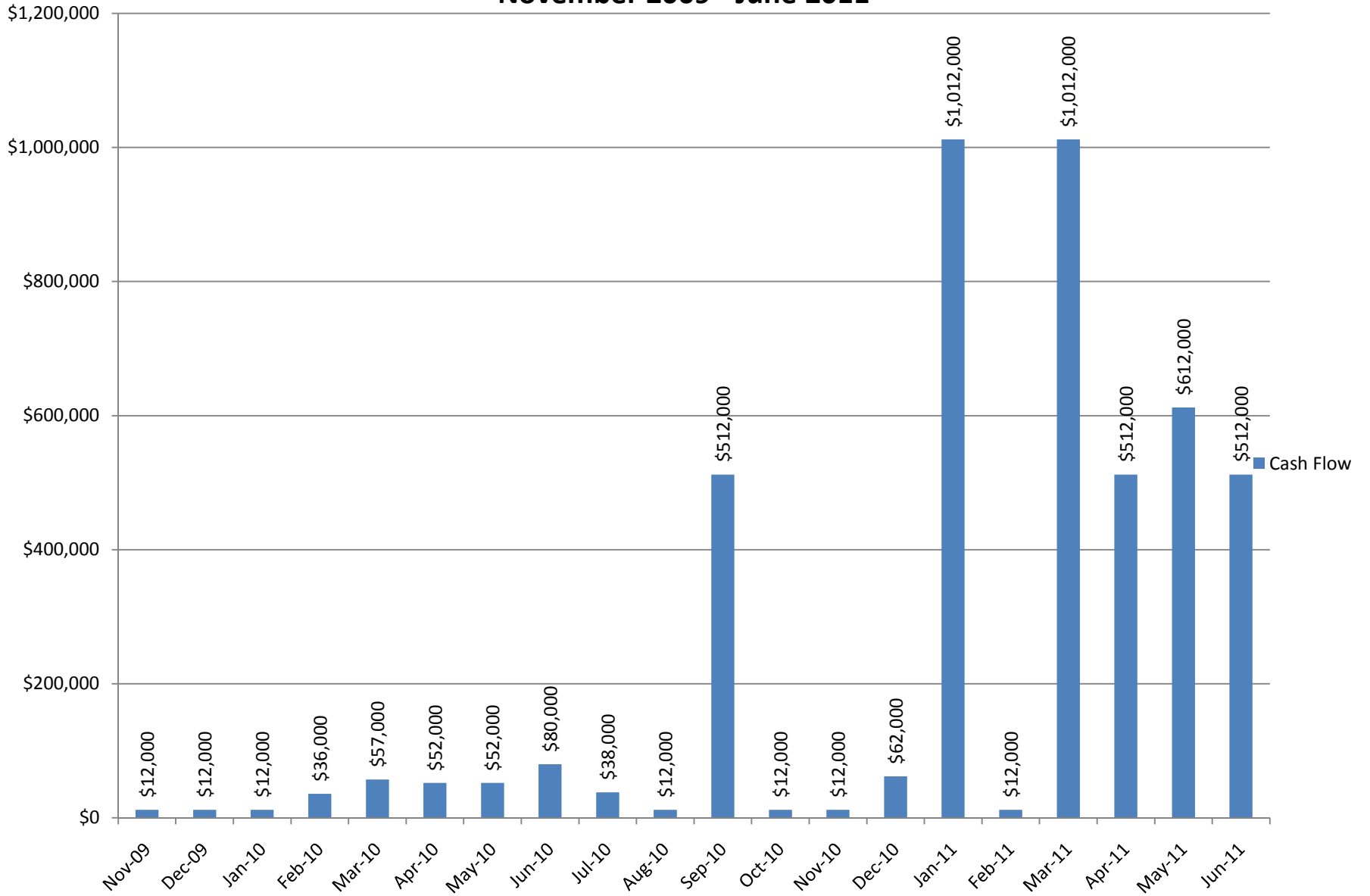
Sample Sensitivity Analysis

Description	Cost, dollars		Comments
	Sand Filtration	Membrane Filtration	
Cost per Acre-Foot/year at 400 acre-feet/year demand	\$1,177	\$1,457	
Cost per Acre-Foot/year at 500 acre-feet/year demand	\$941	\$1,166	
Cost per Acre-Foot/year at 600 acre-feet/year demand	\$784	\$971	
Cost per Acre-Foot/year at 700 acre-feet/year demand	\$672	\$833	
Cost per Acre-Foot/year at 800 acre-feet/year demand	\$588	\$729	
Facility Design Capacity, million gallons per year	240	240	300 days/year operation
Facility Design Capacity, acre-feet per year	720	720	300 days/year operation
<i>Dollars per Acre-Foot Produced on Annual Basis – Treatment Only</i>	<i>\$654</i>	<i>\$809</i>	<i>based on 720 ac-ft/yr sold to customers</i>

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Recycled Water Project Cash Flow

November 2009 - June 2011





About SRT Consultants

SRT Consultants (SRT) provides a wide range of water resources engineering and regulatory and environmental compliance services in California. SRT also provides staff augmentation services for public and private utilities working as an integral part of your organization. Through this work, SRT has developed a strong understanding of daily operational needs, capital project implementation needs, cost effective strategies and accountability to all internal and external stakeholders.

SRT was founded on the principles of producing the highest quality work products, focusing on projects that enhance our community and environment, employing the most enthusiastic and creative individuals, and building valued, long-lasting relationships with our clients. SRT offers qualified staff of senior project managers, engineers, certified treatment operators, field technicians, and construction inspectors to serve your needs. We also collaborate with top industry's experts to bring you the best combination of skills and experience.

Senior Management Team

- Tanya Yurovsky, P.E. 27 years of utility and engineering consulting experience
- Dale Newkirk, P.E. 32 years of utility and engineering consulting experience
- Jean Gardner, P.E. 30 years of utility and engineering consulting experience
- Avi Benjamini, P.E. 15 years of engineering consulting experience
- Mark Quady, P.E. 8 years of utility and engineering consulting experience

Program Management Services

SRT has distinguished itself as a program management firm for water resource projects in San Francisco Bay Area. SRT's program management skills include: prioritization, schedule/document control, permitting, environmental review, public outreach, financial management, and constructability assessment. Our project experience encompasses water and wastewater treatment, water supply, conveyance and storage.

Facility Planning and Design Services

SRT's principal and senior project managers have over 100 years of combined experience in planning, design, and construction management of the following types of facilities: water and wastewater treatment plants, water distribution systems, pump stations, reservoirs and storage tanks, and wastewater collection systems and outfalls.

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Funding Support

SRT's thorough understanding of the grant funding process, our technical expertise, and our innovative approaches to project development have helped our clients obtain funding for water and wastewater-related projects. SRT works closely with clients and stakeholders to develop a well-supported grant proposal based on an understanding of your needs, expectations of funding agencies, and specific program requirements. Ongoing internal tracking of both current and emerging funding opportunities, application guidelines, and deadlines combined with regular communications with Local, State and Federal agencies keeps SRT at the forefront of potential funding prospects.

Funding Support Services include:

- ➔ Grant Strategies Development
- ➔ Application Preparation
- ➔ Grant Administration

SRT Consultants also offers services in the following areas:

- ✓ Facilities Planning and Design
- ✓ Feasibility Studies
- ✓ Pilot Studies
- ✓ Master Planning and Capital Program Development
- ✓ Operations and Maintenance Review and Process Optimization
- ✓ Federal, State and Local Agency Coordination, e.g., California Coastal Commission, State and Regional Water Boards, State Department of Health Services
- ✓ Permit Requirement Analysis, Negotiations, and Acquisition
- ✓ Staff Augmentation Services
- ✓ Asset Management
- ✓ Disposal Analysis

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- ✓ Discharge to Receiving Waters Analysis
- ✓ Facility Inspection
- ✓ Condition Assessment and Rehabilitation Design
- ✓ Security and Emergency Operations Planning and Coordination
- ✓ Hydraulic and Dilution Modeling
- ✓ Engineering Services during Construction
- ✓ Facilities Start-up and Operational Support
- ✓ Recycled Water Systems Planning and Design
- ✓ Renewable Energy Studies

SRT understands that to deliver you the best solutions and work products, projects require expertise in specific areas and is dedicated in developing the best team for your needs. Over the years, SRT has developed strong relationships with the following firms and individual consultants:

- Camp Dresser & McKee
- CH2MHILL
- Kennedy Jenks Consultants
- Brown and Caldwell
- Bartle Wells Associates
- TJC Associates
- Winzler & Kelly
- Hydroconsult
- URS Corporation
- MWH Americas
- Black and Veatch
- Carollo Engineers

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Membrane Filtration Fact Sheet

Membrane Filtration (MF) is an approved tertiary treatment process by the State of California. MF technologies are typically used to replace conventional filtration (sand filtration/chemical addition/coagulation/flocculation) in wastewater and water treatment applications. Membranes offer higher removal ratios but require more energy to operate than conventional filtration.

MF utilizes a pressure-driven membrane barrier to separate suspended solids (TSS), bacteria, viruses, colloids and silt in water. Ultrafiltration (UF) membranes provide filtration in the 0.002 to 0.1 micron range. UF is especially well suited to the removal of particles, Cryptosporidium, Giardia, and viruses. The smaller the nominal pore size, the higher the removal capability. Most materials that are used in UF are polymeric and are naturally hydrophobic. Common polymeric materials used in UF include: Polysulfone (PS), Polyethersulfone (PES), Polypropylene (PP), or Polyvinylidene fluoride (PVDF).

Membranes provide a filtrate that is a suitable feed for a Reverse Osmosis or other polishing technology. However, membranes do not address dissolved constituents in the water (TDS).

Many membrane manufacturers offer various procurement options, including:

- Pre-engineered and skid-mounted units
- Lease or lease-to-purchase
- Design/build turnkey installations
- Repair and startup services
- Consumables support and warehousing

The following State-approved manufacturers were contacted as part of the SAM Recycled Water Facilities Planning Study:

- Layne Christensen Company
- Siemens Water Technologies
- DOW Water Solutions
- PALL Corporation
- Parkson Corporation



Sand Media Filtration Fact Sheet

Sand filtration is a conventional treatment process which has been used traditionally in drinking water treatment plants and as tertiary treatment for wastewater. The process works by forcing water downward through a single or dual media filter system by gravity.

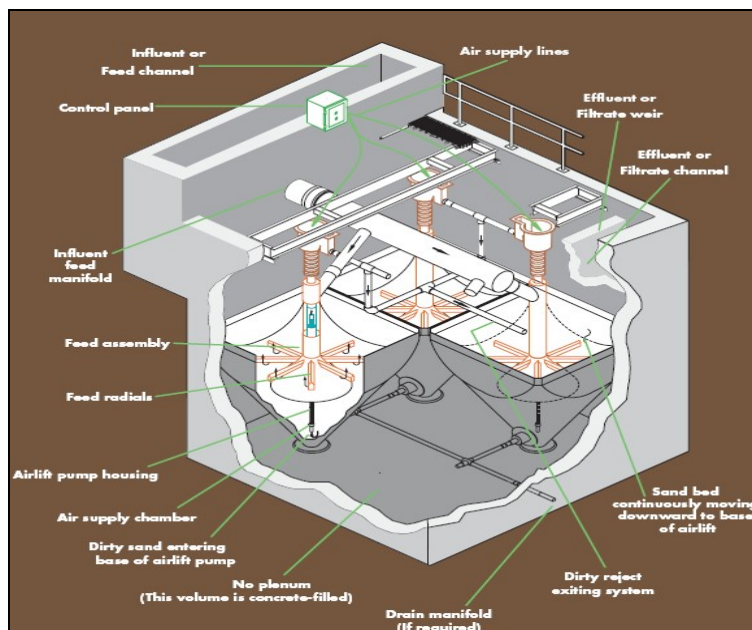
Pretreatment

Pretreatment of incoming effluent is required in most installations for tertiary treatment prior to sand filtration. Pretreatment for sand filtration is usually achieved through addition of chemicals to achieve coagulation and flocculation processes, precipitating suspended solids out of the wastewater stream.

Modular Sand Filtration Units

Several companies offer modular alternatives to the conventional sand filtration unit; one example is the DynaSand Filter. DynaSand is a deep bed upflow continuous granular filter which operates by filtering secondary wastewater effluent while simultaneously cleaning sand filter particles for reuse. It requires no backwash tanks or storage tanks.

DynaSand operates by forcing upward flow of secondary wastewater effluent following coagulation and flocculation through sand settling downward. Effluent enters the top of the filter tank at and flows down through a cylinder that has an airlift pipe running through its center. While the filter is removing suspended matter, a compressor provides suction pressure to the inner airlift tube, which carries sand slurry containing the removed solids upward through a weir and sand washer system. Sand is heavier than the removed solids allowing them to flow over the weir and through the reject pipe as backwash. Filtrate flowing through the sand further cleans sand particles as they fall downward through the washer on their way back to replenish the sand bed. Required surface area is achieved by adding additional filters side by side in a concrete tank.



Sand and Membrane Filtration Technology Comparison Table

Parameter	Continuous Contact Sand Filtration	Membrane Filtration (MF)
Performance <ul style="list-style-type: none"> • Turbidity, NTU • BOD/TSS removal • TDS removal • Virus removal 	<p>< 0.1</p> <p>Yes</p> <p>No</p> <p>2-3 log</p>	<p>< 0.02</p> <p>Yes</p> <p>No</p> <p>6-7 log</p>
Filtration mechanism	Interception/collision/ electrostatic attraction	Sieving/straining
Influent water quality	Affected	Not affected
Water chemistry change	Affected	Not affected
Operating conditions change	Affected	Not affected
Failure mode	Can be catastrophic – microbial penetration	Incremental – individual fiber breaks, water quality not affected
Pretreatment required	Yes	No
Chemical addition required for Na, Cl, and SAR control	Yes	Yes
Rainy season outages tolerated	No	Yes
Backwash	5-10%	5-10%
Power consumption	Low	High
Loading conditions on concrete floor, lb/sf	2,000	1,200
Footprint, sf/MGD	2,400	1,500
Installation	Concrete Basins	Skid-Mounted
Ability to add capacity	Medium to low	High to medium
Chemical consumption	High to medium	Medium to low
Probable capital cost	\$1.5-\$2/MGD	\$2-\$3/MGD
Ease of Operation	More complex than MF	Relatively simple to operate
Media replacement	As needed	Every 5-8 years
Fast-Track Procurement	yes	yes
Competitive products	few	many

Reverse Osmosis Fact Sheet

Reverse Osmosis (RO) effectively uses pressure to push feed water through a semi-permeable membrane, which allows only water to pass, retaining ions and other chemicals. RO produces high quality effluent, stripped of almost all contaminants, and a waste stream highly concentrated with ions of various chemicals. In many cases the water is so stripped of constituents that it is extremely corrosive to pipes and equipment unless supplemented with replacement minerals.

RO membranes have the ability to remove both soluble organic and inorganic matter. In addition, RO has shown high removal rates (>90%) for emerging pollutants of concern such as pharmaceuticals, hormones, and industrial chemicals. RO has been used traditionally to treat reclaimed municipal wastewater for groundwater discharge, cooling towers, and high pressure feed water for boilers.

Pretreatment

Pretreatment of RO feed water has the largest effect on the life of RO membranes as over time the membranes may become scaled or fouled. Pretreatment of secondary effluent for RO preparation is site specific depending on the chemical and biological composition of the feed water. With high levels of iron and manganese, ion exchange or chemical coagulants are added to prevent scale formation. To prevent microorganisms from clogging the membranes, disinfection through UV, chlorine dosing or micro/ultra filtration is used. Adjustment of the feed water pH may also be required to prevent RO membrane corrosion. Membrane filtration is used for RO pretreatment in most installations.