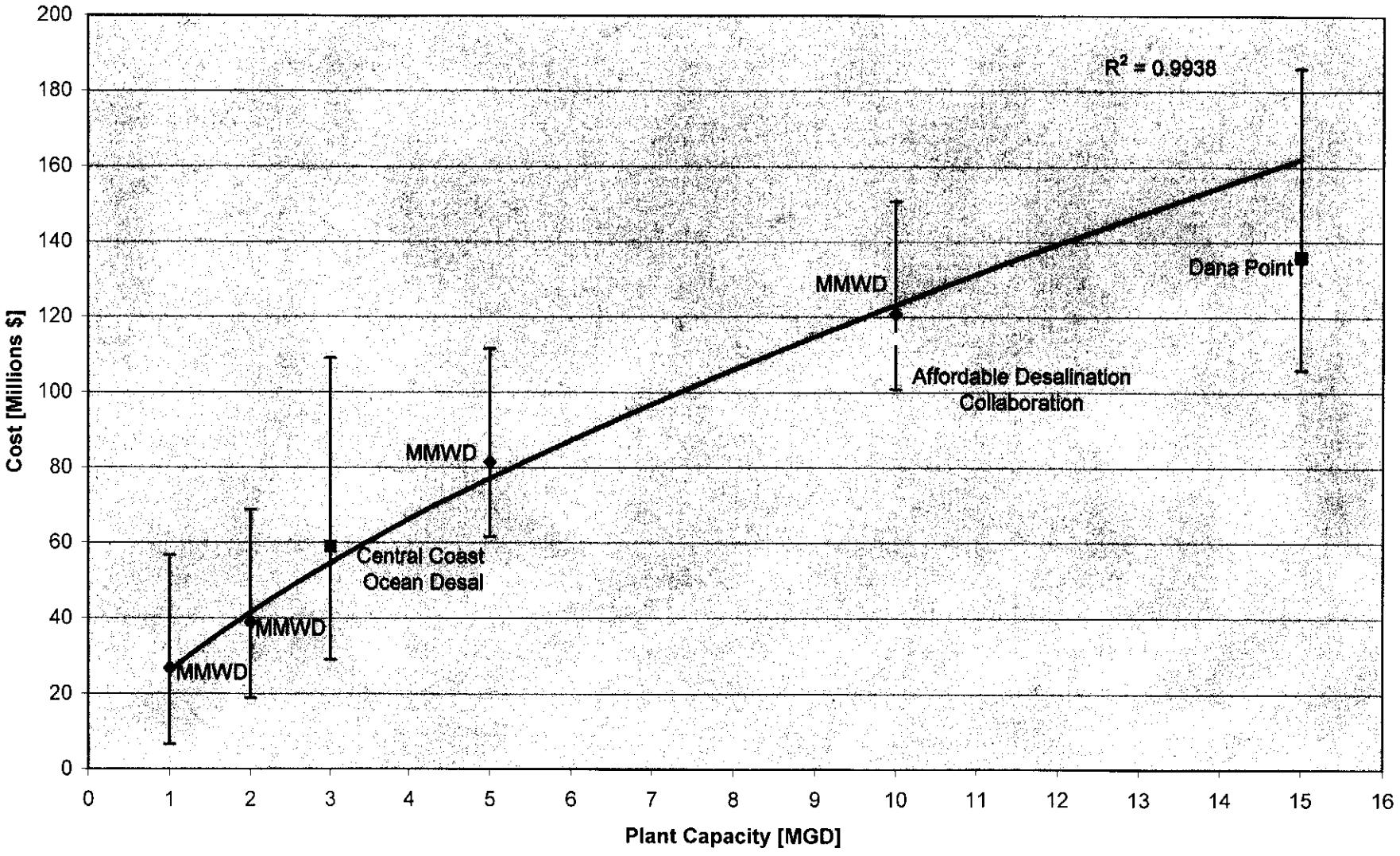
Desalination Plant Capacity Vs. Cost



Attachment 1

Desalination Conceptual Operating Costs

Category	10-MGD Avg Cond	10-MGD Drought Cond	5-MGD Avg Cond	5-MGD Drought Cond	2-MGD*	1-MGD
Chemicals	$1,140,000	$2,797,000	$628,000	$1,399,000	$279,800	$279,800
Power	$2,724,000	$7,042,000	$1,408,000	$3,289,000	$657,800	$657,800
Membrane Replacement	$424,000	$424,000	$215,000	$215,000	$43,000	$43,000
Solids Disposal	$45,000	$173,000	$27,000	$87,000	$17,400	$17,400
Maintenance	$1,228,000	$1,228,000	$795,000	$795,000	$159,000	$159,000
Labor	$740,000	$740,000	$740,000	$740,000	$445,000	$635,000
	$6,301,000	**$12,404,000**	**$3,813,000**	**$6,525,000**	**$1,602,000**	**$1,792,000**

Notes:

1-MGD based on 5 MGD Drought Conditions costs scaled .

1 MGD Labor Costs are 1 supervising operator at $150k, 4 shift operators @ $95k, plus 1 M&E at $105k.

* 2-MGD operated only 12 hours per day

2-MGD labor is 1 supervising operator, and 2 shift operators (day shift operators), and 1 M&E worker at $105k.

10-MGD and 5-MGD Labor Costs are 1 supervising operator at $150k, 4 shift operators @ $95k, plus 2 M&E at $105k each.

Attachment 2A

Desalination Conceptual Cost Estimate - No Uncertainty Factor
Updated 12-09-08
10-MGD and 5 MGD costs taken from KJ report Jan 2007

Unit Process	10 MGD	5 MGD	2 MGD	2-MGD Notes	1 MGD	Notes
Rapid mix	$887,000	$508,000	$195,000	Increase by 1.5 from 1 MGD	$130,000	Based on Volume of concrete
Flocculation	$1,615,000	$869,000	$200,000	Process train doubles	$100,000	Mixing Equipment
Strainers UF Membrane Filters and Building	$11,533,000	$7,885,000	$3,531,981	Factor 1.75 x 1_MGD	$2,018,275	Scaled from 10 MGD not linear, impact of building reduced
Filtrate and backwash Supply tank	$410,000	$206,000	$102,500	Tank volume doubles	$51,250	Scaled from 10 MGD not linear
SWRO Feed Pump Station	$1,193,000	$803,000	$450,000	Pump size doubles factor 1.8	$250,000	four 475 gpm pumps, 1 spare
1st Pass RO and Building	$16,745,000	$9,962,000	$5,128,156	Factor 1.75 x 1-MGD	$2,930,375	scaled from 10 MGD not linear, impact of building reduced
Permeate Tank	$153,000	$153,000	$170,000	1 hour holding time $2/gal	$100,000	1 hour holding time @ $2/gal (50 k gal)
Chlorine Contact Tank	$1,174,000	$540,000	$350,000	120 min holding time $2/gal	$146,750	1 hour holding time @ $2/gal (50 k gal baffled)
Distribution Booster Pumps	$1,294,000	$853,000	$270,000	Pump size doubles factor 1.8	$150,000	Small pump station 3 x 350 gpm pumps, 1 spare
Liq Chemicals	$2,438,000	$1,836,000	$1,500,000	Chems remain same size but freq of delivery increases	$1,500,000	Near bay need to have secure secondary containment. No exterior tanks.
Dry Chemicals	$599,000	$585,000	$500,000	Chems remain same size but freq of delivery increases	$500,000	Lime, magnesium hopper and slurry feed systems post treatment
Carbon Dioxide	$494,000	$388,000	$300,000	Chems remain same size but freq of delivery increases	$300,000	Minimum cost
Backwash Equalization Basin	$253,000	$253,000	$261,000	Factor 1.8 x 1-MGD	$145,000	Cost based on volume required 46,200 gallons and cost of 91 CY concrete
Gravity Thickner	$1,519,000	$1,305,000	$379,750	Process train doubles	$189,875	Scaled from 10 MGD not linear
Centrifuges	$2,226,000	$1,825,000	$634,410	Process train doubles	$333,900	scaled from 10 MGD not linear
Backwash Supply Pump Station	$0	$0	$0		$0	
Brine Pump Station	$792,000	$541,000	$270,000	Pump size doubles factor 1.8	$150,000	3 x 350 gpm pumps, 1 spare.
O&M Building	$600,000	$600,000	$360,000	Building size remains same as 1-MGD	$360,000	1200 sf building at $300/ft for office, storage etc.
Subtotal	**$43,925,000**	**$29,112,000**	**$14,602,798**		**$9,356,425**	
Additional Project Costs						
Site Work (6% subtotal)	$2,635,500	$1,455,600	$730,140		$467,771	
Yard Electrical (8% Subtotal)	$3,514,000	$2,037,840	$1,022,196		$654,880	
Yard Piping (8% Subtotal)	$3,514,000	$2,037,840	$1,022,196		$654,880	
Instrumentation and Controls (5% Subtotal)	$2,196,250	$1,455,600	$730,140		$467,771	
Subtotal Incl additional Project Costs:	**$55,784,750**	**$36,098,880**	**$18,107,469**		**$11,600,727**	
MMWD Specificand Other Costs						
Plant Seismic Piles	$2,400,000	$1,440,000	$648,000	Process train doubles factor 1.8	$360,000	scaled from 10 MGD not linear
Protective Coatings	$660,000	$442,000	$178,200	Surface area of process train doubles factor 1.8	$99,000	scaled from 10 MGD not linear
Transmission pipelines						
Raw Water Transmission Line	$1,727,000	$1,315,000	$875,000	Pipe size increases factor 1.25	$700,000	4000 ft 14 inch HDPE - pipe cost $100k and installation $600k
Brine Transmission Line	$494,000	$420,000	$437,500	Pipe size increases factor 1.25	$350,000	2000 ft of 12 inch HDPE - pipe cost $50k and installation $150/ft
Distribution Pipeline						
Intake System Components						
New Concrete Pier Intake	$4,100,000	$4,100,000	$1,125,000	Larger barge required	$750,000	Floating Barge with trash screens, and marine life exclusionary system
Intake Screens and Pump Station on Pier	$2,593,000	$1,558,000	$450,000	Pump size doubles factor 1.8	$250,000	four 510 gpm pumps, 1 spare
Raw Water Pipe on Pier	$2,505,000	$1,900,000	$500,063	Pipe size increases factor 1.25	$400,050	2000 ft 14 inch HDPE pipe cost $50k and floating installation $200/ft - no trenching
Basic Cost including MMWD Specific Costs	**$70,263,750**	**$47,273,880**	**$22,321,231**		**$15,334,777**	
Contractor markups						
Overhead (6% basic Cost)	$4,215,825	$2,836,433	$1,339,274		$920,087	
Profit (9% Basic Cost)	$6,323,738	$4,254,649	$2,008,911		$1,380,130	
Mob/Bonds/Insurance (3% Basic Cost)	$2,107,913	$1,418,216	$669,637		$460,043	
Subtotal Incl Contractor Markups	**$82,911,225**	**$55,783,178**	**$26,339,053**		**$18,095,037**	
Contingency						
Contingency (25% Basic Cost)	$17,565,938	$11,818,470	$5,580,308		$3,833,694	
Subtotal Incl Contingency	**$100,477,163**	**$67,601,648**	**$31,919,361**		**$21,928,731**	
Escalation To Mid Point of Construction at 5% per year for 3 years	$10,539,563	$7,091,082	$3,348,185		$2,300,217	May not require 3 years but permitting time frame is uncertain
Construction market Uncertainty @ 15% Basic Cost	$0	$0	$0		$0	
Total Construction Cost	**$111,016,725**	**$74,692,730**	**$35,267,546**		**$24,228,948**	
Non Construction Costs						
Permitting (1% 10MGD basic cost)	$702,638	$700,000	$700,001		$500,000	Assumed easier path for permitting smaller facility- however this number could easily double
Engineering (8% basic cost)	$5,621,100	$3,781,910	$1,785,699		$1,226,782	
Services During Construction @ 5% on Basic Cost	$3,513,188	$2,363,694	$1,116,062		$766,739	
Total Facility Costs	**$120,853,650**	**$81,538,335**	**$38,869,307**		**$26,722,469**	
MMWD Distribution System Improvements	$42,000,000	$22,600,000	$1,031,250		$825,000	5,000 ft 12 inch HDPE - pipe cost 75k + installation $150/ft
Total Project Cost	**$162,853,650**	**$104,138,335**	**$39,900,557**		**$27,547,469**	

Attachment 3

E-Mail from Bob Castle to MMWD Board of Directors dated 10/28/2008

Based on the request in today's DOC meeting to see all of the desal cost data side-by-side, attached is a spreadsheet that does just that.

Here is an explanation of what the spreadsheet contains and what has changed since the publication of the Desalination Engineering Report (by Kennedy Jenks / CH2M Hill).

Eliminate "Construction Market Uncertainty Factor" of 15% - At the time of publication of the Engineering Report (January 2007) construction demand had peaked and projects at that time were experiencing a shortage of bids (and qualified contractors) with resultant high bids that far exceeded budgets. Thankfully, that period is behind us. Accordingly, the 15% extra contingency factor is no longer relevant. It is still included on the first tab of the spreadsheet (labelled "Capital Costs") and deleted in the second tab of the spreadsheet (labelled "Cap Cost - No Uncertainty").

Corrected Error in Operations Labor Cost - Tables ES.5 (page 19) and Table 10.9 (page 191) in the Engineering Report listed Operations Labor as $1,650,000 for some cases and $1,065,000 for other cases. The correct figure is $740,000. The error overstates the operations cost by almost $1 million annually.
For the 1-MGD desal plant, the Operations Labor is reduced to $635,000. Since there is less equipment to maintain, only 1 M&E worker is needed.

Costs for 1-MGD Desal Plant - These cost have been extrapolated from the 5 and 10 MGD costs published in the Engineering Report. Notes that explain the logic of the extrapolation are shown to the right of the 1-MGD column. In many cases the extrapolation is not a linear function of plant size. Costs often drop as plant size increases. This is known as economy of scale. The inverse is true as plant size shrinks in some cases.

We will transmit these cost changes to Terry Stigall so that the costs and rate predictions can be updated. This data will then be presented at a future Board Meeting.

Standard Versus Large-Size Membranes - Director Russell has asked us to investigate the potential savings for using larger than standard 8-inch reverse osmosis membranes. All membrane vendors except Koch can supply seawater membranes built to the new industry standard of 16 inches diameter. Koch has elected to make large membranes in 18 inch diameter only, which presents sole source procurement issues. In any event, the economy of scale for large membranes is similar for any of the brands. It allows for more desalination capacity in a smaller building size. Within the seawater desalination industry, the jury is still out as to the pros and cons of operation, maintenance, and

replacement of membranes larger than the current world standard of 8-inch. A study was commissioned by the US Bureau of Reclamation that examined the potential savings by using large diameter membranes. This report was previously transmitted to you. The report estimates a capital cost savings of 7.5% for the RO Building Only (labeled "First Pass RO and Building" on the Capital Costs spreadsheet). If the Board desires, we can reduce the capital cost of this item by 7.5%
for all of the plant sizes. However, this change is well within the accuracy range of these cost estimates.

This is probably a good time to talk about cost estimates and the accuracy range. Table 10.1 (page 176) of the Engineering Report presents the AACE Cost Estimating Guidelines (Association for the Advancement of Cost Engineering). Accuracy increases and contingencies decrease as the design definition of the project increases. At this point in time, the desalination plant is a "Conceptual Design" with estimate accuracy of
-15 to +30% and a recommended contingency of 25 to 30%. The Engineering Report used 25%.

It should be realized that there are still many unknowns regarding a desalination project. The largest of these include permitting and the cost of mitigation to obtain the permits, what it will take to reach agreements with Rod & Gun Club and CMSA, and the details and location of the seawater intake. To remove the uncertainty of these issues would require: 1) Certify the EIR to allow negotiations of these items to proceed; 2) Complete preliminary design of the intake; and 3) The time and budget to carry out these steps. This is not a recommendation. I just want to identify the biggest unknowns.

I hope you find this information useful.

Bob

Attachment 4

Table 10.1: Standard AACE Cost Estimating Guidelines

Cost Estimate Class[a]	Project Level Description	Estimate Accuracy Range	Recommended Estimate Contingency
Class 5	Planning	-30 to +50%	30 to 50%
Class 4	Conceptual (1 to 5% Design)	-15 to +30%	25 to 30%
Class 3	Preliminary (10 to 30% Design)	-10 to +20%	15 to 20%
Class 2	Detailed (40 to 70% Design)	-5 to +15%	10 to 15%
Class 1	Final (90 to 100% Design)	-5 to +10%	5 to 10%

Notes:
(a) Association for the Advancement of Cost Engineering, 1997. International Recommended Practices and Standards.