INNOVATIVE TREATMENT PROCESSES AT THE CHINO BASIN DESALTERS

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Introduction

The need for more water has lead agencies within the Chino Basin in Southern California, that are responsible for water supply, to consider treatment of brackish or contaminated waters in the groundwater aquifer that were previously not considered viable sources. One agency that has faced this decision is the Chino Basin Desalter Authority (CDA). The CDA was created in 2001 and is responsible for implementing the Optimum Basin Management Program (OBMP) which is a broad program to manage the groundwater basin quality and quantity. The CDA, as part of its responsibilities, treats water in the Chino Basin aquifer to acceptable levels for potable consumption. The CDA currently has two facilities that use innovative treatment approaches to meet the water quality goals of the local agencies that receive the final product water. The local agencies which are part of the CDA have stipulated a treatment objective of less than 350 mg/l of Total Dissolved Solids(TDS) and less than 25 mg/l of Nitrate, far more stringent than the drinking water regulations imposed by the Department of Health Services.

The first facility, the Chino I Desalter located in Chino, California was constructed before the creation of the CDA and began operation in the year 2000. The initial treatment process (9.2 MGD) included blending of 2.5 mgd of low TDS well water with 6.7 mgd of well water that was treated by Reverse Osmosis(RO) for reduction of high Nitrates (180 mg/L) and TDS (1,080 mg/L). In early 2005, the facility was expanded by implementing a 4.9 MGD Ion Exchange (IX) System in addition to the RO system to reduce nitrates. Additionally, the treatment process added stripping towers to a side stream consisting of low TDS well water to allow for removal of Volatile Organics. The facility has consistently met its treatment objective over the past five years, with zero violations.

The second facility, which expected to start-up in Spring 2006, is the Chino II Desalter located in Mira Loma, California. The Chino II Desalter has a similar treatment process that includes treatment of well water with high nitrates (90-150 mg/L) and TDS (460-960 mg/L). The treatment process includes a 6 MGD RO System for reduction of TDS and Nitrates and a 4.0 MGD Ion Exchange system for treatment of Nitrates.

This paper will describe the treatment objectives and processes of the Chino I and Chino II Desalter Projects, the type of water the facilities treat, and the operating experience gained from the two projects. The paper is important to other agencies planning to utilize groundwater of poor quality that requires treatment using advanced processes such as ion exchange and reverse osmosis.

Chino Basin Desalter Authority

In 1998 the San Bernardino County Superior Court created and ordered the Chino Basin Watermaster (Watermaster) to develop and implement an Optimum Basin Management Program (OBMP) for the Chino Basin that addressed both the quantity and quality of the basin water. The Watermaster, Inland Empire Utilities Agency (IEUA), all water supply agencies with an interest in the Basin, and the Santa Ana Regional Water Quality Control Board (Regional Board) formed a stakeholder group that together developed the OBMP. The Chino Basin Desalter Authority (CDA) was formed in

September 2001 to facilitate and enable the implementation of division of the OBMP. The member agencies of the CDA are Jurupa Community Services District, Santa Ana River Water Company, cities of Chino, Chino Hills, Ontario, Norco, and Inland Empire Utilities Agency (IEUA).

The Watermaster continues to develop and oversee the OBMP which consists of nine key elements covering a wide range of water activity in the Chino Basin including; 1) Comprehensive Monitoring, 2) Comprehensive Recharge, 3) Water Supply Plan for Impaired Areas, 4) Management Zone Strategies, 5) Regional Supplemental Water Supply, 6) Cooperative Program, 7) Salinity Management Program, 8) Groundwater Storage Management, 9) Storage and Recovery Program.

The development of the Chino I and Chino II Desalters were created and implemented as part of the OBMP element no. 5, which is to develop supplemental water supply within the Basin.

Chino I Desalter

The Chino I Desalter, located in the City of Chino treats groundwater from the lower Chino Basin in order to provide potable water supply to local water users, as well as to help meet some of the basin-wide objectives described in the OBMP. The facility includes a well field, pipelines to send water to the facility, a reverse osmosis system, ion exchange system, and a volatile organic content removal system, brine connection to the Santa Ana River Interceptor (SARI), chemical feed systems and ultimately the pump station to transfer the product water to the end users.

The Chino I Desalter receives water from 14 wells. Wells 1 through 4 have a combined water quality that meets the product requirements as they relate to Total Dissolved Solids content and Nitrate content, however the wells have volatile organics that require treatment. Wells 5 through 15 (Well 12 does not exist) have higher TDS and Nitrate content than would meet the requirements of the agencies that receive the water. Based on the water quality of these treatment wells, these wells are classified as extremely impaired water sources. All of the wells have a flush to waste system that was installed after the initial construction. The flush to waste at each well is used to ensure that the initial water from the well is wasted until the turbidity and silt density are acceptable to feed directly to the Reverse Osmosis (RO) system with only cartridge filtration as pretreatment.

The raw water quality is shown in **Table 1**, which includes the minimum, maximum, and average water quality that is currently being experienced in the facility. The information presented in the table is based on recent water quality taken in 2005. It should be noted that the average TDS is 855 mg/l and the nitrates range from 65-265 mg/ as nitrate.

Table 1: Chino I Desalter Feed Water Quality

Constituent	Units	Wells 1-4 (Side Stream VOC)			Well 5-15 (RO and Ion Exchange)		
		Minimum	Maximum	Average	Minimum	Maximum	Average
Calcium (Ca)	mg/L	9.1	58	17	88	220	149.3
Magnesium (Mg)	mg/L	<1	7.8	7.8	19	55	35
Sodium (NA)	mg/L	52	83	63.5	29	62	47.9
Potassium (K)	mg/L	1.2	2.3	1.3	2.2	3.4	2.81
Bicarbonate (HCO3)	mg/L	98	160	120	250	520	395
Sulfate (SO4)	mg/L	38	56	38.5	23	90	56.3
Chloride (Cl)	mg/L	19	38	20.5	48	180	99.9
Nitrate as (NO_3)	mg/L	6	62.5	15.75	68.5	255	146.5
Fluoride (F) (Natural Source)	mg/L	0.3	1.2	0.85	0.1	0.2	0.15
pH (Laboratory)	Stndrd.	7.3	8.2	8.15	6.6	7.6	7.27
Total Filterable Residue@180C (TDS)	mg/L	240	390	255	460	1350	855
Boron	μg/L	140	1100	650	0	0	0
Silica	mg/L	19	30.5	19.5	29	36	32.9
Aluminum (Al)	μg/L	2200	2200	550	58	58	58
Arsenic (As)	μg/L	8.4	11	10.45	0	0	0
Barium (Ba)	μg/L	0	0	0	110	310	206.7
Copper (Cu)	μg/L	0	0	0	380	380	380
Iron (Fe)	μg/L	1500	1500	375	0	0	0
Total Trihalomethanes (THM'S/ TTHM)	μg/L	0.6	0.6	0.6	0	0	0
Chloroform (Trichloromethane)	μg/L	0.6	0.6	0.6	0	0	0
Trichloroethylene (TCE)	μg/L	9.7	9.7	9.7	0.55	0.55	0.55
p-Isopropyltoluene	μg/L	0.5	0.5	0.125	0.5	0.5	0.5
1,2,3-Trichlorobenzene	μg/L	0.22	0.22	0.22	0	0	0

The Chino I Desalter has a product water quality requirement of 350 mg/l of TDS and 25 mg/l of Nitrates. This treatment objective was set by the Agencies receiving the product water from the facility. The water quality is set to allow the respective agency to blend the product water with local groundwater sources within each of the agency's service area to meet the drinking water requirements.

The Chino I Desalter process flow diagram is shown in **Figure 1**. The well water from Wells 1-4 is treated through a packed tower whereby a blower is used to push air up through a plastic media and drives off the volatile organic compounds (VOC). Groundwater from wells 5-15 are treated through a 6.7 mgd RO system and a 4.9 mgd side stream Ion Exchange System to remove TDS and Nitrates before it is blended with the VOC system product water. After thorough research, the decision to expand the initial 9.3 MGD RO facility by 4.9 MGD utilizing Ion Exchange was reached based on the required water quality objective of the CDA. While traditional RO system can lower the nitrate in the product water, it also lowers the TDS in the product water to concentrations much less than 100 mg/L, substantially increasing the corrosivity of the product water. The Ion Exchange system, while removing nitrates, does not remove any TDS, thereby providing a final blend water, when mixed with the RO permeate and VOC effluent, that met the water quality objective without providing over-treatment. This treatment scenario is expected to provide energy cost savings compared to the traditional RO treatment plant. The final 14.1 mgd of product water is stabilized using caustic soda and disinfected with sodium hypochlorite.

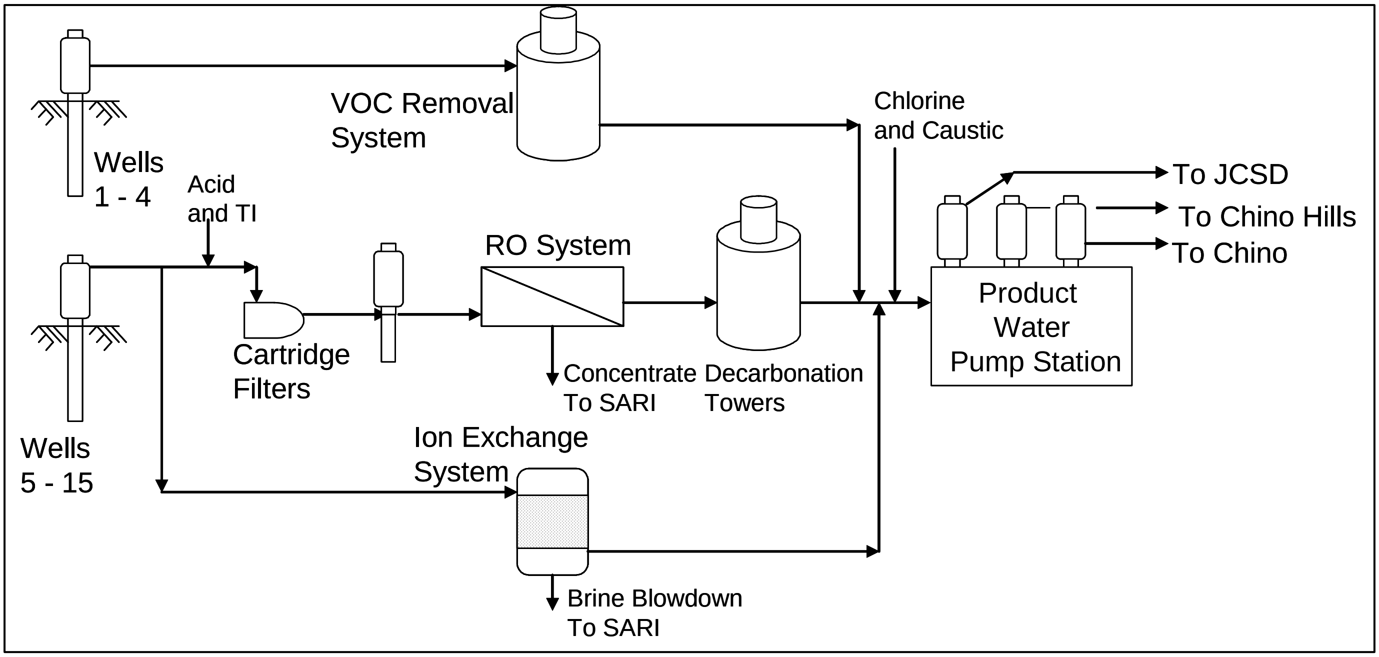

Figure 1: Chino I Desalter Process Flow Diagram

The RO System includes the addition of sulfuric acid to reduce the pH of the incoming water to prevent calcium carbonate scaling and threshold inhibitor to prevent scaling with sparingly soluble salts. Following the chemical addition, are 5 cartridge filters (4 on line and one standby) utilizing 1 micron cartridge filters as pretreatment to the RO trains. The replacement of cartridge filters occurs monthly (or sooner depending on the differential pressure). There are 4 RO trains consisting of a high pressure feed pump and a two stage single pass RO configuration. The RO trains each have 36 – 7 element pressure vessels configured in a 24:12 array. Each RO train has a design capacity of 1.68 mgd and utilize 400 square foot DOW/Filmtec RO membranes. The RO System operates as a design recovery of 80-85%.

The brine or concentrate stream that comes from the RO system is discharged to the Santa Ana River Interceptor (SARI) which is a collection pipeline that takes the brine to an ocean discharge in Orange County. The CDA pays to discharge the brine to the SARI pipeline. The Chino I Desalter has a brine flow of approximately 2.05 mgd. This flow is used to determine the Capital, Fixed and Flow based costs for the brine facilities. The Capital Cost is calculated as $14.1 million, the Fixed Cost is calculated based on $8,045 per MGD of flow and the $589 per million gallons of Flow for the flow based costs.

Following the RO trains, the product water is treated through induced draft decarbonation towers to remove carbon dioxide and adjust the pH of the final product water prior to stabilization with caustic soda and disinfection with sodium hypochlorite.

All of the well water does not need to be treated through the RO system and therefore a side stream is routed around the RO process. However, since the wells have a significant nitrate level, it is necessary to treat the sidestream to remove nitrates to a reasonable level to maximize the amount of sidestream flow. The process that is used to remove the nitrate is an Ion Exchange Process, whereby the flow is passed through a bed of anionic resin in a pressure vessel which removes the nitrate ions. This process requires that the pressure vessels with resin periodically be regenerated by passing a 10-12% sodium chloride solution over the resin to force the exchange the chloride with the nitrate that has adhered to the resin during normal operation. This exchange process creates a brine solution, 3% of the influent to the IX, which is also wasted to the SARI line.

The expanded facility has been in operation since August 2005 and continues to meet its water quality objective with zero violations. The complex combination of RO, IX and VOC treatment at the plant has been proven to be successful.

Chino I Desalter Construction and Startup

The Chino I Desalter was completed in 2000. There were various separate projects for construction of the facility. There was a contract for the well drilling, one for well equipment installation, one for construction of the RO facility, and product pumping facilities, one contract in 2004 for construction of VOC facilities and site improvement, and one contract for construction of the Ion Exchange facility. The following are the costs of the facilities:

Table 2: Chino I Desalter Project Costs

Chino I Desalter Existing Facilities (9.3 MGD)[1]	
Estimated Construction Cost for 11 Wellsites	$ 12.0 Million
Estimated Construction Cost for 29,000 ft PVC PL from Wellsite to Plant	$ 3.0 Million
Estimated Construction Cost for 23,500 ft PVC PL from Reservoir to Plant	$ 2.5 Million
Estimated Construction Cost for 5,600 ft VC disposal PL from Plant	$ 2.0 Million
Estimated Construction Cost for 8,329 ft CML PL from Plant to Chino Hills	$ 1.0 Million
Estimated Construction Cost for 62,200 ft CML PL from Plant to JCSD	$ 11.0 Million
Estimated Construction Cost for Chino Reservoir	$ 3.0 Million
Subtotal Offsite Facilities	**$ 34,.5 Million**
Cost for Chino I Desalter Reverse Osmosis Plant [1]	**$ 29.99 Million**
Chino I Desalter Expansion Facilities (4.9 MGD)[2]	
Cost for Chino I Desalter Onsite Improvements (VOC Removal System, Storm Drain)	$ 2.15 Million
Cost for Chino I Desalter Ion Exchange Treatment System	$ 4.1 Million
Additional SARI Capacity Purchase	$ 4.14 Million
Cost for Chino I Desalter Expansion Offsite Facilities including wells and pipeline	$ 9.04 Million
Estimated Engineering Costs and Construction Management [3]	$ 4.5 Million
Total Chino I Desalter Facilities Cost	**$ 88.4 Million**

1. Chino 1 Desalter Existing Facilities Costs are in 2000 dollars
2. Chino I Desalter Expansion Facilities Costs are in 2005 dollars
3. Engineering Costs are Estimated for Entire Project

There are many lessons that have been learned during the operation of the Chino I Facilities. Some of the most important lessons are directly related to the pretreatment of the feedwater to the facility and are summarized below.

When the Chino I well facilities were originally installed, they were not installed with the capability to flush to waste at each of the wells. This feature was provided as a flush to the equalization basin at the actual Chino I Facility which is over two miles away. The issue with this approach was realized early in the operation when many solids were discharged to the RO facility and ultimately ended up on the Cartridge Filters. The problem was that there were many wells feeding into the pipeline to the facility and depending on the actual production capacity which varies based on the demand from the of the facility, there would be wells starting and stopping at random. Each time the wells would start, they would discharge a significant amount of turbidity and suspended solids into the pipeline to the facility. The only way to resolve this issue was to either install flush to waste capabilities at the each of the wells or to revise the overall plant controls to require the system to shutdown and restart each time a well was started. The second approach of starting and stopping the RO system for each well was not practical and therefore flush to waste capabilities were added to the wells.

A second issue that was realized was that the Cartridge filters were not of very good quality and allowed for bypassing of the cartridge filters within the housing. The actual design of the housings do not have an intermediate support and therefore would allow the cartridges to sag within the housing and impaired the sealing. This issue was rectified by modifying the housing to add intermediate supports.

Along with the housing having so much trouble, the micron rating of the cartridges was also an issue. The original design was based on a 10 micron rating. This design was typical of other systems which had been designed in southern California. It was quickly realized that with so much solids being introduced from the wells, the micron rating was very important to the long term operation of the membranes. The membrane system was experiencing high differential pressure in the frontend of the system. Overtime, the micron rating was reduced to 1 micron and the change out interval for a 15 psi differential pressure is approximately monthly or less.

Another issue that was encountered with the Chino I Desalter pretreatment system was the issues with controlling many wells to the facility. The original design for each of the wells included a variable frequency drive with all of the wells controlling to a single pressure at the Chino I Desalter. This control strategy never worked properly due to the long distance between the wells and the treatment plant and the time it took to control the pumps in response to pressure changes. The Chino I Operators therefore chose to control each of the wells by using the speed of the pumps. The operators would then set the pump to a set speed and would then monitor the flow. Each well was not controlled to flow due again to the inability to control quick enough with the control flow.

The last pretreatment issue that has been encountered is the loss of production from the wells. The Chino I Desalter feed wells have experienced a loss in capacity over time and as production has continued. The Desalter is now bringing online more new wells by installing wells 13, 14 and 15 in 2005. The new wells will allow the facility to shutdown and redevelop many of the original wells.

Chino II Desalter

The Chino II Desalter is located in Mira Loma, California and provides a high quality water for potable use to the agencies. The facility provides water to the City of Ontario, the Jurupa Communities Services District (JCSD). The Facility is operated by the Jurupa Community Services District. An interesting aspect of the Chino II Desalter is that it incorporates many upgrades based on experience gained in the operation of the Chino I Desalter. The Operators of the Chino I Desalter were included in the design process to ensure that the facility improved upon the already successful Chino I Desalter.

The Chino II Desalter receives water from 8 wells. Wells 1 through 9A (well 5 was not constructed) have higher TDS and Nitrate concentrations than would meet the requirements of the agencies that receive the water. All of the wells are provided with a flush to waste system to ensure that the initial water upon startup of the well is wasted until the turbidity and silt density are acceptable to feed directly to the Reverse Osmosis (RO) system with only cartridge filtration as pretreatment. The flushing system discharges the initial water to a stormwater drain system that ultimately discharges to the Santa Ana River.

The raw water quality from the Chino II Well is shown in **Table 3**, which includes the minimum, maximum, and average water quality that is currently being experienced in the facility. The information presented in the table is based on recent water quality taken in 2005. It should be noted that the average TDS is 593 mg/l and the nitrates range from 58-222 mg/l as nitrate.

Table 3: Chino II Desalter Feed Water Quality

Constituent	UNITS	Minimum	Maximum	Average
Calcium (Ca)	mg/L	75.0	180.0	112.0
Magnesium (Mg)	mg/L	8.6	16.0	12.5
Sodium (NA)	mg/L	25.0	47.0	32.8
Potassium (K)	mg/L	1.9	3.8	2.7
Bicarbonate (HCO3)	mg/L	190.0	270.0	221.3
Sulfate (SO4)	mg/L	17.0	100.0	42.5
Chloride (Cl)	mg/L	41.0	120.0	69.4
Nitrate as NO_3	mg/l	57.6	221.5	89.2
Fluoride (F) (Natural Source)	mg/L	0.1	0.2	0.2
pH (Laboratory)	Stndrd.	7.0	7.8	7.5
Total Filterable Residue@180C (TDS)	mg/L	380.0	1000.0	592.5
Aluminum (Al)	µg/L	51.0	51.0	51.0
Arsenic (As)	µg/L	0.0	0.0	0.0
Barium (Ba)	µg/L	110.0	160.0	125.0
Boron	µg/L	0.0	0.0	0.0
Chromium (Total Cr)	µg/L	1.6	7.3	3.6
Chromium (Total Cr - CrVI screen)	µg/L	1.9	4.6	3.2
Iron (Fe)	µg/L	28.0	28.0	28.0
Silica	mg/L	26.0	33.0	29.6
Vanadium	µg/L	5.2	12.0	8.1

The Chino II Desalter, similar to Chino I, has a product water quality requirement of 350 mg/l of TDS and 25 mg/l of Nitrates to allow the respective agency to blend the product water with local groundwater sources to meet the drinking water requirements. The difference in the Chino II Desalter is that the facility wheels its product water in the Jurupa Communities Service District piping and is ultimately distributed to the JCSD, City of Norco, and the City of Ontario. The facilities allow the cleanup of the groundwater for use as a potable source. Additionally, the facilities provide for redundancy to the water capacity of the various agencies.

The Chino II Desalter process flow diagram is shown in **Figure 2**. The well water from Wells 1-9A is treated through a 6.0 mgd RO system and a 4.0 mgd side stream Ion Exchange System to remove TDS and Nitrates. The final 10.0 mgd of product water is stabilized using caustic soda and disinfected with sodium hypochlorite prior to being pumped from a transfer pump station to the final three million gallon product storage tank and distribution pump station.

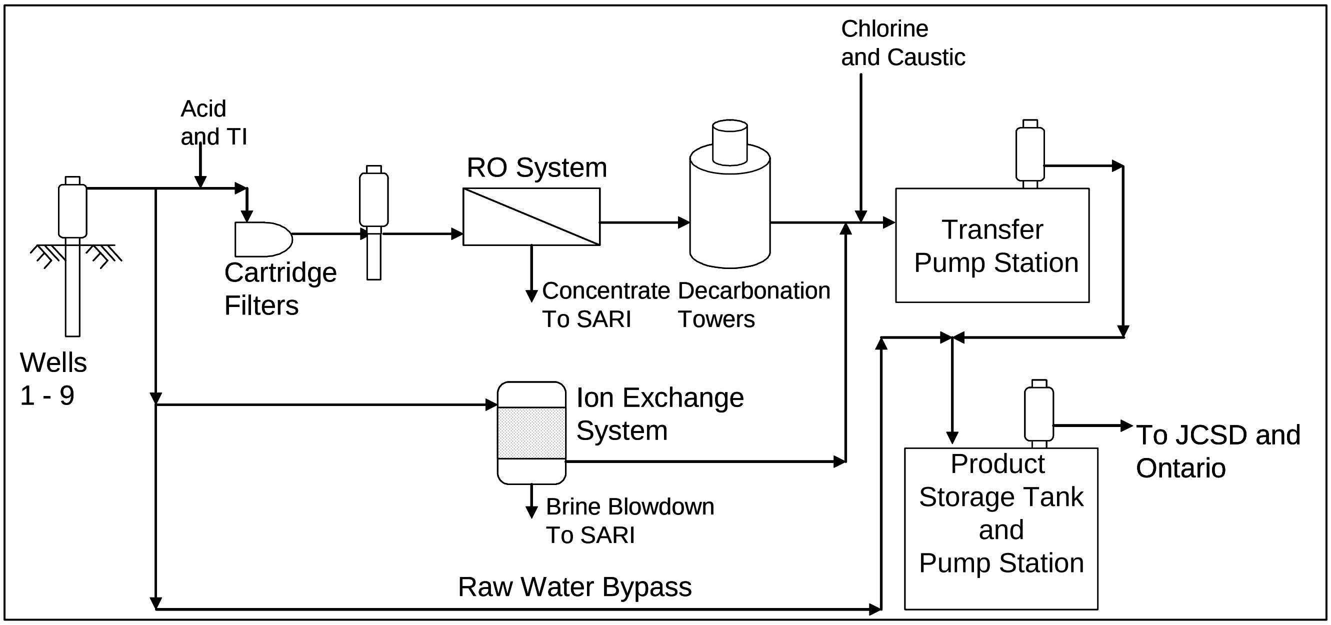

Figure 2: Chino II Desalter Process Flow Diagram

The RO System, similar to Chino I Desalter, includes the addition of sulfuric acid to reduce the pH of the incoming water to prevent calcium carbonate scaling and threshold inhibitor to prevent scaling with sparingly soluble salts. A large Carpenter 20 static mixer was added to the facility to ensure proper mixing of the sulfuric acid before the addition of the threshold inhibitor. This feature allowed the sulfuric acid and threshold inhibitor to be routed in the trenches minimizing piping runs to the injection locations.

An additional feature of the Chino II Desalter is the feed piping changes from cement mortar lined steel to 316 Stainless Steel upstream of the chemical addition. The influent piping was changed to stainless steel at the request of the operators due to some leaks and pressure limitation experienced with the FRP piping used as the feed piping in the Chino I Desalter. The facility incorporates the feed piping in the trenches allowing for side entry cartridge filters to eliminate the large overhead piping similar to Chino I.

Following the chemical addition, are 5 horizontal cartridge filters utilizing 1 micron cartridge filters as pretreatment to the RO trains. Additionally, there are manual flow meters on each of the cartridge filters to compare flow to each of the units to ensure they are not experiencing preferential flow.

Downstream of the pretreatment chemicals and cartridge filters are 3 RO trains consisting of a high pressure feed pump and a two stage single pass RO configuration. The RO trains each have 48 – 7 element pressure vessels configured in a 32:16 array. Each RO train has a design capacity of 2.0 mgd and utilize 400 square foot DOW/Filmtec RO membranes. The RO System operates as a design recovery of 80-85%. Based on experience gained at the Chino I Desalter, the DOW/Filmtec BW-30 RO membranes were selected.

Similar to the Chino I Desalter, the concentrate stream that comes from the RO system is discharged to the Santa Ana River Interceptor. The Chino II Desalter has a brine flow of approximately 1.3 mgd. This flow is used to determine the Capital, Fixed and Flow based costs for the brine facilities. The Capital Cost is calculated as $10.1 million, the Fixed Cost is calculated based on $8,045 per MGD of flow and the $589 per million gallons of Flow for the flow based costs.

Following the RO trains, the product water is treated through forced draft decarbonation towers to remove carbon dioxide and adjust the pH of the final product water prior to stabilization with caustic soda and disinfection with sodium hypochlorite. The forced draft decarbonation towers were used instead of the induced draft blowers to allow for better maintenance access of filters and blowers and to minimize the potential for corrosion of the fans with the aggressive RO permeate.

As with the Chino I Desalter, all of the well water does not need to be treated through the RO system and therefore a portion of the flow is routed around the RO process. Since the well water has a significant nitrate level, it is necessary to treat the sidestream to remove nitrates to a reasonable level to maximize the amount of sidestream flow. Again, the process that is used to remove the nitrate is an Ion Exchange Process. The same manufacturer of the Ion Exchange System at Chino I Desalter, designed and constructed the Chino II Desalter IX System. This provides the CDA the opportunity to purchase replacement resin from the same manufacturer when the initial load is spent. This will provide for better overall operations and maintenance economics for the facilities.

As an additional process at the Chino II Desalter, there is a raw water bypass that was installed to allow raw water to be blended with the combined RO and IX product streams. The raw water bypass allows for increased capacity as well as the addition of alkalinity and for further stabilization in the event the RO and IX product water is not stabilized with caustic addition. The ultimate benefit realized with the capability to bypass is produce high quality water at a net savings in energy and operation and maintenance costs.

Chino II Construction and Startup

The Chino II Desalter construction was began in 2003. There were various separate projects for construction of the facility. There was a contract for the well drilling, one for well equipment installation, one for construction of the RO facility, transfer pump station, product storage tank and product pumping facilities, and one contract for construction of the Ion Exchange facility. The following **Table 4** presents the costs of the facilities:

Table 4: Chino II Desalter Project Costs

Chino II Desalter Facilities (10 mgd)	
Chino II Desalter	$14.55 Million
Chino II Desalter RO membranes	$0.54 Million
Chino II Well Drilling	$2.54 Million
Chino II Well Equipping	$6.87 Million
Chino II Raw Water Pipeline and Brine Line	$5.31 Million
Chino II Ion Exchange	$4.42 Million
Chino II SARI Connection Fee	$10.11 Million
Chino II Engineering Fees/Construction Admin.	$11.57 Million
Total Capital Cost for Chino II Desalter Facilities	**$55.91 Million**

Construction was completed in 2005 and the facility has been going through various startup issues. Various important obstacles were encountered during the startup that were not anticipated, however were overcome with novel approaches to ensure a viable and functioning facility.

First, there were many delays encountered in the well construction and implementation due to siting of the wells on private land. The main delay resulted from the acquisition of the property from the private entities. These delays required that the CDA provide provisions for starting the facility with only a portion of the wells until the other wells were completed. Allowing for a portion of the wells to be used was not an issue in this instance since the wells were actually producing more water than was originally anticipated in the design.

A second issue encountered was water production problem requiring that one of the wells be abandoned. Upon completion of the well construction, the water production from the well was found to be much lower than the anticipated design capacity. As a result, the well was abandonded. As for the remaining wells that were drilled, they were higher capacity wells and produced a better feedwater quality in TDS and nitrates than compared to the design feedwater quality used for the facility. The wells were pumped and found to have Heterotrophic Plate Counts above 500 which is the California DHS limit for the feedwater to the facility. This issue was mitigated for the project wells by disinfecting the aquifer in addition to the wells and then flushing them for long periods of time prior to initiating flow to the treatment facility. Additionally, the evaluation of the water quality showed that the facility would still produce the design product water quality with regards to TDS and Nitrate.

Another issue that was encountered with the treatment plant was the disinfection of the media for the Ion Exchange. The IX resin was also found to have bacteria based on testing. The issue with IX resin is that it cannot be chlorinated to allow disinfection. Therefore, alternative methods were developed to allow hydrogen peroxide to disinfect the resin without causing adverse affects to the resin beds prior to putting them into operation.

As with many facilities, the Chino II Desalter startup was challenging for the CDA, however, the lessons learned from the Chino I Desalter and the flexibility provided in the Chino II Desalter ultimately allowed for a fully functioning facility that meets the water quality goals set fro the project.

Conclusions

The Chino I and Chino II Desalter have been constructed by the Chino Basin Desalter Authority to improve the water quality and to provide additional water to the local communities from the Chino Basin. Additionally, the facility provides for cleanup of the groundwater in the Chino Basin. The Chino I and Chino II Desalter facilities both implement advanced water treatment processes including Reverse Osmosis and Ion Exchange. These treatment processes provide lots of flexibility for the CDA in managing the product water quality. With the incorporation of Ion Exchange system as part of the water treatment facility, the CDA has realized energy savings and cost savings in the operation and maintenance of the facilities. The Chino I Desalter has consistently produced high water quality, far exceeding the limitations set forth by the Department of Health Services for five years.

The Chino II Desalter has recently been started in the Spring of 2006 and is meeting the water quality goals of the project and exceeding the requirements of the Department of Health Services as well. The advanced treatment processes are being successfully used to achieve the target water quality required by the receiving agencies. The processes are going to be used to expand the Chino II Desalter as well as provide further improvements within the basin in years to come.

As with all operating water treatment plants, there are many lessons that have been learned during the operation about the specific water and the specific system capabilities. This is especially true with the Chino I Desalter Facilities. Some of the most important lessons are directly related to the pretreatment of the feedwater to levels that allow it to feed the RO system, including the need for flush to waste facilities at the wells, the need for good quality cartridge filters, the importance of the appropriate micron rating of the cartridge filters, the importance of a well coordinated pump control strategy and the reality that the wells will loose capacity over time. The advantage of having the Chino I Desalter operating experience is that it was able to be used in the design of the Chino II Desalter.