Ed Archuleta *has served as General Manager for the El Paso Water Utilities Public Service Board since 1989. He is responsible for all aspects of water and wastewater service to the Greater El Paso Metropolitan Area, a population of approximately 700,000 people. Under his management, the utility has been recognized regionally and nationally for leadership in conservation, reclamation, and management. From 1974 to 1989, Ed worked for the City of Albuquerque in various positions including Assistant Director/Operations, Public Works Department. Prior to that, he planned and designed water and wastewater projects for a multinational consulting engineering firm in Iowa and a regional firm in Albuquerque. Ed earned bachelor's and master's degrees in civil engineering from New Mexico State University, and a Master of Management Degree from the University of New Mexico. He is a registered Professional Engineer in Texas, New Mexico, and Iowa and is Chairman of the American Water Works Association Research Foundation, a trustee of the Association of Metropolitan Water Agencies, and an American Academy of Environment Engineers Diplomat.*

PLANNING AND DEVELOPMENT OF IMPAIRED WATERS AT EL PASO WATER UTILITIES

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ABTRACT

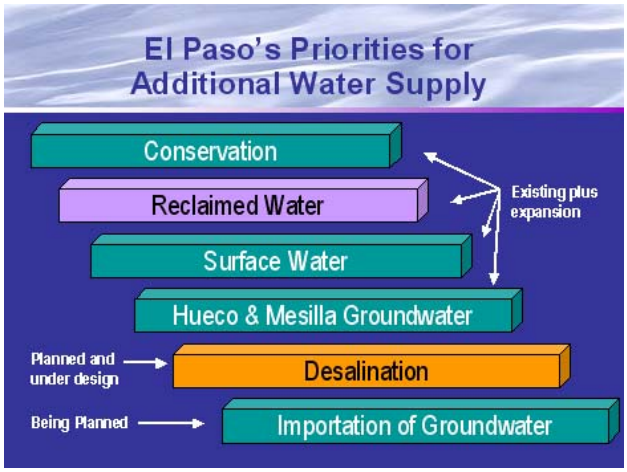
El Paso Water Utilities serves approximately 700,000 people in the greater El Paso metropolitan area with water and wastewater services. The Utility has well-established strategic and water resource management plans.

El Paso's water management portfolio includes one of the most aggressive and successful conservation programs in the country, conjunctive use of groundwater and surface water, and a growing utilization of reclaimed water.

The strategic and prudent use of brackish groundwater (impaired waters) will assist El Paso in meeting its current and long-term water supply needs, this is, employing total water management.

This presentation describes El Paso's successful reclaimed water program that includes both indirect potable reuse, as well as direct non-potable reuse. Furthermore, it discusses El Paso's plans to design and build the largest brackish groundwater desalination plant in the country with an output of 27.5 million gallons per day. The plant is currently being designed and completion is expected in late 2005.

Editor's Note: The following PowerPoint presentation was given by Mr. Archuleta at the conference.

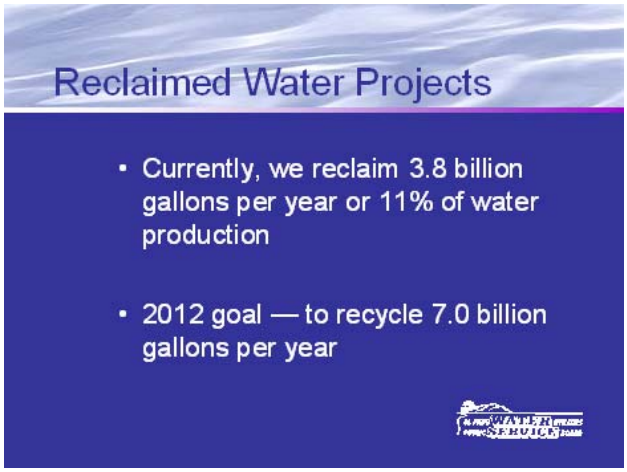


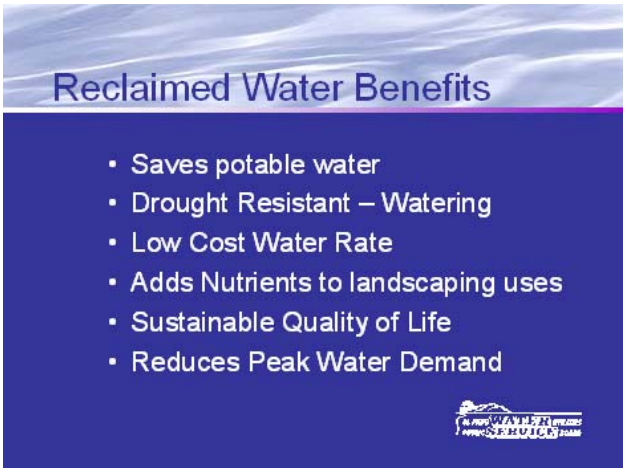
Good Morning.

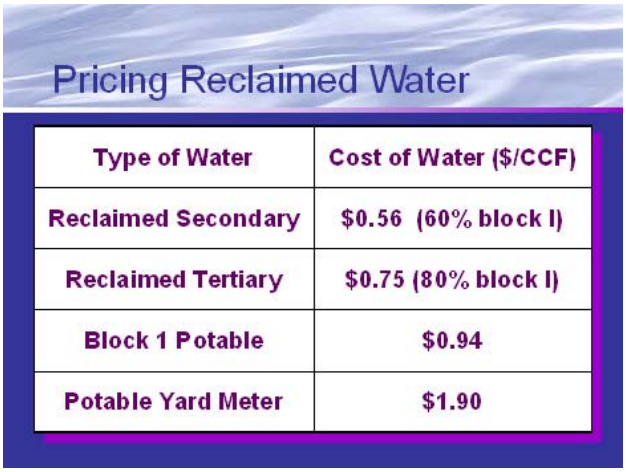
The availability of water for human use is reported to become, within this century, one of the world's top challenges to overcome. Here in El Paso, it will be our top challenge within the next 25 years.

"Water Planning" is a very timely topic in the Southwest today.

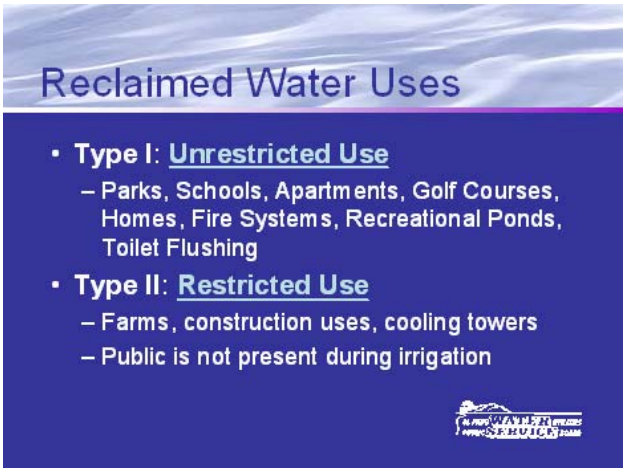
For instance, San Antonio just completed a huge reclaimed water project that is serving multiple customers. I believe that the public, the user, and professionals all need to be familiar with reclaimed water and to promote its safe and effective use. The public will increasingly come to accept reclaimed water as one of several alternative solutions to our water supply problems.







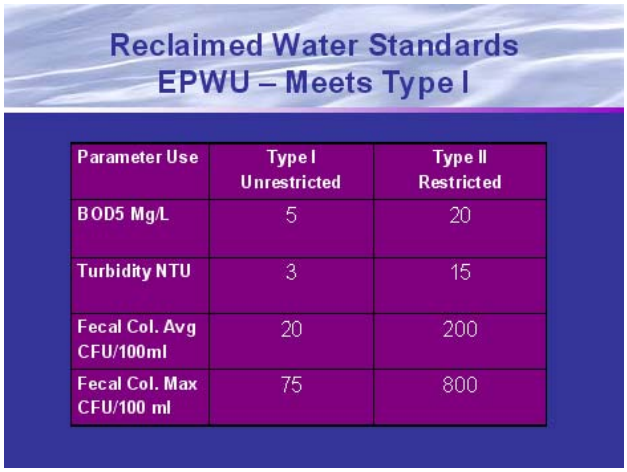
Reclaimed water is priced lower than the rate charged for potable water. The price is a big incentive for many customers to convert. In El Paso, the Fred Hervey plant sells its water for $0.75 per one-hundred cubic feet while the other three plants sell water for $0.56 per one-hundred cubic feet. This is about half of what most people pay for water in El Paso. The lowest potable water rate available is $0.94 per one-hundred cubic feet.



Two "types" of reclaimed water meet water quality standards.

Water quality standards are based on the potential for human exposure to this water.

An important qualifier in the definition of reclaimed water is whether human exposure potential is unrestricted or restricted.

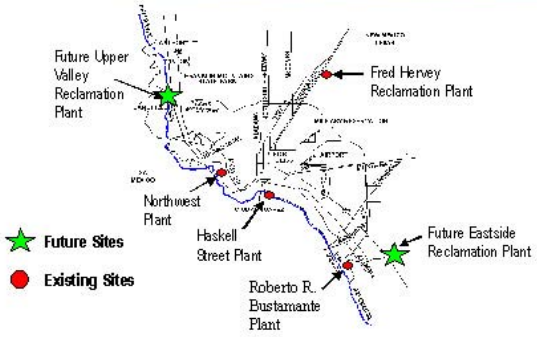


Primary wastewater treatment removes contaminants primarily through gravity separation (coarse organic and inorganic solids).

Secondary wastewater treatment removes dissolved organics through biological or chemical treatment. Type I water requires at least secondary treatment in order to meet water quality.

Tertiary treatment involves the removal of nutrients and other contaminants.

EPWU Reclaimed Water Facilities



Present – Annual 2002 Total Reclaimed Use By Plant

- Bustamante Plant – 635 MG/YEAR
- Haskell Plant – 684 MG/YEAR
- Fred Hervey Plant – 2,160 MG/YEAR
- Northwest Plant – 317 MG/YEAR
- Total Reclaimed Used – 3,796 MG/YEAR

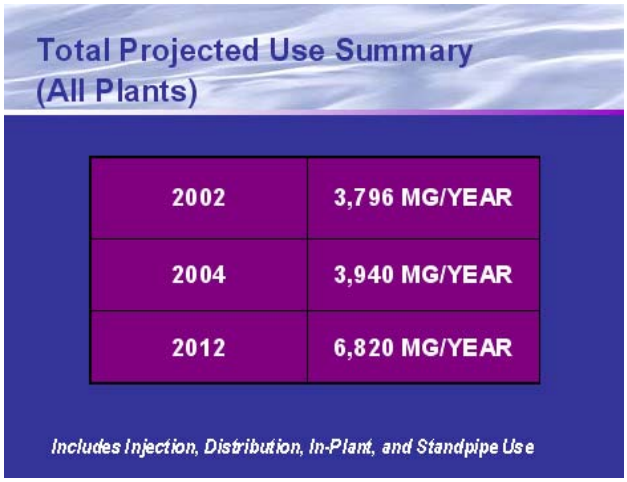
Includes Distribution, Injection, In-Plant, and Standpipe Uses

Summary Current Peak Day Reclaimed Water Use

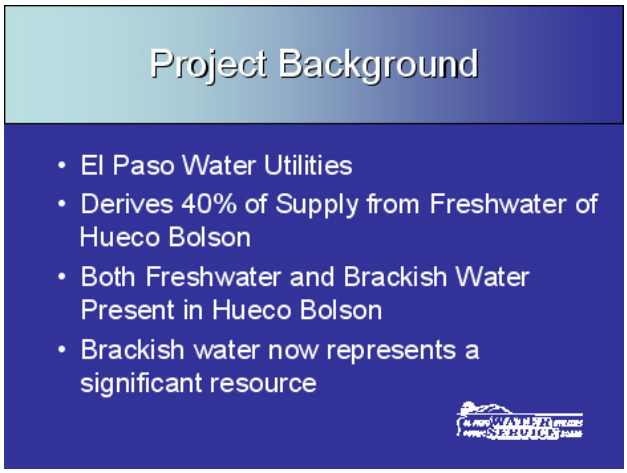
Northwest Plant - West Side	1.8 MGD
Fred Hervey Plant - Northeast	6.0 MGD
Bustamante Plant - Lower Valley	2.0 MGD
Haskell Plant - Central	2.6 MGD
Total Of All Plants	**12.4 MGD**

OFFSETS PEAK WATER DEMAND

Includes Distribution System and In-Plant Uses

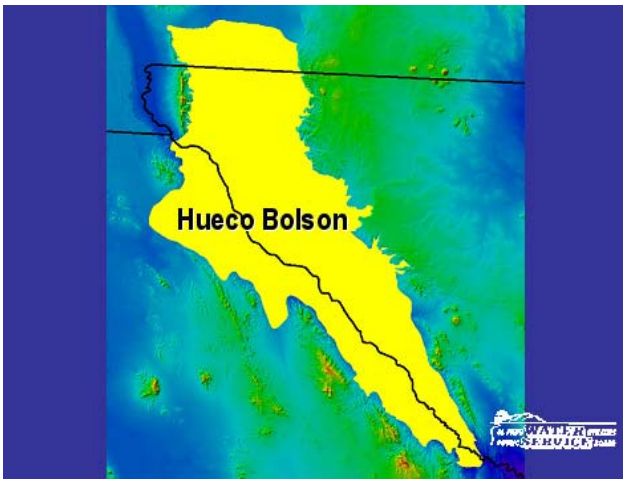


El Paso's Joint Desalination Facility Project will eventually supply 27.5 MGD of water to the El Paso area, and has been in the making for over 10 years. The implementation of a large inland desalination project involves many considerations not readily apparent to many considering a project employing reverse osmosis desalination. It involves more than constructing a treatment plant—many issues must be considered when planning a desalination project. While no two projects are identical, many of the issues we have addressed in developing this project may reasonably be expected in development of an inland desalination project. Similarly, project specific requirements not required in this project, may be required in another. El Paso Water Utilities, the water service purveyor for the greater El Paso area, began analyzing desalination as a treatment option over 10 years ago with feasibility studies and small pilot efforts to characterize the resource. In 2000, EPWU formalized and committed to desalination as a supply option with the publication of the Eastside Brackish Groundwater Desalination Facilities Plan. MCI and CDM were retained for this project in the spring of 2001.



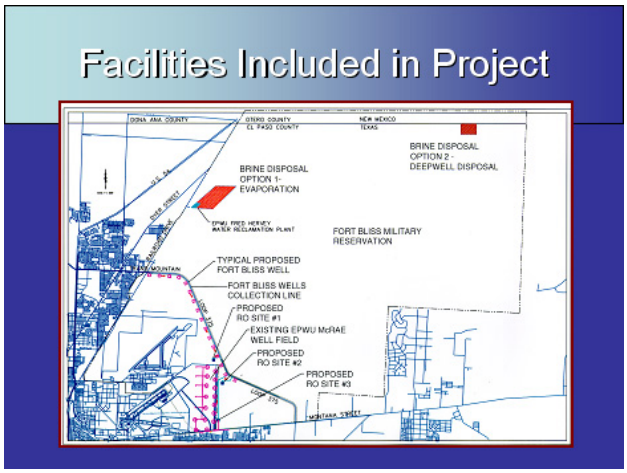
• EPWU water portfolio currently consists of three supplies: Rio Grande surface water, the Mesilla Bolson, and Hueco Bolson groundwaters. EPWU formerly derived 60% of its supply from the Hueco Bolson, but that amount has been reduced through development of surface water.

• The economics of water supply and the state of technology have evolved such that desalination is now an economically viable option. Therefore, EPWU embarked on this project to serve a twofold function: preserve the freshwater of the Bolson for drought periods, and develop this new source of supply for the future as a first alternative to more expensive importation options.

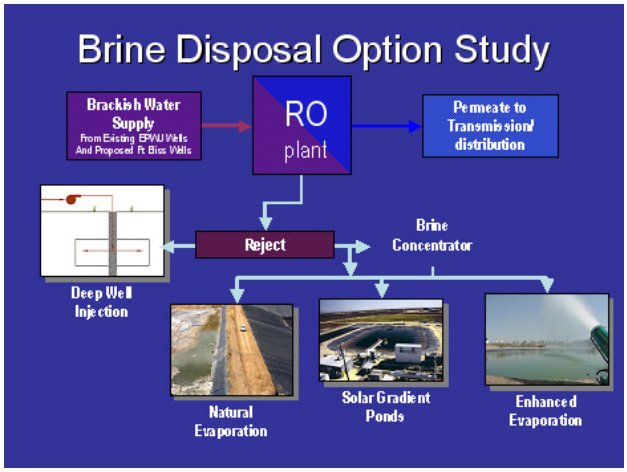


• The Hueco Bolson is an approximately 200-mile long groundwater basin extending from New Mexico through Texas and into Mexico. It also encompasses the Tularosa basin, although there is a slight topographic divide near the Texas/New Mexico border that defines the border of the Hueco/Tularosa. While there are substantial fresh water deposits in the Hueco Bolson, they are small in comparison to the more than 25 million acre-feet of brackish water.

• The raw water supply will be treated with reverse osmosis technology and then blended with raw water that is bypassed around the treatment facility to produce water, meeting the goals of the project.
• Fort Bliss and EPWU were both considering building separate plants of 20 and 7.5 MGD. Talks were initiated to evaluate the feasibility of a combined plant, and through diligent efforts by both participants, it was determined a combined project addressed both parties needs better than independent ones, with the additional benefit of being more cost effective.
• This project, as most inland plants, involved consideration of much more than the simple design of a reverse osmosis desalination plant.

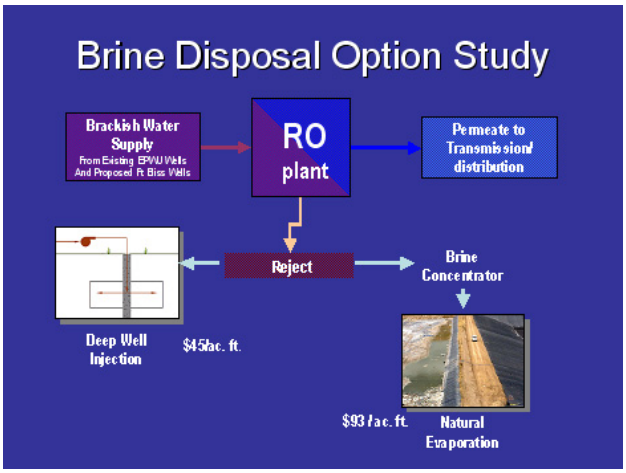


Project features being considered and evaluated according to the National Environmental Policy Act (NEPA) include two concentrate disposal locations and methods (evaporation ponds vs. deep well injection) and three potential plant locations.



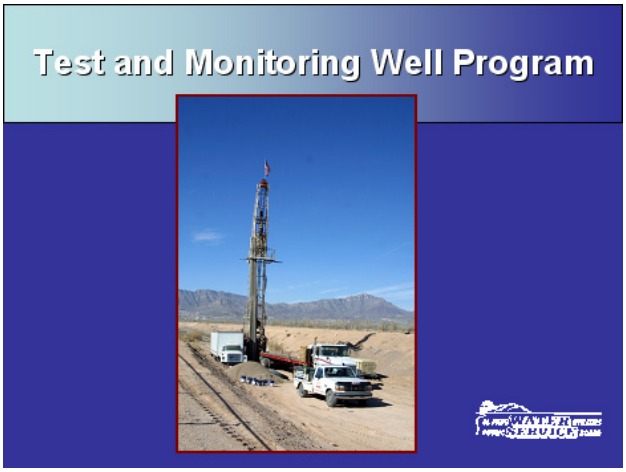
A brine disposal option study was implemented in the early phases of the project because the brine disposal investigating, permitting, and construction requirements represented the critical path for the project schedule. The options being considered can be immediately implemented technologically. Certainly, there are many other options that might be considered, but they are project specific.

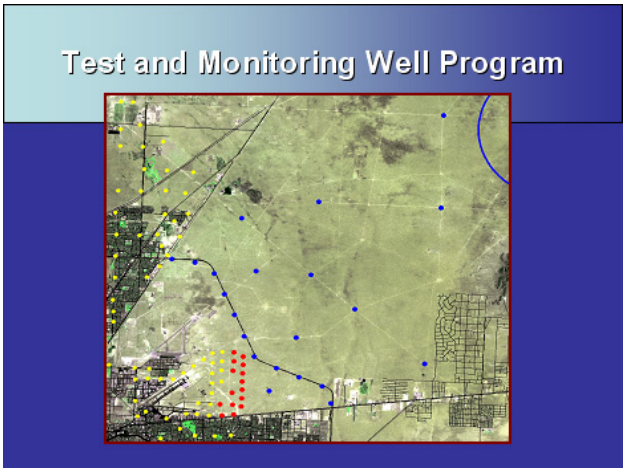
Following screening of the available options, it was determined that deep-well disposal was the most cost-effective option. However, the requirements for the regulatory permitting cycle necessitated substantial subsurface investigations.



It was decided that, based on cost considerations, the project would pursue the deep-well option as the preferred option with evaporation ponds as the alternate. However a critical path schedule was developed identifying the point at which a go/no-go decision would be made on the implementation of deep-well disposal. This approach will allow the maintenance of the original project schedule.

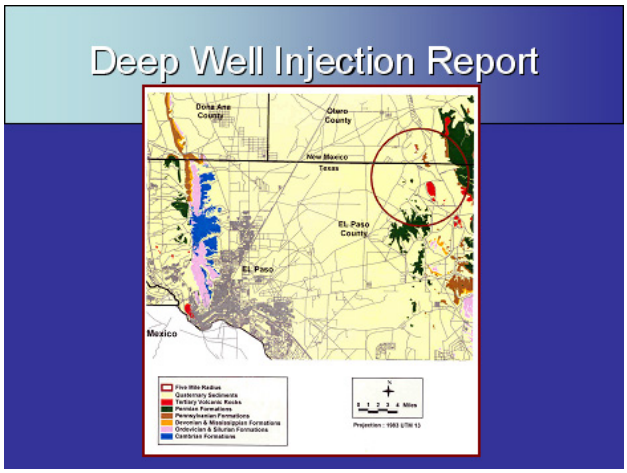
The deep well disposal option is anticipated to cost approximately $11 million to implement in terms of capital, while the evaporative option will require as many as 640 acres of dual lined ponds and approximately $21 million in capital costs. Disposal costs including amortized capital operation are estimated to be $45/acre-foot for deep-well disposal, $93/acre-foot for evaporation with brine concentration, and $115/acre-foot without brine concentration.



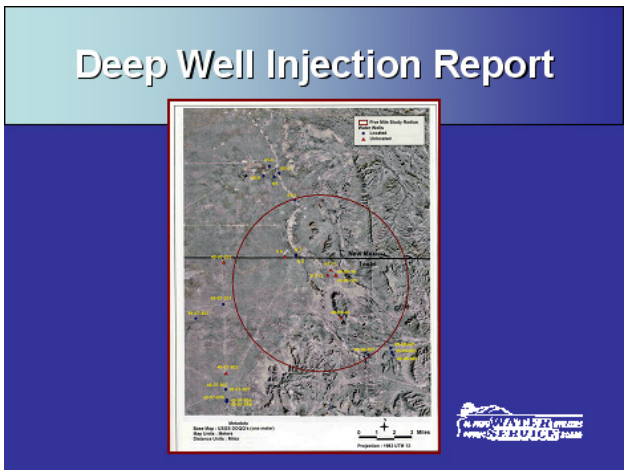


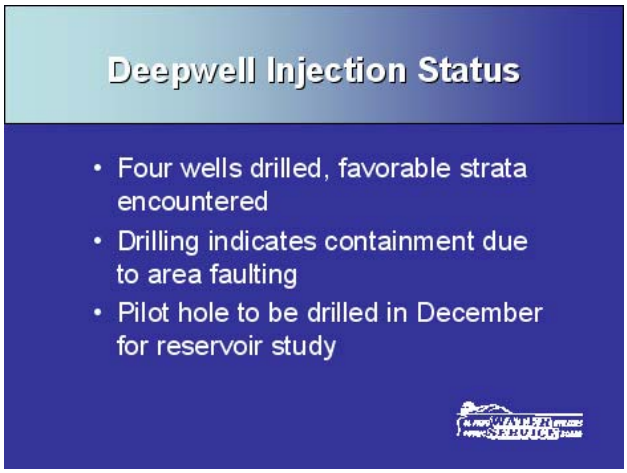
To address the lack of data on the Fort Bliss property, a program was initiated to define the resource quality.

- The slide shows the monitor and test well locations required to characterize water quality in the previously unexplored area.
- Once these wells were drilled, simulations of alternative well locations were completed to predict aquifer response.
- The best quality of water was determined using the so-called “blend 1 alignment.” We also were able to protect the existing freshwater supply by forming a groundwater trough to intercept the movement of brackish water.



• The ground siting area for deep well injection of concentrate was located using the consultant's Brine Disposal report, based upon previous work by Witcher and others on the McGregor range.
• Investigations focused on the area within a five-mile radius as shown in the slide.
• An existing well survey, gravity survey, seismic evaluations, and investigative drilling program were then developed.

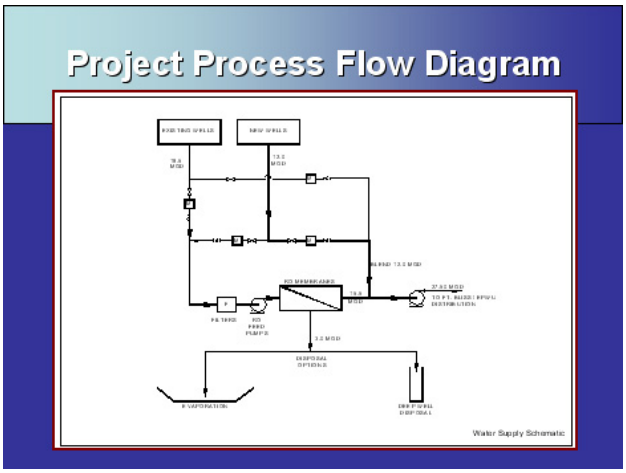


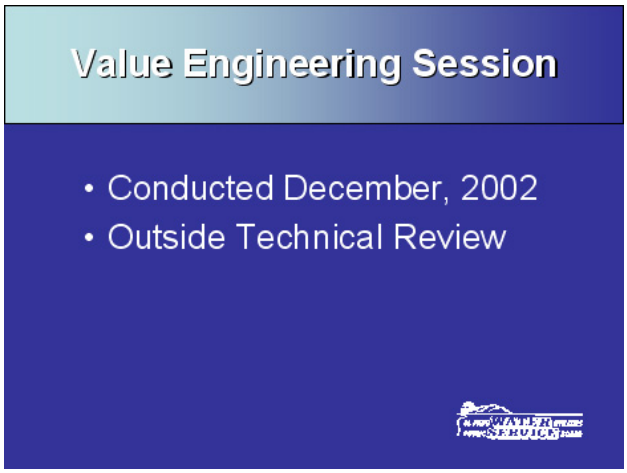


• The top of the Fusselman Dolomite was encountered at 2200 feet in one exploratory well, and 2900 feet in a second well to the south. Over 1500 feet of consolidated bedrock existed above the Fusselman.
• Seismic results on area faulting are still being compiled.
• A pilot hole program will commence in December for reservoir studies, water quality acquisition and developing regulatory permit data for injection of the concentrate.
• TCEQ has been instructed to expedite processing of desalination projects.

• Support for the project — CDM constructed a 30-gpm pilot unit, which EPWU now owns and will incorporate into the project.
• Pilot testing began in September of 2002 and has since been relatively continuous. The testing to date has confirmed water supply quality considerations.
• Membranes have been tested from four of the five municipal scale suppliers (Tri-Sep, Hydranautics, Film-Tec, Osmonics, and Koch will be tested).
• Studies will now focus on pretreatment, maximizing recovery without acid, and antiscalant evaluation.

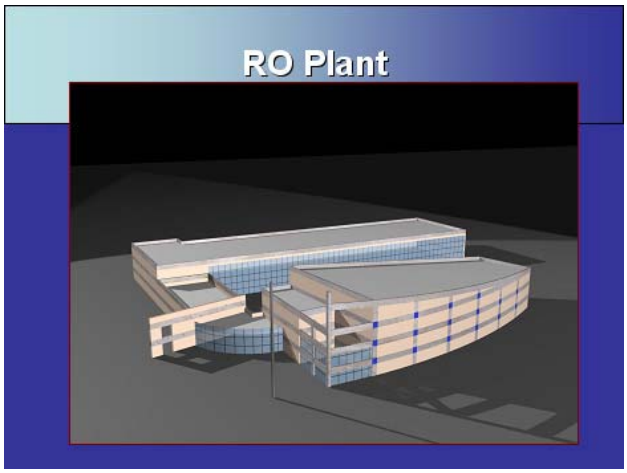
• UTEP has conducted an effort under an US Bureau of Reclamation grant.
• UTEP evaluated nanofiltration softening followed by medium pressure reverse osmosis and various combinations of lime softening followed by medium pressure reverse osmosis. Results are to be published in November of 2003.





Completed by Parsons Engineering with subconsultants at approximately 35% design level.

• Preliminary Design Report completed May, 2003.
• 5 each – 2 stage modules. 3 MGD nominal capacity (48:24), 336:168, 2520 total membranes.
• Target blend water quality is 230 chlorides, approx. 600 TDS.
• Acid feed facilities will be provided. However, pilot studies indicate the possibility of operating without an acid feed facility
• One spare module space is left for a membrane concentrator or potential third stage concentrator.
• Sand separation is conducted on site.



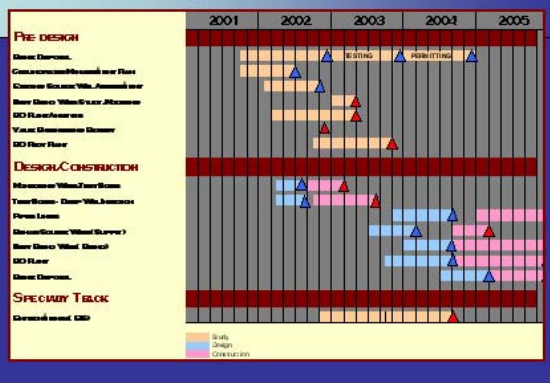
The targeted blended water quality is 250 mg/l chloride and 600 to 700 mg/l total dissolved solids (TDS).

Estimated Project Costs

Blend Wells	$12.0 M
Supply Wells	4.5 M
Pipelines	14.5 M
Desalination Plant	25.0 M
Disposal (Deepwell)	11.0 M
Estimated Project Total	**$67.0 M**

The estimated cost of the finished water produced is $700 per acre foot; using a 5% discount rate for capital and O&M.

Project Schedule



Milestones

- Completed Design of Well Improvements –October, 2003
- Commenced Design of Desalination Plant – September, 2003
- Pilot Hole Drilling , December 2003
- NEPA Studies – Projected Completion in August 2004