Economic Evaluation of Salinity Impacts

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Why do we care about salinity?

- Economic burden
- Increased costs incurred due to higher salinity
- Reduction in income and other benefits

Need for Economic Evaluation

- Who is being affected and what are the economic impacts of Rio Grande water with higher salinity?
- Are the economic impacts small or large?
- How are economic impacts related to changes in salinity concentrations?
- Is investment in salinity control appropriate and if so how much investment is justified?

Economic Evaluation Approaches

Economic impacts of salinity related to:

- Replacement and production costs (equipment replacement/avoidance/treatment)
- Changes in consumer surplus (benefits/income)
- Non-market benefits and costs
  - Hedonic and Contingent Valuation methods
- All require knowledge of relationship between salinity concentration and physical/economic impact

Economic Impact Examples

- Increased costs due to higher salinity
  - Higher equipment replacement costs (shorter life)
  - Higher cost of salinity tolerant equipment
  - Added treatment cost/higher alternative source (desalination)
  - Higher water use/cost to avoid damages (leaching)
- Reductions in income and other benefits
  - Reduced crop yields
  - Restricted to less profitable industries and crops
  - Lower value/less desirable landscape/riparian/recreation/environment
  - Non-sustainable (long term) productivity and water use

Few Economic Studies

- Economic Impacts of Colorado River Salinity, Milliken Chapman, 1988. Damage function estimates developed.
- Salinity Management Study, Metropolitan Water District and USBR,1998. 1988 damage functions with local water use data.
- Central Arizona Salinity Study, USBR, 2003. Used 1988 damage functions with local water use data.
- All the above use the same damage function relationships. Each study also strongly emphasizes the importance of modifying the evaluation and using site specific data.
- Several rural and agricultural salinity damage studies conducted in Australia.

Economic Impact Estimates

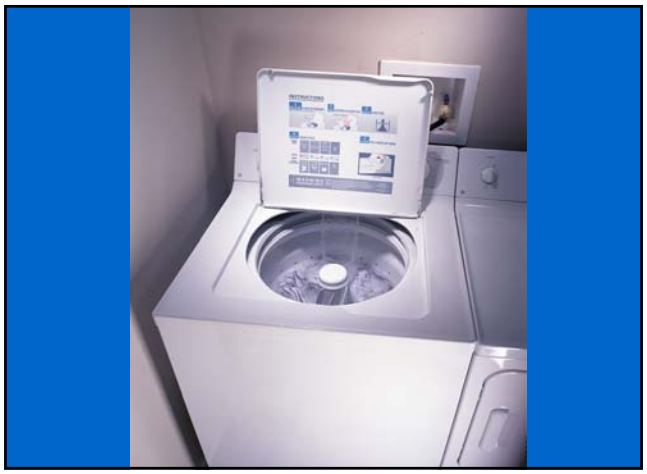
Central Arizona Salinity Study considered impacts in five categories:

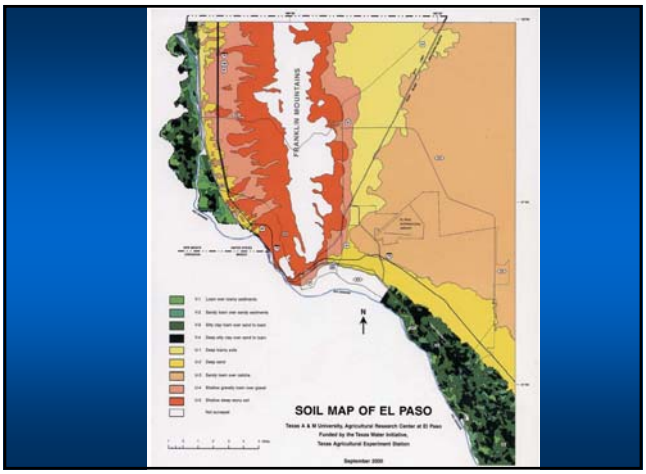
- Residential
- Commercial
- Industrial
- Agriculture
- Water Utilities

Residential Damages

Damages were estimated for:

- Cost of reduced life of appliances (faucets, washers, etc.)
- Avoidance costs (bottled water, softeners)
- Water uses categorized: sanitary, cooling, irrigation, kitchen, laundry, other. Irrigation damages assumed to be zero.
- Used local data for population, number of households, appliances, base water demand quantity and base water quality.
- CASS base residential water quality for Tucson was 316 mg/l (drinking standard of 500 mg/l) and for Phoenix area agriculture the base water quality was 907 mg/l.





Industrial and Commercial

Damage estimates:

- Economic Census data to identify local industries
- Water uses categorized: process, boiler, cooling, sanitary, irrigation
- Milliken Chapman damage functions applied by water use category

Agriculture Damages

Two factors considered:

- Reduced yield (UCR equations)
- Cost of leaching (additional water use cost)
- The studies acknowledge the estimated damages were approximate and that crops have different tolerances to salinity, and soil and growing conditions differ dramatically.
- The studies did not estimate or consider economic impacts of shifts to more salt tolerant, lower value crops.
- Ejeta et al. 2004, estimated that returns to EBID farmers averaged $258 per acre and returns to EPCWID#1 of $205 per acre, the difference was largely attributed to water quality.

Water Utilities

- Higher treatment facility and distribution system costs (shorter equipment life)
- No costs from corrosion were assumed based on other study findings that salinity is not the cause of corrosion
- Alternative supply costs and avoided cost savings were not estimated or included (desalination, import)

Economic Impact Results

- Economic impacts of salinity were estimated to be $30 million per year for each 100 mg/l increase or decrease in CAP & SRP water in the five categories of use in the Central Arizona region (2000 dollars).
- Residents are estimated to incur 45% of the impacts.
- MWD-USBR 1998 study estimated urban annual damage costs in Southern California from the SWP to be $0.50 per acre-foot for each 1 mg/l of salt above 100 mg/l and damages of $0.68 per acre-foot per 1 mg/l change in water from the Colorado River.

Rio Grande Evaluation Considerations

- Can and should build on work from previous studies.
- Previous studies provide good big picture indications of impacts, but, conditions and impacts differ greatly at different locations. Models and impacts from other areas should not be used as a cookie cutter.
- Previous study calculations are based on existing population, demands and uses. Population growth and changes in use are important considerations in evaluating economic impacts of salinity.

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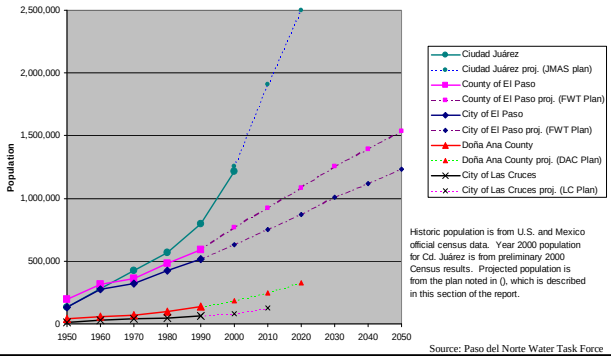
Historic and Projected Population in the Paso del Norte 1950-2050



Historic population is from U.S. and Mexico official census data. Year 2000 population for Cd. Juárez is from preliminary 2000 Census results. Projected population is from the plan noted in (), which is described in this section of the report.

Source: Paso del Norte Water Task Force

Rio Grande Evaluation Considerations

- Because of significant differences from other locations, the use of local, site specific water use, quality, conditions and impacts is very important for evaluating Rio Grande economic impacts.
- Use of local site specific conditions and impacts to evaluate economic damages is emphasized in all studies.
- The buck (salt) stops where? Evaluation considerations may also include impacts such as sustainability, long-term build up and leaching of salts and the affects of salinity on downstream users and the environment below Fort Quitman.

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Elephant Butte Reservoir
below 20% storage capacity- Michelsen

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