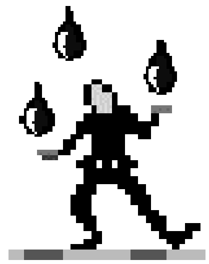
Supporting Document E-6

Alternative Feasibility Handbook

DRAFT MATERIALS

Bosque Management



Reservoir Management

Urban Conservation

Irrigation Efficiency

Land Use

Middle Rio Grande
Regional Water Plan

Mission: Balance use with renewable supply

FEASIBILITY of CANDIDATE ALTERNATIVE ACTIONS

March 1, 2003

Middle Rio Grande Assembly
&
Mid-Region Council of Governments

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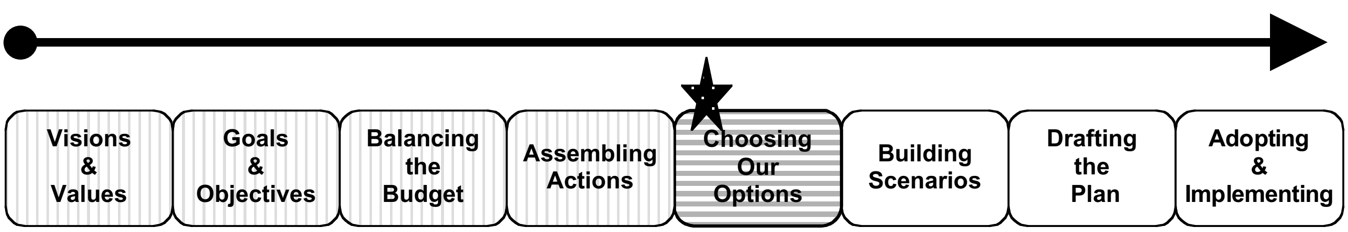
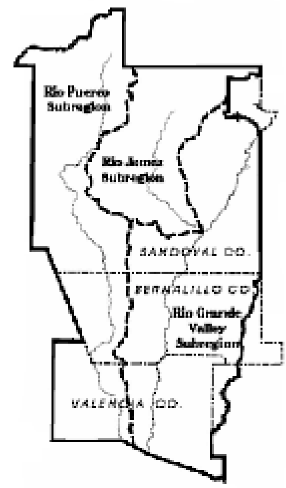
Acre foot - An expression of water quantity. One acre-foot will cover one acre of ground one foot deep. An acre-foot contains 43,560 cubic feet, 1,233 cubic meters, or 325,829 gallons (U.S.). Also abbreviated as ac-ft or af.

The Planning Process



The *mission* of the Water Assembly is to develop a regional water plan of sustainable water management strategies in an open, inclusive and participatory process and to establish a process to implement the plan.

Introduction



We in the Middle Rio Grande region have learned that we use more water than is renewed. How will we balance our water budget? The future is bound to bring new users and uses. How will we add those into the current uses and remain balanced? How will we maintain the visions and values of the region? By planning.

Throughout the course of planning activities, numerous suggestions have been made to balance the region's budget. While all of the original suggestions are still in the database, the Water Assembly distilled them into 44 candidate alternative actions that could potentially be included in the Regional Water Plan. These alternatives were grouped into seven categories:

- Increase water supply
- Decrease or regulate water demand
- Water rights regulation
- Water quality protection
- Implementation of plan & management of water resources
- Funding

The 44 Candidate Alternatives were sent to approximately 2500 Water Assembly members within the region, and placed on the Assembly's web site. Everyone who received the booklet had the opportunity to "vote" by postcard for the most and least preferred alternatives. Attendees at the 5th series of Community Conversations learned more about the candidate alternative actions, and “voted” for the most and least preferred alternatives. Those results can be found at the end of this booklet.

Being based upon preferences, those choices were made with a minimum of technical information available. The next step was to evaluate the candidate actions for technical, economic, legal, and social/ cultural feasibilities. In October 2002, the Mid-Region Council of Governments awarded a contract to D. B Stephens and Associates to provide detailed analyses for 25 of the 44 alternatives. Ideally, all 44 alternatives would have been subject to an expert assessment. Funding constraints precluded this. Based on a preliminary review, including the results of the public preferences, of the 44 alternatives, the Water Assembly selected 25. The results are found in Part I of this booklet. The other nineteen were evaluated by the Alternatives Working Team, and the Analysis Team who conducted “light” assessments of the remaining 19 alternatives. Part II of this booklet provides those results. Please note that these findings are still drafts, which are currently undergoing an intense peer review process.

Each alternative has been analyzed for how much might it might cost, how much water might be saved or demand reduced, how much time would it would take to implement, and what were some of the key trade-offs. For all 44 alternatives, the experts assembled by D. B Stephens and Associates also provided a feasibility rating for the attributes of technical, physical / hydrological / environmental, economic, legal and social / cultural (a further explanation can be found in the appendices).

At the Regional Forum, these evaluations will be presented. There will be another opportunity to select preferred alternatives but with the added benefit of a more detailed understanding of those alternatives. When identifying preferred alternatives, please keep in mind that all 44 alternatives are still acceptable and available. Those selected for expert analyses were not selected because they are in any way “preferred.”

Part I

Detailed Evaluation of 25 Alternative Actions
Prepared by Daniel B. Stephens & Associates, Inc.

Dominique Cartron
Daniel B. Stephens & Associates, Inc.
John Shomaker
John Shomaker and Associates, Inc

Daniel B. Stephens & Associates, Inc. (DBS&A) coordinated the work of a team of experts in evaluating alternatives for addressing the water supply needs in the Middle Rio Grande Water Planning Region. The focus of the alternative analysis was to provide fact sheets that summarized technical issues, costs, and potential impacts to water supply or demand and the environment, in accordance with a template prepared by the Water Assembly. Legal, economic, and social/cultural experts also provided analyses of select alternatives in their respective areas of expertise. The scope of work for this effort included:

- Technical (physical / hydrological / environmental), economic, legal, & social/ cultural feasibility analysis (25 alternatives)
- Not all 25 alternatives receive each type of analysis
- Lead analysis for 6 alternatives was legal or economic
- Technical (physical / hydrological / environmental), economic, legal & social / cultural feasibility rating (44 alternatives)
- Level of effort: 2 -5 working days per alternative to conduct lead evaluation and draft fact sheet

In addition, all 44 of the alternatives were given feasibility ratings for each of five attributes. Separate Attribute Ratings are based on professional judgment of technical team. Further information about the methodology used can be found in the appendices.

The Brief Analysis is provided to allow direct correlation to the material presented at the Forum. This information summarizes the more detailed analysis below, which is further explained in the Fact Sheets prepared for each alternative.

Alternatives to Increase Water Supply

Watershed Plans (A-66)

Technical Lead: Joanne Hilton

DEFINITION: Implement local and regional watershed management plans through all land and water agencies in the planning area

Once a water plan is agreed upon, coordinate the implementation among the numerous agencies at local, state, tribal, and federal level, which have some jurisdiction in the matter.

BRIEF ANALYSIS:

Water:
- Watershed treatments may improve water quality
- For potential changes in supply, thinning was evaluated because it has the largest impact on regional supplies
- Thinning forests increase stream flow where precipitation > 20 in/yr
- Save 5,000–15,000 ac-ft/yr for 30- 70% of such area

Cost:
- Thinning: $250-$1,000/acre depending on terrain

Time:
- Immediate to ongoing

Tradeoffs:
- Thinning may increase erosion and add new road construction
- Environmental impacts, if not done properly

Other Considerations:
- Watershed treatment also includes enhanced infiltration (A-33) erosion prevention (A-33) & development controls
- Increased streamflow likely to fulfill existing water rights - not result in new water right
- Watershed treatments such as grazing management could result in improved water quality
- Forest management can help to prevent catastrophic forest fires

Separate Attribute Ratings

4 Technical Feasibility
4 Physical, Hydrological, Environmental Feasibility
4 Economic Feasibility
4 Social and Cultural Implications
3 Legal Implications

Space for Notes

DETAILED ANALYSIS:

Technical Feasibility

- Watershed treatments may improve water quality
- For potential changes in supply, thinning was evaluated because it has the largest impact on regional supplies
- Published research indicates the best potential for measurable increases in streamflow due to watershed thinning activities are at higher elevations, where precipitation is greater than 18-20 inches
- Some local positive benefits in the pinon-juniper terrain, such as a less flash flooding, but no significant increases in annual streamflow are expected
- About 300,000 acres in Middle Rio Grande Region receive more than 20 inches of precipitation, which represents about 9% of the area within the region.
- Thinning 30-70% of the area that receives more than 20-inches per year precipitation, assuming a 0.7 to 0.9-inch per year increase in yields, would equal approximately 5,000-15,000 acre-feet per year.
- Yield increases would be considerably less in dry years
- Costs to conduct feasibility studies and detailed plans for watershed projects are in the range of $20,000 - $200,000 per project
- Costs for establishing watershed groups to address water quality and quantity issues are relatively minor; primarily funds are needed for facilitation and communication with the watershed groups
- Costs for watershed thinning projects vary considerably, depending primarily on the steepness and accessibility of the terrain
- Treatment costs for accessible, flatter terrain are approximately $250-$500/acre
- Treatment costs for steeper terrain may be on the order of $1,000 per acre
- Additional expenses required for environmental assessment and mitigation

Legal Feasibility

- Federal land and environmental laws: National Forest Management Act, NEPA, Clean Water Act, Endangered Species Act, National Historic Preservation Act, American Indian Religious Freedom Act
- Access and rights of way: MRGCD, Pueblos, private
- Who owns surplus water created by water savings?
- Should law create incentives to salvage water? (topic to be discussed in Regional Legal Issues report)
- Local ordinances/state laws likely will have to be amended or adopted allowing inter-jurisdictional authority

Social/Cultural Feasibility

- Local participation in watershed management planning is critical
- Local support will facilitate adoption of watershed management plans and there may be local economic benefits from participating in thinning projects.

Bosque Management (A-1)

Technical Lead: James Cleverly

DEFINITION: Restore Bosque habitat and manage vegetation in the Bosque to reduce evapotranspiration by selectively removing vegetation and promoting native plants

For example, the Russian olive and salt cedar trees are high water consumers and inhibit the growth of other low-water plants. Return the Bosque either to cottonwood or a mosaic of grasses, trees and shrubs . Research is underway to determine how much water would be saved.

BRIEF ANALYSIS:

Water:
- Removing high water use plants in Bosque (17~~3~~,000 ac) could save 17,680 ~~3,900~~ ac-ft/yr

Cost:
- Initial removal cost: $180~~-$600~~$2500/acre
- Minimal maintenance cost- in areas with high success rates. Maintenance costs increase in at less successful sites are the regrowth must be removed more frequently.

Time:
- Immediate to ongoing

Tradeoffs:
- Necessity of increased protection due to increased access

Other Considerations:
- Revegetation not recommended where cottonwood overstory is present
- Endangered species may be affected if projects improperly planned
- Increased streamflow likely to fulfill existing water rights - will not result in new water right

Separate Attribute Ratings

4 Technical Feasibility
5 Physical, Hydrological, Environmental Feasibility
4 Economic Feasibility
5 Social and Cultural Implications
5 Legal Implications

Space for Notes

DETAILED ANALYSIS:

Technical Feasibility

- Remove salt cedar, Russian olive, willow, and herbaceous ground cover
- Save 13,900 acre-ft if entire Bosque (13,300 acres) treated
- Mechanized or chemical removal methods
- Maintain to prevent recurrence
- Decreased fire danger, benefits minnow
- Demand decreased by 1 af reduction per acre treated
- About $600 an acre for mechanical removal
- $100-200 per acre for chemical removal — less feasible and raises environmental and permitting questions
- Natural revegetation recommended in the Middle Rio Grande area
- COE project near Los Lunas — $20,000 an acre restored (includes restored river channel and new flood channels in Bosque)

Legal Feasibility

- Federal land and environmental laws: National Forest Management Act, NEPA, Clean Water Act, Endangered Species Act, National Historic Preservation Act, American Indian Religious Freedom Act.
- Access and rights of way: MRGCD, Pueblos, private
- Who owns surplus water created by water savings?
- Should law create incentives to salvage water? (topic discussed in Legal Issues report)

Social/Cultural Feasibility

- Enhances access and multiple use
- Increased patrol and protection through increased access
- Local involvement in planning projects important

Reservoir Management (A-45)

Technical Lead: Rob Leutheuser

DEFINITION: Reduce open water evaporation in storage reservoirs by retaining water at higher elevations or latitudes, or by reducing surface areas.

Under the provisions of the Rio Grande Compact, NM must reserve a certain amount of water in the Elephant Butte reservoir for use by Texas. Both the shape of the reservoir, which has been compared to a champagne glass, and the location, which is in a hot area of the state, contribute to a high percentage of evaporation. Water lost to evaporation is not counted toward the deliverable to Texas. Proposal is to reduce the amount of water lost to evaporation by any of various means, including,
1. Cover Elephant Butte Lake with surfactants, a thin layer of goop that would reduce evaporation. SNL is working to develop a non-hazardous product that would do this.
2. Store some or all of the water in a cooler region. With a better management plan, it might be possible to minimize the water sent to Elephant Butte and keep it in a cooler region of the state. Or, it may be possible to negotiate new agreements with Texas and Colorado within the Compact.
3. Aquifer storage and recovery may solve some of the legal obstacles to alternate storage.

BRIEF ANALYSIS:

Water:
- Save 3,800-7,300 ac-ft/yr by moving 50,000 to 100,000 ac-ft from Elephant Butte Reservoir to El Vado or Abiquiu Reservoirs

Cost:
- Elephant Butte to Abiquiu = $130/ac-ft

Time:
- 5 years to decades

Tradeoffs:
- Impact on recreation
- Inundation of private property

Other Considerations:
- Dredging
- Surfactants
- New Reservoirs

Separate Attribute Ratings

4 Technical Feasibility
4 Physical, Hydrological, Environmental Feasibility
4 Economic Feasibility
2 Social and Cultural Implications
2 Legal Implications

Space for Notes

DETAILED ANALYSIS:

Technical Feasibility

- Move storage to higher reservoirs

–50,000 af from EB to Cochiti — 1,750+ af
–50,000 af from EB to El Vado — 3,850+ af
–100,000 af EB to Abiquiu — 4,200 to 7,300 af
–100,000 af EB to new Wagon Wheel Gap —11,700 af
–5,000 af EB to new Indian Camp —155 af

- Dredge sediment to reduce evaporation loss

–50,000 af sediment from Abiquiu—1,600 af
–50,000 af sediment from Cochiti—4,500 af
–Environmental impacts at reservoir & spoil site; severe if sediment released to stream.
–Impacts of changed downstream hydrograph

- Surfactants to reduce evaporation loss

–Range 25 to 70 % reduction in evaporation

Economic Feasibility

~~•~~ Change management existing storage space — no capital cost $130/af O&~~M~~ (probably only feasible alternative)

~~Probably only feasible alternative~~

- New reservoirs

–Wagon Wheel Gap — $150 million
–Indian Camp — $35 million
–Decades to implement if ever

- Dredging at $7,500/af of sediment saves

–: $83,000 per af initial cost at Cochiti
–: $234,000 per af initial cost at Abiquiu

- Economic benefits to MRG of expanded supply

Legal Feasibility

- Requires new reservoir management and authorization by owner/operator: El Vado – MRGCD; Abiquiu – Albuquerque (200,000 af authorized); Cochiti – COE and Federal legislation
- State Engineer permit: Impairment? Public welfare? Conservation?
- Rio Grande Compact: Texas and Colorado approval and adjustments to compact accounting. Article VII restricts upstream storage when EB drops below 400,000 af
- New or expanded reservoirs: subject to federal laws listed in A-1

Social/Cultural Feasibility

- Impacts on recreation, land owners around Elephant Butte if lake levels decline
- Impacts on residents, low-lying historical and cultural sites around reservoirs
- Additional water in storage benefits all groups in region

Surface Modeling (A-38)

Technical Lead: Rob Leutheuser

DEFINITION: Increase monitoring and modeling of surface water system to improve water management at the watershed level, and retain excess water flow from Elephant Butte Reservoir during wet cycles.

> Under the Rio Grande Compact, NM accrues credits for excess water flow and debits for deficits. A spillover of the Elephant Butte dam wipes out all accumulated debits. Proposal is to improve monitoring of the snow pack so that NM is able to predict how much water to let flow down to Elephant Butte and thereby manage the wet year water excess to NM's best interest.

BRIEF ANALYSIS:

Water:
- No direct water savings from modeling
- Water savings could occur if modeling is used to improve efficiency

Cost:
- O & M costs = $1M on URGWOM
- Federally financed

Time:
- Ongoing

Tradeoffs:
- Reduction of downstream surface waters if operations are changed to retain more water in reservoirs

Other Considerations:
- No single permanent management agency

Separate Attribute Ratings

5 Technical Feasibility
3 Physical, Hydrological, Environmental Feasibility
5 Economic Feasibility
5 Social and Cultural Implications
5 Legal Implications

Space for Notes

DETAILED ANALYSIS:

Technical Feasibility

- No direct savings
- Less probability of EB spill
- RiverWare model – routing
- NRCS runoff forecasts – supply prediction
- Modular Modeling System – runoff distribution
- ET Toolbox – demand prediction
- Initial Cost? URGWOM ~$1M per year to develop
- SNOTEL site $25-$20,000: USGS gage $12,000
- O&M cost: URGWOM ~$250,000/yr
- Costs covered by federal programs

Legal Feasibility

- ~~Management or regulatory functions would require change in state law~~
- ~~Regional utility could function under Joint Powers Agreement Act~~
- ~~Credits for water savings: same issues as A-1 and A-66~~
- Retain excess flows - no legal issues if occurs during a spill year. ~~?~~ M~~m~~ust satisfy OSE permit requirements
- Non-spill year retention of flows would require strict Compact compliance & OSE permit requirements
- Assumes a Regional Water Authority would implement coordination of surface water modeling.
  - Planning and coordination powers in place in Mid-Region Council of Governments
  - Management or regulatory functions would require change in state law
  - Regional utility could function under Joint Powers Agreement Act
- Credits for water savings: same issues as A-1 and A-66
-

Aquifer Storage (A-46)

Technical Lead: Mark Miller

DEFINITION: Inject water treated to drinking water standards for aquifer storage in appropriate locations throughout the water planning region.

Use the aquifer as interim storage for surplus water. It may be possible to pump surplus water back into the aquifer. Technical issues exist regarding quality of the water to be injected. It is not known how much of the water would be retrievable. Further research is needed.

BRIEF ANALYSIS:

Water:
- Arroyo recharge: 100-10,000 ac-ft/yr
- Wastewater ASR: 1,000s ac-ft/yr
- Transfer from EB: 100,000 ac-ft/yr

Cost:
- Low cost to recharge surface water
- High cost to treat wastewater for recharge

Time:
- One to 20 years

Tradeoffs:
- Diverts surface water to ground water

Other Considerations:
- Rio Grande Compact issues
- Impacts to Elephant Butte and recreation

Separate Attribute Ratings

4 Technical Feasibility
4 Physical, Hydrological, Environmental Feasibility
4 Economic Feasibility
3 Social and Cultural Implications
3 Legal Implications

Space for Notes

DETAILED ANALYSIS:

Technical Feasibility

- Aquifer storage via injection wells and Infiltration basins
- Recovery well production
- Potential sources of water
  - –Seasonal excess surface water, storm flows
  - –San Juan Chama Project water
  - –Transfer Elephant Butte storage for evaporation savings
  - –Treated M&I wastewater
- Small-scale ASR: 100 to 1,000 af injected
- Large-scale ASR: 10,000 to 100,000 af
- Enhanced arroyo recharge
  - – $80 per af stored for 200 af injected
- Treated municipal wastewater ASR via infiltration basins
  - –$780 per af produced for 5,500 af capacity
- Transfer of Elephant Butte storage to aquifer storage
  - –$100 per af stored for 100,000 af
- Infrastructure capital cost
  - –Central Avra Valley: $94 per af capacity
  - –Sweetwater: $143 per af capacity
- O&M costs
  - –Granite Reef USP (infiltration basins): $2.50 per af

Legal Feasibility

- Ground Water Storage and Recovery Act provides legal mechanism for ASR (state issue)
- Must comply with Underground Injection Control regulations (state and federal issue)
- ASR may have Rio Grande Compact implications (federal/compact issue)
- Current analysis does not identify any Indian or local government issues

Reuse Greywater (A-24)

Technical Lead: Beth Salvas

DEFINITION: Promote, through incentives, on-site residential and commercial greywater reuse and recycling.

> Provide incentives to implement greywater reuse systems in residential and commercial properties. Greywater reuse systems would require separate on-site plumbing which makes them more expensive to implement. Considerations also include defining standards for the level of treatment for greywater so that it is healthy enough for non-potable uses. For example, how to mitigate the presence of household chemicals and biological hazards in greywater.

BRIEF ANALYSIS:

Water:

- Fresh water diversion reduction: 20 to 25% (consumptive use remains constant)

Cost:

- New construction: $65 to $650 per system
- Retrofit (assumes easy access to plumbing): $135 to $1,250 per home

Time:

- Immediate for new construction once ordinances are adopted

Tradeoffs:

- Reduced return flow

Other Considerations:

- Permitted as a liquid waste disposal system (complex)
- NMED proposed regulatory changes could streamline permitting process.

Separate Attribute Ratings

3 Technical Feasibility
2 Physical, Hydrological, Environmental Feasibility
2 Economic Feasibility
3 Social and Cultural Implications
3 Legal Implications

Space for Notes

DETAILED ANALYSIS:

Technical Feasibility

- Implemented in California, Arizona, Texas
- Reduces fresh water demand by amount of greywater recycled (20 to 25%)
- Reduces return flows (up to 60%)
- Retrofit cost: $135 – $1,250 per house
- New construction cost: $65 – $650 per house
- Monitoring required to avoid contamination from wastewater (e.g. toilets, baby diaper washing, kitchen waste)
- Commercial cost estimate with Aquamake System:
  - –Cost range for different capacities
  - –Installation: $50K – $500K
  - –O&M costs: $500 – $4K

Economic Feasibility

- The cost of residential and non-residential building will increase
- Financial incentives would have to be sufficient to offset these increased building costs
- Local construction industry might benefit

Legal Feasibility

- Must comply with all applicable NMED regulations (state issue)
- NMED must approve greywater reuse (state issue)
- Local governments provide incentives for reuse and recycling (local issue)
- Current analysis does not identify any Federal, Indian, or compact issues

Social/Cultural Feasibility

- Beneficial in rural communities where water users have domestic wells and septic systems
- Poorer rural households are less likely to have income to pay for implementation
- Supports traditional water use which included rainwater harvesting and recycling of water

Reuse Treated Effluent (A-27)

Technical Lead: Sue Umshler

DEFINITION: Reuse treated wastewater for non-potable uses.

The cost to bring wastewater to a state where it can be used for watering lawns, etc., is much lower than cleaning the water to a drinkable level. Find a way to distribute the treated wastewater for any or all non-drinking needs. The treated wastewater can be reused once or several times before it is returned to the river or lost to evaporation. Several implementation approaches are possible. One approach is to retrofit homes and businesses with a second set of water pipes. Another approach is to apply this to new construction only.

BRIEF ANALYSIS:

Water:
- Available for reuse: 9,900 ac-ft/yr in 2003 to 27,900 ac-ft/yr in 2050

Cost:
- $54-$131 Million capital costs in 2003
- $6-$14 Million O & M in 2003

Time:
- 5 to 10 years

Tradeoffs:
- Reduced river flow and return flow credits
- Water quality issues

Other Considerations:
- Reduced river flows -possible endangered species impacts

Separate Attribute Ratings

3 Technical Feasibility
3 Physical, Hydrological, Environmental Feasibility
3 Economic Feasibility
2 Social and Cultural Implications
4 Legal Implications

Space for Notes

DETAILED ANALYSIS:

Technical Feasibility

- Current technologies
- New or expanded treatment plant(s), pipeline, pump stations, and storage
- Time to implement could range from 5 to 10 years
- No effect on demand
- Could extend supply by offsetting current consumptive uses, may reduce downstream user's supply
- ❍ Estimate of reuse water available for supply demand 2003: 1,224 mg (3,745 af) to 3,240 mg (9,914 af), 2050: 2,800 mg (8,500 af) to 9,100 mg (27,900 af)
- Significant water quality issues: soil loading, human exposure must be limited or high quality treatment required; public education and acceptance essential
- Reduces return flows
- Estimated initial total capital cost – 2003: $54.0 to $130.7 Million
- Estimated O&M costs for first year of operation – 2003: $5.74 to $14.01 Million

Economic Feasibility

- Construction industry impacts in MRG
- O&M may create jobs in MRG

Legal Feasibility

- Must comply with all applicable NMED and Federal regulations (state and Federal issue)
- If municipalities return treated wastewater to river for return-flow credit (or to pay off pumping debts), such water cannot be used for non-potable uses and it reduces river flow to meet compact requirements (state, local, compact issues)
- Reduction in flow could affect all downstream users including Pueblos, Compact requirements to Texas, endangered species, and Clean Water Act requirements (Federal and Indian law issues)

Social/Cultural Feasibility

- Can provide irrigation for parks, other recreational uses
- Benefits and water-quality impacts not evenly distributed

Desalination (A-39)

Technical Lead: Mark Miller

DEFINITION: Utilize technological advances for treating deep saline and brackish water for potable or non-potable use in the region.

> Desalination is used in various parts of the world to obtain fresh water. These techniques could be applied to brackish water in several of the NM basins, or even to ocean water. Possible sources: Tularosa basin (near Alamogordo); an unnamed basin West of Albuquerque; Gulf of California or other ocean. Brackish water may be available at the bottom of Rio Grande basin.
>
> There are significant technical, economic, and environmental issues associated with this, including the cost of desalination, disposal of brine waste, and the cost of deep water pumping.

BRIEF ANALYSIS:

Water:
- New supply only from saline formations not connected to the Rio Grande

Cost:
- $600-$1,400/ac-ft produced
- High pipeline costs
- High energy costs

Time:
- One to 10 years

Tradeoffs:
- Unknown impact on aquifer

Other Considerations:
- Permitting: OSE and NPDES
- Brine disposal

Separate Attribute Ratings

2 Technical Feasibility
4 Physical, Hydrological, Environmental Feasibility
3 Economic Feasibility
3 Social and Cultural Implications
3 Legal Implications

Space for Notes

DETAILED ANALYSIS:

Technical Feasibility

- Established and improving desalination technologies
  - 13,600 units – worldwide
- Saline and brackish source water in western part of Region
  - Distant valley-fill aquifer, Glorieta Sandstone, San Andres Limestone
- Brine-disposal: deep wells, evaporation ponds, treat and discharge
- Costs rise with increasing salinity
- Economy of scale in capital cost
- Energy cost is 50 to 75% of O&M, energy intensive
- Typical costs $620 to $1,440 per af
- Costs for MRG higher for wells, pipelines, brine ponds
  - $3,180 per af for 112 af production
  - $1,300 per af for 22,400 afy production

Economic Feasibility

- Economic benefit to MRG from expanded supply
- Energy intensive: power (and construction) industry benefit
- Federal and/or state financing would have greater impact in MRG than local financing

Legal Feasibility

- No OSE jurisdiction over aquifers with top at 2,500 ft or deeper, and water more than 10,000 ppm. Notice of intent to OSE (state issue)
- If within jurisdiction of OSE, must file application to appropriate (state issue)
- Saline and brackish water near and within Tribal lands in western part of region (Indian issue)
- If disposing of brine, may need a groundwater discharge or NPDES permit (state and federal issue)
- Review application by OSE to appropriate brackish water to meet state line delivery obligations (compact issue)
- Current analysis does not identify any federal (non-compact) issues.

Alternatives to Decrease or Regulate Water Demand

Urban Conservation (A-18)

Technical Lead: Myra Segal Friedmann

DEFINITION: Adopt and implement local water conservation plans and programs in all municipal and county jurisdictions, including drought contingency plans.

Many programs are possible, for example, publicity campaigns, pricing schemes, or installation of low-flow devices.

Encourage xeriscaping and drip irrigation. For example, bluegrass requires three times as much water as does native gramma or buffalo grass. In urban areas, where half or more of total water use is for landscaping, the substitution of low-water-use plants for high-water use varieties will save significant amounts of water.

Note that groundwater pumping supplements river flow when it is returned as waste water. Therefore, reducing pumping will result in less return flow to the river, with its consequences, both to the environment and to the State's ability to meet its Compact obligations.

BRIEF ANALYSIS:

Water:
- Demand reduction: 149,000-155,000 ac-ft by year 2010
- Demand reduction: 238,000-292,000 ac-ft by year 2050

Cost:
- Per household: $25 to $950 for indoor plus $500 to $5,400 for landscape conversion

Time:
- Immediate and ongoing

Tradeoffs:
- Reduces return flow

Other Considerations:
- High level of voluntary compliance required

Separate Attribute Ratings

4 Technical Feasibility
5 Physical, Hydrological, Environmental Feasibility
3 Economic Feasibility
4 Social and Cultural Implications
5 Legal Implications

Space for Notes

DETAILED ANALYSIS:

Technical Feasibility

- Residential outdoor: OSE "low" guidelines
- Residential indoor: "conserving house" (Vickers)
- Analysis assumes full, immediate compliance with conservation guidelines
- Effective conservation may reduce savings under drought mitigation plan
- Accumulated water savings compared with year 2000, and total water use in gpcd:

–2010 low pop., 149,000 af saved , 160 gpcd

–2010 high pop., 195,000 af saved, 160 gpcd

–2020 low pop., 109,000 af saved , 135 gpcd

–2020 high pop., 120,000 af saved, 135 gpcd

–2050 low pop., 238,000 af saved, 120 gpcd

–2050 high pop., 292,000 af saved, 120 gpcd

Economic Feasibility

- Outdoor residential, golf courses and parks: reduce area, change plantings and irrigation systems (at $\$2/ft^2$ – \$520 million)
- Indoor: \$25 to \$950 per household

Legal Feasibility

- OSE may claim preemption if local ordinances have effect of regulating water under OSE jurisdiction (state issue)
- Local governments must adopt conservation plans (local issue)
- Current analysis does not identify any federal, compact, or Indian law issues

Social/Cultural Feasibility

- Requires high level of voluntary compliance
- Urban and rural interests must be balanced
- Counties likely to be responsible in rural areas
- Domestic well users different from urban water system users

Urban Water Pricing (A-21)

Technical Lead: Brian McDonald

DEFINITION: Examine a variety of water pricing mechanisms and adopt those that are most effective at conserving water. The mechanisms to be examined include: a) price water to reflect the true value; b) institute a moderately increasing block price schedule; c) institute a steeply increasing block price schedule; and d) other feasible incentives and subsidies for conserving water.

In order to implement and enforce several of these mechanisms, metering and recording are necessary.

BRIEF ANALYSIS:

Water:

- 10% reduction for 100% increase in cost

Cost:

- Assumes doubling of public water supply prices
- $6,300 per acre foot reduction in demand

Time:

- Rate change approval and implementation (1 year)

Tradeoffs:

- Assumes excess revenues reinvested in water related projects
- Equity issues regarding low-income households

Other Considerations:

Separate Attribute Ratings

5 Technical Feasibility
3 Physical, Hydrological, Environmental Feasibility
2 Economic Feasibility
3 Social and Cultural Implications
5 Legal Implications

Space for Notes

DETAILED ANALYSIS:

Economic Feasibility

- Urban water demand is price inelastic within the range of current water prices which range from \$0.93 per 100 cu.ft. to \$3.50 per 100 cu.ft. for the residential users in Southwestern cities:
- For every 100% increase in the price of water, the urban demand for water decreases only 20% (in summer) and 10% over a 12-month period.
- Since demand is price inelastic, increases in the marginal price of water *alone* will not achieve significant reductions in residential water use
  - Higher prices for water will result in revenue enhancements for the water utility
  - However, regulatory practice does not allow public or private water utilities to benefit from revenue enhancements from higher water prices. Increased water revenues are generally used to fund water supply projects and water infrastructure.
- Tucson has the steepest increasing block rate in the region, charging \$1.03 per unit for the first 15 units, \$3.50 per unit for the next 15 units, and \$4.92 per unit for the next 15 units. Albuquerque in the summer months only charges \$1.20 per unit for the first 20 units, \$1.80 per unit for the next 10 units, and \$2.40 per unit for units over 30 for the average residential customer.
- Salt Lake City has the flattest block rate structure, charging \$0.61 per unit in the October-May time period for usage over 5 units and \$0.93 per unit in the June-September time period for usage over 5 units. (Note: one unit equals 100 cubic feet or 748 gallons).

Legal Feasibility

- ~~Difficult to implement outside of a water utility~~
- Privately formed public water utilities may not generate profit. Therefore revenue enhancements due to rate increases must be reinvested in operations and projects.
- General police powers will allow some regulation of use even if not served by public water system, but may not go so far as to be regulatory taking

Social/Cultural Feasibility

- Rural domestic well users - no impact
- Smaller municipalities - higher impact
- Poorer residents more greatly impacted
- Generally will not affect higher income users who can afford/ will pay increased prices to maintain their lifestyle (Equity issue- lower income users will not have this same choice)

Conservation Incentives (A-22)

Technical Lead: Myra Segal Friedmann

DEFINITION: Provide local government programs that offer subsidies for adoption of water efficient technologies and utilization of water saving devices.

> Promote the transition to water-saving devices and water-efficient technologies through incentives sponsored at the local level. (This could apply to both municipal and industrial customers.)

BRIEF ANALYSIS:

Water:
- Possible reduction in demand
- Savings are accounted for in A-18

Cost:
- Rebate costs: $140 to $200 per ac-ft saved

Time:
- Immediate and ongoing

Tradeoffs:
- Reduced wastewater flows and return

Other Considerations:
- Requires very strong conservation commitment to achieve projected savings

Separate Attribute Ratings

5 Technical Feasibility
5 Physical, Hydrological, Environmental Feasibility
3 Economic Feasibility
4 Social and Cultural Implications
5 Legal Implications

Space for Notes

DETAILED ANALYSIS:

Technical Feasibility

- Existing technologies (may be improved)
- No physical infrastructure
- Incentives demonstrate commitment by supplier
- Reduced wastewater flows and increased concentrations cause sewer-system and treatment problems.

Economic Feasibility

- Cost per af of savings over 25 year life of converted item from Albuquerque's experience over 7 years:
  - –Toilets – $180
  - –Xeriscape – $140
  - –Clothes washer – $215
- Reduce expenditure for water rights
- Local businesses benefit
- Less pumping results in reduced demand for electricity

Education (A-56)

Technical Lead: Myra Segal Friedmann

DEFINITION: Establish region-wide educational programs, including public and private school curricula, to encourage voluntary conservation of water.

Over the long-term this will raise consciousness and change lifestyle use of water.

BRIEF ANALYSIS:

Water:
- Reduced demand 3-15% (5% = 8,700 acre-feet)
- Water savings included in A-18 water savings

Cost:
- $80,000 per year
- $9 per acre foot water saved per year

Time:
- Immediate and ongoing

Tradeoffs:
- Reduces return flow

Other Considerations:
- Most successful if integrated with other conservation programs

Separate Attribute Ratings

5 Technical Feasibility
5 Physical, Hydrological, Environmental Feasibility
4 Economic Feasibility
4 Social and Cultural Implications
5 Legal Implications

Space for Notes

DETAILED ANALYSIS:

Technical Feasibility

- Albuquerque’s outreach now visits 180 classrooms per year, about 4,500 students
- Water fairs reach more students
- Programs may yield 3 to 15% water savings, which would be part of the savings described in A-18
- Cost: $60,000 per year salary plus 22,500 in materials

Agricultural Metering (A-7)

Technical Lead: Mike McGovern

DEFINITION: Meter and manage surface water distribution flows through all irrigation systems to conserve water.

Allows the accurate measurement and control of permitted water use and associated losses. Metering by itself may encourage conservation.

BRIEF ANALYSIS:

Water:
- 10% estimated improvement in irrigation system efficiency

Cost:
- Estimated MRGCD cost (NMISC funded) for 2003-04: $160,000
- Proposed program cost: $7 Million

Time:
- 5 year implementation

Tradeoffs:
- Increased administrative, operational, and maintenance cost

Other Considerations:
- Legal technicalities regarding "banked" water rights

Separate Attribute Ratings

4 Technical Feasibility
4 Physical, Hydrological, Environmental Feasibility
3 Economic Feasibility
1 Social and Cultural Implications
5 Legal Implications

Space for Notes

DETAILED ANALYSIS:

Technical Feasibility

- Automatic metering and canal gate control of irrigation flows at the lateral, sub-lateral, and on-farm
- Allows for rotational irrigation scheduling and a 10% improvement in overall irrigation system efficiency (Compatibility of fixed rotations with "supplemental income generation" farming?)
- Total estimated ***diversion water*** reduction (MRGCD = 41,522 acre-feet & small Sandoval Co. Systems = 1,281 acre-feet)
- Estimated savings of ***incidental depletions*** = 1,300 af
- Possible overall system irrigation efficiency improvement from estimated existing 31.6% to 35.8%
- MRGCD has begun metering program - estimated cost 2003-2004: $160,000 (NMISC funding assistance)
- 146 new lateral area meters, control gates: each meter/gate combination approximately $43,000.
- Add new staff, design, install, training
- Provision of 12 portable on-farm flow meters (spot checks)
- Program cost: $7 Million; 5-year implementation

Economic Feasibility

- Saved diversion water could economically sustain local agriculture (water remains in agriculture)
- Real-time deliveries, if possible, may allow farmers to grow different, more profitable crops
- Local construction sector would benefit from the installation of meters/gates
- If farmers pay for meters, could adversely affect agricultural sector
- Funds from banking saved water could cover costs for metering

Legal Feasibility

- OSE may claim preemption if local/conservancy district ordinances have the effect of regulating water under OSE jurisdiction (state issue)
- Authority of MRGCD to impose metering requirements (local government issue)
- No authority to impose metering requirements on Indian land (Indian issue)
- Current analysis does not identify any Federal or Compact issues

Social/Cultural Feasibility

- Many social issues:
  - –Costs to irrigators and those that pay MRGCD al valorem mil levy within the MRGCD system commanded area.
  - –Effect upon irrigation patterns
  - –Could result in increase in price of water
  - –Many crops grown are for supplemental or subsistence income; there could be significant cultural and social implications

Irrigation Efficiency (A-10)

Technical Lead: Mike McGovern

DEFINITION: Develop and employ alternatives to maximize irrigation efficiency on all irrigated land in the region.

This is a follow-up to alternative A-7. Mechanisms include, but are not limited to:

1. Install drip, sprinkler, surge, or furrow irrigation where feasible. Note that this may not be feasible for some field crops such as alfalfa.
2. Laser-level fields to remove depressions where [excess] irrigation water settles.
3. Aggregate the small, strip farm plots so that alternatives become cost-effective.

BRIEF ANALYSIS:

Water:

- 7-14% improvement in on-farm irrigation efficiencies through land preparation, on-farm water management, on-farm water metering
- Program would address three farming/irrigation categories of use

Cost:

- $29 Million for regional program

Time:

- 5-10 years

Tradeoffs:

- Reduces recharge to ground water, which could impact ecosystems within the overall MRGCD irrigated areas

Other Considerations:

- Significant technical and financial assistance components

Separate Attribute Ratings

4 Technical Feasibility
4 Physical, Hydrological, Environmental Feasibility
3 Economic Feasibility
2 Social and Cultural Implications
5 Legal Implications

Space for Notes

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DETAILED ANALYSIS:

Technical Feasibility

- MRGCD and small Sandoval systems on-farm water efficiency (Ef) today is estimated at 50%
- Improved land preparation - possible 7% improvement in Ef
- Improved on-farm water management - possible 15% improvement in Ef
- On-farm water metering: possible 8% improvement in Ef
- Total *diversion* water savings of approximately 42,000 acre-feet (MRGCD = 38,685 acre-feet & Small Sandoval Co. Systems = 3,444 acre-feet)
- Estimated savings of ***incidental depletions*** = 2,200 af
- Funding and implementation of intensive 5 to 10 year On Farm Water Management (OFWM) Program in the Middle Rio Grande including design studies: $29M
- Program might result in On-Farm water efficiency improvement from existing estimated 48%-50% to say 62%
- Requires significant technical and financial assistance components
- Basin (flood) and border irrigation practices are traditional "cultural" practices, can be 80 to 90 % efficient

Economic Feasibility

- Saved water could economically sustain local agriculture (water remains in agriculture)
- Local construction sector would benefit
- If farmers pay for improvements, could adversely affect agricultural sector
- Funds from banking saved water could cover costs for on-farm improvements

Social/Cultural Feasibility

- Flood irrigation is a traditional "cultural" practice
  - –Smaller and traditional farmers may resist
  - –Smaller farmers - cost burden
- Bosque maintenance through irrigation system is integral part of region's agricultural identity
- Lower water tables – domestic well impacts

Conveyance Systems (A-9)

Technical Lead: Mike McGovern

DEFINITION: Develop conveyance alternatives for water transportation in agricultural irrigation systems.

Most irrigation systems in the MRG planning region deliver water and carry some return drainage flow through unlined ditches (canals). Off-farm irrigation water losses exist as riparian evapotranspiration, seepage, illegal diversion, and canal breaches, resulting in substantial amounts of water not being delivered to users.

This alternative action calls for the study of the off-farm conveyance system issues and proposed solutions such as various types and combinations of canal lining systems, pipes, and improved diversion and regulatory structures, to reduce losses preferably without impacting aesthetics. Such changes will improve irrigation efficiency and conservation, resulting in diverted water savings.

BRIEF ANALYSIS:

Water:

- Estimated 20% of MRGCD canals lined = estimated 40% reduced seepage
- Estimated 35% of Sandoval Co. acequias lined = estimated 60% reduced seepage

Cost:

- MRGCD program: $121,000,000
- Sandoval Co. acequias: $22,000,000

Time:

- MRGCD: 20 years ($8 million/yr)
- Sandoval Co. acequias: 5 years ($3.2 million/yr)

Tradeoffs:

- Reduced seepage to groundwater/ reduced return flows

Other Considerations:

- Legal issue regarding use of saved diversion water
- Cultural practice of ditch maintenance in small Sandoval systems

Separate Attribute Ratings

5 Technical Feasibility
4 Physical, Hydrological, Environmental Feasibility
3 Economic Feasibility
2 Social and Cultural Implications
5 Legal Implications

Space for Notes

DETAILED ANALYSIS:

Technical Feasibility

- Proposed canal lining program
- 100% canal lining not feasible - Bosque and aquifer require some seepage
- Water savings expressed in diversion, not consumptive use amounts
- Only secondary data available on MRGCD and small systems in Sandoval County
- Estimated 20% of MRGCD canals lined = estimated 40% reduced seepage
- Estimated 35% of Sandoval Co. acequias lined = estimated 60% reduced seepage
- Concrete lining technique - 50 year life span, 75% seepage efficient
- *Diversion water* savings: 71,000 acre-feet (MRGCD = 67,813 acre-feet & small Sandoval systems = 3,051 acre-feet)
- Estimated savings of ***incidental depletions*** = 1,500 af
- Program Costs (including other structures, studies): $121,000,000 for MRGCD and $22,000,000 for small Sandoval systems

  –cost per acre of diverted water saved: $1,700 for MRCGD and $5,300 for small Sandoval systems

  –implementation schedule: 15 to 20 year for MRGCD and 5 years for small Sandoval systems

  –new conveyance efficiency (Ec): from 64% to 80% for MRGCD and from 70% 88% for small Sandoval systems

Economic Feasibility

- Saved water could economically sustain local agriculture (water remains in agriculture)
- Real-time deliveries may allow farmers to grow different, more profitable crops not true
- Local construction sector would benefit from the installation of linings and construction
- Funds from banking saved water could cover costs for metering

Legal Feasibility

- No legal issues with developing new conveyance systems
- Legal issue of "ownership" of saved water / reduced diversions

Social/Cultural Feasibility

- Cultural practice of ditch maintenance
- Recreational use of ditch roads
- Bosque maintenance is part of regional identity and local culture (possible degradation of Bosque ecology due to lining of ditches and lowering of water table in specific areas) Canal lining program needs to optimize seepage reduction while maintaining local aesthetic and not negatively affecting cultural and social practices

Alternatives to Change Water Uses to Increase Supply / Decrease Demand

Low-Water Crops (A-11)

Technical Lead: Brian McDonald

DEFINITION: Develop markets for locally-grown produce, and low-water alternative crops.

Increasing production of low-water alternative crops would reduce overall dependence on water. Research is required to identify the crops and the markets, and plan for the transition. Investigate the associated costs, labor, and time requirements.

BRIEF ANALYSIS:

Water:

- Switching 5,000 acres from alfalfa to sorghum would reduce consumptive use by 4,300 acre-feet

Cost:

- Variable, depends on market

Time:

- Immediate and ongoing

Tradeoffs:

- Change in crops requires different farming infrastructure
- May require more labor & maintenance

Other Considerations:

- No economic incentive for switching crops
- 90% of MRG acreage in forage crops (high water use)

Separate Attribute Ratings

2 Technical Feasibility
4 Physical, Hydrological, Environmental Feasibility
4 Economic Feasibility
5 Social and Cultural Implications
5 Legal Implications

Space for Notes

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DETAILED ANALYSIS:

Technical/Economic Feasibility

- 90 percent of irrigated crop acres in 2000 were forage (75%: alfalfa and pasture; 15%:other forage crops such as corn and other hay for cattle, dairies, and horses. The agricultural market in this region is livestock-based
- Alfalfa is a high water use crop (28.20 inches annual consumptive use)
- Other varieties of alfalfa may have lower consumptive use
- New Mexico dairy industry growth increased the demand for alfalfa and raised the price of alfalfa by 50% since 1985; current market conditions favor alfalfa production
- Alfalfa production is amenable to part-time farming on small plots and is low risk because it is relatively drought-tolerant
- Change in crops requires different business infrastructure: farm labor, crop storage and processing facilities, and marketing and distribution networks and cooperatives
- Other crops have higher risks and require more labor. Incentives in the form of economic market conditions or outright subsidies will be required to induce local farmers to switch from alfalfa to other crops.
- In 2000 there were 41,494 irrigated acres in the Middle Rio Grande region, with 21,200 acres in alfalfa and 10,020 acres in pasture
- Switching 5,000 acres from alfalfa to sorghum in the Belen area would reduce consumptive water use by an estimated 4,300 acre-feet of water
- Local farmers currently face a zero marginal price for agricultural water, and there is no metering of agricultural water. Thus, there is no economic incentive to switch to low-water use crops. Saving water does not economically benefit the individual farmer under current practice.
- Farmers in the Middle Rio Grande region are at a competitive disadvantage in the market for fresh produce serving local consumers. Compared to Southern New Mexico, there is a shorter growing season, lower yields, no established infrastructure for processing, inadequate farm labor, and smaller farms so that economies of scale cannot be easily attained.
- Opportunities exist at local farmers' markets for local farmers to sell directly to consumers, especially for fruit crops and vegetables.

Social/Cultural Feasibility

- Development of markets essential so smaller farms can benefit
- Requires labor and maintenance that current subsistence farmers cannot provide (not compatible with "weekend" farming)
- High cultural value placed on farming – if support provided to farmers (market development, education etc.) then could benefit traditional culture.

Land Use (A-30)

Technical Lead: Phyllis Taylor

DEFINITION: Adopt policies to integrate land use and transportation planning and water resource management in all government jurisdictions in the Middle Rio Grande water planning region.

Take water supply limitations into account when making land use development decisions. Develop mechanisms for local governments to adopt policies that coordinate water impact considerations with all land development and other uses of water.

BRIEF ANALYSIS:

Water:
- Change in policy had no immediate effect on demand, see A-18 and A-22

Cost:
- Administration and enforcement costs

Time:
- Immediate and ongoing

Tradeoffs:
- Reduced wastewater return flows
- Reduction in water provider revenues
- Increase in development costs

Other Considerations:
- May require more stringent regulatory controls

Separate Attribute Ratings

4 Technical Feasibility
5 Physical, Hydrological, Environmental Feasibility
2* Economic Feasibility
5 Social and Cultural Implications
3 Legal Implications

* This alternative does not have a potential for water loss.

Space for Notes

DETAILED ANALYSIS:

Technical Feasibility

- Linking land use policy and water can provide incentives/support policies that reduce water demand.
- Policies/approaches include requiring higher densities, conservation, xeriscaping, storm water management, reuse & conservation
- Proof of water availability for new subdivisions already required in Counties, but is not uniformly enforced and cumulative impacts are not always evaluated
- Other water related planning approaches

–Instituting development fees to include cost of water rights

–Locating of growth to protect water quality and aquifer recharge areas

- Impact on water demand occurs over time
- California

–Land use approval linked to water supply since 1995

–Large developments must verify water availability

–Local government must confirm with water utility

Economic Feasibility

- Reduced demand diminishes need for acquiring current and future water rights
- Reduced land subsidence from additional groundwater pumping
- Reduced cost from lack of drought reserve
- Increased residential and commercial building prices

Legal Feasibility

- ~~Raises many of same issues discussed in A-38~~No federal legal or Rio Grande Compact Issues
- A regional or multi-jurisdictional land-use initiative would not implicate state law if management took the form of cooperation among local entities within their existing authorities. ~~Will face many of same limitations discussed in A-21~~
- ~~Land use authority will provide additional basis for regulation, especially subdivision laws~~

Social/Cultural Feasibility

- All residents in region benefit from integrated planning approach
- Policies could preserve agricultural lands being lost to development
- New development would bear costs
- Increase price of new housing could exclude lower income groups

In-Fill/Density (A-28)

Technical Lead: Phyllis Taylor

DEFINITION: Increase building densities (as compared to typical suburban density) and infill development through adoption of local government land use policies and regulations.

> This would be accomplished through local government land use policies, regulations, and incentives. Implementing this would require regulatory changes at the local level, for example, making house lots smaller or building multi-story dwellings. Higher-density development would reduce the relative footage of landscaping and associated water use

BRIEF ANALYSIS:

Water:
- Increased density can reduce outdoor water use
- Increase from 5.7 to 7.4 dwellings per acre for new construction reduces outdoor use by 170 acre feet per year

Cost:
- Administration and enforcement costs

Time:
- Effective when new development takes place

Tradeoffs:
- Congestion due to increased density

Other Considerations:
- Not attractive in rural areas
- Reduces sprawl

Separate Attribute Ratings

5	Technical Feasibility
4	Physical, Hydrological, Environmental Feasibility
2*	Economic Feasibility
4	Social and Cultural Implications
4	Legal Implications

* This alternative has a potential for water savings

Space for Notes

DETAILED ANALYSIS:

Technical Feasibility

- Local governments have the authority to implement
- Infrastructure can be designed or upgraded to accommodate higher densities
- Reduction in water demand will occur as new development takes place
- Changes in land use patterns will have most impact by affecting residential densities

Technical Feasibility

- Increase in density from 5.7 to 7.4 units per acre could reduce residential outdoor water use by 170 acre-feet per year for new construction
- Potential funding sources: utility rates, general obligation bonds, and state and federal grants

Economic Feasibility

- Reduced demand diminishes need for acquiring current and future water rights
- Reduced land subsidence from additional groundwater pumping
- Reduced cost from lack of drought reserve
- Increased residential and commercial building prices

Social/Cultural Feasibility

- Reduces sprawl
- Less pressure on agricultural lands for development
- Increase price of new houses could exclude lower income groups

Alternatives for Water Rights Regulation

Instream Flow (A-63)

Technical Lead: Susan Kery

DEFINITION: Change state water law to include in-stream flow as a beneficial use.

Under current law, to maintain a water right, you must put it to beneficial use. Water flowing in the river, known as "in-stream flow," has not been declared a beneficial use in New Mexico. However, the health of the river affects state parks and animals that live in the river environment.

By determining beneficial use to include in-stream flow there would be some legal protection for riparian uses of water.

BRIEF ANALYSIS:

Water:
- Benefit to riparian environments

Cost:
- Water right transaction cost (move water from existing beneficial use to instream flow use)

Time:
- Immediate and ongoing

Tradeoffs:
- May not necessarily augment flows (water could be lost to seepage)

Other Considerations:
- OSE has authority to recognize instream flow as beneficial use
- Additional statutory clarification would strengthen
- Requires gaging

Separate Attribute Ratings

4 Technical Feasibility
4 Physical, Hydrological, Environmental Feasibility
3 Economic Feasibility
4 Social and Cultural Implications
3 Legal Implications

Space for Notes

DETAILED ANALYSIS:

Technical/Legal Feasibility

- Does not require a change in state law, although a change in state law would further strengthen the protection of instream flow in New Mexico
  - Instream flow refers to concept of leaving water in streambed where it provides aquatic and riparian environments for fish and wildlife and recreational and aesthetic uses
- Instream flow recognized in New Mexico through Attorney General's opinion
- State Engineer could legally approve a water right transfer application to an instream purpose
  - Priority would be priority of transferred right
  - No "point of diversion" necessary, must gauge use
- No new appropriations for instream flows, since surface water is fully appropriated
- Case law on beneficial use
  - Federal "silvery minnow" case
  - State/Federal programs allowing for the storage and release of water for instream purpose
- Specific instream flow statutes in 11 of the 18 states that apply the prior appropriation doctrine to surface water
  - Neighboring states of Colorado, Arizona, Utah, and Montana all have instream flow statutes
  - Colorado, Utah, Montana: only state or Federal authorities may apply for instream flow protection
  - Example of statutory language (Colo): the appropriation of waters in natural streams and lakes "required for minimum stream flows or for natural surface water levels or volumes for natural lakes"
  - Appropriations of instream flow will not guarantee water remains in the river

Conjunctive Management (A-144)

Technical Lead: Susan Kery

DEFINITION: Address groundwater/surface water interactions in the statutes for administering water rights.

> There is a connection between surface water and shallow ground water. That is, by extracting groundwater, surface water will percolate down to the shallow groundwater and "fill in" the volume of water that has been pumped. This interaction has a time lag and will not be immediately observable. For groundwater wells near the river, the effect may take days or weeks depending on the separation distance. For groundwater wells further away, the effect could take weeks or years. One example of the need for this accounting of the interaction of surface water and groundwater is that a junior water rights holder who has pumped groundwater, could later "infringe" on the water supply to senior surface rights holders, particularly during a time of drought.

BRIEF ANALYSIS:

Water:
- Maximizes use of available water resources

Cost:
- Administrative and permitting costs

Time:
- Immediate and ongoing

Tradeoffs:
- Requiring junior users to purchase or lease senior water rights can offset tension
- Administrative (OSE) change necessary to implement

Other Considerations:
- Reduced uncertainty about water availability and transfer

Separate Attribute Ratings

4 Technical Feasibility
4 Physical, Hydrological, Environmental Feasibility
2 Economic Feasibility
2 Social and Cultural Implications
4 Legal Implications

Space for Notes

DETAILED ANALYSIS:

Technical/Legal Feasibility

- Alternative is legally feasible under present state of law: both conjunctive management and priority administration are recognized by state law
- Priority administration recognized in New Mexico, but very rarely used
- Conjunctive management does not increase water available, but maximizes water sources to best extent
- Conjunctive management of water can occur through the permitting process
  - Water right holder with both ground and surface rights can request permission to manage water rights in a manner which takes advantage of whether it is a wet year (rely on surface water) or a dry year (rely on groundwater)
  - Can conjunctively manage surface water by requesting permission to drill supplemental well
- Priority administration an issue in a hydrologically connected system, since effects of groundwater pumping on surface water dependent on location of well
  - May be "futile call" if senior surface user calls priority on junior users
  - Allowing for augmentation plans (as in Colorado) may alleviate impacts on seniors caused by out-of-priority junior use
- No Rio Grande Compact issues with conjunctive management in planning region, since water needed for state line delivery measured north of planning region (Otowi gage)
- Opportunities to maintain river flows and protect Bosque ecosystem (pump groundwater when river is low)

Economic Feasibility

- Reduced uncertainty about water availability during times of water shortage
- Senior water right holders will have more reliable water availability
- Increased certainty has positive impact on business climate
- Could facilitate water transfers

Social/Cultural Feasibility

- Senior water rights/traditional agricultural groups benefit if they can conjunctively manage their rights
- If junior users implement, then possibly adverse to senior users
- Cost to drill supplemental wells undue burden on senior water rights holders
- Urban water users have more sustainable water supply

Alternatives for Water Quality Protection

Water Quality(A-47)

Technical Lead: Bob Gray

DEFINITION: Identify, protect and monitor areas vulnerable to contamination (quality issue) and restrict groundwater supply wells in sensitive areas.

This is a particular issue where there is a high-density of shallow wells, septic systems, and leaking storage tanks. Development near many public wells is not monitored or controlled and could create sources of contamination of the public water supply.

In addition, high concentrations of domestic wells in close proximity to septic systems represent a serious regional water contamination issue. Local governments do not keep records on the relative placement of wells and septic systems.

BRIEF ANALYSIS:

Water:
- Higher treatment costs required to make water available for different beneficial uses
- Arsenic and septic contamination are primary water supply concerns

Cost:
- Cost of administration and management
- High cost to monitor ground water quality
- High clean-up costs

Time:
- Immediate and ongoing

Tradeoffs:
- Development restrictions in vulnerable areas

Other Considerations:
- New standards (i.e., arsenic by 2006)
- Already numerous contaminated areas
- Identification and protection of vulnerable areas

Separate Attribute Ratings

4 Technical Feasibility
3 Physical, Hydrological, Environmental Feasibility
2 Economic Feasibility
4 Social and Cultural Implications
5 Legal Implications

Space for Notes

DETAILED ANALYSIS:

Technical Feasibility

- Identification of highly vulnerable areas for Bernalillo County complete
- Vulnerability studies in Valencia and Sandoval County should be updated
- Numerous regulatory programs protect water quality and remediate contaminants
- NMED program for local communities
- High costs to monitor groundwater quality
- Restricting supply wells in sensitive areas
  - –Public health issue (reducing exposure of public to contaminants does not eliminate contamination/ will not increase water supply)
- Initiatives to reduce contamination from septic tanks
  - –Bernalillo County — new ordinance in place
  - –Sandoval and Valencia County — no ordinance
  - –Implementation of septic regulations is essential for success
- Arsenic is the most widespread contaminant of concern for water supply
  - –New arsenic standard becomes effective in 2006
- Quantification of contaminant aspects of water supply difficult to estimate without complex studies
- Point Source contaminants: majority from underground storage tanks (in New Mexico)
  - –Underground (fuel) storage tanks (USTs) 58.5%
  - –Oil and Gas 13.7%
  - –Miscellaneous industry 10.1%
  - –Centralized sewage works 4.5%
  - –Mining 3.7%
  - –Other (dairies, landfills, storage tanks) 9.5%
- Areas in region with shallow groundwater contamination from septic tanks and other on-site domestic wastewater disposal
  - –Bernalillo
  - –Corrales
  - –Albuquerque
  - –Bosque Farms
  - –Los Lunas
  - –Belen

Domestic Wastewater (A-26)

Technical Lead: Sue Umshler

DEFINITION: Expand use of centralized wastewater collection and treatment systems into all areas of urban and suburban development within the water planning region.

> Certain areas of the region rely on septic tank systems which do not adequately purify the water before it returns to the groundwater. Technical limits such as distance and pipeline size make implementation costly.

BRIEF ANALYSIS:

Water:
- No effect on demand
- Supply could be increased with use of treated wastewater

Cost:
- Regional system expansion capital cost in 2003: $67-181 Million
- Regional system O&M cost for 2003: $3-12 Million

Time:
- Ongoing

Tradeoffs:
- More water for use, less pollution, reduced ground water recharge
- May induce new development

Other Considerations:
- Major infrastructure development required

Separate Attribute Ratings

4 Technical Feasibility
4 Physical, Hydrological, Environmental Feasibility
3 Economic Feasibility
3 Social and Cultural Implications
5 Legal Implications

Space for Notes

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DETAILED ANALYSIS:

Technical Feasibility

- Current technologies
- Pipelines, pump stations, and new or expanded treatment plant(s) required
- Time to implement could be phased-in over planning period and segment costs
- No effect on demand
- Could increase supply if treated water discharged to surface water source or aquifer
- Significant reduction of dispersed pollution sources to vadose zone and potentially groundwater aquifer – estimated between 1.6 to 3.0 mgd (5.0 to 9.2 af/d) in 2003 and 5.2 to 8.4 mgd (16 to 25.8 af/d) in 2050
- Geological and environmental impacts are unpredictable because only location of discharge of effluent changes
- Could provide more direct water for silvery minnow or riparian area used by willow flycatcher
- Estimated initial total capital cost to implement 2003: $67.2 to $180.6 Million
- Estimated O&M costs for first year of operation – 2003: $3.3 to $11.7 Million

Economic Feasibility

- Construction industry impacts in MRG
- O&M may create jobs in MRG
- Federal or state financing may create greater positive impact on MRG economy than local financing

Alternatives for Implementation of Plan & Management of Water Resources

Water Bank/Authority (A-67)

Lead: John Utton

DEFINITION: Establish a regional water management authority to provide professional water resource management and to administer or assist in a water banking program.

A regional authority can provide coordination and consistent implementation of the regional water plan. Currently, water management is under the authority of various federal, tribal, state, and local departments.

Water banking is a term used for several different concepts. It may be used to allow the authorized agency to make decisions about water transfers quickly. Water banking is also used to denote a system of leasing out unused water to avoid losing water rights.

However, water banking may be detrimental to the acequia systems.

BRIEF ANALYSIS:

Water:
- Maximizes water resource management

Cost:
- Cost of administration

Time:
- Requires change in state law or joint powers agreement necessary prior to implementation.

Tradeoffs:
- Would require local authorities to give up some autonomy

Other Considerations:
- No statewide water banking law

Separate Attribute Ratings

2 Technical Feasibility
4 Physical, Hydrological, Environmental Feasibility
2 Economic Feasibility
3 Social and Cultural Implications
2 Legal Implications

Space for Notes

DETAILED ANALYSIS:

Technical/Legal Feasibility

- Threshold issue: does region want:
  - Improved regional planning and coordination?
  - Regional water management/regulatory authority?
  - Regional water utility?
- MRCOG has planning/coordination powers already
- Management or regulatory functions would require change in state law/ with OSE ceding some authority
- Regional utility could function under Joint Powers Agreement Act. Would require local municipalities to give up some autonomy.
  - Alb., Bern. Co., & Los Ranchos signed JPA to create Alb. Metropolitan Water and Wastewater Authority (2000)
- New Mexico has no statewide water banking law
- Limited water banking in Lower Pecos - approved 2002
- ~~Sen. Sue Wilson will introduce state water banking legislation in 2003 session~~
- Limited water banking within acequias -legislation passed in 2003
- Water reallocation occurs under existing state law (OSE must permit changes to point of diversion and place and purpose of use)
- MRGCD can reallocate water within its boundaries consistent with Conservancy Act
- MRGCD formed water bank in 1995, but OSE has not approved use of bank for non-agricultural purposes.
- Because no rights in the Middle Valley are adjudicated the key issue is establishing an expedited process for approving deposits in a water bank.

Economic Feasibility

- Could provide the financial incentive to local farmers to implement many of the other alternatives (e.g., A-7 and A-10)
- Could reduce the adverse economic impact of short-term water crises, such as droughts, on the agricultural sector
- Transfer of water from low-income, rural areas to high-income, urban areas could adversely impact economic sustainability of agriculture in MRG region
- Combination of alternatives (e.g., A-7 and A-10) could accommodate agricultural sector water needs and growth in other sectors (possible win-win situation)

Social/Cultural Feasibility

- Current planning regional - poorly planned areas absorb impacts from other communities
- Water banking facilitates movement of water from agriculture to other uses - social costs to irrigating communities and families

Social/Cultural Feasibility

- Traditionally opposed by acequias
- Opportunity for supplemental income without losing water right or subdividing land (retain long lots)
- Utility should represent all interests in region

<u>Growth Management (A-52)</u>

Technical Lead: Phyllis Taylor

<u>DEFINITION</u>: Develop a sustainable and coordinated growth management plan for adoption and implementation by local governments in the middle Rio Grande region in order to: 1) reduce water consumption; 2) minimize impact on water resources; 3) encourage conservation-oriented economic development and 4) ensure adequate water supplies for any proposed development.

A number of political issues affect this alternative, including:

1. Water authority is at the State level; land use authority is vested at the local level. Coordination would require one oversight agency.
2. There is both strong support and strong opposition to this alternative.

Growth policies need to recognize economic impacts and the limits of sustainability imposed by the amount of water available.

<u>BRIEF ANALYSIS:</u>

Water:
- Preserves water resources through efficiency of use

Cost:
- Cost of administration and implementation of local plans

Time:
- Implementation subject to regional policy decisions

Tradeoffs:
- Legal complexities of regionalization
- May shift growth to less regulated areas

Other Considerations:
- Regionalization of land use management
- Changes in land use development patterns
- Region-wide cooperation essential

Separate Attribute Ratings

4 Technical Feasibility
4 Physical, Hydrological, Environmental Feasibility
3 Economic Feasibility
3 Social and Cultural Implications
4 Legal Implications

Space for Notes

DETAILED ANALYSIS:

Technical Feasibility

- Urban service areas – tie growth to capacity and extent of public water systems
- Rural water supply – tie growth to proof of adequate water supply
- Location of growth – protect water quality and aquifer recharge areas
- Growth boundaries (“leapfrog” over boundaries – must be regional)
- Conservation-oriented economic development
  - Increase incentives for industries that use less water, use water efficiently, and/or have high value added relative to water use
  - Decrease incentives for industries that do not meet these criteria
- Applies to “new” growth
- Restrictions on housing — shifts growth to other areas, socioeconomic impacts
- Commercial development restrictions – increase commercial densities, may shift growth in low land value industry outside of region
- Job mix approach – incentives for high value added jobs could increase prosperity with less job growth and provide jobs for underemployed locals. High cost of training, long-term implementation
- See A-28 and A-30 for projected savings based on change in land use patterns and response to development incentives

Economic Feasibility

- Reduction in demand reduces cost of acquiring water rights for future
- Higher land costs increase housing costs
- Groundwater retained for drought reserve increases certainty of water availability
- Decreased price and demand for land on fringe of urban development

Legal Feasibility

- Local governments have planning authority in local jurisdictions
- If plan is mandatory or implemented by a regional land-use planning entity, considerable legal issues arise
- Regionalization of land-use management could require wholesale changes in both state law and local ordinances
- Regulation of water use limited by existing rights.

Social/Cultural Feasibility

- Possible higher housing costs impact lower income groups
- Could shift growth to other areas unless done at regional level
- All residents in region benefit from integrated planning approach
- Policies could protect agricultural lands being lost to development

Funding Alternatives

Severance Tax (A-59)

Technical Lead: Brian McDonald

DEFINITION: Establish a State-based water severance tax for water projects, planning and conservation.

The proposal is to tax the net withdrawal of water from the water system, especially ground water which is being depleted at a higher rate than it is being recharged. Establishing a severance tax or other taxing mechanism would implicitly recognize water as a State resource. The income could be used to fund other water management implementations.

BRIEF ANALYSIS:

Water:
- 1% reduction in water demand

Cost:
- Assumes a 10% increase in after tax price
- $8000 per acre foot reduction in water demand
- Water consumption tax: $100 per ac-ft = $20+ Million / yr

Time:
- Implementation dependent on changes in State law

Tradeoffs:
- Detrimental to agricultural sector (most farmers could not afford this)
- Fluctuation of tax revenue streams
- Revenue would not keep up with inflation without tax increases

Other Considerations:
- Tax administration- regional or state level
- Legal and political complexities
- Lack of metering or monitoring infrastructure

Separate Attribute Ratings

2 Technical Feasibility
3 Physical, Hydrological, Environmental Feasibility
2* Economic Feasibility
3 Social and Cultural Implications
2 Legal Implications

* This alternative could result in some water savings

Space for Notes

DETAILED ANALYSIS:

Economic Feasibility

- Broad-based tax on all regional water consumption would raise $20.4 million per year
  - Tax rate at $100 per af = $0.000307 per gallon of water
  - Based on total consumptive use of 204,701 af
  - 41.5% – public water supply, primarily municipal and industrial use
  - 47.1% – agriculture, including surface and groundwater
- Tax rate should be higher on mined groundwater to account for associated social costs
- Metering recommended to determine actual consumptive use
- Water tax rates for different users based on income to reduce regressivity of the tax, (e.g., $100/af municipal use, $50/af agriculture)
- Lack of metering, especially in agriculture, makes this alternative difficult to implement. Even with metering, tax is based upon consumptive use, which would have to be estimated in most uses. A tax which uses an estimated tax base (consumptive use) may not be acceptable to taxpayers. Opportunities would also exist for tax avoidance.
- Tax revenue stream will be cyclical, if based upon consumptive use. During drought years tax revenue would fall, while in wet years it would increase. Difficult to project annual available tax revenue
- Since water consumption is physically constrained, tax revenue would not grow over time and would not keep up with inflation without periodic increases in the tax rate
- Taxing the value of consumed water is not feasible, since there is not a uniform price charged for water use in the region

Legal Feasibility

- Change in state law required
- Tax based on transaction amount (like gross receipts) is more viable
- Regional assessment could occur through local government authorities
- Formation of regional authority to assess & collect raises several legal issues (see A-67)

PART II

Qualitative Evaluation of 19 Alternative Actions
Compiled by Alternative Working Team and Analysis Team

Alternatives to Increase Water Supply

Importation of Water (A-69)

DEFINITION: Acquire additional water rights without condemnation from various sources from within or outside the water-planning region, and import water from other basins where possible.

Under NM law, water rights are a property right and can therefore be condemned if it is in the public interest to appropriate the water for another use.

It is becoming increasingly difficult to find willing sellers and the cost to purchase and transfer water from place to place is quite high.

BRIEF ANALYSIS:

Water:
- Possible increased availability of water resources

Cost:
- High cost to construct pumping and conveyance systems

Time:
- Long range

Tradeoffs:
- Interbasin conflicts
- Diminish water at source in order to increase water at destination

Other Considerations:
- Legal, environmental, and social constraints

Separate Attribute Ratings

4 Technical Feasibility
4 Physical, Hydrological, Environmental Feasibility
4 Economic Feasibility
2 Social and Cultural Implications
3 Legal Implications

Space for Notes

Water Harvesting (A-44)

DEFINITION: Encourage on-site rainwater harvesting.

The vast majority of rainfall is lost to evaporation. If a percentage of this rain could be collected, it would provide a significant additional source of water. There are legal issues concerning impoundment of storm water and impairment of water rights as well as issues bearing on the quality of harvested water.

BRIEF ANALYSIS:

Water:
- Water harvested from rooftops might reduce depletion by 5%
- At 8 in. rainfall/yr, yield is about 4,900 gal/1,000 sq ft rooftop

Cost:
- Special storage tanks: $1 per gallon (other costs for system)

Time:
- Immediate and ongoing

Tradeoffs:
- Currently, rooftop water runoff to river or into soil moisture zone
- Quality of harvested water: safe for outdoor use

Other Considerations:
- Legal issues: impoundment of stormwater and impairment of rights
- Maximize capture & storage of typical high-intensity rainfall

Separate Attribute Ratings

5 Technical Feasibility
3 Physical, Hydrological, Environmental Feasibility
3 Economic Feasibility
3 Social and Cultural Implications
5 Legal Implications
OSE has authority to regulate, may do so if widespread implementation results in significant amount of water harvested

Space for Notes

Soil and Vegetation Management (A-33)

DEFINITION: Establish erosion prevention measures and use soil and vegetation management techniques to reduce runoff and increase infiltration throughout the watershed, including forested mountains and uplands.

> Expand watershed management programs. These programs are intended to slow runoff and reduce erosion through various means, for example, installing better groundcover, restoring grasslands and canopy environment, and controlling watercourse drainage.
>
> Establish vegetation management programs. Regional forests, including the Bosque, are currently full of small diameter trees and brush. This not only presents a fire hazard, but it also consumes water and prevents natural infiltration of rainwater and snowmelt.

BRIEF ANALYSIS:

Water:
- Intent: slow runoff, reduce erosion, increase infiltration
- Possible gain to ground water

Cost:
- Medium to high cost for implementation
- High maintenance cost

Time:
- Immediate expansion of existing programs, but ongoing

Tradeoffs:
- Potential reduction of surface flow to river

Other Considerations:
- Program effectiveness dependent on research/evaluation

Separate Attribute Ratings

4	Technical Feasibility
3	Physical, Hydrological, Environmental Feasibility
4	Economic Feasibility
5	Social and Cultural Implications
4	Legal Implications

Space for Notes

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Vegetation Removal Products (A-2)

DEFINITION: Develop the economic potential of non-native species removal, harvesting, and output of products by local industries.

The objective is to develop products that use the plants being removed by vegetation management programs. If implemented successfully, this could become an income source rather than a cost.

BRIEF ANALYSIS:

Water:

- Salt Cedar biomass to energy conversion
- 202 to 785 ac-ft/yr water saved per acre of Salt Cedar removed

Cost:

- Small power generation plant: $800,000
- Clearing Salt Cedar: $500 to $1,000 per acre
- Net cost range: from loss of $820/acre to gain (profit) of $445/acre

Time:

- Power plant on-line in one year

Tradeoffs:

- Need market for energy distribution

Other Considerations:

- Furniture manufacture
- Pulpwood

Separate Attribute Ratings

2 Technical Feasibility
4 Physical, Hydrological, Environmental Feasibility
4 Economic Feasibility
4 Social and Cultural Implications
5 Legal Implications

Space for Notes

Storm Water Management (A-34)

DEFINITION: Enhance and expand local government storm water plans and programs to control runoff using swales, terraces, and retention structures to minimize erosion, enhance infiltration and recharge, and prevent pollution of surface and ground water.

The majority of local governments in the region do not have programs of this nature because the cost is relatively high and the benefits are either long-term or indirect.

BRIEF ANALYSIS:

Water:
- Enhanced infiltration with some recharge to ground water
- Reduced levels of urban storm water pollution to water resources

Cost:
- Cost associated with administration and enforcement of regulations
- Cost of construction of stormwater control structures

Time:
- Immediate and ongoing

Tradeoffs:
- Reduces runoff into the river

Other Considerations:
- Clean Water Act Urban Storm Water Regulations – Phase II

Separate Attribute Ratings

4 Technical Feasibility
3 Physical, Hydrological, Environmental Feasibility
3 Economic Feasibility
5 Social and Cultural Implications
5 Legal Implications

Space for Notes

Vegetation Management (A-40)

DEFINITION: Continue evapotranspiration studies and apply findings to vegetation management programs in the water planning region.

> Evapotranspiration is the water given off by plants. More research is needed to understand how much water comes from which types of plants and under what conditions. Use this information to minimize riparian water loss.

BRIEF ANALYSIS:

Water:
- Possible gain to ground water

Cost:
- Medium to high research costs
- Implementation costs unknown

Time:
- Ongoing, long term

Tradeoffs:
- Unknown

Other Considerations:
- Funding availability
- Application of research results

Separate Attribute Ratings

5 Technical Feasibility
3 Physical, Hydrological, Environmental Feasibility
4 Economic Feasibility
4 Social and Cultural Implications
5 Legal Implications

Space for Notes

Wetlands (A-36)

DEFINITION: Create constructed wetlands for groundwater recharge, water harvesting, and habitat improvement, and hydrological management of the Rio Grande.

Use constructed wetlands as an alternative method for treatment of sewage and other forms of greywater. Technical considerations include the difficulty of protecting the wetland plants from destruction by heavy downpour and floods. In addition, a significant amount of water is lost to evaporation and evapotranspiration.

BRIEF ANALYSIS:

Water:
- Potential for recharge to ground water

Cost:
- Medium cost to construct wetlands and catchments

Time:
- Ongoing, long term

Tradeoffs:
- Reduced flow to the river
- Potential increase in evapotranspiration

Other Considerations:
- Improved water quality and habitat
- Clean Water Act Urban Storm Water Regulations – Phase II
- Potential for State/Federal program funding

Separate Attribute Ratings

2 Technical Feasibility
1 Physical, Hydrological, Environmental Feasibility
(Do not work well; cause evaporative losses, public health issues.
1 Economic Feasibility
3 Social and Cultural Implications
3 Legal Implications

Space for Notes

Weather Modification (A-42)

DEFINITION: Conduct research on innovative water supply enhancement techniques such as weather modification.

If a way is found to do this effectively in this region, it could create additional water supply. This is a highly experimental field.

BRIEF ANALYSIS:

Water:
- Cloud seeding program to increase precipitation
- 10 to 20 percent gain in precipitation in experimental target areas

Cost:
- Annual operating costs: $200,000 to $500,000

Time:
- Immediate and ongoing

Tradeoffs:
- Unpredictable results of cloud seeding

Other Considerations:
- Program in partnership with State and Federal agencies
- Cloud seeding dependent on moist air mass

Separate Attribute Ratings

5 Technical Feasibility
3 Physical, Hydrological, Environmental Feasibility
3 Economic Feasibility
3 Social and Cultural Implications
5 Legal Implications

Space for Notes

Alternatives to Decrease or Regulate Water Demand

Metering Water Supply Wells (A-8)

DEFINITION: Meter all water supply wells, including domestic wells, throughout the water-planning region.

Under the current system, domestic wells owners are allowed up to 3 acre-feet per year. Metering is not required so there is no way to monitor actual water use. Once the amount of water being used is known, there may be an incentive to use less of it.

BRIEF ANALYSIS:

Water:
- Metering may provide incentive to use less water

Cost:
- Domestic well meter (installed) costs about $400
- Monitoring and enforcement costs would be significant

Time:
- Medium to long term period to implement

Tradeoffs:
- Based on public input, metering is not strongly supported

Other Considerations:
- Metering could provide a basis to change domestic well statutes
- Funding assistance by the State

Separate Attribute Ratings

3 Technical Feasibility
4 Physical, Hydrological, Environmental Feasibility
1 Economic Feasibility
2 Social and Cultural Implications
4 Legal Implications

Space for Notes

Domestic Well Controls (A-61)

DEFINITION: Reduce the allowed pumping from domestic wells and restrict drilling of domestic wells where surface waters or the aquifer could be impaired.

This alternative requires that well metering be in place.

BRIEF ANALYSIS:

Water:
- Intent is to preserve water in "critical management areas"

Cost:
- Domestic well meter (installed) costs about $400
- Monitoring and enforcement costs would be significant

Time:
- Medium to long term period to implement

Tradeoffs:
- Development limitations in critical management areas
- Drilling restrictions and/or pumping limitations

Other Considerations:
- Designation of critical management area by State Engineer
- Potential opposition to regulation but support for cumulative effects

Separate Attribute Ratings

4 Technical Feasibility
4 Physical, Hydrological, Environmental Feasibility
3 Economic Feasibility
2 Social and Cultural Implications
2 Legal Implications

Space for Notes

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Acequia Conservation Programs (A-60)

<u>DEFINITION</u>: Fund irrigation organizations to develop and implement water conservation programs.

There are two common types of irrigation organizations: traditional acequias and Conservancy District ditches. The approach to conserving may differ whether one considers traditional community acequias or conservancy district acequias. Conservancy district acequias tend to be much larger and might require federal funding to implement the changes.

Note: The Conservancy District of the MRG was created in 1924 to manage water delivery along the Rio Grande between Cochiti lake to Elephant Butte. The district taxes property owners to fund management of the ditches and dams.

<u>BRIEF ANALYSIS:</u>

<u>Water:</u>
- Decreased demand may be possible through efficiency of use

<u>Cost:</u>
- Minimal cost to implement

<u>Time:</u>
- Immediate

<u>Tradeoffs:</u>
- Social and cultural implications

<u>Other Considerations:</u>
- Increased viability of acequia systems

Separate Attribute Ratings

5 Technical Feasibility
4 Physical, Hydrological, Environmental Feasibility
4 Economic Feasibility
5 Social and Cultural Implications
5 Legal Implications

Space for Notes

Alternatives to Change Water Uses to Increase Supply / Decrease Demand

Maintain Water Resource Database (A-73)

DEFINITION: Establish and integrate a regional Geographical Information System (GIS) database of publicly accessible information on water resources and photo imagery covering the water planning region.

This would be a helpful tool for planning and modeling, provided the data is accurate.

BRIEF ANALYSIS:

Water:
- Efficiencies of water use justified through information and analysis

Cost:
- Cost of computerized mapping and data management can be high

Time:
- Ongoing

Tradeoffs:
- Potential for conflicting data and information
- Potential for disagreement over analysis and interpretation

Other Considerations:
- Regional data repository
- Homeland Security issues (i.e., Bioterrorism Preparedness and Response Act of 2002)

Separate Attribute Ratings

5 Technical Feasibility
5 Physical, Hydrological, Environmental Feasibility
3 Economic Feasibility
4 Social and Cultural Implications
5 Legal Implications

Space for Notes

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Alternatives for Water Rights Regulation

Water Rights Adjudication (A-71)

DEFINITION: Identify, quantify, and adjudicate all water rights and the order of wet water utilization in the water-planning region.

> Adjudication is the legal process of reviewing all water rights claims in an area to determine which are actually defensible. The process results in a clear accounting of how much water may be used and by whom. Currently, on average, there are more claims than there is water, so this process would clarify who must stop using water during a water shortage.

BRIEF ANALYSIS:

Water:
- Prerequisite to water rights determination

Cost:
- High cost to administer

Time:
- Long term to complete adjudication

Tradeoffs:
- Uncertainty of junior rights
- Process may create social conflict

Other Considerations:
- Tribal and acequia concerns
- More orderly management of water

Separate Attribute Ratings

4 Technical Feasibility
5 Physical, Hydrological, Environmental Feasibility
5 Economic Feasibility
3 Social and Cultural Implications
3 Legal Implications

Space for Notes

Evaporative Loss Accounting (A-51)

DEFINITION: Establish more equitable accounting for evaporative losses in Rio Grande Compact water.

Per the Rio Grande compact, NM is required to keep a certain amount of water in Elephant Butte reservoir A large amount of the water in the reservoir is lost to evaporation. The evaporative loss would normally be shared among all water users, both Texas and New Mexico. Change the Compact so that Texas is responsible for some of the evaporative loss, which would reduce the delivery amount that New Mexico owes Texas. Renegotiating the Compact is highly unlikely.

BRIEF ANALYSIS:

Water:
- Reduction in evaporative losses of water in Rio Grande system
- Storage location changes

Cost:
- Cost undetermined

Time:
- Medium to long range period to implement

Tradeoffs:
- Impact on lake recreation uses

Other Considerations:
- Rio Grande Compact issues
- River management
- Fair distribution of consumptive accounting

Separate Attribute Ratings

4 Technical Feasibility
3 Physical, Hydrological, Environmental Feasibility
4 Economic Feasibility
5 Social and Cultural Implications
1 Legal Implications

Space for Notes

Alternatives for Water Quality Protection

Well Head Protection (A-50)

DEFINITION: Enforce wellhead protection programs on all public water supply wells within local government jurisdictions.

Federal and State regulations stipulate that public water supply wellheads must be protected to prevent contamination of groundwater. These regulations are not enforced. Most communities lack wellhead protection programs.

BRIEF ANALYSIS:

Water:
- Protection of water resources from contamination

Cost:
- Administrative cost of regulation and enforcement

Time:
- Immediate and ongoing

Tradeoffs:
- Stringent development controls near public water supply wells

Other Considerations:
- Well head protection zone should be delineated on technical merits
- Requires local government zoning authority

Separate Attribute Ratings

4 Technical Feasibility
3 Physical, Hydrological, Environmental Feasibility
2 Economic Feasibility
4 Social and Cultural Implications
5 Legal Implications

Space for Notes

Alternatives for Implementation of Plan & Management of Water Resources

Public Involvement Program (A-53)

DEFINITION: Through open and inclusive processes, ensure public involvement in water planning by continuing regular public information/dissemination programs and public relations campaigns, and citizen planning committees. Keep the public engaged in this process.

The theory is that as the public becomes better informed of the scale and complexity of the problems, there will be more pressure for change. People who understand the problem will be motivated to conserve water. Public participation ensures that a broad array of interests is represented.

BRIEF ANALYSIS:

Water:
- Water savings may be initiated and ensured by an informed public

Cost:
- Significant funding necessary for public outreach

Time:
- Ongoing

Tradeoffs:
- Inherent conflict of competing interests

Other Considerations:
- Public involvement may influence water programs and policies
- Funding for public involvement programs

Separate Attribute Ratings

5 Technical Feasibility
5 Physical, Hydrological, Environmental Feasibility
3 Economic Feasibility
5 Social and Cultural Implications
5 Legal Implications

Space for Notes

Preserve Deep Water for Drinking (A-15)

DEFINITION: Preserve, but continue to draw, deep-well water for drinking purposes only.

Removing vast quantities of water from the aquifer is lowering the water table and creating various surface water problems. Proposal is to limit consumption of aquifer waters for drinking purposes only and obtain water for other purposes from other sources.

The technical issue is how to deliver two grades of water to urban user. Installation of a dual-piping system is quite costly for existing construction. An alternative is to make treated river water available from the taps and provide ground water in bottled form.

BRIEF ANALYSIS:

Water:
- Preservation of high-quality deep well water

Cost:
- Cost undetermined

Time:
- Medium range time to implement

Tradeoffs:
- Restricting and controlling deep well water
- May require new infrastructure

Other Considerations:
- Changes to public drinking water habits
- Distribution of drinking water

Separate Attribute Ratings

1 Technical Feasibility
1 Physical, Hydrological, Environmental Feasibility
1 Economic Feasibility
2 Social and Cultural Implications
2 Legal Implications

Space for Notes

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Active Water Resource Management (A-143)

<u>DEFINITION</u>: Encourage active water resource management by the State Engineer (OSE/ISC).

Currently the Office of the State Engineer (OSE/ISC) administers water rights and associated data. The role of the OSE/ISC should be expanded to be proactive in managing our overall water resource.

<u>BRIEF ANALYSIS:</u>

Water:
- Water efficiency savings

Cost:
- Administrative costs

Time:
- Immediate and ongoing

Tradeoffs:
- Increased complexity in water rights administration

Other Considerations:
- Watershed impacts
- Potentially significant economic impacts

Separate Attribute Ratings

5 Technical Feasibility
5 Physical, Hydrological, Environmental Feasibility
3 Economic Feasibility
4 Social and Cultural Implications
5 Legal Implications

Space for Notes

Water Funding Alternatives

Regional Water Planning Program (A-58)

DEFINITION: Water Funding - Establish dedicated and continuing funding for Regional Water Planning as an ongoing process and as a basis for water management at local, regional and state levels.

The Regional Water Plan (RWP), once submitted and approved, will require periodic revision.

BRIEF ANALYSIS:

Water:
- Regional Water Plan can effect local water management efficiencies

Cost:
- Administrative costs associated with planning process

Time:
- Current and ongoing

Tradeoffs:
- Potential for incompatible and contentious local water management without consensus on regional water policy

Other Considerations:
- Necessity of dedicated, ongoing funding
- Regional plans provide crucial input to State Water Plan

Separate Attribute Ratings

5 Technical Feasibility
5 Physical, Hydrological, Environmental Feasibility
3 Economic Feasibility
4 Social and Cultural Implications
4 Legal Implications

Space for Notes

Results from 5th Series of Community Conversations

Participants at the 5th Series of Community Conversations were asked to select their top 5 Most Liked (M) and bottom 5 Least Liked (L). Card votes were either sent or sometimes submitted at Community Conversations, while Dot votes were at Community Conversations.

	Alternative Action	Alt. Id No.	Dot Preferences				Card Preferences			
			Totals		Ranking		Totals		Ranking	
			M	L	M	L	M	L	M	L
Increase Water Supply	*Watershed Plans*	A-66	1	0	41st	41st	3	0	32nd	39th
	Bosque Management	A-1	77	0	1st	41st	19	3	3rd	30th
	Reservoir Management	A-45	23	4	5th	23rd	20	3	1st	30th
	Surface Modeling	A-38	9	1	19th	38th	5	0	23rd	39th
	Aquifer Storage	A-46	13	17	12th	9th	6	10	21st	9th
	Reuse Greywater	A-24	16	1	9th	38th	13	2	7th	34th
	Reuse Treated Effluent	A-27	17	0	7th	41st	11	2	9th	34th
	Desalination	A-39	5	8	29th	15th	7	14	18th	4th
	Importation of Water	A-69	7	27	26th	5th	6	18	21st	2nd
	Water Harvesting	A-44	12	3	12th	26th	7	4	18th	27th
	Soil and Vegetation Management	A-33	12	3	13th	26th	9	5	15th	23rd
	Vegetation Removal Products	A-2	0	3	44th	26th	2	6	36th	19th
	Storm Water Management	A-34	5	2	29th	31st	2	4	36th	27th
	Vegetation Management	A-40	3	8	34th	15th	1	8	42nd	15th
	Wetlands	A-36	8	3	23rd	26th	3	6	32nd	19th
	Weather Modification	A-42	2	41	38th	2nd	0	30	44th	1st
Decrease or Regulate Water Demand	*Urban Conservation*	A-18	34	1	3rd	38th	17	0	5th	39th
	Urban Water Pricing	A-21	12	32	13th	4th	11	10	9th	9th
	Conservation Incentives	A-22	12	2	13th	31st	4	3	29th	30th
	Education	A-56	9	3	19th	26th	8	0	16th	39th
	Irrigation Efficiency	A-10	17	2	7th	31st	11	0	9th	39th
	Agricultural Metering	A-7	9	20	19th	8th	10	9	12th	13th
	Conveyance Systems	A-9	8	2	23rd	31st	8	7	16th	18th
	Metering Water Supply Wells	A-8	10	63	18th	1st	10	15	12th	3rd
	Domestic Well Controls	A-61	2	11	38th	12th	2	11	36th	6th
	Acequia Conservation Programs	A-60	9	5	19th	21st	5	10	23rd	13th
Change Water Uses to Increase Supply / Decrease Demand	*Low-Water Crops*	A-11	11	13	17th	11th	5	8	23rd	15th
	Land Use	A-30	39	11	2nd	12th	20	6	1st	19th
	In-Fill/Density	A-28	5	23	29th	7th	7	11	18th	6th
	Preserve Deep Water for Drinking	A-15	8	2	23rd	31st	10	5	12th	23rd

	Alternative Action	Alt. Id No.	Dot Preferences				Card Preferences			
			Totals		Ranking		Totals		Ranking	
			M	L	M	L	M	L	M	L
Water Rights Regulation	*Instream Flow*	A-63	14	36	11th	3rd	14	10	6th	9th
	Conjunctive Management	A-144	3	2	34th	31st	3	1	32nd	37th
	Water Rights Adjudication	A-71	19	9	6th	14th	12	4	8th	27th
	Evaporative Loss Accounting	A-51	15	2	10th	31st	5	1	23rd	37th
Water Quality Protection	*Water Quality*	A-47	5	5	29th	21st	2	0	36th	39th
	Domestic Wastewater	A-26	4	8	33rd	15th	4	2	29th	34th
	Well Head Protection	A-50	1	6	41st	20th	2	3	36th	30th
Implementation of Water Plan & Management of Water Resources	*Water Bank/Authority*	A-67	6	15	27th	10th	3	12	32nd	5th
	Growth Management	A-52	32	4	4th	23rd	19	11	3rd	6th
	Public Involvement Program	A-53	2	0	38th	41st	4	5	29th	23rd
	Maintain Water Resource Database.	A-73	1	8	41st	15th	1	6	42nd	19th
	Active Water Resource Management	A-143	3	7	34th	19th	5	5	23rd	23rd
Water Funding	*Severance Tax*	A-59	6	27	27th	5th	5	9	23rd	13th
	Regional Water Planning Program	A-58	3	4	34th	23rd	2	8	36th	15th

Italicized indicate those evaluated by DB Stephens and Associates.

Appendices

Explanation of Separate Attribute Ratings

1. Technical Feasibility
2. Physical, Hydrological, Environmental Feasibility
3. Economic Feasibility
4. Social and Cultural Implications
5. Legal Implications

Technical

1. Major impediment, very high cost, requires developing and proving new technology, lengthy or unknown time frame to implement.
2. Technology is under development but not proven, not cost effective, lengthy time frame to implement.
3. Innovative technology, costs are generally higher than market price of water, moderate time frame to implement
4. Can be implemented fairly quickly, cost effective, common technology.
5. No impediments, quick, very cost effective, already being done.

Physical

1. Will lose some water, (e.g. increases evaporation), highly detrimental environmental effects, degrades water quality.
2. Potential to lose water, negative environmental effects, potential to degrade water quality, significant infrastructure requirements
3. Does not necessarily gain water or improve water supply management. No significant environmental impacts, does not improve or impair water quality, moderate infrastructure requirements
4. Results in some water savings, potential to enhance natural environment, may improve water quality. Few infrastructure requirements
5. Results in significant water savings, environmental enhancements, improves water quality. No infrastructure requirements or highly feasible infrastructure requirements.

Economic

1. Economic impacts are borne solely by the region, without state or federal assistance.
2. Economic impacts are borne by the region, with minimal outside assistance.
3. Economic impacts are borne by the region with some state funding of the alternative.
4. Significant amount of funding will come from state and federal resources. Region will contribute minor portions. Beneficial to regional economy
5. Majority of funding will come from federal and state sources outside the region, with region gaining significant economic benefit. Highly beneficial to regional economy

Social/Cultural

1. Unacceptable to broad range of social groups.
2. At least one social group will oppose the alternative.
3. Advantages and disadvantages are in equilibrium.
4. Generally acceptable to most social groups, some resistance may still occur.
5. Acceptable and desirable for most social groups.

Legal

1. Very difficult change in existing federal/interstate law; high risk that any proposed change to such existing law would not be successful, not in compliance with Compact, permit applications precedent-setting approval not likely within planning period
2. Possible to change law, but difficult due to political opposition; lengthy process to make legal change, Compact issues, permits are extensive, technically complex, and may require entire planning period to obtain approval. Few permits, if any, exist for similar projects
3. Possible, more routine, less controversial legal change; still may involve complex approval requirement; may involve potentially novel concept, significant permitting efforts, but some similar permitting has been achieved.
4. Minimal legal barriers; local or regulatory change already supported by statute, permitting process lengthy, but similar projects already permitted
5. No legal barriers/already occurring; permitting routine.

The Water Assembly is working in partnership with the
Mid-Region Council of Governments
to develop a regional water plan.

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This document was prepared by the Public Participation and Communication Working Team of the Water Assembly, with input from the Alternatives Working Team and D. B. Stephens & Associates, February, 2003.