

# **Supporting Document E-5**

## **Alternative Evaluation Handbook**

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## **PART 1**

### **INTRODUCTION AND PURPOSE**

The purpose of this Handbook is to present a general process and methodology for conducting an analysis of preliminary alternatives for regional water management. Although the methodology developed for this purpose is intended for application in the Middle Rio Grande Water Planning Region, it is suitable for use in other regions and for other purposes. This methodology provides a basis for setting priorities among many and varied water management alternatives. This methodology is also designed to meet the objectives of the *Regional Water Planning Handbook* adopted for use by the New Mexico Interstate Stream Commission.

There are common steps in any alternatives analysis process: identification of alternatives, screening for in-depth analysis, development and application of criteria for analysis, and preliminary testing and validation of the methodology. Ultimately, this process will produce recommendations for the management of water resources that will benefit the entire region. What is important here is that the alternatives analysis process is consistent, comprehensive, and flexible for application to a wide range of water management alternatives.

#### **Background Information**

This Handbook is one of a number of products prepared for the Regional Water Plan for the Middle Rio Grande Region. The Plan is being developed through a joint effort by the Middle Rio Grande Water Assembly, a non-profit corporation, and the Middle Rio Grande Water Resources Board of the Middle Rio Grande Council of Governments (MRGCOG), an association of local governments in the planning area. Development of this Handbook was accomplished through the Alternatives Work Group, which is organizationally part of the Water Assembly's Action Committee, and is provided with MRGCOG staff support.

The Alternatives Work Group was established to aid and assist in the completion of Task Three of the initial Scope of Work for the Middle Rio Grande Regional Water Planning Program. This Program is being funded in part by the New Mexico Interstate Stream Commission (ISC). Additional funding is provided through the Water Assembly and contributions from the local government members of the MRGCOG.

The principal purpose of Task Three is to formulate a preliminary alternatives analysis process in accordance with the ISC contract. Task Three of the Scope-of-Work was designed to establish a formal and structured decision making process for

identifying and evaluating feasible alternatives for regional water management to meet anticipated water demand.® To carry out this purpose, a sample selection from a list of preliminary alternatives would be chosen for analysis and public review. Other related subtasks in Task Three included information-gathering activities through survey research and development of a public comments database. Public input was, and will continue to be, instrumental in the compilation of potential and preliminary alternatives. Such information-gathering activities are useful in the identification and screening of alternatives, and even in the alternatives analysis process itself. The alternatives analysis process developed for the Regional Water Plan requires a significant effort in the education and participation of the general public.

Membership of the Alternatives Work Group is comprised of participants of the Middle Rio Grande Water Assembly with technical and clerical support from the staff of the Middle Rio Grande Council of Governments. This Work Group has undertaken the lead role in the development of a basic methodology for identifying, clarifying, and analyzing water management alternatives that may be suitable for implementation in the Middle Rio Grande Water Planning Region. Since the Alternatives Work Group is an advisory group, recommendations will be submitted to the Water Assembly Action Committee and the Middle Rio Grande Water Resources Board for consideration and acceptance.

### **Purpose of Methodology**

This Handbook on Methodology provides the rationale and step-by-step procedures for conducting an analysis of proposed water management alternatives. Such an analysis is required in order to determine the feasibility and priority of actions for implementing a Regional Water Plan. This Handbook is a decision making tool and is for guidance only. A complete and fully detailed analysis of alternatives will require an extensive effort using additional qualified expertise and adequate public input and feedback.

Although there are numerous techniques that may be applied to the alternatives analysis process for the Regional Water Plan, the methodology presented in this report is the result of many hours of research and deliberation by the Alternatives Work Group. This methodology establishes a sound procedural basis for the selection of most feasible alternatives for regional water resource management. A simple flowchart of the alternatives analysis process is provided in APPENDIX A and is fully explained in the following sections of this Handbook.

The outcome of this analysis process should provide guidance to decision makers who have the authority to carry out actions defined by recommended alternatives. In

most cases, that authority will be implemented by local governments; but in other cases, the general public must commit to individual and community responsibilities concerning their use and consumption of water supplies.

## **PART 2**

### **IDENTIFICATION AND SCREENING OF ALTERNATIVES**

To implement the Regional Water Plan, there are numerous alternative actions available that can result in the conservation, preservation, and/or efficient management of the water resources available in this region. In following a basic assumption that there may not be adequate water to serve future demands in this region=s water scarce environment, the Regional Water Plan must consider various alternatives in the management of water use. A do-nothing alternative will continue the depletion of existing water resources, perhaps to the point of exhaustion.

Alternatives, as defined for purposes of this report, are specific technical, planning, and management actions proposed to reduce water consumption or achieve more efficient use of existing and future water resources. In order to identify practical and achievable alternatives for water management, a systematic procedure is required for identifying and selecting appropriate alternatives to determine the most feasible actions in implementing a Regional Water Plan.

#### **Compilation of Alternatives**

By utilizing the public involvement process, a collection of potential alternatives has been gathered for subsequent analysis. Many of these potential alternatives have been submitted by members of the general public who participated in a variety of advertized public meetings, conferences and workshops, and were received in various forms such as oral comments, facilitator=s notes, and written suggestions. One of the initial procedures developed by the Alternatives Work Group was to reduce, through a screening process, the extensive listing of suggested alternatives to a workable number for more rigorous analysis of individual alternatives.

Also, more detailed and often technical alternatives were provided by the participants of the Middle Rio Grande Water Assembly and the members of its Action Committee. There is a wealth of water resource expertise in the Action Committee and specific suggestions for proposed alternatives were submitted on numerous occasions. In particular, a technical group, AEl Grupo Tecnico@ which was formed to aid in the completion of Task One of the initial Scope of Work, was extremely helpful in suggesting complex and visionary strategies for more efficient utilization of water resources on a basin-wide scale.

All suggested alternatives are, and will continue to be, documented and acknowledged as having a potential for consideration in the Regional Water Plan.

Furthermore, these alternatives, in many cases, need to be continually refined or adjusted to meet localized circumstances in their implementation. The initial list of the potential alternatives used in the development of this methodology, is provided in APPENDIX B of this report. That initial list used for purposes of developing the methodology contained 169 proposed alternatives which had been gathered over

a period of several months. All of the suggested alternatives were accepted regardless of their level of detail, practicality, or applicability to the issues of water management.

### **Screening Process**

Because the initial listing of alternatives came from a variety of sources and levels of interest and understanding, there is a need for refinement. Some of the alternatives were expressed impulsively, a significant number were redundant or repetitious, many were not applicable to real water management issues, and many were either too vague or too specific. It became clear to the Alternatives Work Group that the list of alternatives needed to be organized and generalized.

The Alternatives Work Group determined that a significant screening of the proposed list of alternatives could be accomplished if a simple criterion was applied. Consequently, a first screening was based on the question: "As water saved or gained by the proposed alternative?" A written survey was conducted among the members of the Alternatives Work Group in which each of the proposed alternatives was rated as "Yes," "No," or "Unknown" in response to the question. Composite scores were calculated and a reduced listing of alternatives was established. That listing contained 43 water management alternatives. APPENDIX C presents the first screening based on water saved or gained.

In addition, the screened list of alternatives was organized into groupings or categories that reflected commonality and the general nature of the alternative. The categories were as follows:

- Urban Water Management
- Agricultural Water Management
- Regional Watershed / Basin Management
- River / Bosque Management
- Water Supply Enhancement

Obviously other categories could be identified, but for purposes of the screening process, it was useful to sort the alternatives as indicated above for subsequent review and discussion. A further refinement was made to the first screening list of

alternatives in order to develop a more succinct and generalized presentation for public discussion and comment. Thus, a second screening was formulated by editing and combining similar alternatives to further reduce the overall number of alternatives.

That second screening resulted in a listing of 21 water management alternatives, which was presented in a series of public meetings called "Community Conversations" conducted at four locations throughout the region. Using the same five categories described above, that listing is provided in APPENDIX D of this Handbook. In response to the Community Conversations, there may be further refinement to this listing of alternatives, and in a practical sense, refinement of alternatives will be an ongoing process into the final draft of the Regional Water Plan.

### **Statements of Alternatives**

The wording in the second screening list was generalized for purposes of public discussion, but each alternative in itself might imply a number of particular actions that would be needed to achieve the full benefit of that alternative. The analysis of alternatives will require formulation of a written statement clearly describing each alternative to avoid misinterpretation. There must be a common understanding and agreement on the wording of each alternative to prepare it for analysis. Thus, each alternative will have to be constructed as a singular and very detailed statement prior to the analysis process.

Ultimately, as required in the Regional Water Planning Template (provided in the *Regional Water Planning Handbook*) each alternative will include a "detailed description of specific and practical means by which the supply of the region may be reconciled with the present and future demands of the region, . . ." The fully developed alternatives of the Regional Water Plan should include components of management, water conservation, water development, and infrastructure development, as well as a water quality management plan. To the extent possible, information on the costs and benefits will be prepared as part of the description of each alternative.

For purposes of this Handbook, however, the "Statements of Alternatives" will be formulated to carry out an analysis process that will result in the identification of the most feasible alternatives to be recommended for consideration and adoption in the Regional Water Plan. Brief examples of Alternative Statements are presented in APPENDIX E. These statements were formulated specifically for testing purposes by the Alternatives Work Group and as such are abbreviated and, in some cases, lacking in critical information such as costs and benefits, social and/or environmental



impacts, and descriptive details regarding the alternative action.

## **PART 3**

### **ALTERNATIVES ANALYSIS**

The analysis of alternatives is one of the required planning elements of the Regional Water Planning Template. This Handbook has been developed to provide guidance and consistency in a preliminary alternatives analysis. Such analysis is necessary for purposes of selecting the most feasible alternatives for recommendation as part of the Middle Rio Grande Regional Water Plan.

#### **Overview of Methodology**

In order to understand the feasibility or effectiveness of an alternative, a consistent method or process must be applied in order to evaluate the technical implications as well as public acceptance of a water management alternative. The methodology developed for a preliminary analysis of alternatives in a Regional Water Plan involves the dual scrutiny of technical review and public preferences. It is crucial, however, that the public involvement is supplemented, to some extent, with education about the issues of water management in order to provide an informed contribution to the analysis process. A systematic procedure for analysis will be used to achieve a rating and ranking of alternatives.

Beginning with a large list of proposed alternatives, a screening process is applied to reduce the number of alternatives to a more practical listing of alternatives for analysis purposes. From the refined list, alternatives can be selected for rewriting into a more specific form referred to as an Alternative Statement. The alternatives are then subjected to a scoring process which proceeds along two separate and independent tracks: one track for consideration of technical feasibility and the other track for measuring public preferences.

The scoring of alternatives is complicated by the fact that there may be many issues involved with each alternative. Consequently, the Alternatives Work Group developed a set of categories, or criteria, for the analysis of alternatives. Alternatives are scored in each of six categories and a summation of those scores establishes a quantitative value for the alternative. Scoring is done through group or a representative sampling process, and then composite scores are calculated as the result. Thus, each alternative will receive two scores, one for technical feasibility and one for public preference. A convergence of these scores will be plotted on a two-dimensional grid which will indicate the most feasible and preferred alternatives. In effect, this convergence of the rating scores will establish a ranking of alternatives for further development and consideration in the Regional Water Plan. This ranking process

was adapted from a recent study conducted at Texas A&M University to survey regional planning officials about water management strategies.\*

The validation of this methodology was achieved by simply conducting a test of select alternatives through an abbreviated process. The test scoring was done under controlled conditions and the results were evaluated for reasonableness by the Alternatives Work Group. In-depth technical analysis and broad-based public input were not considered necessary for this preliminary analysis of alternatives.

### **Categories of Evaluation**

The Regional Water Planning Template presents an outline of the components for a regional water plan. The Template was developed to provide a state-wide uniformity of regional plans. As part of the Template, an alternatives analysis must be conducted in the development of a regional water plan. The two relevant components taken from the Template in terms of this Handbook are: the Water Plan Alternatives; and Evaluations.

It is anticipated that the water plan alternatives will be continually refined and expanded with details as the development of the Regional Water Plan progresses. However, in order to prepare the recommendations that initially identify the most feasible and acceptable alternatives, the preliminary analysis described in this Handbook will provide key information on the relative merits of alternatives.

The evaluations referred to in the Regional Water Planning Template establish standards for the analysis of alternatives. Those standards include the following:

- Technical feasibility
- Political feasibility
- Social and cultural impacts
- Financial feasibility
- Implementation schedule
- Physical, hydrological and environmental impacts

The Alternatives Work Group adopted these standards as criteria for the alternatives analysis. The Work Group determined that each water management alternative could be evaluated under specific criteria defined by the six categories reflecting the Template standards listed above. The Work Group expanded each category with

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\*Texas A&M University. Water Management Strategies: Ranking the Options. Report is available at the following website location, <http://tx-water-ed.tamu.edu/strategies.html>

relevant topics of consideration. Questions are posed under each of the topics of consideration, and are intended to characterize the criteria categories and provide a basis for consistency in scoring the alternatives. The alternatives analysis criteria are shown in APPENDIX F.

### **Double Track Scoring Process**

The scoring of alternatives will proceed on two tracks. One track will require the completion of a public preference survey. The other track involves a feasibility evaluation to be conducted by a panel (or panels) of individuals with diverse expertise in management and/or use of local and regional water resources. Both of these tracks will be activated concurrently but completely independent of each other. Both tracks will review and score the alternatives with similar and comparable rating scales.

The public preference survey will be conducted through a random selection procedure utilizing written questionnaires. Ideally, the respondents in this survey will be somewhat informed or knowledgeable of the water issues that will be identified in the survey. The survey instrument will present a simple format for rating a list of alternatives, written as alternative statements, under the six categories previously discussed as the standards of criteria. For each of the alternative statements, six scores will be requested. The six scores will be summed for a single rating score for the alternative. A mean score will then be calculated for each alternative from each respondent, and a composite score will be calculated for all of the respondents. The scoring for each category, or standard, will be done on a typical rating scale of 1(low) to 5(high) as follows:

- 1 -- Strongly oppose
- 2 -- Slightly oppose
- 3 -- Neither oppose nor prefer
- 4 -- Slightly prefer
- 5 -- Strongly prefer

The feasibility evaluation will be conducted by a select panel or panels of individuals with particular expertise and knowledge about the water resource issues inherent in the proposed alternative. A written questionnaire format will also be used, similar to the public preference survey form. However, scoring will be conducted with a rating system of 1(low) to 5(high) concerning the perceived feasibility of the proposed alternative. The rating scale will be as follows:

- 1 -- Not feasible
- 2 -- Slightly feasible
- 3 -- May or may not be feasible
- 4 -- Mostly feasible

## 5 -- Very feasible

As in the public preference survey, there will be six scores and a summation for each alternative. A mean score for feasibility will be calculated for each of the alternatives, and a composite score will be calculated for the panel.

### **Convergence of Ratings**

After each proposed alternative has been rated, there will be two composite scores: one that characterizes public preference, and one that reflects technical feasibility. A convergence of these scores can be attained through the application of a two-dimensional grid where the composite scores can be plotted as x-y coordinates, with values for feasibility on one axis and values for preference on the other axis. Thus, each alternative will be represented as a single point on the preference-feasibility grid, indicating recommended priorities for an action plan of most feasible, most preferred alternatives. A model of the preference-feasibility grid is shown in APPENDIX G of this Handbook.

## **PART 4**

### **VALIDATION OF METHODOLOGY**

The methodology provided in this Handbook establishes a basis for the preliminary analysis of water management alternatives. This methodology can be applied on a more regional scale and may be expanded to incorporate a higher level of technical analysis as appropriate for the completion of the Regional Water Plan. This methodology has been tested on a small scale to ascertain a reasonable and logical outcome. The test application of the methodology was conducted by the Alternatives Work Group with the assistance of the Middle Rio Grande Water Assembly and the staff of the Middle Rio Grande Council of Governments.

#### **Testing of Select Alternatives**

Identification of alternatives, in itself, involves a complicated process in order to foster consensus on the scope and detail of a written alternative. Furthermore, an alternative must be suitable for evaluation and comparison with other alternatives. Some of the proposed alternatives might be considered as a "family" of alternatives; others may be more effective if implemented in various combinations or scenarios of alternatives. Without a doubt, the ultimate wording of any alternative will be crucial to the development and adoption of the Regional Water Plan.

For purposes of testing and validating the methodology, the Alternatives Work Group prepared a select list of ten alternatives for consideration. These alternatives were each written in an abbreviated statement format to describe the intent of the action implied by the alternative. The select alternatives were chosen to display a range and diversity of potential water management strategies. Some of the select alternatives are intuitively daring and may be politically provocative. The Alternatives Work Group felt that diversity of alternatives needed to be tested in order to validate the methodology. As noted previously, the alternative statements for testing purposes are provided in APPENDIX E.

Two special survey forms were prepared for distribution to individuals in order to rate each of the alternatives according to the process described in this Handbook. One form was designed for the public preference survey and one was designed for the technical feasibility survey. A survey form was printed for each alternative statement, with instructions and a scoring table to record the ratings. A matrix table was necessary because each alternative had to be scored in terms of the six criteria as explained in the methodology. Examples of the two survey forms are shown in APPENDIX H. Each of the participants in the survey received a package with ten

scoring sheets (one for each alternative statement) and the three page explanation of the Alternatives Analysis Criteria (see APPENDIX F).

For the Public Preference Survey, a randomly selected list of 20 individuals was pulled from the mailing list for the Water Assembly, which contains over 2,000 entries. A cover letter and survey packages were mailed out to this group. Eleven respondents returned a completed Public Preference Survey.

The Technical Feasibility Survey was distributed to a group of technically qualified individuals who have some expertise in one or more fields of water resources management and planning. Survey packages were provided to the members of the technical group (el Grupo Tecnico) of the Water Assembly's Action Committee, who were invited to participate in the survey. Packages were also sent to the Technical Committee of the Water Resources Board of the MRGCOG. There were eleven respondents who returned a completed the Technical Feasibility Survey.

### **Scoring and Rating Outcome**

A total of 22 survey forms were completed and returned for analysis. The Public Preference Survey results and the Technical Feasibility Survey results are displayed in APPENDIX I of this Handbook. It was determined by the Alternatives Work Group that eleven respondents for each survey would be adequate for methodology testing purposes and would effectively compensate for any biased returns. Mean (average) scores were calculated for each alternative based on the ratings for the six criteria as checked by each respondent. Thus, a single mean score was calculated for each proposed alternative from each respondent. A final mean, or composite, score was calculated from the scores from all of the respondents. The survey results reveal composite rating scores ranging from 2.26 to 3.84 in the Public Preference Survey and ranging from 2.76 to 3.90 in the Technical Feasibility Survey.

The convergence of the composite rating scores from the two surveys can be plotted on a two-dimensional grid in the form of a scatter plot. APPENDIX J shows the Preference-Feasibility grid results for the ten tested alternatives. Each of the alternatives is represented by a point on the grid, with a location that identifies the priority ranking of alternatives in relation to each other. The outcome of the test reveals a general agreement, or consensus of opinion, between the public and the technical groups. None of the alternatives received a rating that was high in one group and low in the other group. Two of the alternatives were considered to be low in priority by both groups, weather modification and importation of water from other basins, both alternatives that are relatively extreme.

## **Conclusion**

It was the consensus of the Alternatives Work Group that the alternatives analysis methodology presented in this Handbook produces a reasonable outcome. It should also be noted that the procedures that were tested could be simplified or refined for future application. Furthermore, it is believed that this methodology can be applied in a rigorous and complex analysis, and that the decision-making process would be widely acceptable when controversial actions are proposed in a water management plan. Of significance is the potential for balancing the public and technical review of the alternatives while identifying priorities for water management in a regional arena.