

AN EXAMINATION OF THE BUCKHORN-MESA WATERSHED ENVIRONMENTAL
IMPACT STATEMENT (U.S.D.A., S.C.S., 1978): A LOOK
AT STATE-OF-THE-ART REPORTS

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ABSTRACT

The National Environmental Policy Act of 1969 was written with the intent of fostering a spirit of harmony in the day to day operations of Federal agencies with the environmental concerns voiced by the general populace. To examine how Federal agencies have assimilated E.I.S. procedures and guidelines a typical report was reviewed. In general, compliance with environmental law and procedural guidelines was found to be adequate. In some ways, particularly in assessment of Cultural Resource Impact, the statement was exceptional in its evaluation. However, the sections of the report detailing the benefits and costs of the alternatives was not up to the standards expected in an E.I.S. Because the benefits and costs were not calculated in consistent units and the no action alternative was not adequately examined, the entire alternatives section is called to question. By re-evaluating the data provided in the E.I.S. in consistent units, it was found that the alternative selected had neither the highest benefit/cost ratio nor the lowest environmental impact. It is concluded that alternatives should be as fully evaluated as the project itself in order to integrate environmental considerations into the overall planning process.

INTRODUCTION

The purpose of this study is to review the requirements and guidelines of the National Environmental Policy Act of 1969 (hence-forth referred to as NEPA or the Act) and the Council on Environmental Quality (CEQ), and to examine how Federal agencies have assimilated these mandated procedures into Environmental Impact Statements (EIS). For the purpose of this examination, an EIS filed in 1978 was selected at random; by chance it turned out to be the Final EIS for the Buckhorn-Mesa Watershed (U.S.D.A., SCS, 1978) in the State of Arizona.

NEPA was written in very general terms, being specifically written by Congress as a mandate to Federal agencies on environmental policy. Section 102(C) of the Act detailed what the legislators determined appropriate for the newly required Environmental Impact Statement:

"...detailed statements on all major Federal actions significantly affecting the quality of human environment include, (i) the environmental impact of the proposed action, (ii) any adverse environmental effects which cannot be avoided should the proposal be implemented, (iii) alternatives to the proposed action, (iv) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and (v) any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented."

To the agencies that prepare impact statements, Section 102(C) of the Act has been interpreted as delineating a format. Indeed in the EIS reviewed, this five-fold division was followed. In terms of CEQ guidelines, this division of reports is not a necessity, but it does supply a means of standardization.

The real purpose in reviewing any EIS is not merely to check that standard format was used, but rather that the CEQ guidelines (40 CFR part 15002 (C)) are followed:

"Section 101 of NEPA sets forth the substantive requirements of the Act, the policy to be implemented by the 'action-forcing' procedures of Section 102. These procedures must be tied to their intended purposes, otherwise they are indeed useless paperwork and wasted time..."

...(i) In securing more accurate, professional documents the lead agencies are responsible for the professional integrity of reports, and care should be taken to keep any possible bias from data prepared by applicants out of

the environmental analysis. A list of people who helped prepare documents, and their professional qualification should be included in the EIS. (ii) Recording in the decision how the EIS was used. To this end agencies must also produce a concise public record, indicating how the EIS was used in arriving at the decision. The record must state what the final decision was; whether the environmentally preferable alternative was selected; and if not, what consideration of national policy led to another choice. (iii) Insure follow-up of agency decisions..."

The intent of this study is to check on the degree of compliance with these CEQ guidelines through analysis of a randomly selected EIS. We want to take the information as presented in the case study EIS to derive: 1) what is the project; where it is located and why it is needed; 2) what are the present physical conditions in the project area; 3) what are the economics of the selected project and its alternatives; 4) what are the environmental impacts of the selected course of action and its alternatives. The objective of using this open-ended inquisitive approach in review of an EIS is simply to find: 1) if the information as presented in the EIS would lead a trained professional reviewing the statement to the same logical conclusion as that of the lead agency; 2) if the EIS complied with NEPA, CEQ guidelines, and other legal formats which regulate Federal manuscripts; 3) whether the alternative selected by the lead agency had the lowest environmental impact, and if not, was it properly justified in the report.

WHAT IS THE PROJECT (LOCATION AND NEED)

The plan to be implemented in the Buckhorn-Mesa watershed is a watershed protection and flood prevention project located in Maricopa and Pinal Counties, Arizona. The project is to be carried out by the sponsoring local organizations with Federal assistance under provisions of Public Law 83-566, 83rd Congress, 68 Stat. 666, as amended. The purposes of the project are to reduce flooding and associated flood damages occurring within the flood prone area, to reduce sediment and erosion throughout the watershed, to increase efficiency of irrigation water use, and to allow flood protection to lands now undergoing rapid urbanization.

The actual project consists of five floodwater retarding dams which are designed to trap 823 acre-feet of sediment over a 100 year design life of the structures. Downstream sediment damage to cropland, urban land, and other developments will be reduced. The land treatment measures as detailed in the EIS have essentially been installed.

PRESENT PHYSICAL CONDITIONS

The watershed in question covers 69,172 acres in eastern Maricopa and northwestern Pinal Counties, Arizona. Included within the watershed are a portion of Apache Junction and the northeastern quadrant of Mesa. Both of these towns are within the greater Phoenix metropolitan area. About 85% of the population in the watershed is classified as urban and 15% as rural. Of the total watershed area, nearly 60% is flood prone. The area that would be inundated by a 100-year flood is 25% of the watershed. This flood-prone area is undergoing a tremendous rate of population and development growth. About 27% of the flood-prone area is irrigated cropland.

Floods are part of the natural scene in the watershed. Since 1910, an estimated 40 floods have occurred. The magnitude of damage expected from a storm to occur on the average of once in 100 years (one percent frequency of event) would seriously affect the local economy for several years. The flood resulting from a storm of this magnitude would inundate approximately 28,300 acres; of which approximately 60% is in urban or irrigated agricultural uses. Projections indicate that by the year 2000, even without the flood protection afforded by the proposed project, the land use will change to primarily urban use; crops being reduced to small acreages on "ranchettes."

The economy of the area is based heavily on retirement-recreational type development, and many people are engaged in employment in the service trades. Residents employed outside the watershed commute to the Mesa-Tempe-Phoenix area, and in the mines in the Superior area.

The native vegetation is Sonoran Desert type. Wildlife species inhabiting the watershed include a wide variety of mammals, birds, amphibians, and reptiles. The watershed includes three species on the endangered list, one species on the threatened list, four are peripheral, and two are of undetermined status (including Gila Monster).

Archaeological and historical sites in the watershed were examined and evaluated by Arizona State University. In the opinion of the investigators only site AZ U:10:51 (ASU) warranted additional investigation. No sites in the area were listed in the Federal Register of Historic Places. The Arizona State Historic Preservation Officer concurs that none of the cultural resources located and identified meets criteria for inclusion in the National Register.

CONSIDERATION OF THE ALTERNATIVES (ECONOMICS AND IMPACTS)

From the data presented in the EIS, there are six listed alternatives that were considered by the lead agency. Through close review of the material, it was found that in reality there were seven alternatives; as it was found that the actual project to be implemented was not listed in the Alternatives section of the EIS.

In specific the Alternatives as listed are:

- No. 1 - No Project
- No. 2 - Structural Protection of Existing Urban Development Only, with Further Urban Buildup Prevented.
- No. 3 - Structural Protection for All Flood Prone Areas, but With Further Urban Buildup Prevented on Prime Irrigated Cropland.
- No. 4 - Alternative to The Spook Hill Floodwater Retarding Structure.
- No. 5 - Accelerated Land Treatment and Floodways.
- No. 6 - Accelerated Land Treatment and Flood Water Retarding Structures.

Recall from page 2 of this paper that the project selected by the lead agency was described as five floodwater retarding structures, floodways, and the already implemented land treatment measures. Obviously this constitutes a seventh alternative. It is indeed curious that this option was not listed in the Alternatives section of the EIS. Upon closer examination it was found that discussion of this seventh alternative was contained within discussion of Alternative No. 1 - the No Project alternative:

"Alternative No. 1 - No Project

This alternative includes the ongoing land treatment program. Because technology land use, and land ownership change, the land treatment program is a continuous updating process. The Soil Conservation Service through the Natural Resource Conservation Districts, will continue to provide technical assistance for installation of this program.

Land use projections for the "No Project" alternative are the same as for other alternatives. As desert land and cropland are taken for urban development, the following are among the impacts that are expected: loss of productive cropland; loss in scenic quality; reduced air and water quality; more energy use; loss in wildlife habitat; and more traffic congestion.

Officials of the community recognize that a flood problem exists. With or without this project, a flood plain management program will be developed. The flood plain management program will be developed. The flood plain management program will encompass proper land-use planning, protective measures for existing developments, and land use regulation.

Specific flood hazard areas will be identified through detailed flood plain information studies. Common recognition of these hazards will be the key to the action program for flood plain management that will follow.

The first item in the action program is adjustments in existing structures and occupancy in the identified flood hazard areas. Because of characteristics of the flood plain, the studies may show that most present development is in a flood hazard area. From studies of aerial photographs, it is estimated that there are 19,940 existing homes or commercial establishments that would need to be floodproofed. A preliminary cost estimate to floodproof these establishments is \$64,000,000.

Flood plain land use will be controlled through the following zoning ordinances; subdivision regulations, including utility extensions; building codes; acquisition and evacuation; building financing and related tax assessment adjustments; flood hazard warning signs and notices; and flood insurance. The regulations will have two purposes. One is to maintain regular floodways that will have sufficient cross-section area for passing a specified flood flow through the developed areas without damage.

The second is to regulate development of the floodplain to prevent damage to future development.

Cost of the structural measures would be considerably more than the planned project measures. They would consist, to a great extent, of floodproofing by diking existing development; maintaining floodways for internal drainage of present and projected developments; and floodproofing of future development through either dikes or landfills, with subsequent increases of the flood problem in unfilled areas.

With the planned project measures, only the floodways will be required; and these would be substantially reduced in size.

Under the "No Project" alternative, a total of 823 acre-feet of sediment would move downstream causing damage to roads, bridges, irrigation facilities, urban developments, crops, and other properties over the next 100 years. Periodic floodwater and erosion damage, consisting of scour damage to cropland and other unprotected land, would occur.

On an average annual basis, the project will provide benefits of \$2,808,790 while costs will be \$1,122,800. The net monetary benefits to be foregone by not implementing the project is estimated to be \$1,685,990 annually (USDA, SCS, 1978).

After the fifth paragraph of the preceding discussion, the lead agency ceases to discuss the "No Project" alternative and in fact begins discussion of the measures, impacts, and economic analysis of the selected project. This confusing procedure will be discussed later in this analysis.

The confusion of the Alternatives section is compounded by the manner in which the economic data for each specific alternative is presented. Table 2-A shows the actual economic data for each alternative as presented in the EIS. From the number of blank spaces in the table it is apparent that a great deal of pertinent data was omitted in the environmental report. Through extrapolation of the data from other parts of the report, I was able to obtain a B/C ratio for Alternative No. 2; which is higher than the ratio for the selected program.

The projected environmental impacts of each alternative is contained within Tables 3-A and B. Note should be taken that the projected effect of Alternative 2 is the same (or less) than the projected environmental impact of the selected course of action.

From the data presented in the EIS, what conclusions are we able to draw. First, we find obvious need for some form of flood control in the defined watershed. Present conditions, as resulting from floods under the 100 year event, have caused considerable loss of income, productivity, and environmental quality. Rapid urbanization of flood prone sectors of the watershed will only increase the predicted harmful consequences of flood events.

Second, the watershed in question has been intensively developed over the past 50 years, both in urban and agricultural sectors. This development has already disrupted the natural desert ecosystem in the lower reaches of the watershed. Because of site disruptions accompanied by the secondary effects of urbanization, we can conclude that the potential adverse environmental impacts of any of the presented reasonable alternatives would not be excessively "disruptive." However, that is not to say that some alternatives have less effective disruption than others.

To answer the most important question posed for analysis: are we logically drawn to the same conclusions as the lead agency, we will have to focus specific attention on the Alternative section of the EIS. Recall that Section 102(D) of NEPA specifically stated:

"...Study, develop, and describe appropriate alternatives to recommend courses of action in any proposal which involved unresolved conflicts concerning alternative uses of available resources."

The intent of the authors of the Act was to generate complete review of all appropriate alternative courses of action, and to move this review as early as possible in the decision-making process. The legal necessity for open discussion of alternatives was reinforced by the Court in *Natural Resources Defense Council Inc. vs. Morton* (43, USCA, 133N; 1970) in which it was stated:

"Alternatives must be explored and discussed thoroughly in order to compare with the intent and requirements of Section 432(2)(c) of NEPA."

The alternative section of the Buckhorn-Mesa EIS was improperly presented. First, examine the No Project Alternative. The description of the No Project section immediately relates that No Project includes: 1) continued land treatment measures; 2) land use projections "the same as for the other alternatives," 3) the expected impacts of (a) loss of cropland, (b) loss in scenic quality, (c) reduced air and water quality; (d) more energy use, (e) loss in wildlife habitat; (f) more traffic congestion. All this is adequately presented data from which reasonable conclusions could be drawn about the No Project Alternative. At this point one would expect a statement of benefits and costs for this alternative and then simply move on to discussion of other alternatives. The lead agency did not organize the section in this manner. Through close analysis of the economic data in the No Project Alternative, it was found that what has been described is in reality the course of action desired by the lead agency; described as accelerated land treatment, floodwater retarding structures, and floodways. In other words, the lead agency chose to place the project opted for within the No Project alternative. In this manner, they failed to properly examine the chosen course of action within the framework of the NEPA requirements for discussion of alternatives.

Analysis of the remaining Alternatives is complicated by the poorly presented benefit/cost analysis. I would like to state my concern that agencies which prepare benefit/cost analysis of proposed actions should attach analysis, or summaries thereof, to the environmental impact statement; and should clearly indicate the extent to which environmental costs have not been reflected in such analysis.

Basic principles of engineering economics emphasize the need for evaluation of appropriate alternatives in sound decision making. Summarization of six basic principles would read as follows:

1. Decisions are among alternatives; it is desirable that alternatives be clearly defined and that the merits of all appropriate alternatives be evaluated.
2. Decisions should be based on the expected consequences of the various alternatives.
3. Before establishing procedures for project formulation and project evaluation, it is essential to decide which viewpoint is to be adapted.
4. In comparing alternatives, it is desirable to make consequences commensurable with one another insofar as practicable. That is, consequences should be expressed in numbers. In economic decisions, money units are the only units that meet the foregoing specifications.
5. Only the differences among alternatives are relevant in their comparison.
6. Insofar as practicable, separable decisions should be made separately.

(Grant and Ireson, 1970).

From the data presented earlier, recall that the course of action opted for by the lead agency included intensive land treatment measures, structural measures (flood control dams), plus the intensive use of floodways. All structures are designed for control of the 100 year event, and design life is set at 100 years. This data, as stated in the No Project Alternative and as listed in the EIS appendix as the "Comparison of Benefits and Costs for Structural Measures," has a calculated B/C ratio of 2.5. Alternative No. 1, the No Project alternative does not have an assigned B/C ratio presented in the report. Alternative No. 2; described as structural protection for existing urban developments only, with further urban development prevented; has non-consistent data, but through recalculation we derive a B/C ratio of 2.86. Alternative No. 3; described as structural protection for all flood-prone areas, but with further urban buildup prevented on prime irrigated cropland; has no presented estimation of benefits, and therefore, a benefit/cost ratio is impossible to derive for this alternative. Alternative No. 4; the alternative to Spook Hill flood water retarding structure; was dropped. Alternative No. 5; described as accelerated land treatment and floodways; contains no calculations of potential benefits, therefore it is impossible to derive a benefit/cost ratio for this alternative. Alternative No. 6; described as accelerated land treatment and floodwater retarding structures; again contains no calculated estimate of benefits of the alternative, therefore there is no benefit/cost ratio for Alternative No. 6.

As stated in both the principles of engineering economics and NEPA, the reliable evaluation of appropriate alternatives is not only a requirement but is fundamental to the decision making process. Emphasis must be made that the purpose of NEPA is to bring consideration of environmental impact and alternatives into the decision making process as early as possible. One is forced to ask; with data presented as shown in the case study EIS, how is any reasonable discussion of alternative actions possible?

The close examination of the Alternatives section of the Buckhorn-Mesa EIS has shown that:

1. Incomplete assessment of benefits and costs were done for perfectly reasonable alternatives, without explanation for the omission of such data;
2. the "No Project" alternative was improperly assessed;
3. the alternative selected by the lead agency was not listed in the Alternatives section of the EIS, but was in reality buried in the No Project Alternative;
4. methods used for evaluation of alternatives were not elaborated upon, or even given some sort of explanation in any section of the EIS;
5. basic concepts of engineering economics were ignored in preparation of the Alternatives section by:
 - a. not clearly defining the merits of all appropriate alternatives,
 - b. decisions were not based on the expected consequences of various alternatives, and finally,
 - c. the units used were non-consistent, in fact, some alternatives did not even include a monetary assessment of one key factor.

Even with these problems, it became readily apparent that the alternative opted for by the lead agency was not the alternative with either the highest benefit/cost ratio nor with the lowest environmental effects. Alternative No. 2 had a higher benefit/cost ratio (2.86) and a less significant impact on the immediate environment.

Federal laws and guidelines do not specifically require that the alternative with the highest benefit/cost ratio and the lowest environmental impact be selected, but they do require that adequate description be provided to show why an alternative with a lower B/C ratio and/or a higher environmental impact was selected. Such a description was never presented in the Buckhorn-Mesa EIS. Unless such data can be produced, it is only a logical conclusion that the lead agency was not using the EIS guidelines in preparation of the impact statement.

Full description of all alternatives, including the No Project alternative and the B/C and environmental impacts are necessary for a proper review of an EIS and should be available if the project

planning is to follow the spirit of NEPA, i.e., "...to build into their decision making at the earliest possible point an appropriate and careful consideration of the environmental aspects of the proposed action."

REFERENCES

The National Environmental Policy Act of 1969, 42 U.S.C. & 4321 et seq, 83 Stat. 852, P.L. 91-190

Council on Environmental Quality Preparation of Environmental Impact Statements: Guidelines, 40CFR Part 1500, 38-FR 20550 (Aug. 1, 1973).

Buckhorn-Mesa Final EIS; USDA; SCS; 1978.

Natural Resources Defense Council Inc. vs. Morton, 43, USCA, 133N; 1970.

Grant, E. L. and Ireson, G. W.; Principles of Engineering Economy; Ronald Press, 1970.

Table 1-A

Alternative No Project	Land Treatment Measures	Structures (Dams)		Floodways	Zoning Measures
		Urban	Rural		
1	X				X
2	X	X			X
3	X	X	X		X
Spook Hill Dam 4	Alternative dropped				
5	X				X
6	X			X	X
7	X	X	X	X	X

Table 2-A Data as Presented in the EIS

Alternative	Costs (total)	Benefits (total)	Costs (annual)	Benefits (annual)	B/C ratio
1			\$1,122,800	\$2,808,790	
2	\$ 72,000,000			\$2,058,000	
3	\$124,000,000				
4	no economic data given	alternative dismissed			
5	\$ 75,000,000				
6	\$ 26,400,000				

Table 2-B Derived Economic Data

Alternative	Costs (total)	Benefits (total)	Costs (annual)	Benefits (annual)	B/C ratio
1	no data given	no data	no data	no data	
2	\$ 72,000,000	\$2.058(10 ⁸)	\$7.2(10 ⁵)	\$2.058(10 ⁶)	2.86
3	\$124,000,000	no data	\$1.24(10 ⁶)	no data	
4	alternative dismissed				
5	\$ 75,000,000	no data	\$7.5(10 ⁵)	no data	
6	\$ 26,400,000	no data	\$2.64(10 ⁵)	no data	
7	\$112,280,000	\$2.81(10 ⁸)	\$1.12(10 ⁶)	\$2.81(10 ⁶)	2.50

Table 3-A Projected Environmental Effects

Alternative No.	Beneficial Effects	Adverse Effects
1 (No Project)		-loss of cropland -loss of scenic quality -reduced air quality -reduced water quality -more energy use -loss in wildlife habitat -more traffic congestion
2	-flooding reduced -restricted urbanization -26000 more acres of agricultural open spaces -productive cropland preserved -scenic quality unaffected -water and air quality improved -wildlife habitat preserved -less traffic congestion	-loss of 1316 acres of desert vegetation -visual impact of structures -construction impacts -disturbance of one significant archaeological site -loss of tax revenue
3	-flood effects reduced -restricted urbanization -cropland stays in production -scenic quality unaffected -water and air quality improved -wildlife habitat preserved -less traffic congestion	-loss of desert vegetation -visual impact of structures -construction impacts -disturbance of archaeological site -loss of tax revenue
4	-alternative dismissed	
5	-downstream developments protected from sediment -flood effects reduced -less vegetation disturbance -less visual impact	-sediment would be dumped into RWCD floodways -more irrigated cropland development would be required
6	-flood effects reduced	-greater visual impact -greater impact on negative vegetation -relocation of an additional four homes

Table 3-B Projected Environmental Effects of the Selected Project

Beneficial Effects	Adverse Effects
-protection of urban land -protection of cropland -stabilization of agricultural industry -reduction of sediment load -increased recharge behind retarding structures -provide protection for Superstition Highway and CAP aqueduct -reduction of erosion	-loss of desert vegetation -less recharge downstream from retarding structures -visual impact of structures -construction impacts -relocation of an additional four families -disturbance of one significant archaeological site -loss of tax revenues -accelerated movement of bedload