Appendix 1
***Economics Guidebook*, Chapter 5**
"Economic Analysis for Land Classification"

(Revised, December 2001)

Purpose

To provide a standardized procedure for the economic analysis required in land classification. The most crucial determination is the division (break-point) between arable and non-arable lands (arable lands provide sufficient returns to support a farm family and to pay water operation, maintenance, and replacement charges [OM&R]). This instruction also addresses the economic methodology to distinguish between final arable land classes (classes 1, 2, and 3).

Both the arability determination and the division of arable lands into classes are based on the correlation of physical factors (such as soil characteristics, drainage parameters, and topography) to farm income. The economic correlation is accomplished by farm budgeting in which physical factors are translated into yield potentials and land development costs necessary for sustained irrigation. The development of economic correlations requires interdisciplinary coordination to ensure that technical information analyzed by soil scientists and drainage engineers is applied by economists in a consistent manner. Certain elements involved in land classification, such as determination of crop yield potential, will involve input and concurrence from all disciplines.

Aside from exceptions noted herein, all farm budgeting should be consistent with payment capacity analysis, rather than benefit analysis. Refer to Reclamation=s Technical Standards for Irrigation Payment Capacity (November 30, 1998).

The steps required for the economic analysis along with an example and a recommended format for displaying results follows:

<u>Step 1</u>: Establish the Minimum Crop Yields for Arability.

A "with project" farm budget is developed with crop yields set at levels which result in zero remaining net farm income after deductions for estimated OM&R and a reasonable family living allowance. For lands not currently irrigated, the budget should value land investment at current non-irrigated market value; i.e., no irrigation development costs should be included in the investment value. For lands which are currently irrigated, land investment should be set at current irrigated market value and all existing irrigation development and system costs should be included in total farm investment, either in land values or as separate entries. Arriving at a farm budget which results in no remaining income may require several iterations, especially if the cropping pattern involves multiple crops. The focal point of this first analytical step will be crop yields; specifically, the minimum yields which must be sustained under irrigation to pay OM&R and provide an adequate family living allowance. As is the case in payment capacity analysis, full-time family farms should be budgeted.

An exception to standard payment capacity analyses is that the United States average farm household income should be used as an approximation of a reasonable family living allowance instead of the sum of management, labor, and equity charges. This change in methodology is required to prevent situations in which the charges computed using the payment capacity standards are significantly higher or lower than the amount necessary to maintain a reasonable lifestyle. The 5-year (1995-1999) national average farm household income, as computed by the Economic Research Service of USDA, is about $54,000. Updates are published annually. This standard should be utilized unless it can be documented that farm incomes in the geographic area of the project are significantly different.

As an example of the preceding discussion, assume that a typical farm in a proposed project area is expected to produce corn, alfalfa, and wheat under irrigated conditions. The lowest yields which would result in payment of OM&R and maintenance of an adequate family living allowance are established by trial and error, usually requiring several iterations of the farm budget(s). The data in Table 1 are based on a farm with 300 irrigated acres:

Table 1.

Land Class	Crop Yield Potential	Net Farm Income	Family Living Allowance	Estimated OM&R ($20/ac)	Remaining Income Per Farm
Bottom 3		$60,000	$54,000	$6,000	$0
Corn	110 bushels				
Alfalfa	4.0 ton				
Wheat	40 bushels				

The above analysis establishes the lowest productivity for lands to be arable, and only if indicated yield levels can be attained without any added on-farm irrigation development costs. This minimum productive level is typically called Abottom of class 3@. If the yield potential of a certain land parcel is equal to indicated yields but cannot be attained without expenditure of development costs, then the land would be classified as non-arable since no remaining net farm income is available for payment of those development costs.

Step 2: Establish Yield Potentials and Income for More Productive Lands.

The above analysis established the "floor" for arability (i.e., minimum crop yield). Further analysis is required to (a) determine allowable development costs for those lands which have higher yield potential and (b) divide arable lands into classes 1, 2, and 3.

The next step is to prepare three additional farm budgets for the typical farm: one which depicts the very best yield potentials, and two additional budgets each of which depict an intermediate yield level between the very best yields and the lowest yields established in Step 1 above[1]. References to land class in association with crop yields at this point in the analysis should be viewed as preliminary. Development costs necessary to attain certain yield levels may be so excessive as to push the lands into lower land class or to prevent them from even being arable. This point is discussed under Steps 3 and 4 below.

The yield potentials should be set at levels which are attainable with current technology; that is, yields should not be projected over the life of the project assuming increases due to improved technology and management.

Continuing the example, assume farm budget results are:

Table 2. Farm Budget Results

Crop Yield Potential	Crop Yields	Net Farm Income	Family Living Allowance	Estimated `OM&R (20/ac)	Remaining Net Income per Farm	Income Per Acre
Very Best		$115,500	$54,000	$6,000	$55,500	$185
Corn:	155 bushels					
Alfalfa:	6.5 tons					
Wheat:	65 bushels					
Intermediate - Level A		$100,500	$54,000	$6,000	$40,500	$135
Corn:	140 bushels					
Alfalfa:	5.8 tons					
Wheat:	55 bushels					
Intermediate - Level B		$79,500	$54,000	$6,000	$19,500	$65
Corn:	125 bushels					
Alfalfa:	5.0 tons					
Wheat:	47 bushels					
Lowest		$60,000	$54,000	$6,000	$0	$0
Corn:	110 bushels					
Alfalfa:	4.0 tons					
Wheat:	40 bushels					

Step 3: Establish Maximum Allowable Development Costs.

[1] When cropping patterns are similar for all land classes and the yield differences between land classes are determined to be relatively uniform, the allowable development costs for the intermediate yield levels may be interpolated from allowable development costs for the very best yields and the lowest (bottom of class 3) yields, the latter being zero. Developments costs are discussed in Step 3. Use of interpolation, if justified, alleviates the need to develop farm budgets for the two intermediate yield levels. Detailed farm budgets are always required for the highest and lowest yield levels.

The remaining annual net farm incomes developed in the above analysis are available for the added costs of any development to make the lands suitable for irrigation (e.g., leveling, stone removal, clearing brush, on-farm ditches, and irrigation system sprinklers). As shown in Table 3, these annual amounts are capitalized using an interest rate appropriate for long term farm real estate borrowing to derive maximum allowable development costs. It is presumed that all of the development costs will be borrowed capital, rather than partially from farmer's equity. The interest rate should be the most current 5-year average real estate rate described on page 8 of the Technical Standards for Irrigation Payment Capacity. In this example, the rate is assumed to be 10 percent with a 50-year project life.

Table 3. Maximum allowable development costs

Crop Yield Potential	Remaining Net Farm Income Per Acre	Capitalization Factor (10%, 50 years)	Maximum Allowable Development Costs (dollars/acre)
Very Best	$185	9.9148	$1,880
Intermediate Level A	$135	9.9148	$1,340
Intermediate Level B	$65	9.9148	$640
Lowest	$0	9.9148	$0

Table 3 shows the maximum development costs that can be expended to attain yield potentials and remain arable. For example, if a block of land can achieve the very best yields after correctable deficiencies are removed, then no more than $1,880 can be expended to correct those deficiencies for the lands to remain arable. If more than $1,880 is expended, those lands could not pay OM&R and support a farm family. As another example, if more than $640 per acre is required for a block of land to attain yields indicative of Intermediate Level B, then that land would be classified non-arable. No added money could be spent to develop lands with the lowest yield potential for those lands to be arable.

Step 4: Establish Final Land Classes.

Table 3 correlates yield potentials and maximum development costs to the arability determination. As shown in Table 4, this data is manipulated to derive the final land classes (i.e., the "break-points" among arable land classes).

Table 4. Range of Allowable Development Costs to be in a Particular Land Class

Range of Allowable Land Development Expenditures[2]				
	Yield Potential Very Best	Yield Potential Intermediate A	Yield Potential Intermediate B	Yield Potential Lowest
Final Land Class 1	$1-$540	$0	N/A	N/A
Final Land Class 2	$541-$1,240	$1-$700	$0	N/A
Final Land Class 3	$1,241-$1,880	$701-$1,340	$1-$640	$0
Nonarable	>$1,880	>$1,340	>$640	>$0

[2]The values $1,880, $1,340, and $640 are from the farm budget results. The value $540 is calculated as $1,880-$1,340. The value $1,240 is calculated as $1,880-$640. The value $700 is calculated as $1,340-$640. N/A: not applicable.

Table 4 would be utilized by the classifier to determine final land classes. The first step in applying the table is to determine the yield potential of the land block in question. Once the yield potential is assessed, the ceiling in development costs for each final land class is read from the table.

As an example, assume a land block had yield potential consistent with the intermediate level A. The land could be classified in final class 1 if added development costs are zero; if development costs up to $700 per acre are required, the land would be classified in final class 2; if development costs are greater than $700 per acre, but less than $1,340 per acre, the land would be classified in final class 3; and if development costs are greater than $1,340 per acre, the land would be classified non-arable. Of course, the classifier must make (or have) cost estimates for the various land development corrections which are required (soil improvements, leveling, etc.) in order to properly use the table.

The example used for these guidelines maybe somewhat simplistic compared to possible "real world" situations; for example, there may be multiple farm types, many different crops, lack of reliable yield data, and other associated problems. Nonetheless, although a considerable degree of professional judgment may be necessary to overcome some of these problems, the preceding methodology and format used to display results should generally be adhered to. The determination of the "break point" between arability and non-arability is more crucial than the demarcation among arable land classes and should, therefore, entail a higher level of technical effort.