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April 7, 1988

ECONOMICS TECHNICAL NOTE NO. W-5
200-VI

SUBJECT: ECN - ECONOMICS - P.L. 566 LAND TREATMENT EVALUATION CONSERVATION OPTIONS PROCEDURE

Purpose. To transmit the above named technical note.

Effective Date. When received.

Background. The Conservation Options Procedure was developed to overcome several problems with other procedures. The procedure evaluates alternative conservation systems (conservation options) rather than incrementally analyzing practices and combinations of practices. The procedure uses cost efficiency to determine those options for which net benefit evaluations are to be made.

The monetary benefits are evaluated using partial budget approaches, rather than full budget net income analyses. The main reasons for selecting the partial budget method is to do away with the negative income figures in full budgets caused by using current normalized prices to compute income, and current prices to compute costs of production. The negative net returns from previous procedures give decision makers false impressions of farming operations in project areas.

The Conservation Option Procedure more closely follows the analyses process for CO-01 planning. The differences are the federal discount rates, rather than local farm loan rates; emphasis on national economic development, instead of farm income; use of adjusted current normalized prices for farm products, in place of farm prices; and the use of evaluation units, instead of individual field by field and farm by farm units.

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April 7, 1988

Economics Technical Note No. 5

P.L. 566 Land Treatment Evaluation Conservation Options Procedure

Preface

The purpose of this Technical Note is to describe a method of economic evaluation called the Conservation Options Procedure (COP), which analyzes systems of conservation practices in P.L. 566 watersheds and other project work. The Conservation Options Procedure may be used instead of the Incremental Analysis Procedure (IAP) described in National Bulletin Number 200-3-10 dated May 20, 1983. If watershed planners prefer, they may continue to use the Incremental Analysis Procedure. **However, claimable benefits will be the same for both procedures.** The Conservation Options Procedure uses cost efficiency, net benefits, and nonmonetary factors to evaluate conservation options. The procedure ultimately identifies the National Economic Development (NED) plan, the Resource Protection (RP) plan, and the Recommended plan. The Incremental Analysis Procedure identifies the NED plan by using incremental benefit cost ratios to evaluate practices and combinations of practices.

I. INTRODUCTION

The Conservation Options Procedure is comprised of three stages. The first is a cost efficiency analysis of practices and systems of practices (Conservation Options), which are technically feasible. The second is a net monetary benefit analysis performed on the alternative systems of practices identified in Stage I as being efficient. Stage III adds nonmonetary factors; addresses the trade-offs among the Stage II alternatives; and documents the rationale for selecting the National Economic Development, Resource Protection, and the recommended plans. The Conservation Options Procedure can be condensed to:

* Stage I - Cost Efficiency Analysis
* Stage II - Net Monetary Benefit Analysis
* Stage III - Identify NED, RP, and other Alternative Plans and Select Recommended Plan

The Conservation Options Procedure makes the economic evaluation process more practical. It may also reduce the time required to analyze an evaluation unit. Additionally, the procedure incorporates modifications in the handling of production costs, and changes in cropping sequences, to ensure that the benefits from conservation of soil and water drive the evaluation process. These modifications (the way production costs and changes in cropping sequence are handled), are also applicable to the Incremental Analysis Procedure.

II. GENERAL

II.A. Introduction

This section discusses a collection of issues beginning with the technical and policy constraints that form the foundation for the analysis of erosion control practices in PL-566 projects. The following two sections define, in detail, the costs and benefits associated with soil conservation practices. The subsequent sections discuss interdependent gullies and the use of other studies.

II.B. Technical and Policy Constraints

Although watershed protection plans are not water resource projects, as defined by Principles and Guidelines (P&G), these plans follow the evaluation procedures outlined in P&G. Accordingly, a National Economic Development plan is formulated which ". . . reasonably maximizes net national economic development benefits, consistent with the Federal objective . . ." (P&G Section 1.6.3). The analysis of accelerated land treatment in structural watershed projects also follows the P&G evaluation procedures.

Although yield enhancement and efficiency gains may not be used to formulate watershed protection plans, these benefits may be used in computing net benefits for alternative plans.

In addition, watershed planners are encouraged to use nonmonetary factors to evaluate conservation options.

Finally, an economic analysis of onsite effects is not necessary for conversion of cropland to permanent vegetation.

II.C. Costs

Conservation Option Procedure costs should be expressed in average annual dollars, not annualized costs (average annual equivalents). For the purpose of project evaluation, management costs are defined as any added production input costs (APIC) (including any increase in the management costs), not the net change in budget costs. When financial assistance is provided for management practices, the amortized value of incentive payments (IP) should be included with the added production input cost as a project cost. Efficiency gains (EG) are the net change in budget costs. This change is the difference between added production input costs and reduced variable production costs (RVPC) (which include any reduction in management costs). The reduced variable production costs are viewed as benefits. Care should be taken to avoid double counting of the costs.

The cost for enduring practices includes the amortized initial (I) cost, the amortized present value of the replacement (R) costs, and the annual operation and maintenance (OM) cost. The I and R costs should be amortized at the relevant Federal water resource discount rate for the evaluation period or project life (25 years), not the period of analysis which is the sum of the evaluation period and the installation period. In addition, if there are any added costs associated with an enduring practice, they should be included in the cost of that practice.

Because the Conservation Options Procedure uses average annual dollar values in its evaluation, it is not necessary to develop an installation schedule until the Recommended Plan is selected. The installation schedule is used to compute annualized costs and benefits (i.e., discounted and amortized over the period of analysis) for the Recommended Plan as it is displayed in the Watershed Plan.

Technical assistance (TA) or project administration (PA) costs should not be included when evaluating conservation options in stages I and II. These costs are not applicable to individual conservation options but they need to be included in the net benefit displays for alternative plans in stage III.

The following table summarizes COP costs.

Table 1.--Cost Summary

Cost	I	R	OM	APIC	IP	PA	TA	Ave Ann	Annualized
Stage I									
EPC	x	x	x	x				x	
MPC				x	x			x	
Stage II									
EPC	x	x	x	x				x	
MPC				x	x			x	
Stage III									
EPC	x	x	x	x		x	x	x	
MPC				x	x	x	x	x	
Watershed Plan (Recommended Plan)									
EPC	x	x	x	x		x	x		x
MPC				x	x	x	x		x

I = Initial Cost
R = Replacement Cost
OM = Operation and Maintenance Cost
APIC = Added Production Input Cost
IP = Incentive Payments
PA = Project Administration Costs
TA = Technical Assistance Costs
EPC = Enduring Practice Cost
MPC = Management Practice Cost
Ave Ann = Average Annual Costs (amortized over project life)
Annualized = (amortized over the period of analysis)

II.D. Benefits

The starting point for the benefits analysis is the input from the physical scientists. Beneficial effects will probably fall into one of the following categories.

* Onsite
  * Long-term Productivity
  * Concurrent Damage Reduction
  * Changes in Cropping Sequence
  * Yield Enhancement
  * Reduced Variable Production Costs

* Offsite
  * Water Quality
  * Sedimentation
  * Floodwater

Long-term Productivity (LP) benefits are related to the maintenance of future soil resource base productivity. They are commonly measured in terms of a reduction in the rates in which soil depth and crop yields decline. Concurrent damage reduction (CDR) benefits are associated with the reduction in year-to-year erosion damages. CDR benefits include the effects of conservation practices on yields through reduced runoff of applied nutrients, reduced seed and plant washout, and decreased sedimentation of seeds and plants. These effects have sometimes been referred to as "now time effects." Reduced Variable Production Costs (RVPC) benefits are defined as the reduction in "without treatment" variable input costs associated with a practice. Fixed costs in the "with treatment" condition are assumed to be the same as the "without treatment" fixed costs. For example, farmers generally do not sell their conventional tillage equipment when reduced tillage is adopted. Therefore, their fixed costs are not reduced. In a partial budget format, efficiency gains are the difference between the RVPC and the added production input costs (APIC).

$$EG = RVPC - APIC$$

APIC are treated as project costs; therefore, RVPC represents EG in stages II and III.

Benefits from changes in the crop sequence are associated with modification in the crops grown. An example of such a modification is the conversion from continuous corn to a corn-hay rotation. To simplify the analysis, and to ensure that the effects of changes in the cropping sequence do not adversely affect the evaluation of conservation options, it is assumed that hay must be already produced on other fields; therefore, the corn and hay are moved around among fields. In short, corn will be used for both the without and with treatment conditions. In summary, when computing long-term productivity benefits, and there are changes in the cropping sequence, measure the change in net income in terms of the original cropping sequence. This will ensure that the long-term productivity benefits are based on reduced damage to the resource base, not to budget changes.

Offsite (OFF) benefits accrue to individuals who have no control over the source of damage. In general, they are derived from reducing the runoff of water, sediment, and associated chemicals.

II.E. Interdependent Gully Erosion

In evaluation units where significant (i.e., control requires enduring practices) ephemeral or permanent gully erosion is interdependent with sheet and rill erosion, each of the conservation options must treat the gully erosion as well as the sheet and rill erosion problems. When listing

conservation options in stage I, note those options which completely solve the gully erosion problems. By following this instruction, the cost-efficiency analyses is based on the cost of gully and sheet and rill practices per ton of reduced sheet and rill erosion. Ranking the conservation options by an efficiency measure, such as reduced sheet and rill erosion, will not change the relative position of each conservation option because the effect on ephemeral erosion is constant across conservation options within an evaluation unit.

II.F. Use of Other Studies

Planners are encouraged to make use of information from other watershed projects or comparable studies. In order to make sure of such information, practical and acceptable, these other studies should be in areas with similar soils, crops, problems, and needs.

III. CONSERVATION OPTIONS PROCEDURE STAGE I

As described in 503.10(b) of the National Watershed Manual, the first steps in an evaluation are to identify and analyze the nature and scope of the resource problems. Once this has been done, an interdisciplinary group of technical specialists should develop a list of technically feasible systems of practices which address the resource problems. These stage I systems of practices are called Conservation Options (CO).

Since each CO will affect the identified problems in varying degrees, it is necessary to select a common base for comparing the options. In all cases, the appropriate common denominator depends on the nature of the identified problems. If the primary problem is loss of long-term productivity, then the basis for comparison might be cost per ton of reduced sheet and rill erosion. If the problem is offsite sedimentation, then the basis for comparison might be cost per ton of reduced sediment. When other damages are the major resource problem, different common denominators such as pounds of nutrients or biological oxygen demand levels may be used.

In evaluation units where ephemeral gully or permanent gully erosion are interdependent with sheet and rill erosion, ephemeral erosion is severe enough to require water disposal systems and onsite damages are predominant, stage I requires that the watershed planners only note the presence of significant gully erosion. Estimates of the amount of gully erosion (tons per acre per year) are needed primarily for the evaluation of sediment problems. As such, when conservation options are developed, include options which completely solve the gully erosion problem. This means that in evaluation units where gully erosion is severe, water disposal systems are the foundation of any conservation option. The cost efficiency analysis, in this case, will be based on the cost of gully and sheet and rill practices per ton of reduced sheet and rill erosion.

Onsite gully damages can be computed without estimating the amount (i.e., tons per acre/year) of gully erosion. The only erosion related information needed is an estimate of the dimensions (i.e., length and width) of the voided and the depreciated areas. The computation of onsite and offsite damages is discussed in stage II.

Table 2 provides a suggested display for an evaluation unit where (1) the ephemeral gully erosion is severe enough to require enduring practices, (2) the ephemeral erosion is interdependent with the sheet and rill erosion, and (3) the major problem is loss of long-term productivity. The purpose of table 2 is to document what conservation options were considered and to systematically screen out conservation options that are not technically feasible.

Table 2.--List of Conservation Options - Evaluation Unit A

Conservation Option	Gully *		Sheet & Rill **	
	Permanent (Yes/No)	Ephemeral (Yes/No)	Eros Rate (t/a/y)	Eros Reduction (t/a/y)
1. Without treatment				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

* For the without treatment condition, enter a "yes" if ephemeral or permanent gully is a significant problem that requires a water disposal system. For the remaining conservation options, enter a "yes" if the problem remains.

** When cost-effectiveness is related to other physical problems, use an appropriate parameter such as tons of sediment.

Those conservation options that are not technically feasible, based on the judgment of the interdisciplinary team, should be deleted from further consideration.

The next step in stage I is to perform a cost-efficiency analysis on the remaining conservation options using the relevent physical effect, in this example, tons of soil saved per acre per year.

For project evaluation purposes, management practice costs are defined as added production input costs. These are the costs of added inputs such as insecticides, herbicides, or a no-till planter, instead of the net change in budget costs. When financial assistance is provided for management practices, the amortized value of incentive payments should be included. Stage I management practice costs (average annual dollars per acre) are defined as:

$$MPC = APIC + IP$$

where: MPC = average annual management practice cost
APIC = average annual added production input cost
IP = average annual incentive payment cost

Enduring practice costs are defined as the sum of the amortized initial cost, the amortized present value of the replacement costs, the annual operation and maintenance costs, and any added production input costs associated with an enduring practice. Do not include technical assistance or project administration costs in stage I. These costs are not applicable to individual options, but they need to be included in the net benefit analysis in stage III. Costs are described in more detail in Section II.C. of this technical note. In summary, stage I enduring practice costs (average annual dollars per acre) are defined as:

$$EPC = I + R + OM + APIC$$

where: EPC = average annual enduring practice cost
I = average annual initial cost
R = average annual replacement cost
OM = average annual operation and maintenance cost
APIC = average annual added production input cost

Table 3 is an example of how the cost-efficiency analysis of stage I might be displayed for an evaluation unit where the primary problem is loss of long-term productivity caused by interdependent sheet and rill and severe ephemeral gully erosion. Those conservation options that appear in table 2, but do not appear in table 3, were deleted for technical reasons.

Table 3.--Cost Efficiency - Evaluation Unit A

Conservation Option	Gully Permanent (Yes/No)	Gully Ephemeral* (Yes/No)	Sheet & Rill ** Eros Rate (t/a/y)	Eros Reduction (t/a/y)	Consrvtn Cost ($/a/y)	Option Cost/ RedTon ($/a/y)
1. Without						
2.						
5.						
6.						
7.						
9.						
10.						

* A "no" is entered in the permanent and ephemeral gully columns if the conservation option solves the problem. Record a "yes" if the conservation option does not solve the gully erosion problem.

Sheet and rill erosion should be expressed as tons per acre per year. The erosion reduction is the difference between the without treatment and the with conservation option conditions. The first conservation option listed should be the without treatment option. For display purposes, the conservation options in table 3 may be ranked by cost per ton of reduced erosion. Graphing the information in table 3 may also assist in analyzing and displaying the information.

Those conservation options that are not cost-efficient can be deleted from further consideration in the identification of the NED, RP, and recommended plans. Determining which conservation options are efficient and to be analyzed as alternatives conservation systems in stage II is not based on an absolute standard. Instead, the interdisciplinary team must use their collective experience to decide which options are efficient.

IV. CONSERVATION OPTIONS PROCEDURE STAGE II

Stage II is a net monetary benefit analysis of the alternative conservation systems identified in stage I. The first step in the net monetary benefit analysis is for the interdisciplinary team to quantify the physical effects of the conservation options. As such, before monetary values can be estimated, the agronomist, sedimentation geologist, resource conservationist, recreation specialist, biologist, soil scientist, and water quality specialist must complete their estimates of the physical effects of the project.

A problem associated with calculating onsite benefits of conservation is the degree to which current normalized prices and standard crop budgets produce realistic estimates of absolute net income. To solve this problem, partial budgeting will be used because it focuses on those budget items that tend to have a readily known market value rather than many of the fixed budget costs that are more farm specific. In this case, benefits are determined by subtracting gross returns without treatment from gross returns with treatment, then adding the reduction in variable production costs. This relative measure of income change is probably more reasonable than absolute measures of levels of income derived from whole budget analysis. The basic formula for computing gross onsite benefits is:

$$OSB = (GR_w - GR_w/_o) + RVPC$$

where: OSB = onsite benefits
GR_w = gross returns with treatment

$GR_w/_o$ = gross returns without treatment

RVPC = reduced variable production costs

Since added production input costs are handled as project costs, the RVPC represent the reduction of without treatment variable production costs. This is based on the assumption that farmers will continue to incur their current fixed costs.

Once all monetary benefits, including offsite effects, have been valued, the next step is to compute the net benefits for each of the conservation options identified in stage I as being cost-efficient. Table 4 displays this information.

Table 4.--Net Benefit Analysis - Evaluation Unit A

Conservation Option	Eros Rate (t/a/y)	Eros Reduction (t/a/y)	AA Cost ($/s)	AA BENEFIT					AA NET BENEFIT	
				LP	CDR	OFF	YE	RVPC	ONSITE 1/	OFFSITE 2/
1.										
2.										
3.										
4.										

LP = Long-term Productivity
CDR = Concurrent Damage Reduction
RVPC = Reduced Variable Production Costs
YE = Yield Enhancement
OFF = Offsite Damage Reduction Benefits

1/ Sum of LP & OFF
2/ Sum of CDR, RVPC, & YE

Table 4 provides a clear display of given conservation options contribution to public benefits. The decision maker may use this information to delete from further consideration those conservation options that have insignificant net public benefits.

V. CONSERVATION OPTIONS PROCEDURE STAGE III

At this point in the evaluation, the nonmonetary effects, expressed in quantitative and qualitative terms, are combined with the information developed in stages I and II. The NED and RP plans are identified and the trade-offs among the stage II alternatives are displayed in monetary and nonmonetary terms. In addition, the rationale for selecting the recommended plan is described. The alternative with the greatest net monetary public benefits is designated as the NED plan, and the alternative that achieves an acceptable level of resource protection is designated as the RP plan. It is the role of the interdisciplinary team to define the RP plan criteria. Table 5 provides an example display of the stage III results. When appropriate, items other than those displayed should be used. Use the total net dollar benefits for the justification of the selected alternative.

In stage III, technical assistance and project administration costs are to be included in the costs of alternative plans. The total costs (which include the stage II costs of management and enduring practices, plus technical assistance, and project administration) should be amortized for the evaluation period. In the watershed plan, the costs and benefits of the recommended plan need to be annualized for the period of analysis.

Table 5.--Comparison of Alternatives

Item	Alt 1	Alt 2	Alt 3	Alt 4
Erosion Rate				
Erosion Reduction				
Sediment Reduction				
Costs				
Install PL-566				
Install Other				
Average Annual				
Economic Benefits				
Onsite				
Offsite				
Net Economic Benefits				
Social Effects				
Environmental Effects				