

WHILE WE WAIT...

PLEASE TELL US YOUR DISCIPLINE!

Plan Formulation

Economics

Cultural Resources

Environmental

Cost

Real Estate

Engineering

PM

Other (please specify below)

Click on the Annotation option *N* on the left side of your screen and then use the Pencil Tool or checkmark to mark your response.

IWR PLANNING SUITE 101

Presented by:

Erin Rooks & Michelle Hilleary, Ph.D.
 Institute for Water Resources
 29 June 2023

Email us at:

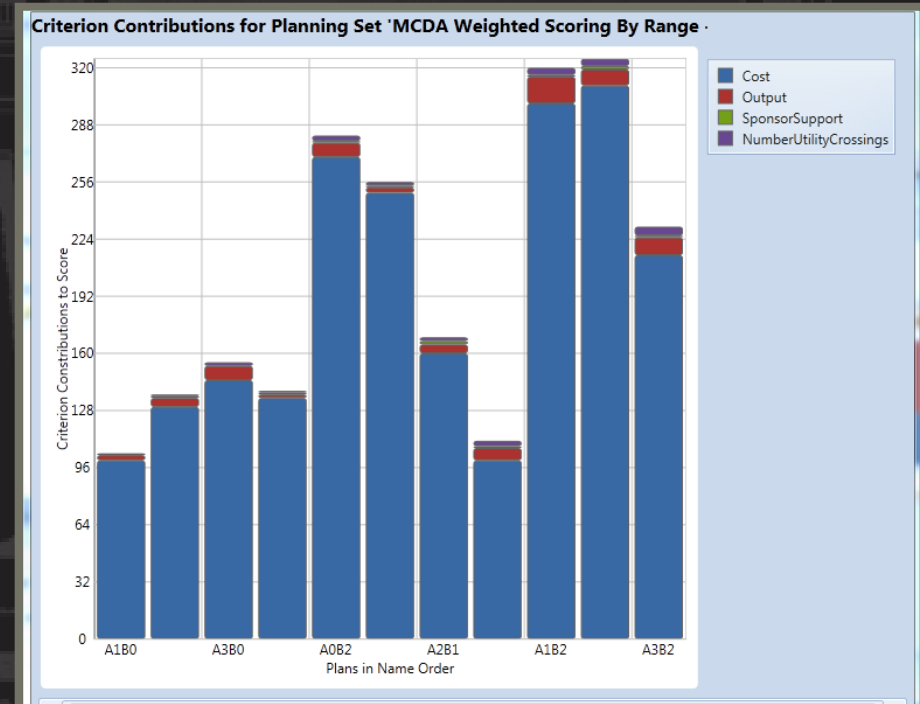
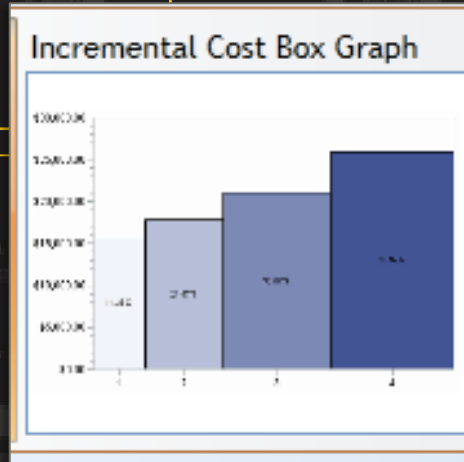
DLL-CEIWR_IWR-PLAN

Learn More:

[IWR Planning Suite \(army.mil\)](http://army.mil)



US Army Corps
 of Engineers®



Distributions Variable Profile Tolerance Rules Correlation Matrix

Distribution Types

The triangular distribution is defined by P1, a minimum returned value, P2, the most likely value, and P3, the maximum returned value.

* Binary variables are restricted to a Fixed Distribution of either 0 or 1. Validate Distributions & Matrix

Plan	Variable	Variable Type	Distribution Type	P1	P2	P3	P4	P5	P6	P7	P8
No Action Plan	Cost	Currency	Fixed	\$0.00							
A1B0	Cost	Currency	Triangular	\$50.00	\$100.00	\$150.00					
A2B0	Cost	Currency	Triangular	\$50.00	\$130.00	\$150.00					
A3B0	Cost	Currency	Triangular	\$100.00	\$145.00	\$190.00					
A0B1	Cost	Currency	Triangular	\$105.00	\$135.00	\$200.00					



What's your familiarity with IWR Planning Suite?

I haven't used any version of the software.

I've used a few times over the years

I have used within the last 6 months

OBJECTIVE

Introductory overview of the IWR Planning Suite

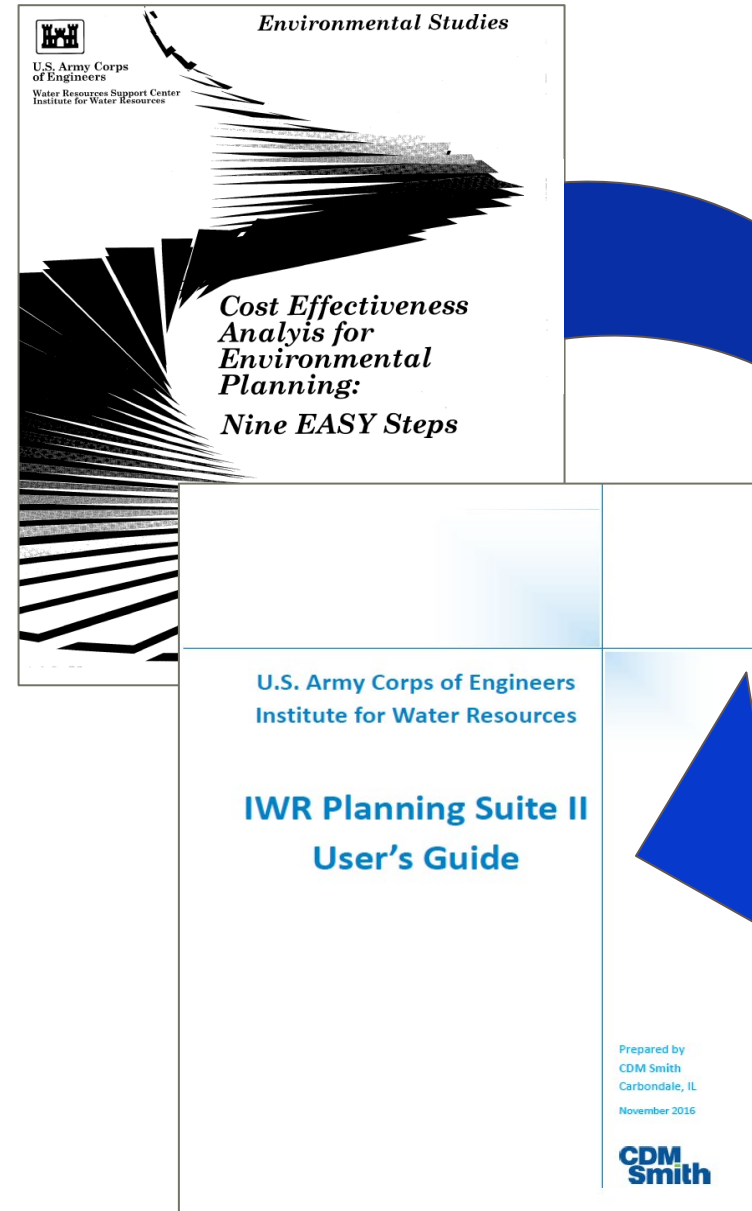


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U.S. ARMY

 **TOPICS**

- Background and Overview
- Current Features
- Contemporary Examples and Future Applications



BACKGROUND AND OVERVIEW



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HISTORY & BACKGROUND

- Desktop software
- Built originally 1990s for Cost Effectiveness and Incremental Cost Analysis (CE/ICA) and plan generation and Ecosystem Restoration
- Updated platform, graphing and added features in 2010s
- Certified Planning Model
- Now used in multiple business lines

Then

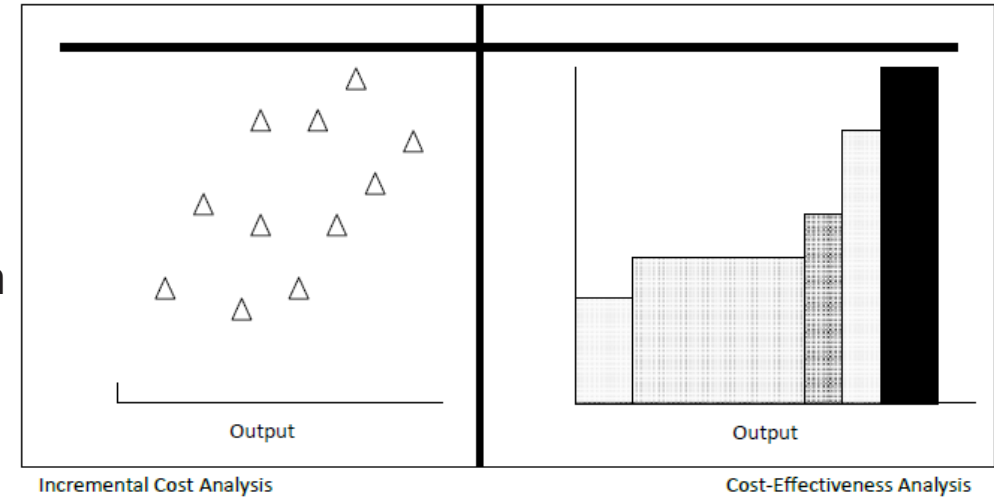


Figure 1

Examples of Typical Cost-Effectiveness and Incremental Cost Graphs

Now




IWR PLANNING SUITE: STATUS & GUIDANCE

- **CERTIFIED**
- **31-MAY-2018 CECW-P Memorandum**
 - Review plans approved after 31-MAY-2018 must use latest software
 - Studies engaging in multiple criteria decision analysis (MCDA) should engage the ECO-PCX to develop a strategy for appropriate and policy compliant use
- **Planning Guidance Notebook (ER 1105-2-100; TBD EC)**
 - Provides instruction for NED and NER methods
 - Provides instruction on use of CE/ICA during selection of NER plan and for all recommended mitigation plans



IWR PLANNING SUITE HELP

Go to <https://publibrary.planusace.us/#/series/IWR%20Planning%20Suite>



Library Home Advanced Search

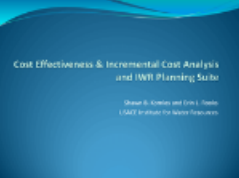
Search Results

Title ▾ Date ▾ Relevance ↓

Count: 40

1
2

Filter by Region 
Documents Found




CE/ICA and IWR Planning Suite (Version 2.0.6) Comprehensive Training Slides

Document Identifier:

Date: September 2017

Creator(s): Institute for Water Resources




Certification of the Average Annual & Interest During Construction Tool

Document Identifier:

Date: August 2011

Creator(s): Headquarters U.S. Army Corps of Engineers



Certification Report: Model Evaluation of the Planning Tool for Ecosystem Restoration and Mitigation: IWR Planning Suite (Version 1.0.11)

Document Identifier:

Date: May 2008

Creator(s): Institute for Water Resources



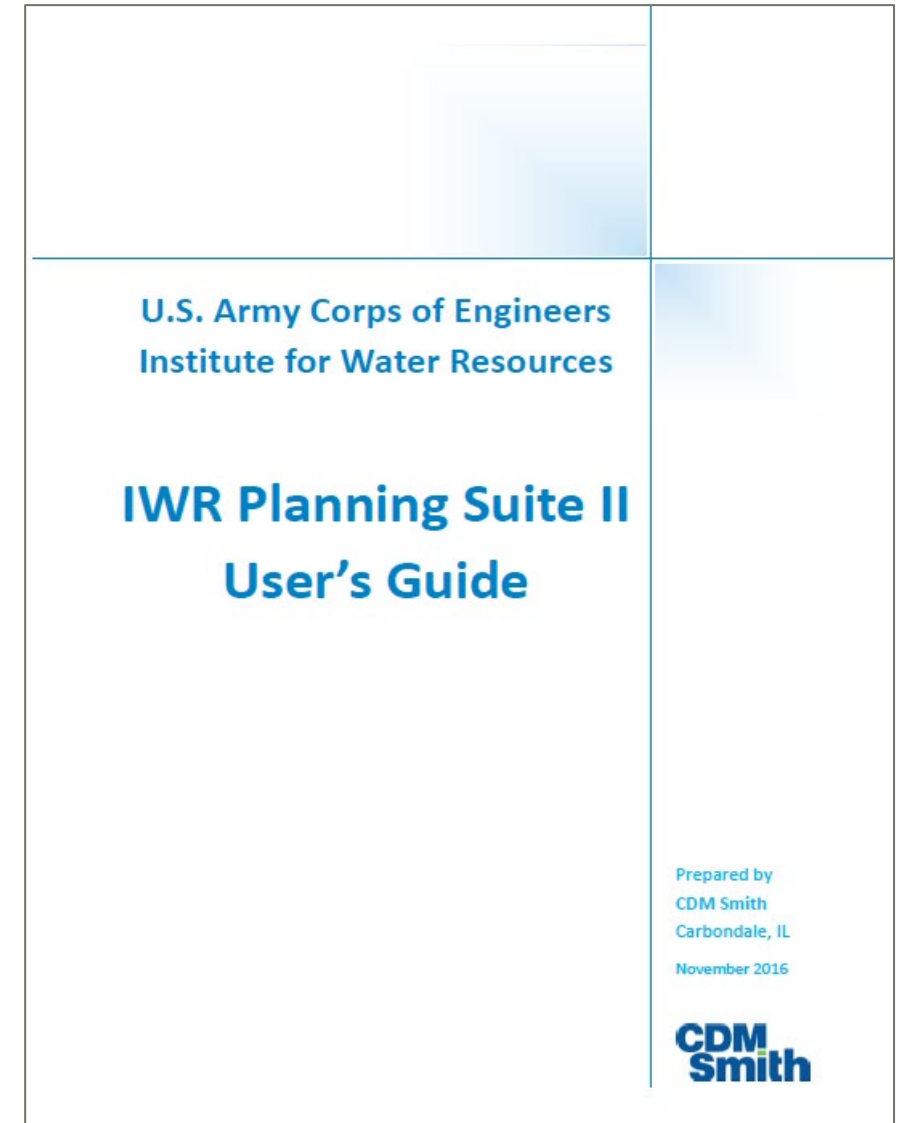
DOWNLOADING THE SOFTWARE

32

1. Make sure all previous versions of the IWR Planning Suite software have been uninstalled from your computer
2. Request software from the USACE App Portal
 - <https://app-portal.usace.army.mil/esd/Home>
 - “USACE IWR Planning Suite II 2.0.9.35 (November 29 2022)”
3. Should install automatically within 24 hours of submitting your request

IWR PLANNING SUITE: THE BASICS

- Supports formulation & comparison of alternative plans
- Calculates annualization of monetized & non-monetized costs and benefits
- Automates CE/ICA, documentation, visualization, reporting, and communication of CE/ICA
- Multiple and derived variable assessment with uncertainty on CE/ICA results
- Support risk-informed decision making

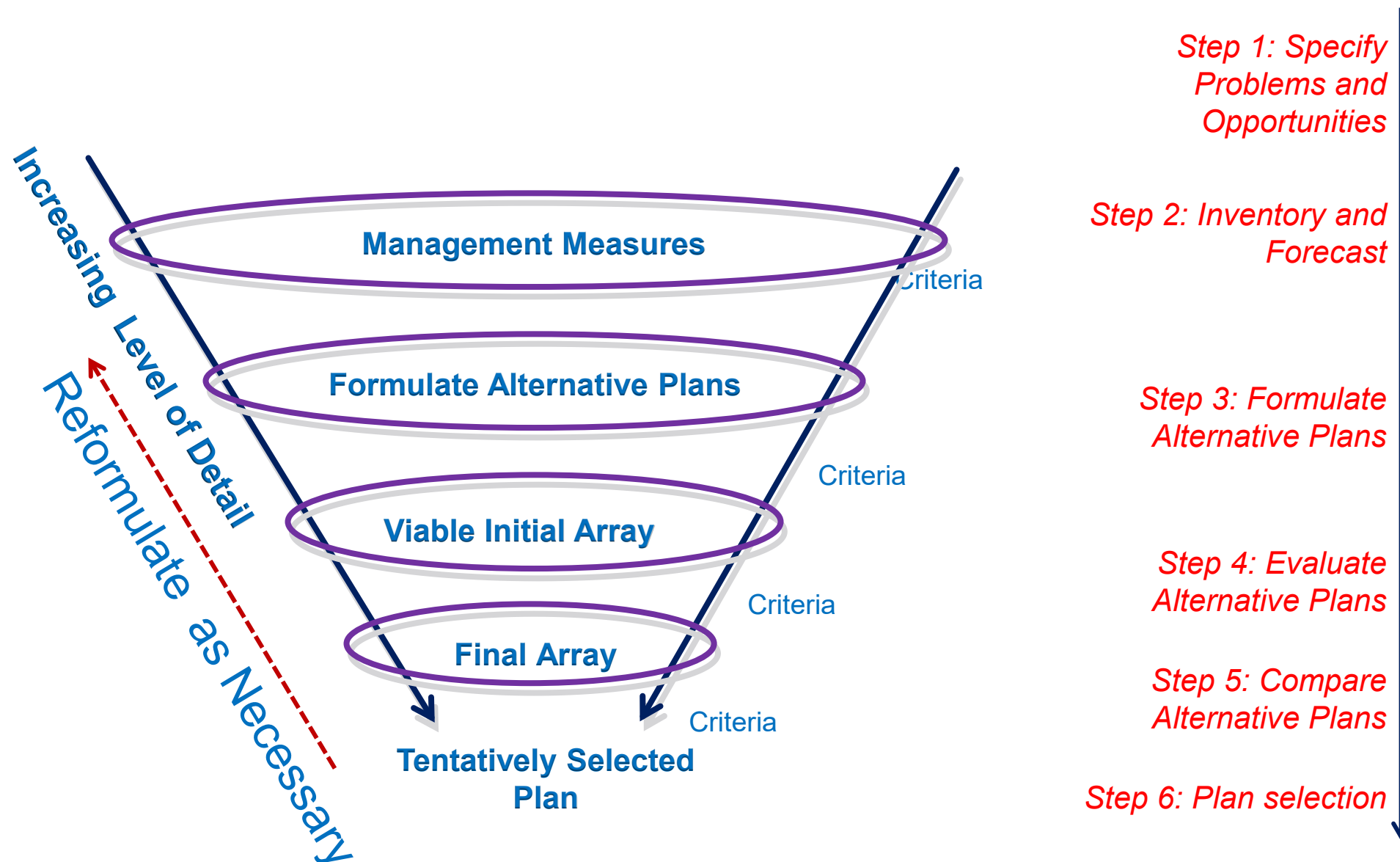


IWR PLANNING SUITE'S ROLE IN PLANNING

- There are two methods for analyzing alternatives in IWR Planning Suite:
 - Input pre-formulated alternatives
 - Input management measures and define relationships in order to generate alternatives
- Software can and should be used to optimize fully formulated alternatives



IWR-PLANNING SUITE'S ROLE IN THE PLAN FORMULATION PROCESS



CURRENT FEATURES



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IWR PLANNING SUITE MODULES



Generate
Plans

Plan Generation



Weights, Ranking
& Analysis

Multi-Criteria Decision
Analysis (MCDA)



Perform
CE/ICA

Cost-Effectiveness
& Incremental Cost
Analysis (CE/ICA)



Uncertainty Planning
Set Distributions

Uncertainty



Annualizer

Annualizer



Watershed
Wizard

Watershed
Wizard



IWRPS II: INTERFACE & USABILITY

IWR Planning Suite II

Home Generator Uncertainty MCDA Tools

Properties & Attributes Variable Sensitivity Generator Uncertainty MCDA Modules

Properties Constraints Delete Create New User-Entered Set Perform CE/ICA Graphs & Reports Report Builder

Planning Sets

- User-Entered Sets
- Generated Sets
 - Generated Planning Set 1
 - Generated Planning Set 1 CEICA 1 (CEICA)
 - Generated Planning Set 2
 - Generated Planning Set 2 CEICA 1 (CEICA)
- Uncertainty Sets
- Watershed Sets

Planning Set Properties

Planning Set Information:

Name:

Description:

HUC:

Plan Count: 60

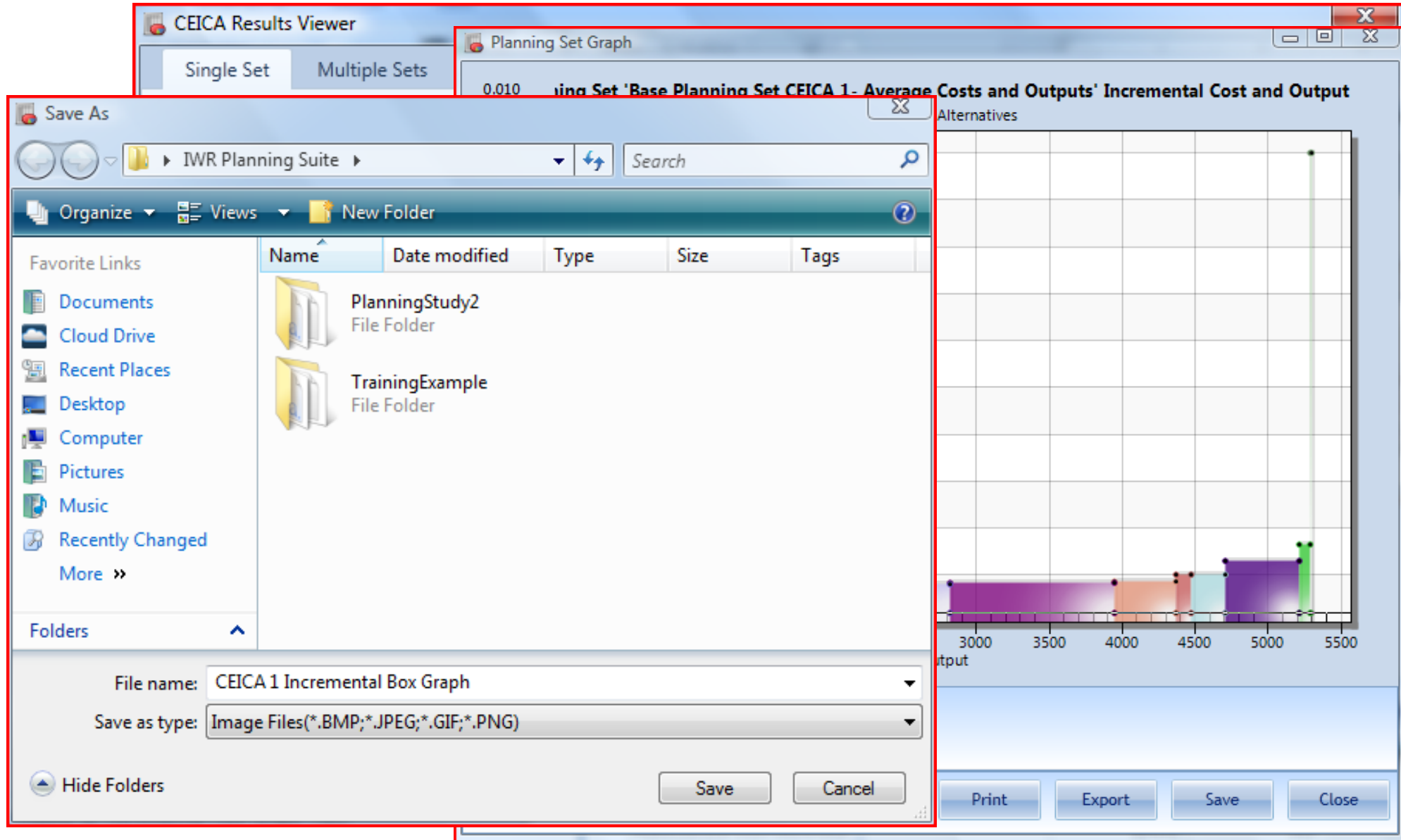
Parent Set: Generated Planning Set 1

Show plan-specific geographic information

Plan	Plan Description	Cost	Output	Cost Effective
No Action Plan	Default No Action Plan	\$0.00	0	Best Buy
A1B0C0		\$970.00	1,900	Cost Effective
A2B0C0		\$1,000.00	1,920	Cost Effective
A0B1C0		\$145.00	60	Cost Effective
A0B2C0		\$750.00	625	Non-Cost Effective
A0B3C0		\$900.00	1,300	Non-Cost Effective
A1B1C0		\$1,115.00	1,960	Cost Effective
A2B1C0		\$1,145.00	1,980	Cost Effective
A1B2C0		\$1,720.00	2,525	Non-Cost Effective
A2B2C0		\$1,750.00	2,545	Non-Cost Effective
A1B3C0		\$1,870.00	3,200	Non-Cost Effective
A2B3C0		\$1,900.00	3,220	Non-Cost Effective
A0B0C1		\$300.00	250	Cost Effective
A0B0C2		\$560.00	1,400	Best Buy
A0B0C3		\$1,030.00	1,600	Non-Cost Effective
A0B0C4		\$1,200.00	2,000	Cost Effective
A1B0C1		\$1,270.00	2,150	Cost Effective
A2B0C1		\$1,300.00	2,170	Cost Effective
A1B0C2		\$1,530.00	3,300	Best Buy
A2B0C2		\$1,560.00	3,320	Cost Effective
A1B0C3		\$2,000.00	3,500	Cost Effective
A2B0C3		\$2,030.00	3,520	Cost Effective

Planning Study Example [Generated Planning Set 1 CEICA 1] v2.0.9.1 7/20/2018

GRAPHING PACKAGE



The screenshot displays the CEICA Results Viewer application. A 'Save As' dialog box is open in the foreground, showing the file path 'IWR Planning Suite' and two folders: 'PlanningStudy2' and 'TrainingExample'. The file name is 'CEICA 1 Incremental Box Graph' and the save type is 'Image Files (*.BMP;*.JPEG;*.GIF;*.PNG)'. In the background, the 'Planning Set Graph' window is visible, showing a bar chart titled 'Planning Set 'Base Planning Set CEICA 1 - Average Costs and Outputs' Incremental Cost and Output'. The x-axis is labeled 'Output' and ranges from 3000 to 5500. The y-axis is labeled 'Incremental Cost and Output'. The chart shows several bars of different colors (purple, orange, cyan, dark purple, green) representing different alternatives. The 'Alternatives' section is visible above the chart.

Alternative	Output (Approx.)	Incremental Cost (Approx.)
1	3000	4000
2	4000	4500
3	4500	4800
4	4800	5000
5	5200	5200



REPORT BUILDER

CEICA 1 and CEICA 4 Best Buy Comparison [Compatibility Mode] - Microsoft Word non-commercial use

File Home Insert Page Layout References Mailings Review View

Paste Font Paragraph Styles Editing

Clipboard Font Paragraph Styles Editing

Page Break

Intersection of Best Buy Plans

4/15/2015

Counter	Plan-Code	Planning-Set	Output-Units	Cost	Aver
1	No-Action-Plan	Base-Planning-Set-CEICA4-High Base-Planning-Set-CEICA1-Average	-0.000 -0.000	-0.000 -0.000	-0 -0
2	A1B0C0D0E0F0G0H0I0J0K0L0	Base-Planning-Set-CEICA4-High Base-Planning-Set-CEICA1-Average	-237.000 -237.000	-6.880 -4.590	-0 -0
3	A1B0C0D0E0F0G1H0I0J0K0L0	Base-Planning-Set-CEICA4-High Base-Planning-Set-CEICA1-Average	-857.000 -857.000	-28.600 -19.070	-0 -0
4	A1B0C0D0E0F0G1H0I1J0K0L0	Base-Planning-Set-CEICA4-High	-1.055.000	-38.160	-0



PLAN GENERATOR

- Generates all possible combinations of solutions and determine the effects associated with each combination.
 - Unit costs/benefits are assumed additive by default.
 - Relationships can be modified or overridden by user.
- Each plan is based on solutions and their relationships to one another.
 - Solutions (type of activity or structure)
 - Number of scales for each solution (magnitude of activity or size of structure)
 - Unit cost, unit output, other variables
 - Solution relationships (combinability or dependency)



PLAN GENERATOR

Solutions & Scales

Solution	Code	# Scales
A	A	2
B	B	1
C	C	1

Buttons: Move Up, Move Down, Add New, Reapply Name

Scaled Solution Effects on Variables

Code	Scale	Name	Cost	Output
A	0	No Action	\$0.00	0
A	1	A1		
A	2	A2		
B	0	No Action		
B	1	B1		
C	0	No Action		
C	1	C1		

Solution Relationships

Relationship Type: Combinability Dependency No solutions are combinable

Solution: A, B, C

Is **Not** Combinable With: A C

Edit Mode: Create New Relationship Edit Existing Relationship

Buttons: Create, OK, Cancel

Plan	Cost	Output
A0B0C1	\$7.00	80
A0B1C0	\$5.00	100
A1B0C0	\$4.00	200
A1B0C1	\$11.00	280
A1B1C0	\$9.00	300
A2B0C0	\$10.00	450
A2B0C1	\$17.00	530
A2B1C0	\$15.00	550
No Action Plan	\$0.00	0

 **ANNUALIZER**

- Interpolates NER benefits over the period of analysis
- Annualizes NED benefits and project costs
- Estimates:
 - Average annual equivalent NED costs and benefits
 - Net present values
 - Average annual NER outputs
- The only USACE certified tool for annualizing NER outputs.
- Helps users understand the timing of expected returns on investment.



ANNUALIZER

Annualization Calculator

Annualization Set: Annualization Set 1 [Create / Manage](#)

Initial Terms

Base Year: 2013 Discount Rate %: 3.75%
Period of Analysis (years): 50 Capital Recovery Factor: 0.044574

Cost | NED Benefits | NER Outputs

Initial Cost Details

Total Initial Cost - \$294,343.00

Construction	Real Estate	Pre-construction Monitoring	PED	Other	
\$230,579.00	\$14,019.00	\$8,624.00	\$24,460.00	\$16,661.00	= \$294,343.00

Total Investment Cost - \$297,068.91

Total Initial Cost		IDC		
\$294,343.00	+	\$2,725.91	=	\$297,068.91

Initial Investment

Total Investment Cost	PV Factor	Present Value
\$297,068.91	1.0	\$297,068.91

Cost Annualizer

Year	Total Future Costs	PV Factor	Present Value
2014	\$2,640.00	0.929017	\$2,452.61
2015	\$2,640.00	0.895438	\$2,363.96
2016	\$2,640.00	0.863073	\$2,278.51

Net Totals

Total Cost:	Present Value:	Average Annual Equivalent Cost:
\$538,928.91	\$401,993.03	\$17,918.52

[Export Table To Excel](#) [View & Print Report](#) [Save](#) [Close](#)



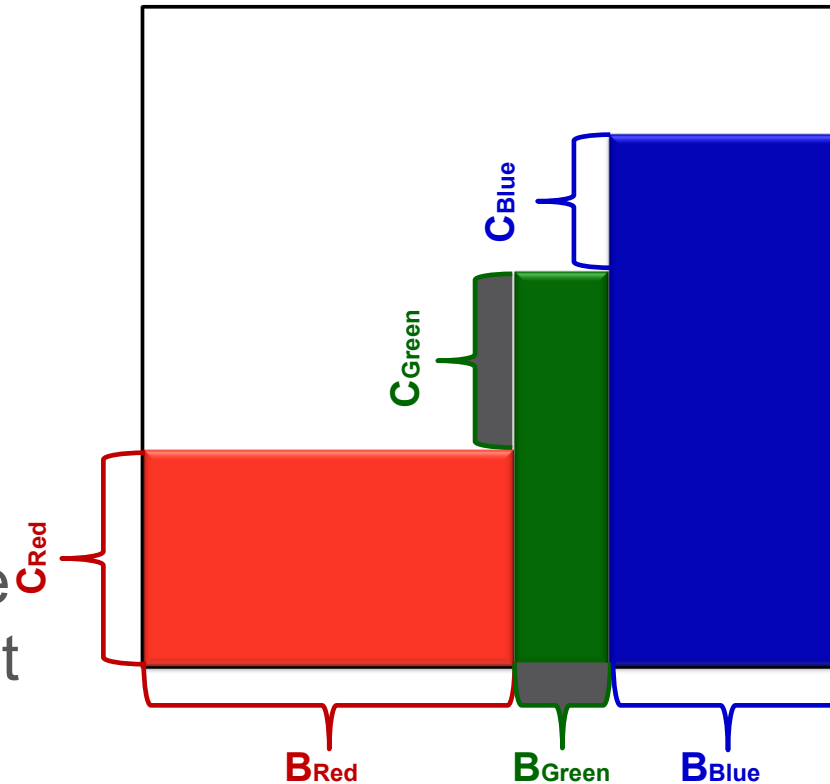
- Identifies the least cost solution for each possible level of output
- Compares monetary costs and non-monetary outputs (AAHUs)
- Required for all mitigation and ecosystem restoration projects
- Does not give you a single correct answer, but helps you to better understand and compare your alternatives

Incremental Cost Analysis:

$$\frac{\text{Change in Cost (C)}}{\text{Change in Benefits (B)}}$$

Cost effective: for a given level of output, not other plan costs less (no other plan yields more output for less money)

Best buy: cost-effective plans that provide the greatest increase in output for the least increases in cost. (They have the lowest incremental cost per unit).



 **CE/ICA IN IWR PLANNING SUITE**

Planning Set Graph

Perform CE/ICA Analysis

Parent Set: Planning Set 1

Name: CEICA on Planning Set 1

Description: Planning set generated by Cost Effective/Incremental Cost Analysis

CE/ICA Variables

Cost Variable: Cost

Output Variable: Output

Analyze Cancel

Multicolor Monochrome

Print Export Save Close

Plan	Cost	Output	Cost Effective
No Action Plan	\$0.00	0	Best Buy
A1B0C0	\$970.00	1,900	Cost Effective
A2B0C0	\$1,000.00	1,920	Cost Effective
A0B1C0	\$145.00	60	Cost Effective
A0B2C0	\$750.00	625	Non-Cost Effective
A0B3C0	\$900.00	1,300	Non-Cost Effective
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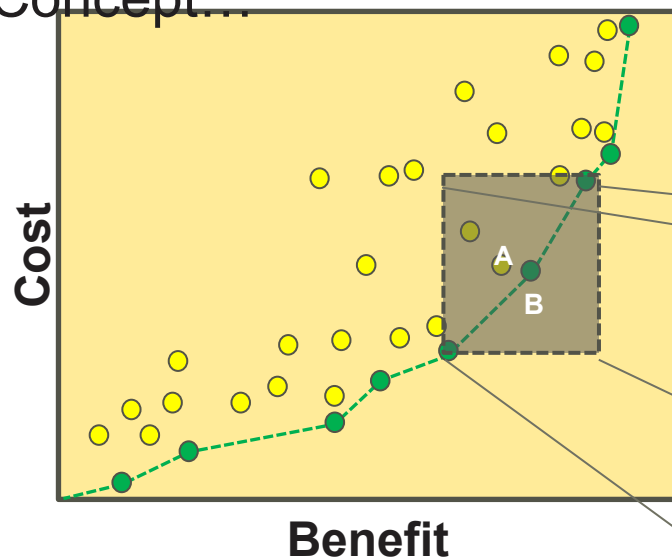


UNCERTAINTY

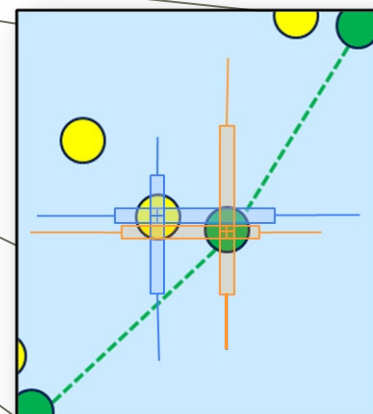
26

- Include variability/uncertainty around variables through assigning a probability distribution
- More robust and risk-informed information for decision-making

The Concept...

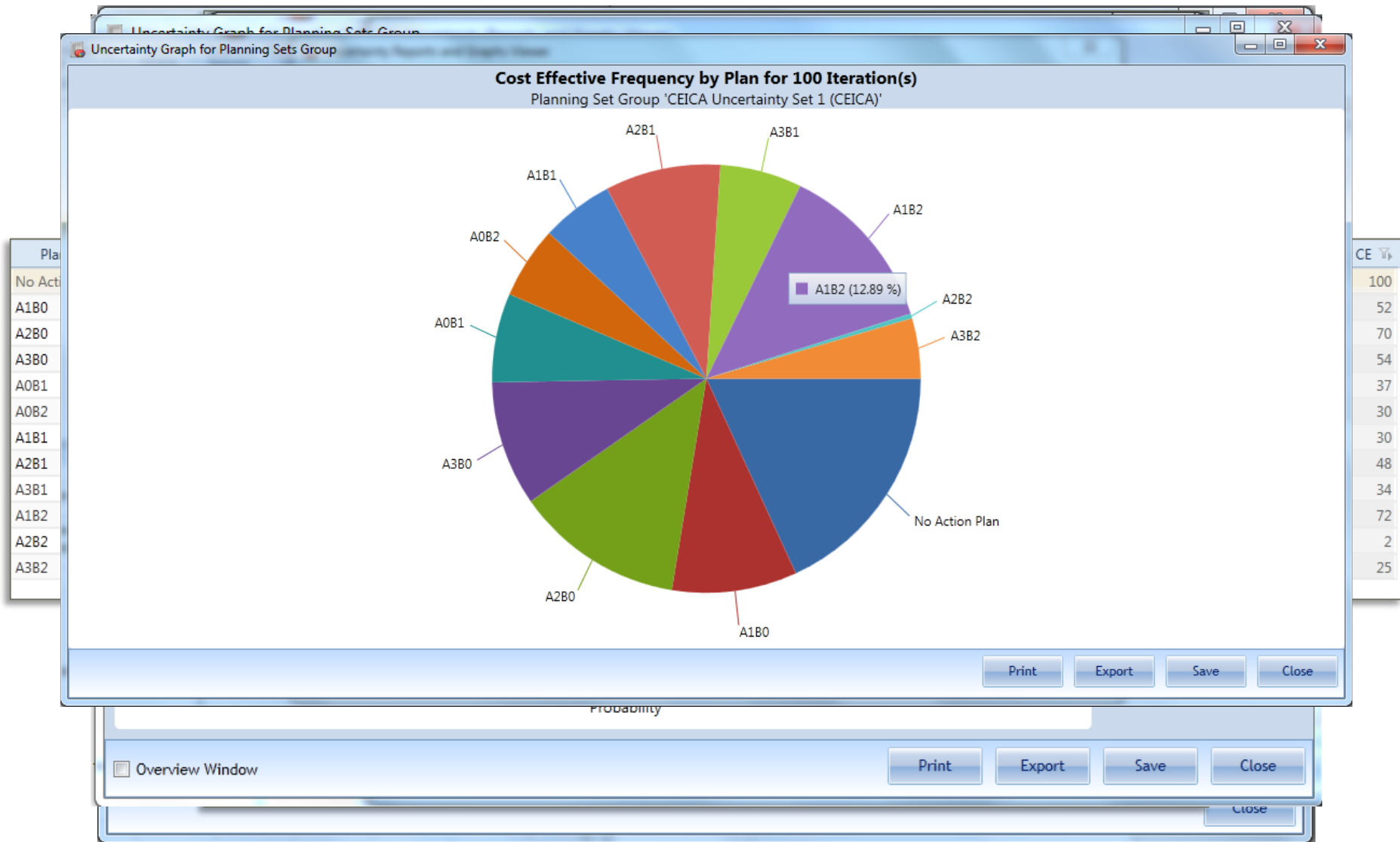


Which plan is a better investment?





UNCERTAINTY



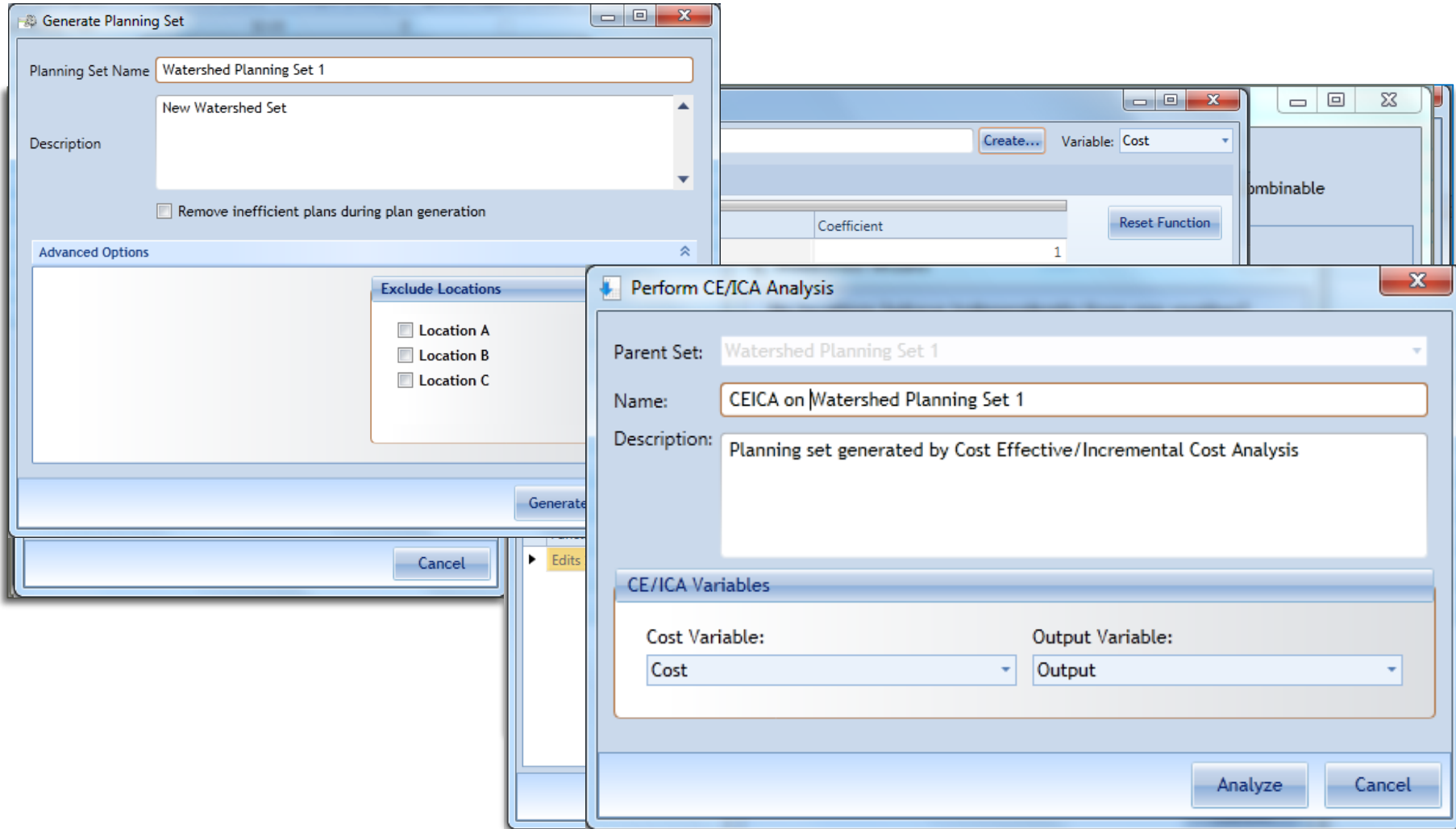


WATERSHED ANALYSIS

- The Watershed Wizard allows the user to complete a watershed analysis based on multiple calculations.
- Leads the user through a series of steps in which they can define locations, relationships, and additive effects between proposed plans in order to generate a set of plans to represent the scenario.
- The user can define one plan per site, more than one plan per site, or generate plans for each site based on their selections.
- Provides a more transparent framework for formulating multiple solutions and scales across multiple locations
- Users can then run CE/ICA on the generated watershed planning sets



WATERSHED ANALYSIS



The image displays two overlapping dialog boxes from the Watershed Analysis software. The background dialog is 'Generate Planning Set', and the foreground dialog is 'Perform CE/ICA Analysis'.

Generate Planning Set Dialog:

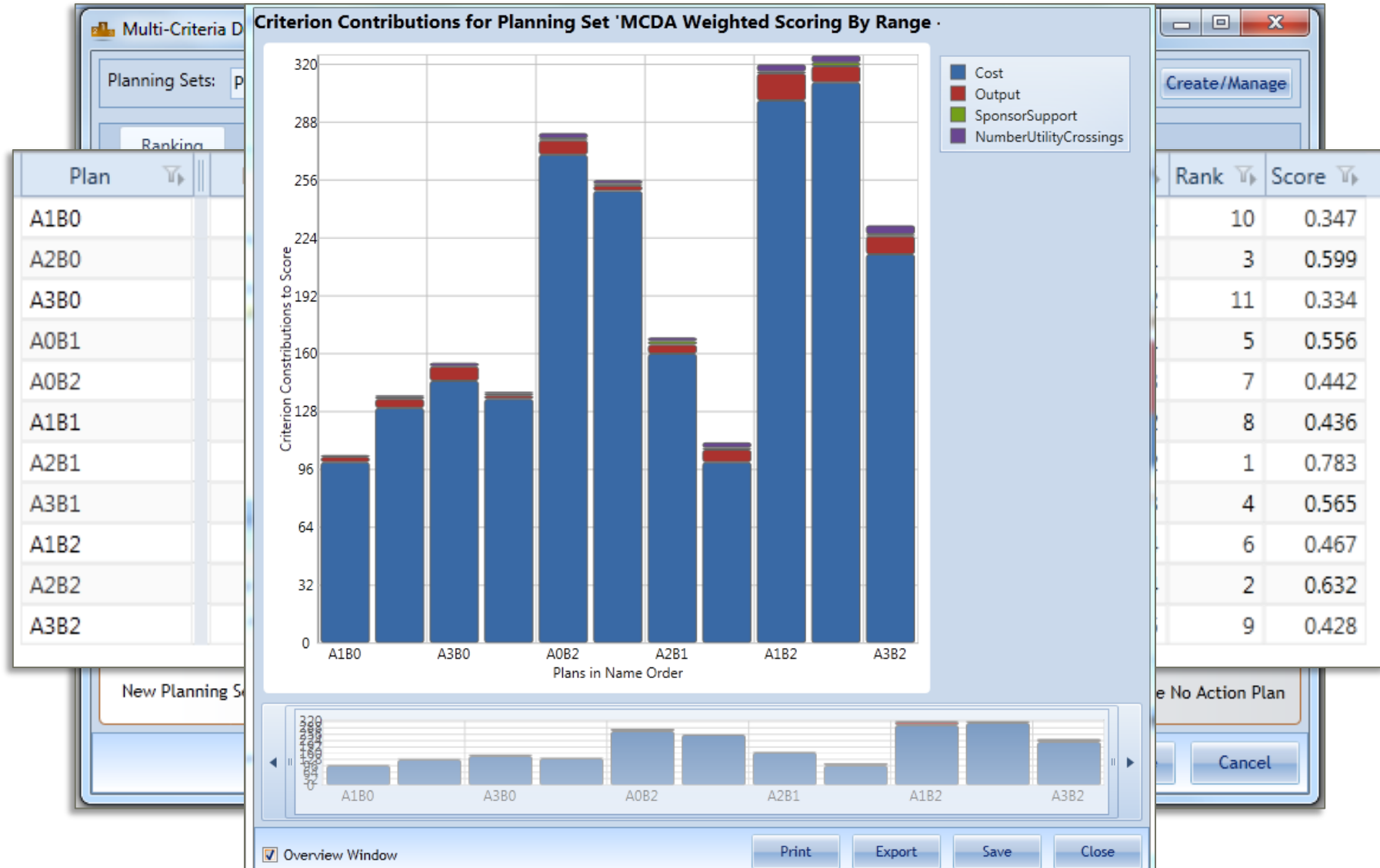
- Planning Set Name: Watershed Planning Set 1
- Description: New Watershed Set
- Remove inefficient plans during plan generation
- Advanced Options:
 - Exclude Locations:
 - Location A
 - Location B
 - Location C

Perform CE/ICA Analysis Dialog:

- Parent Set: Watershed Planning Set 1
- Name: CEICA on Watershed Planning Set 1
- Description: Planning set generated by Cost Effective/Incremental Cost Analysis
- CE/ICA Variables:
 - Cost Variable: Cost
 - Output Variable: Output



- Weight the criteria and choose the appropriate ranking and normalization methods.
- Create and save multiple weighting scenarios
- Helps the decision maker balance criteria (i.e., acres of wetland restored, jobs created) against a given set of solutions
- The process can be used to measure qualitative units such as socioeconomic factors or cultural resources with a user defined or a commonly accepted scale.
- Decision makers often use more than one criteria for decision making. MCDA provides a context for stakeholders to voice their opinions and potentially come to a consensus around decisions.





WHICH MODULES HAVE YOU USED?



Generate
Plans



Weights, Ranking
& Analysis



Perform
CE/ICA



Uncertainty Planning
Set Distributions



Annualizer



Watershed
Wizard

Click on the Annotation option \mathcal{N} on the left side of your screen and then use the Pencil Tool or checkmark to mark your response.

CONTEMPORARY EXAMPLES AND FUTURE APPLICATIONS GIVEN CONTEXT OF COMPREHENSIVE BENEFITS MEMO AND PR&G



U.S. ARMY



US Army Corps
of Engineers®



IWR PLANNING SUITE & CURRENT CONTEXT

Supporting:

- Comprehensive Benefits Evaluation
- Environmental Justice
- PR&G ASPs (forthcoming)
- New Planning EC
- **Expanded use of CE/ICA**
- **Multi-Criteria Decision Analysis (MCDA)**



SACW

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
CIVIL WORKS
108 ARMY PENTAGON
WASHINGTON DC 20310-0108

5 January 2021

MEMORANDUM FOR COMMANDING GENERAL, U.S. ARMY CORPS OF ENGINEERS

SUBJECT: POLICY DIRECTIVE – Comprehensive Documentation of Benefits in Decision Document

1. Purpose. This memorandum issues policy direction on the comprehensive assessment and documentation of benefits in the conduct of U.S. Army Corps of Engineers (USACE) water resources development project planning. This policy updates current procedures, and emphasizes and expands upon policies and guidance to ensure the USACE decision framework considers, in a comprehensive manner, the total benefits of project alternatives, including equal consideration of economic, environmental and social categories. This directive pertains to pre- and post-authorization decision documents (reports), as well as other decision documents approved under delegated authorities. In addition, the directive may be applied to benefit-cost analyses required to support budgetary decision-making processes. As stated in my 15 July 2020 memorandum to the Deputy Commanding General for Civil and Emergency Operations, one of my highest priorities is to ensure this policy directive is implemented as soon as practicable.

2. Applicability. This directive applies immediately to all USACE elements having Civil Works planning, engineering, design, construction, and operations & maintenance responsibilities. The policies contained in this directive shall remain in effect and fully applicable unless and until modified, supplemented, amended, or rescinded expressly and in writing by the ASA(CW). See also, paragraph 8, Limitation on Modification.



EXAMPLES OF NON-MONETARY/HABITAT UNITS IN CE/ICA

CE/ICA Metric

- Community Resilience Units
- Number of Parcels Protected
- Community Viability Units
- Access/Moorage Days

Study

Utqiagvik “Barrow” Coastal Erosion
([2019 Director’s Report](#))

Kenai Bluffs Erosion ([2019 Director’s Report](#))

Nome Navigation ([2020 Chief’s Report](#))

St. George Navigation ([2020 Chief’s Report](#));

Elim Navigation ([2021 Chief’s Report](#))



EXAMPLE STUDY:

UTQIAGVIK “BARROW” ALASKA COASTAL EROSION

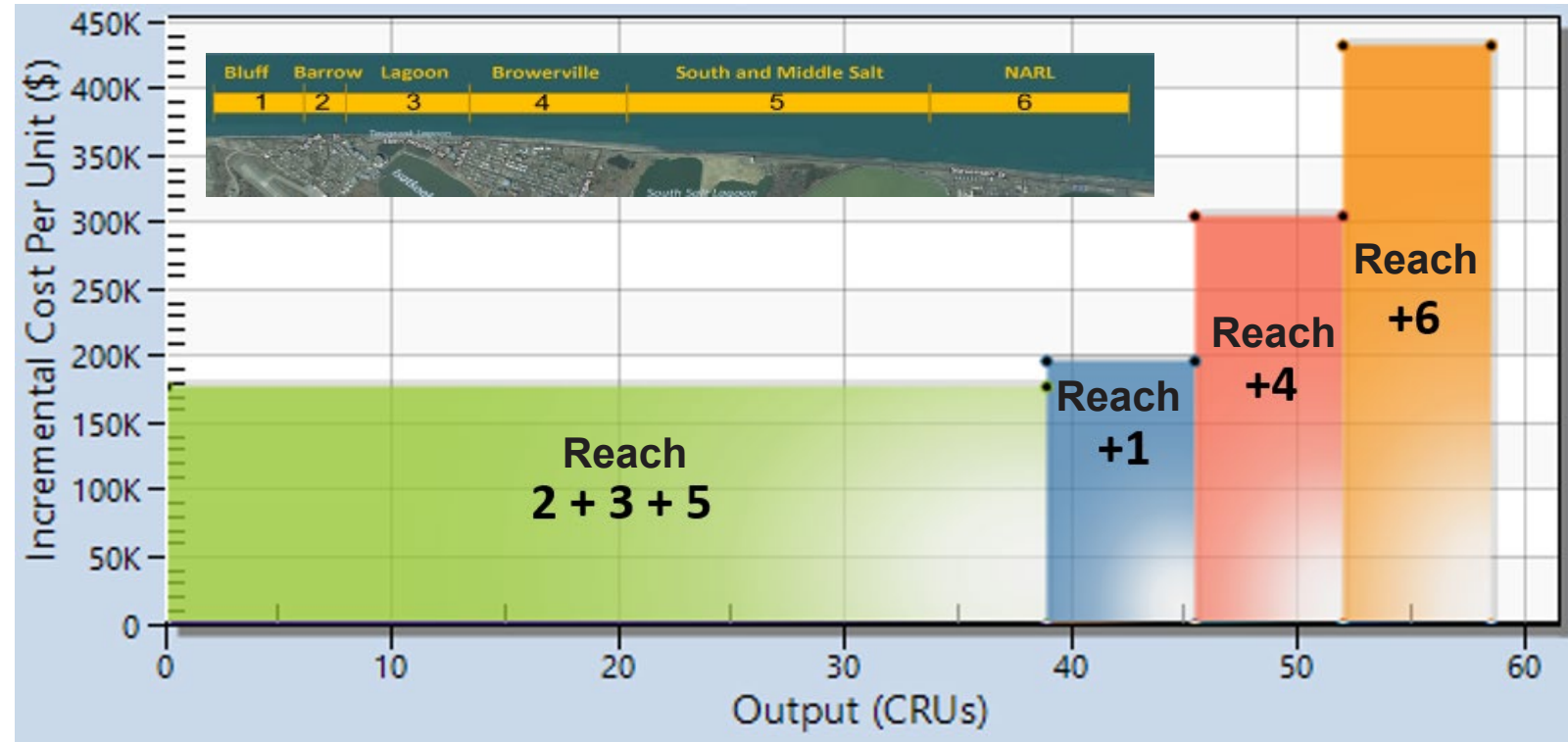
Community Resilience Framework

Identify the types of risk that exist in Barrow within the three resilience areas.





EXAMPLE STUDY: UTQIAGVIK “BARROW” ALASKA COASTAL EROSION

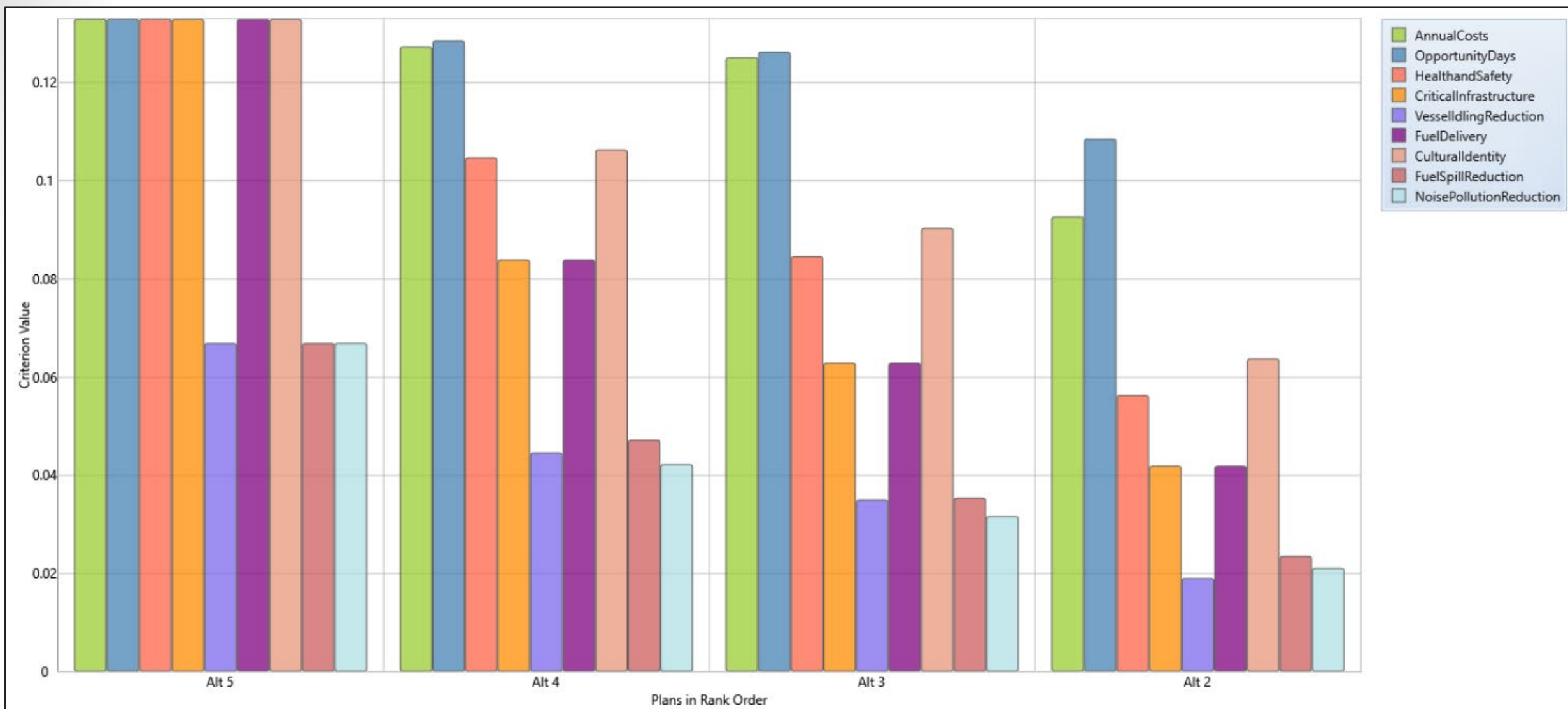


Scenario	Annualized Cost*	CRU	Inc. Cost per Unit
No Action	\$0	0	\$0
R2+R3+R5	\$6,954,662	38.94	\$178,599
R2+R3+R5+R1	\$8,243,785	45.49	\$196,813
R2+R3+R5+R1+R4	\$10,238,975	52.03	\$305,075
TSP → R2+R3+R5+R1+R4+R6	\$13,078,893	58.58	\$433,575

*Cost estimates at time of Agency Decision Milestone



EXAMPLE STUDY: ELIM MCDA





- MCDA module can support creation of the Effects Table required by the New Planning EC.
- Latest version of IWR Planning Suite includes capability to export normalized values as a CSV file in the MCDA module.
- More training on when and how to use MCDA forthcoming.
- Advanced and detailed 2020 MCDA presentation available here:
<https://publibrary.planusace.us/document/60a1297b-9939-421b-c3fe-53ae905aaa4c>
- Contact ECO-PCX and email us at:
DLL-CEIWR_IWR-PLAN



PRESENTATION OUTLINE

- MCDA – what is it and why do we need it
- Nomenclature
- Scoring & Ranking – 4 easy steps
 - Alternatives & Criteria
 - Weighting
 - Scoring & Ranking
 - Exploring Results
- Scoring & Ranking Methods
 - Efficient Frontier
 - Weighted Scoring
 - Compromise Programming
 - Outranking
- Tips/Tricks/Gotchas
- Example and deeper dive



IWR PLANNING SUITE TRAINING RESOURCES & ASSISTANCE

- Links to the software, certification memo, and other related resources can be found at:

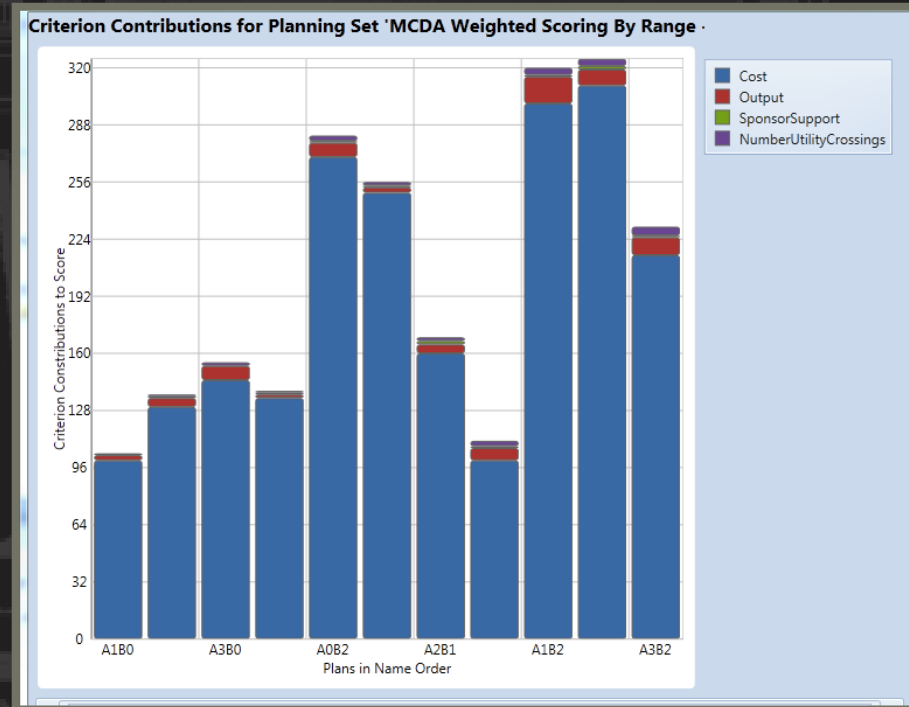
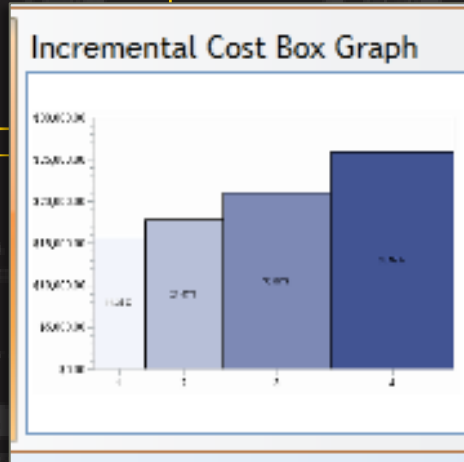
<http://www.iwr.usace.army.mil/Missions/Economics/IWR-Planning-Suite/>

- Training materials that highlight IWR Planning Suite's capabilities, improvements and case study applications are available online at the IWR Planning Assistance Library
- Customized or study-specific training is also available upon request. For support please contact:
 - IWR Planning Suite Development Team at: **DLL-CEIWR_IWR-PLAN**
 - ECO-PCX
 - Collaboration and Public Participation Center (CPCX)

QUESTIONS?

Email us at:
DLL-CEIWR_IWR-PLAN

Learn More:
[IWR Planning Suite \(army.mil\)](http://army.mil)



Distributions Variable Profile Tolerance Rules Correlation Matrix

Distribution Types

The triangular distribution is defined by P1, a minimum returned value, P2, the most likely value, and P3, the maximum returned value.

* Binary variables are restricted to a Fixed Distribution of either 0 or 1. Validate Distributions & Matrix

Plan	Variable	Variable Type	Distribution Type	P1	P2	P3	P4	P5	P6	P7	P8
No Action Plan	Cost	Currency	Fixed	\$0.00							
A1B0	Cost	Currency	Triangular	\$50.00	\$100.00	\$150.00					
A2B0	Cost	Currency	Triangular	\$50.00	\$130.00	\$150.00					
A3B0	Cost	Currency	Triangular	\$100.00	\$145.00	\$190.00					
A0B1	Cost	Currency	Triangular	\$105.00	\$135.00	\$200.00					

