



# The Rapid Benefits Indicators (RBI) Approach: A Process for Assessing the Social Benefits of Ecological Restoration

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**EPA Tools and Resources Webinar**

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❖ Ecosystem Services (ES) = nature's benefits to people, including both financial benefits and other types of social benefits for human well-being (health, recreation, spiritual, cultural)

❖ ES of freshwater wetlands include:

- ❖ Flood and storm water regulation
- ❖ Scenic landscapes
- ❖ Learning opportunities
- ❖ Recreational opportunities
- ❖ Wildlife
- ❖ Water treatment / filtering
- ❖ Food / harvested products
- ❖ Urban temperature moderation

All of these may contribute, directly or indirectly, to public health





## Environmental decisions require tradeoffs



*Which of these sites should we spend money on?*

Both ecological and social criteria are important.

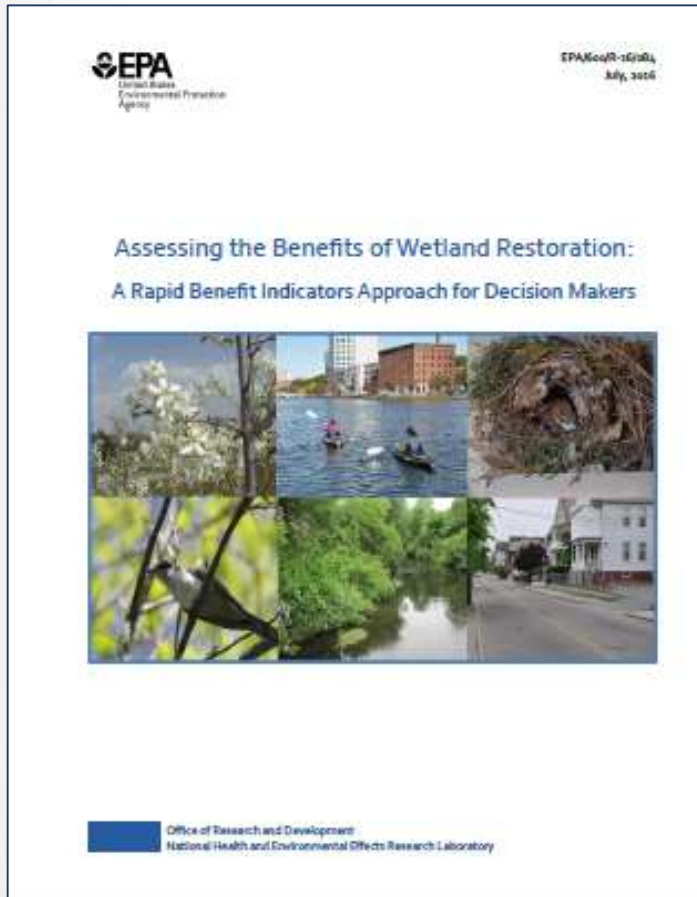
# Challenges and Motivation

- Scarce funding for smaller, more urban sites
- Lack of easily-applied methods to include benefits





# A rapid assessment approach using benefit indicators



- ❖ A framework for compiling and using benefit indicators
  - ❖ Based on economic principles
- ❖ User-friendly
  - ❖ Can be applied with different levels of detail, depending on context
- ❖ Focus is on benefits to people
- ❖ Designed to be used along with a biophysical/functional assessment
- ❖ Initial application to freshwater wetlands in a watershed ranging from urban to rural
  - ❖ May be applied, with modifications, to other ecosystems

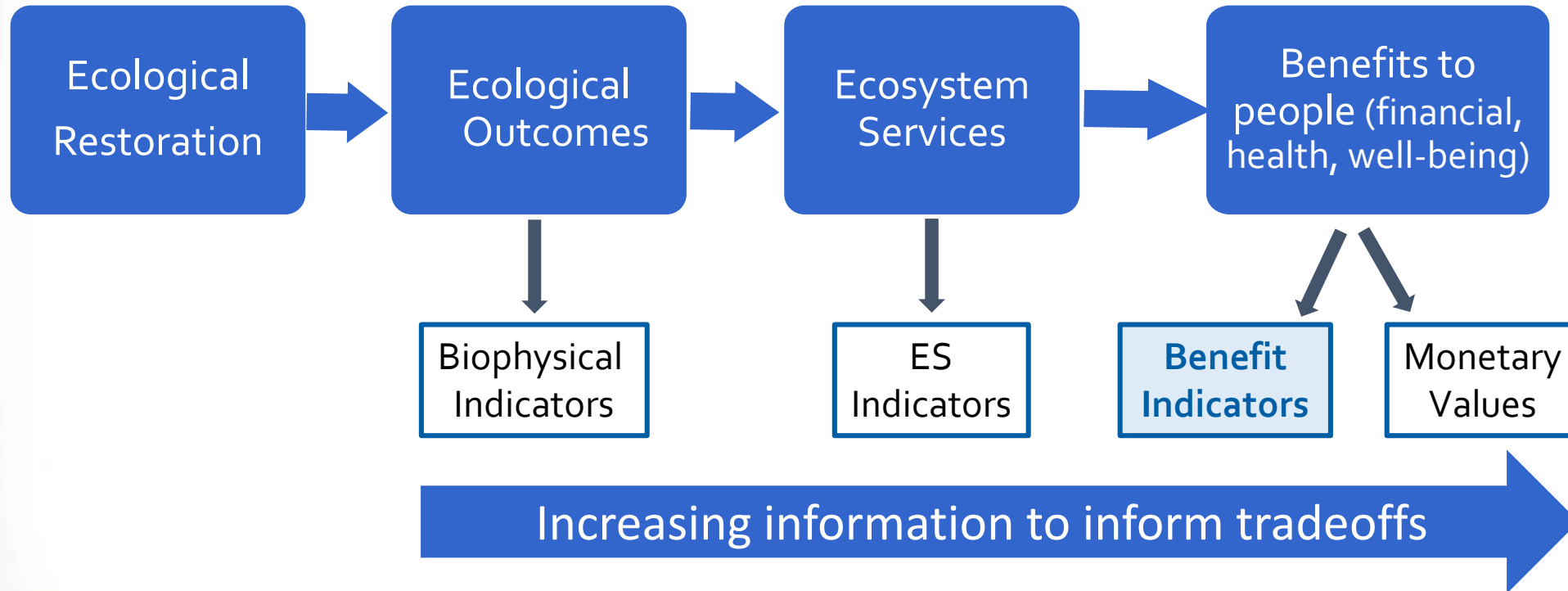


## Who can use our guide?

- ✓ Those who conduct or advocate for restoration, including:
  - ✓ Watershed groups
  - ✓ Community groups
  - ✓ Federal, state, or local managers
- ✓ Funders

## ❖ A few contexts for use:

- ❖ prioritize sites or projects
- ❖ funding decisions
- ❖ inform the public
- ❖ preliminary assessment for a more complex evaluation
- ❖ augment benefit transfer approaches



## What are benefit indicators?

- ❖ Indicators are metrics that simplify complexity to inform decisions and actions
- ❖ Benefit indicators are based on economic models and empirical evidence of factors that affect value, i.e. **scarcity metrics**





## Benefit indicators answer these questions:



1. Can people benefit from an ecosystem service?
2. How many people benefit?
3. How much are people likely to benefit?
4. What are the social equity implications?
5. How reliably will services be provided over time?

# 1. Can people benefit from an ecosystem service?

Yes, if:

There is demand



If required, complementary inputs are available



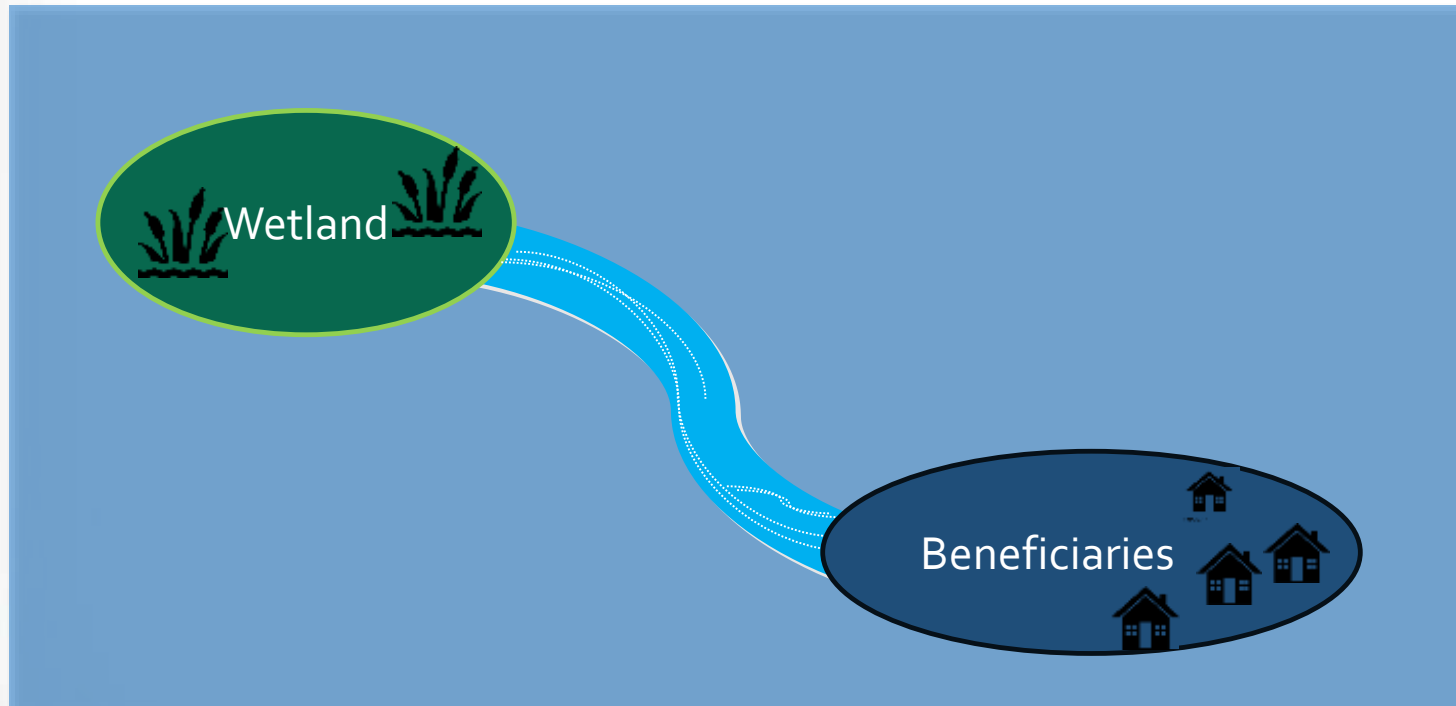
There is sufficient quantity and quality of the service



## 2. How many people benefit?

How many people are within the relevant benefits area?

More people who benefit → Greater value



The number of people who benefit is often a stronger determinant of aggregate social value than value per person (Bateman et al., 2008)

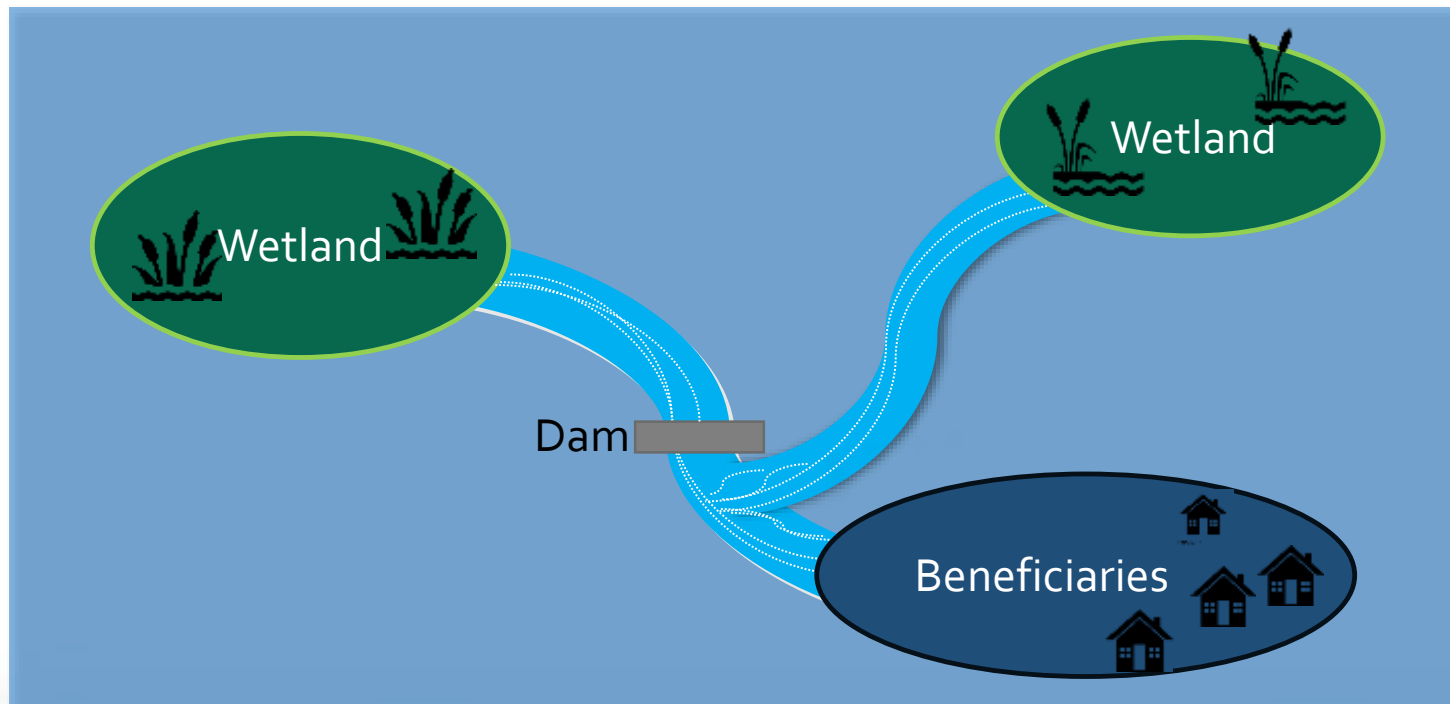


### 3. By how much do people benefit?

#### 3.1 Substitutes:

How many natural and technological substitutes are there?

Fewer substitutes or lower quality substitutes → Greater value

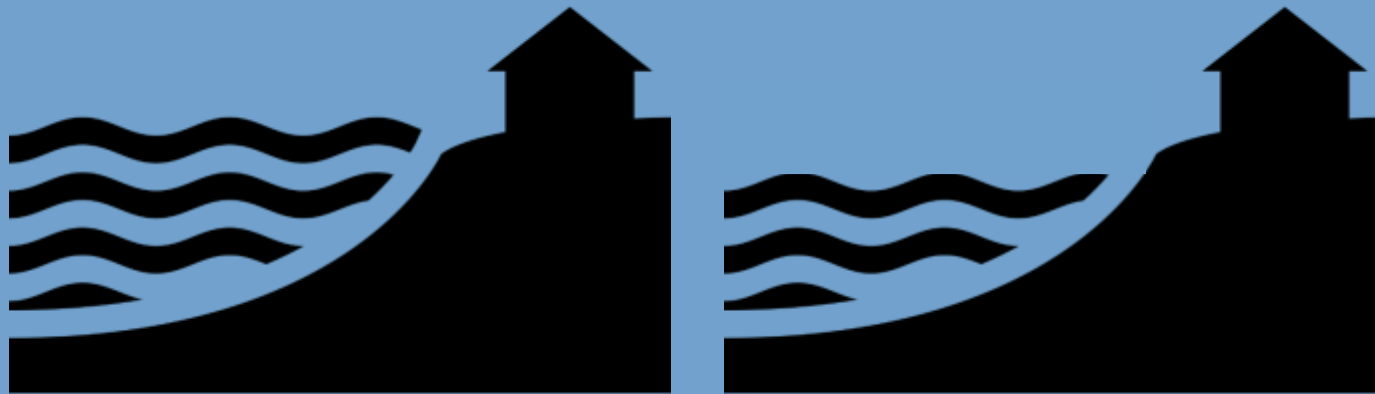


## 3. By how much do people benefit?

### 3.2 Quality:

Higher quality service → Greater value

How much is flood risk reduced?



### 3. By how much do people benefit?

#### 3.3 Quality of complements:

Higher quality complements → Greater value





## 3. By how much do people benefit?

### 3.4 Strength of Preferences:

Includes factors such as avidity, willingness/ability to adapt



not so avid angler



avid angler

## 4. What are the social equity implications?

### **Social Equity:**

Are groups that are particularly socially vulnerable affected?



## 5. How reliably will services be provided over time?

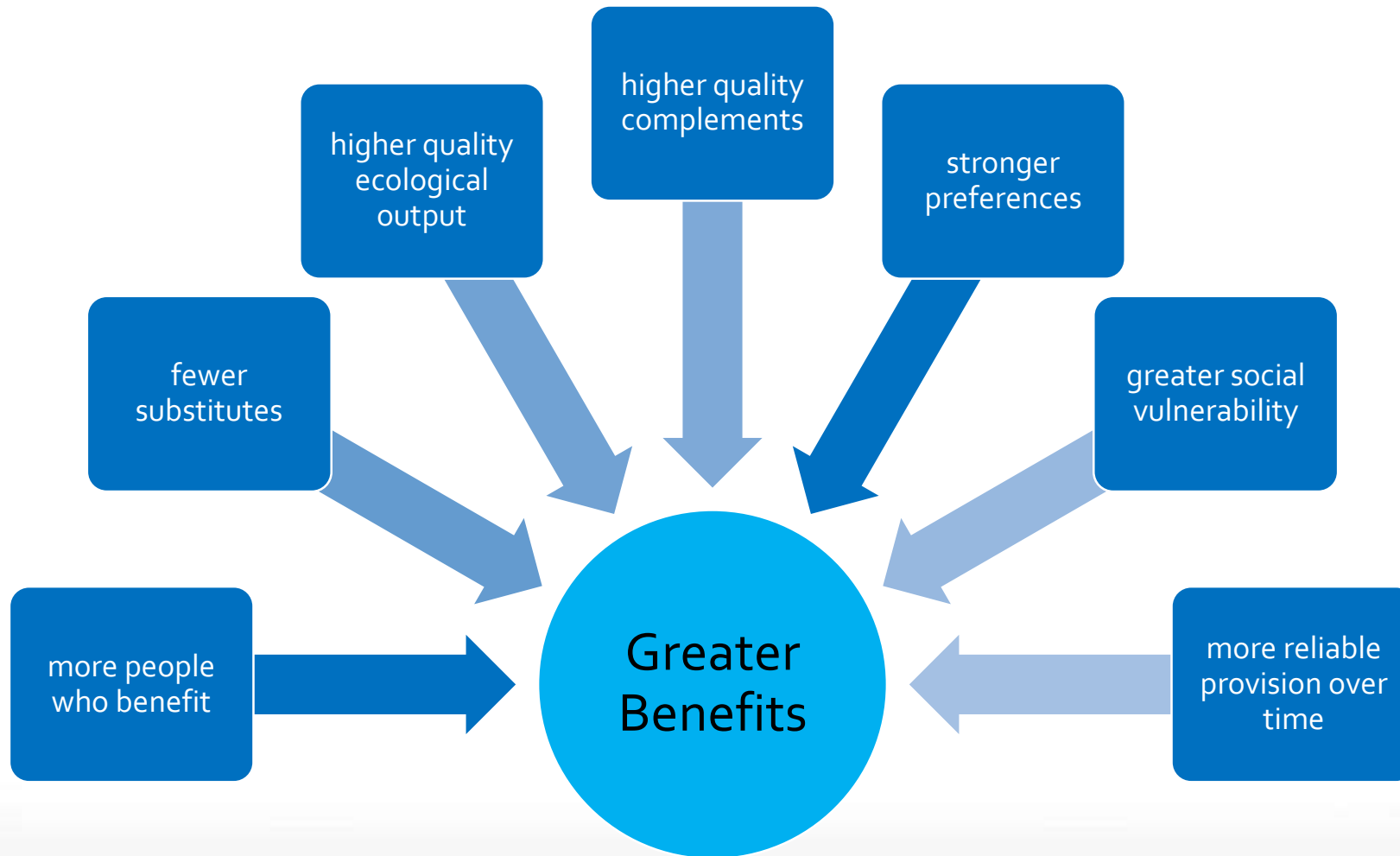
### **Reliability:**

How sure are we that benefits will continue?

More reliable → Greater value







**Instructions:**

This Excel spreadsheet contains macros. Respond to security message (if any) by agreeing to enable macros.

This tool allows you to create up to four analysis scenarios by specifying which benefits and weights are included in an analysis. You can compare the analyses results on the map and table at right.

Touch any "Edit" button to create or modify a scenario.

Touch any "View" buttons to view results of a scenario analysis at right.

Mouse-over any information icon **i** for a description of tool features.

Clear All Scenarios

<b>Edit</b> Scenario 1	<b>Edit</b> Scenario 2	<b>Edit</b> Scenario 3	<b>Edit</b> Scenario 4
<b>View</b> Scenario 1	<b>View</b> Scenario 2	<b>View</b> Scenario 3	<b>View</b> Scenario 4

Benefits	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Flood risk	20		20	
Scenic views		40	30	
Education				
Recreation	50	50		
Bird watching	30			
Social equity		10	30	
Reliability			20	
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>0</b>

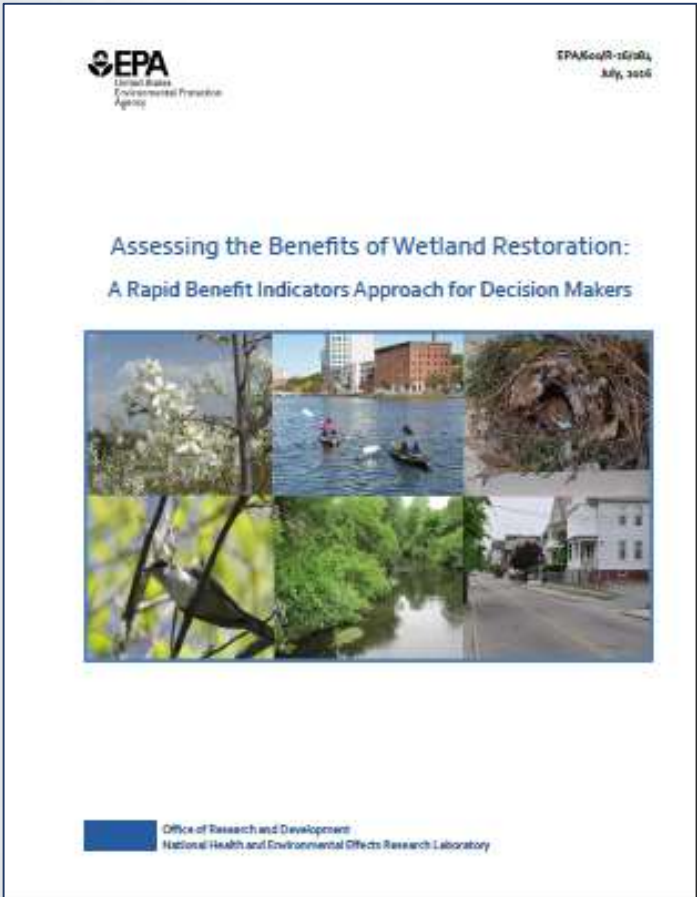
### Top dozen ranked sites mapped and described [More](#)

#### Scenario 3

Rank	Value	Site
1	0.6	430
2	0.55	454
3	0.5	256
4	0.45	455
5	0.4	425
6	0.35	258
7	0.3	427
8	0.25	449
9	0.2	424
10	0.15	55
11	0.1	259
12	0.05	452

Red 'X's indicate locations of all sites  
 Red circles indicate 12 top ranked sites  
 Circle size is proportional to rank value

# Applying the approach



1. Download our Guidebook and tools from:  
<https://www.epa.gov/water-research/rapid-benefit-indicators-rbi-approach>
2. Read the Guidebook – learn from our example application
3. Try out one of our tools for compiling benefit indicator information
  1. Fillable PDF – easiest to use, works on any computer, least automated, requires data for your sites
  2. Excel® spreadsheet checklist tool – easy to use, requires appropriate software and operating system, and data for your sites
  3. Python GIS tool – requires GIS skills, provides the most detail and automates data handling



## ❖ The Guidebook includes examples of 5 Ecosystem Services:

❖ Flood water regulation

❖ Scenic landscapes

❖ Learning opportunities

❖ Recreational opportunities

❖ Birds






**Justin will describe and demo the tools using scenic views as an example...**

## Services and Benefits Addressed in this Guide

This guide addresses the following important services and benefits provided by wetlands in urbanized areas. We selected these because:

- They may be provided by relatively small, urban sites
- They are relevant to our example watershed
- They were mentioned in our interviews with managers

Wetlands can provide other services, and multiple types of benefits may result from each service. We are not providing indicators for a comprehensive set of freshwater wetlands' benefits, but are focusing on this subset of possible benefits. The approach we illustrate can be applied in a similar way to other services and benefits.

Ecosystem Service	How people benefit
 Flood water regulation	<b>Reduced Flood Risk:</b> The risks from floods to people and structures are reduced.
 Scenic landscapes	<b>Scenic Views:</b> People can enjoy scenic views.
 Learning opportunities	<b>Environmental Education:</b> People can benefit from studying nature or from enhanced connection to nature.
 Recreational opportunities	<b>Recreation:</b> People can enjoy recreation
 Birds	<b>Bird Watching:</b> People can watch or hear birds.



# Workflow for Different Tools



**Rapid Benefit Indicators (RBI) Checklist Tool -  
Fillable Forms**



**Rapid Benefit Indicators (RBI) Checklist Tool**



**RBI Spatial Analysis Tools**

Rapid Benefit Indicator (RBI) Checklist Tool - Fillable Forms.PDF - Adobe Acrobat Reader DC

File Edit View Window Help

Home Tools Rapid Benefit Indica... x

1 / 9 59.8%

Step	Question/Category	User Entries
1	<b>Describe the decision context</b>	
1.A	What are the main objectives of the assessment? Are some objectives more important than others, or are there additional important objectives? If so, specify.	
1.B	What is the geographic scope for the decision?	
1.C	Who are the affected members of the public or stakeholder groups?	



# Fillable PDF – Select Benefits

Rapid Benefit Indicator (RBI) Checklist Tool - Fillable Forms.PDF - Adobe Acrobat Reader DC

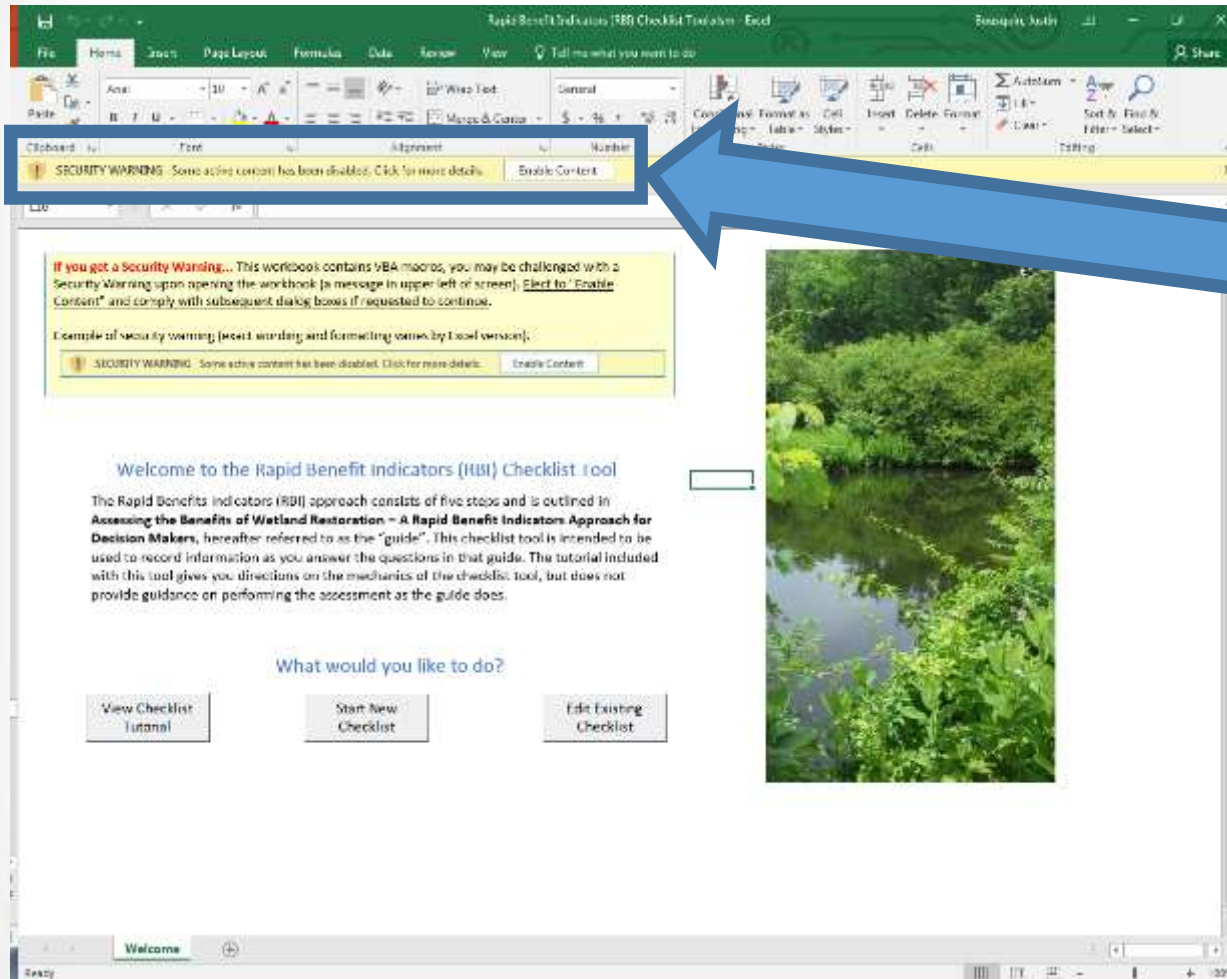
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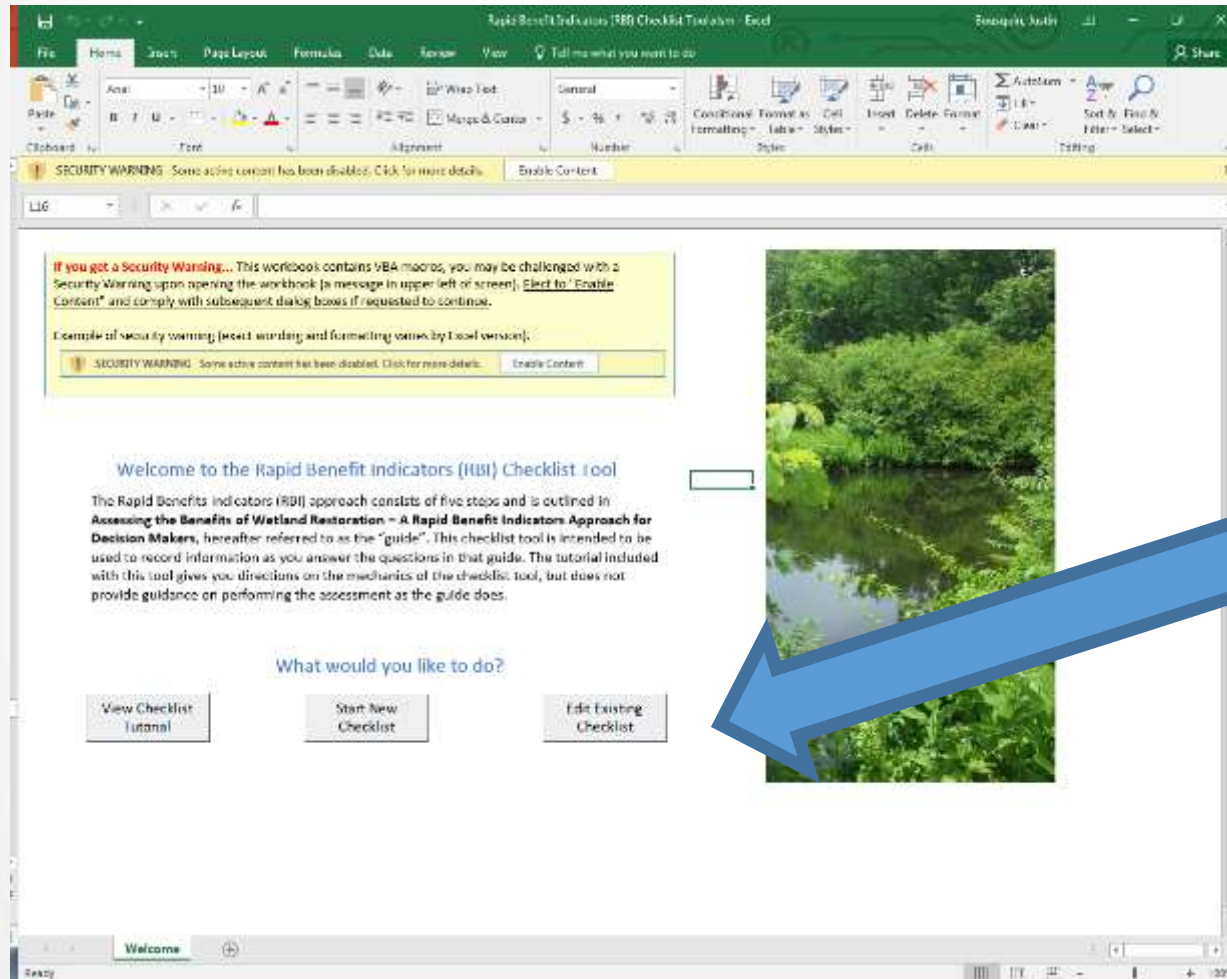
1.B What is the geographic scope for the decision?	
1.C Who are the affected members of the public or stakeholder groups?	
1.D Are there important stakeholder or public needs or wants? Are there any conflicting needs/wants?	
1.E Is a rapid assessment sufficient?	<input checked="" type="radio"/> Yes <input type="radio"/> No
1.F Number of sites	2
1.G Site names or identifiers	A B
1.H Is there any additional information important to framing the decision?	

# Checklist Tool – Getting Started



- ❖ Familiar Excel interface, but with additional macro-enabled functionality
- ❖ Which must be enabled

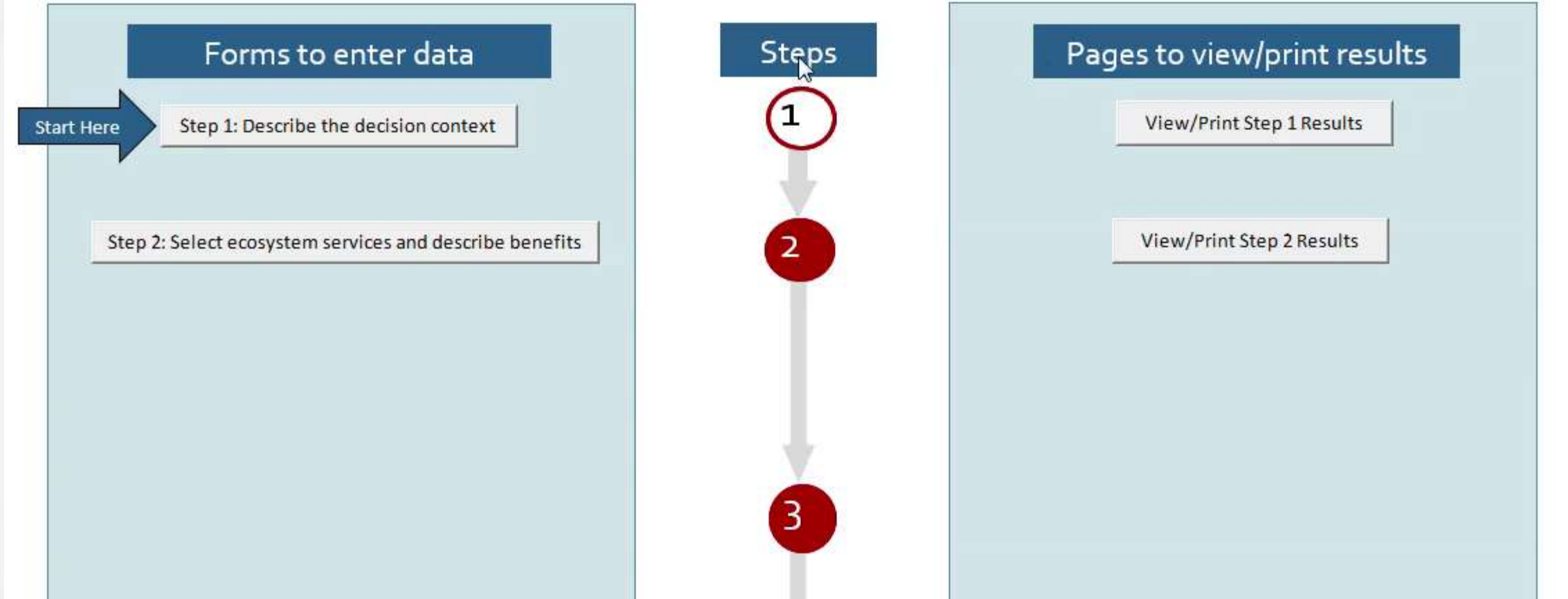




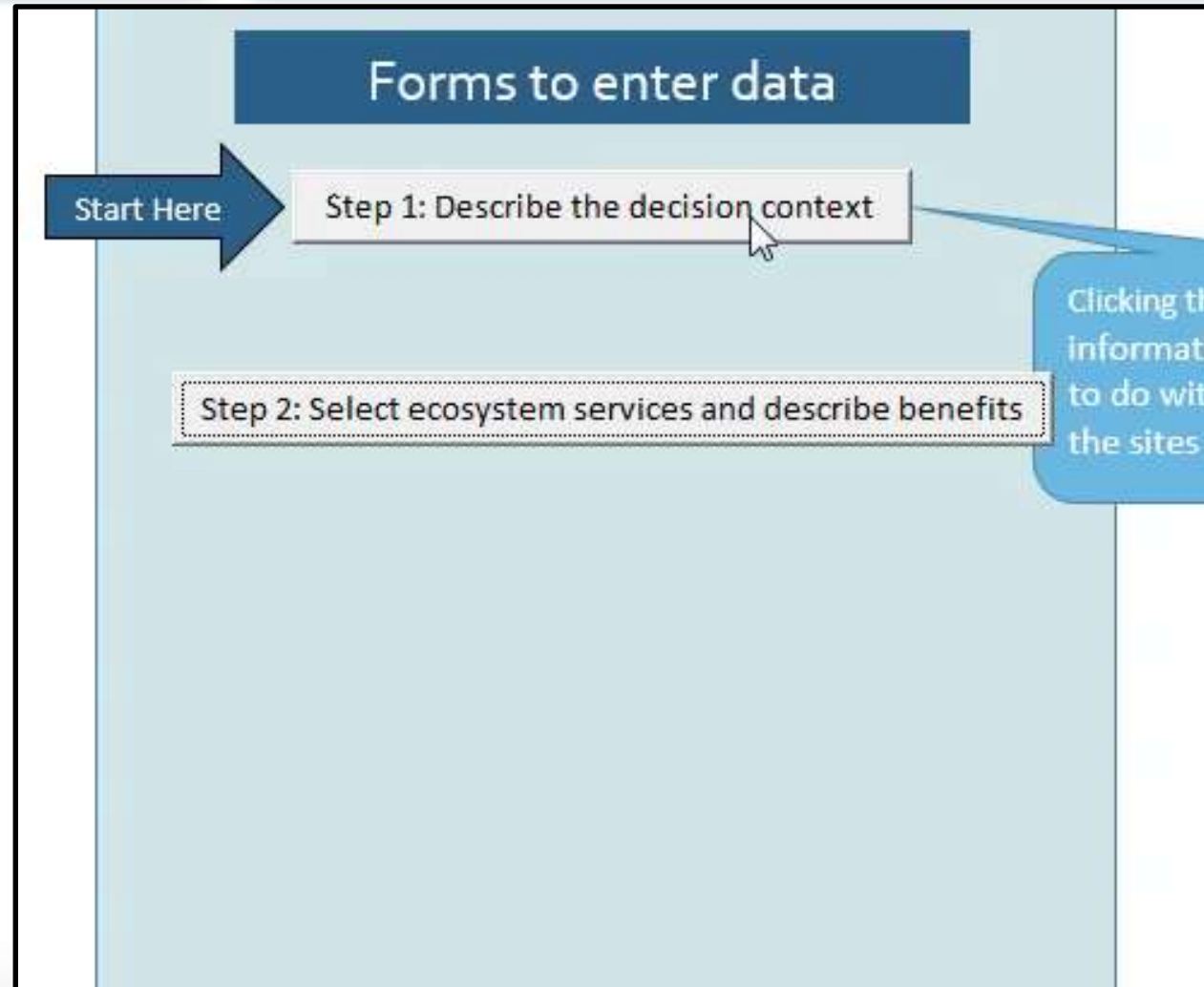
- ❖ Familiar Excel interface, but with additional macro-enabled functionality
  - ❖ Which must be enabled
- ❖ Welcome screen has navigation buttons
  - ❖ Tutorial
  - ❖ Start New Checklist
  - ❖ Edit Existing Checklist

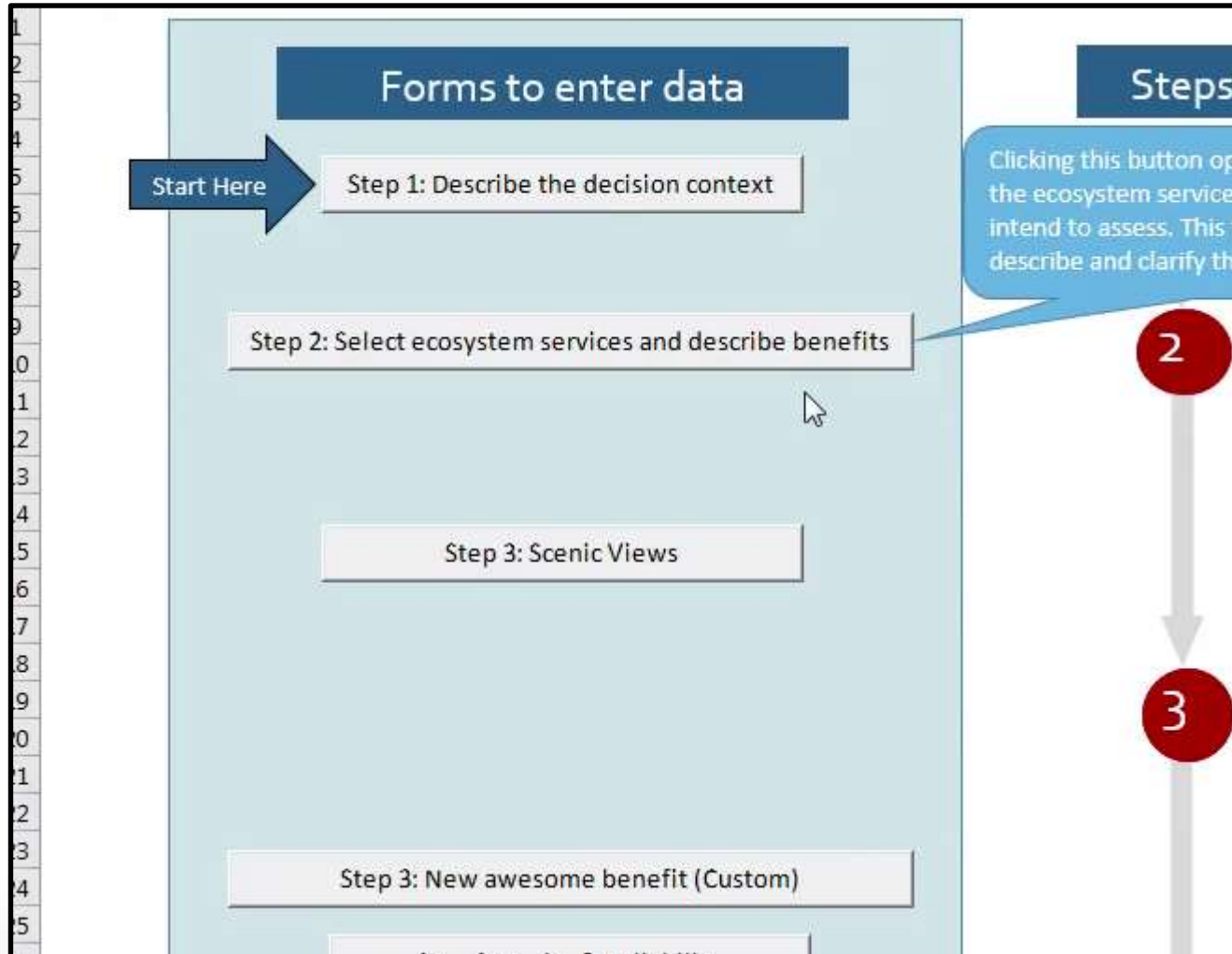


# Checklist Tool – Entering Results



# Checklist Tool – Select Benefits







Scenic Views - Site B

A. Is the site visible from homes, roads or trails?  Yes  No

B. Will site restoration improve the scenic quality of the landscape?  Yes  No

C. Scenic View benefits do not require Complementary Inputs (NA)  Yes  No  NA

1. How many people or homes within 160 feet of the site?  UNITS?

2. How many people or homes within 325 feet of the site?  UNITS?

3. Do trails or roads pass within 325 feet of the site?  Yes  No

A. 1 Does the site have features or characteristics of aesthetic interest?  Yes  No

Note the features or characteristics

B. How much wetlands and open water are within 650 feet of the site? (number or percent cover)  UNITS?

C. How many different natural land cover types are within 650 feet of the site? (number of types)

D. Does the site meet these people's visual preferences?  Yes  No

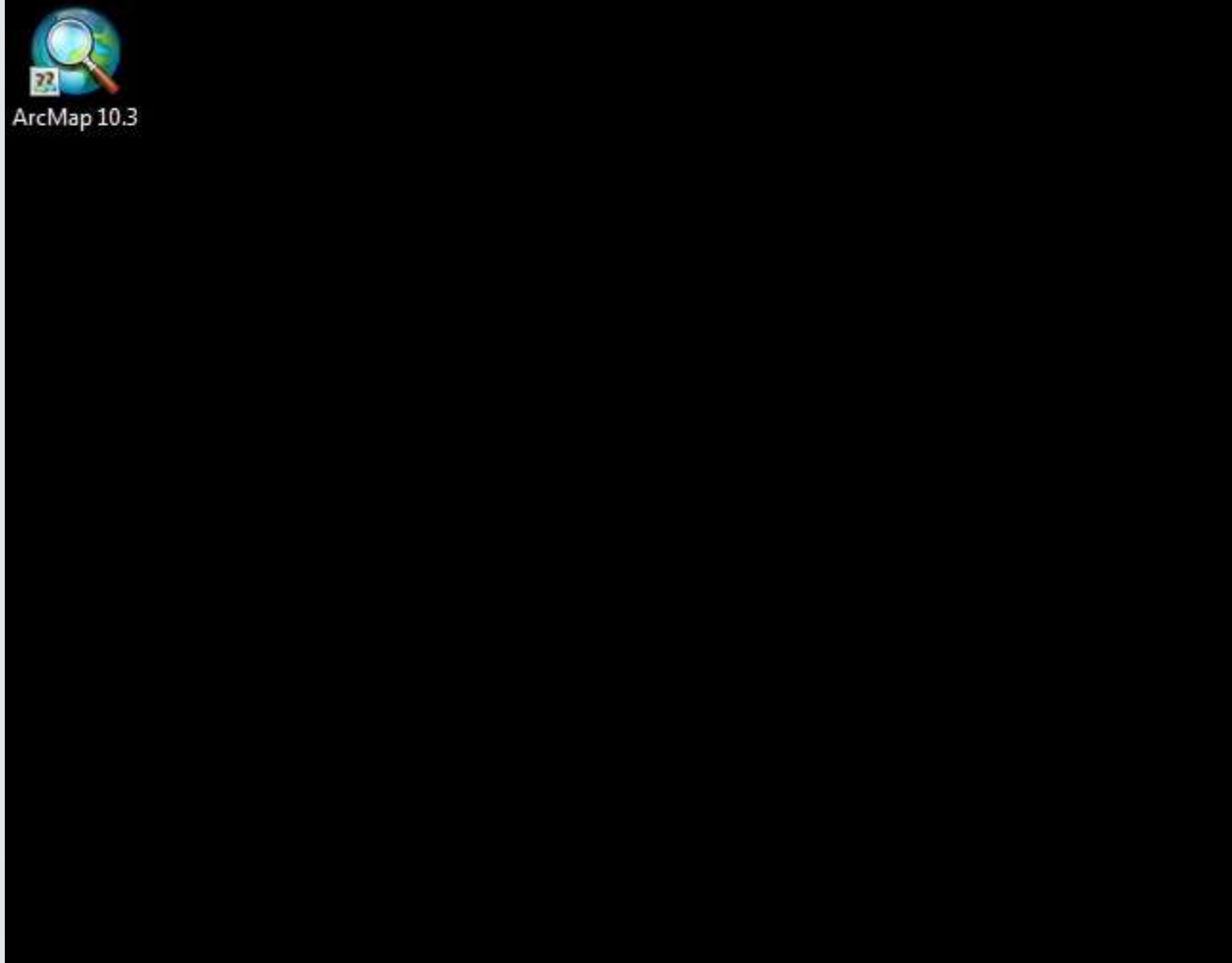


Checklists are used during the assessment to record metrics

Neither tool calculates those metrics

Both tools result in a summary report

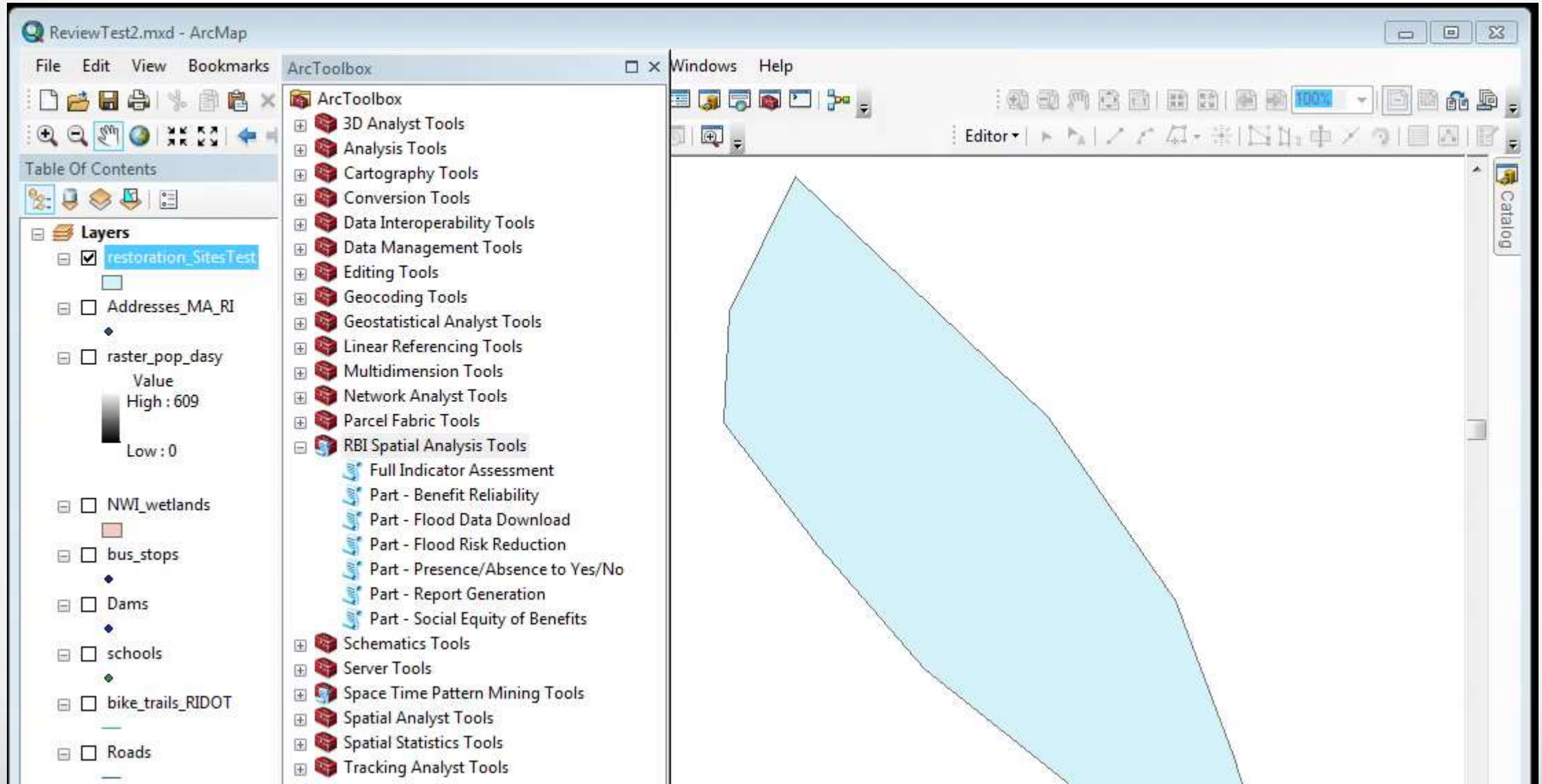
- ❖ Use the Fillable form (up to 2 sites)-
  - ❖ If your system will not support other tools
  - ❖ For printing blank forms for manual entry
- ❖ Use the Excel checklist (up to 10 sites)-
  - ❖ If your system will support it
  - ❖ For extra guidance through data gathering
  - ❖ To limit re-entry of information and color code summary



Step 1: Download (will be on GitHub):

<https://github.com/USEPA/Rapid-Benefit-Indicators-Tools>

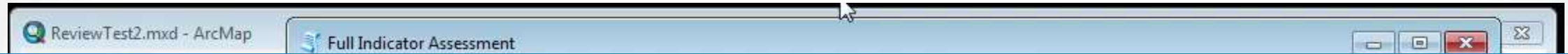
Step 2: Add to ArcToolbox



The screenshot displays the ArcMap interface with the following components:

- Table Of Contents:** Lists several layers, with **restoration\_SitesTest** selected and checked. Other layers include **Addresses\_MA\_RI**, **raster\_pop\_dasy** (with a legend showing a value range from 0 to 609), **NWI\_wetlands**, **bus\_stops**, **Dams**, **schools**, **bike\_trails\_RIDOT**, and **Roads**.
- ArcToolbox:** A tree view of tool categories. The **RBI Spatial Analysis Tools** category is expanded, showing sub-items: **Full Indicator Assessment**, **Part - Benefit Reliability**, **Part - Flood Data Download**, **Part - Flood Risk Reduction**, **Part - Presence/Absence to Yes/No**, **Part - Report Generation**, and **Part - Social Equity of Benefits**.
- Main Map Area:** Displays a large, irregularly shaped polygon filled with a light blue color.
- Interface Elements:** Includes a menu bar (File, Edit, View, Bookmarks, Windows, Help), a toolbar with various icons, and a **Catalog** pane on the right side.





Spatial Analysis Tools are a way to speed up calculating many of the indicator metrics

- ❖ Can process many sites at once
- ❖ Output color coded summary pdf

But come with extra requirements:

- ❖ Require ArcGIS
- ❖ Require spatial datasets
- ❖ Basic understanding of GIS principles



# Tool Outputs - Summarize Indicators

❖ PDF

❖ Spatial Tool

Step 4		Summarize the Indicators		Site	
Benefit	Indicators	B	A		
Flood Risk	3.2 How Many Benefit?	2.5 mi downstream of site and in flood zone			
	3.3.A Service Quality	Area of restoration site (acres)			
		Features that increase retention volume?			
	3.3.B Scarcity	Dams and levees 2.5 mi downstream?			
	3.3.C Complements	Wetlands within 5 mi (number or %)			
3.3.D Preferences	NA				
Scenic Views	3.2 How Many Benefit?	Are people worried about flood risk?			
		Number within 160 ft of site			
		Number within 325 ft of site			
	3.3.A Service Quality	Weighted number who benefit			
	3.3.B Scarcity	Are there roads or trails within 325 ft of site?			
Environmental Education	3.2 How Many Benefit?	Aesthetic features or characteristics?			
		Wetlands or water within 650 ft (number or %)			
	3.3.A Service Quality	Natural land use types within 650 ft (types)			
	3.3.B Scarcity	Will people find it aesthetically pleasing?			
	3.3.D Preferences	Education institutions within 0.25 mi of site			

Step 4		Summarize the Indicators		Site	
Benefit	Indicators	Site 1 B	Site 2 A		
Risk	3.2 How Many Benefit?	2.5 mi downstream of site and in flood zone			
		Area of restoration site (acres)			
	3.3.A Service Quality	Features that increase retention volume?			
		Dams and levees 2.5 mi downstream?			
	3.3.B Scarcity	Wetlands within 5 mi (number or %)			
3.3.C Complements	NA				
3.3.D Preferences	Are people worried about flood risk?		NA	NA	
Scenic Views	3.2 How Many Benefit?	Number within 160 ft of site		1	0
		Number within 325 ft of site		9	0
		Weighted number who benefit		3.4	0
	3.3.A Service Quality	Are there roads or trails within 325 ft of site?		Yes	No
	3.3.B Scarcity	Aesthetic features or characteristics?			
Environmental Education	3.2 How Many Benefit?	Wetlands or water within 650 ft (number or %)		7.7	35.0
		Natural land use types within 650 ft (types)		4	2
	3.3.A Service Quality	Will people find it aesthetically pleasing?			
	3.3.B Scarcity	Education institutions within 0.25 mi of site			
	3.3.D Preferences	Habitat/wildlife of education interest?			
Recreation	3.2 How Many Benefit?	Within 0.5 mi of the site (percent area)			
		Within 0.5 mi of the site (percent area)			
	3.3.A Service Quality	Educational facilities or infrastructure on site?			
	3.3.B Scarcity	Will people prefer characteristics of the site?			
	3.3.D Preferences	Number within 1/3 mi of the site			
Recreation	3.2 How Many Benefit?	Are there bike paths within 1/3 mi of site?			
		Are there bus stops within 1/3 mi of site?			
		Number within 0 to 0.5 mi of site			
	3.3.A Service Quality	Number within 0.5 to 6 mi of site			
	3.3.B Scarcity	Total area of green space around site			
Recreation	3.2 How Many Benefit?	Total area of green space around site			
		green space within 2/3 mi of site			
	3.3.A Service Quality	green space within 1 mi of site			
	3.3.B Scarcity	green space within 12 mi of site			
	3.3.C Complements	Infrastructure supporting recreation			
3.3.D Preferences	Are there additional features on site?				
Recreation	3.2 How Many Benefit?	Number within 0.2 mi of site			
		Number within 0.2 mi of site			
	3.3.A Service Quality	ENTER QUESTION			
	3.3.B Scarcity				
	3.3.C Complements				

All of the tools allow the user to view results and make tradeoffs between possible restoration sites based on benefits

Benefit	Indicators for Woonasquatucket Example	Site B	Site A	
Scenic Views	3.2 How Many Benefit?			
		Number within 160 ft of site	1	0
		Number within 160- 325 ft of site	9	0
		Weighted number who benefit	3.4	0
		Are there roads or trails within 325 ft of site?	Yes	No
3.3.A Service Quality	Aesthetic features or characteristics?	Yes		
3.3.B Scarcity	Wetlands or water within 650 ft (number or %)	7.7		
3.3.C Complements	Natural land use types within 650 ft (types)	4		
3.3.D Preferences	Will people find it aesthetically pleasing?	Yes		
Recreation	3.2 How Many Benefit?			
		ENTER QUESTION		



# Make Decision

Step 4	Summarize the Indicators		Site	
Benefit	Indicators		Site 1 B	Site 2 A
Flood Risk	3.2 How Many Benefit?	2.5 mi downstream of site and in flood zone	142	2
	3.3.A Service Quality	Area of restoration site (acres)	0.54	766
		Features that increase retention volume?		
	3.3.B Scarcity	Dams and levees 2.5 mi downstream?	Yes	Yes
		Wetlands within 2.5 mi (percent area)	8.48	12.97
			NA	NA
		Worried about flood risk?		
		Number within 160 ft of site	1	0
		Number within 160-325 ft of site	9	0
		Number who benefit	3.4	0
	Streams or trails within 325 ft of site?	Yes	No	
	Features or characteristics?			
	Water within 650 ft (percent area)	30.8	35.0	
	Use types within 650 ft (types)	4	2	
	Is it aesthetically pleasing?			
	Substitutions within 0.25 mi of site	0	2	
	State/wildlife of education interest?			
	Wetlands within 0.5 mi of the site (percent area)	4.9	12.4	
Environ Educ	3.3.B Scarcity			
	3.3.C Complements	Educational facilities or infrastructure on site?		
	3.3.D Preferences	Will people prefer characteristics of the site?		
		Number within 1/3 mi of the site	766	34
		Are there bike paths within 1/3 mi of site?	Yes	No

As the decision becomes more complex with more benefits being consider it becomes apparent how vital stakeholder input, decision context and other information are to your actual decision



## Project Team:

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- ❖ Rhode Island Coastal Resources Management Council



Photo: Woonasquatucket River Watershed Council

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# Questions?

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For more info or to download tools visit:

<https://www.epa.gov/water-research/rapid-benefit-indicators-rbi-approach>