TOOLS FOR UNDERSTANDING AND ASSESSING BLUE CARBON

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Sea&Shore SOLUTIONS

ACKNOLWEDGMENTS


Institute for Applied Ecology

OREGON EXPLORER


The Nature Conservancy

PNW Blue Carbon Working Group


OCMP
Oregon Coastal Management Program

Pew


silvestrum CLIMATE ASSOCIATES

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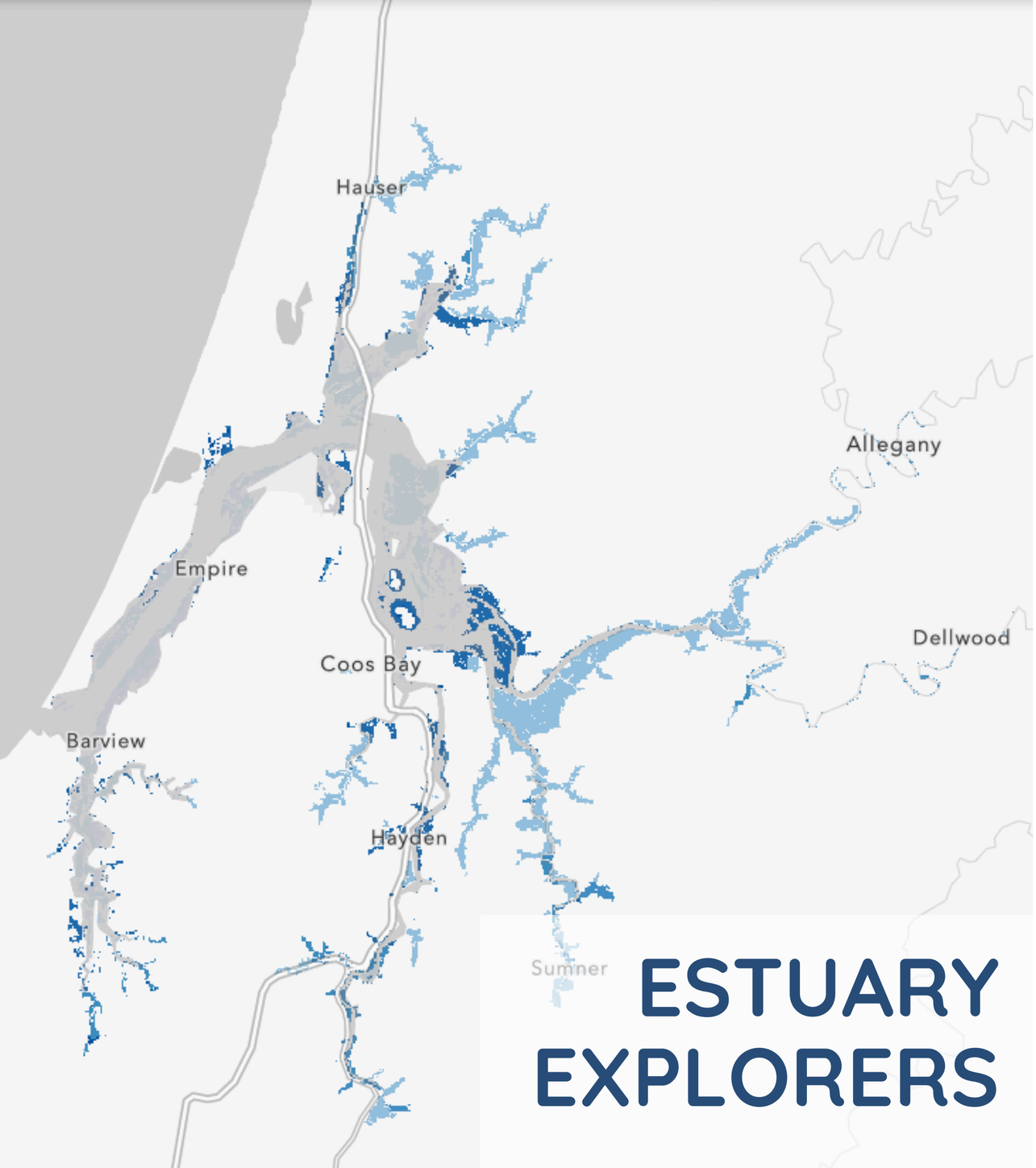

ESTUARY EXPLORERS

1. Enter a project name	
2. Select a salinity range for the project site	Range 1 0-0.5 PSU / Range 2 0.5 -5 PSU / Range 3 >5 PSU
3. Select method for calculating CO2 equivalents	Sustained Global Warming Potential *[Default]* / IPCC AR5 Global Warming Potential ☐

Physical Setting		Land Cover Category	Tidal Wetland Distur	
Location	**Hydrology**		Wetland area to be **excavated** (acres)	Wetland area to diked & draine (acres)
Tidal Wetlands	Tidal	Tidal Forested Wetland		
		Tidal Scrub-Shrub Wetland		
		Tidal Emergent Wetland		
		Seagrass		
		Tide Flat		
		Open water		
Non-Tidal	Wet	Reed canarygrass		
		Wet Forest		
		Wet Scrub-Shrub		
		Wet Grassland		
		Wet Pastureland		
	Dry	Dry Forest		
		Dry Scrub-shrub		
		Dry Grassland		
		Dry Pastureland		
		Total:	0.00	0.00

BLUE CARBON CALCULATOR

CASE STUDIES

1. **Explore** current and potential habitat types and carbon flux
2. **Assess** the impact of a restoration project
3. **Compare** restoration scenarios to identify the most effective approach

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1

EXPLORE CURRENT AND POTENTIAL HABITAT TYPES AND CARBON FLUX

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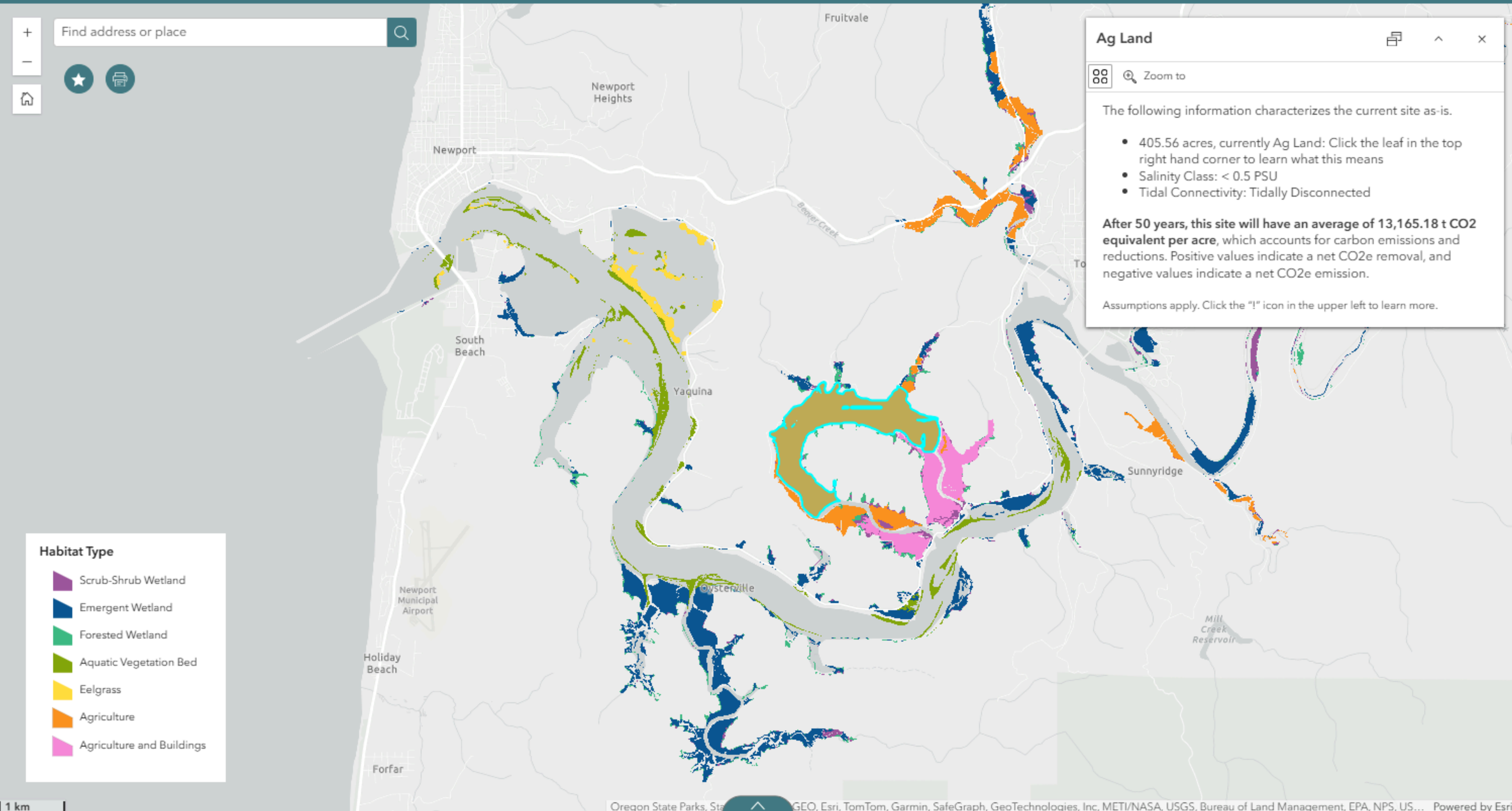
SCENARIO

No restoration is planned, but there is interest in exploring potential sites or projects. This information may identify sites for deeper assessment.

TOOL

Blue Carbon in Yaquina Estuary

Blue Carbon in Yaquina Estuary



Ag Land

Zoom to

The following information characterizes the current site as-is.

- 405.56 acres, currently Ag Land: Click the leaf in the top right hand corner to learn what this means
- Salinity Class: < 0.5 PSU
- Tidal Connectivity: Tidally Disconnected

After 50 years, this site will have an average of 13,165.18 t CO2 equivalent per acre, which accounts for carbon emissions and reductions. Positive values indicate a net CO2e removal, and negative values indicate a net CO2e emission.

Assumptions apply. Click the "!" icon in the upper left to learn more.

Blue Carbon in Yaquina Estuary

Find address or place

Fruitvale
Newport Heights
Newport
Beaver Creek
South Beach
Yaquina
Oysterville
Newport Municipal Airport
Holiday Beach
Forfar
Mill Creek Reservoir

Ag Land

Zoom to

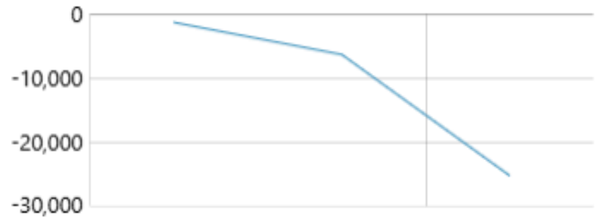
The following information characterizes the current site as-is.

- 6.70 acres, currently Ag Land
- Salinity Class: < 0.5 PSU
- Tidal Connectivity: Tidally Disconnected

After 50 years, this site will have an average of -25,244.10 t CO2 equivalent per acre, which accounts for carbon stocks and fluxes. Positive values indicate a net CO2e removal, and negative values indicate a net CO2e emission.

Carbon Flux

Carbon emissions and removals over time in CO2 equivalent. Positive values indicate a net carbon removal, while negative values indicate a net carbon emission.



Assumptions apply. Click the "!" icon in the upper left to learn more.

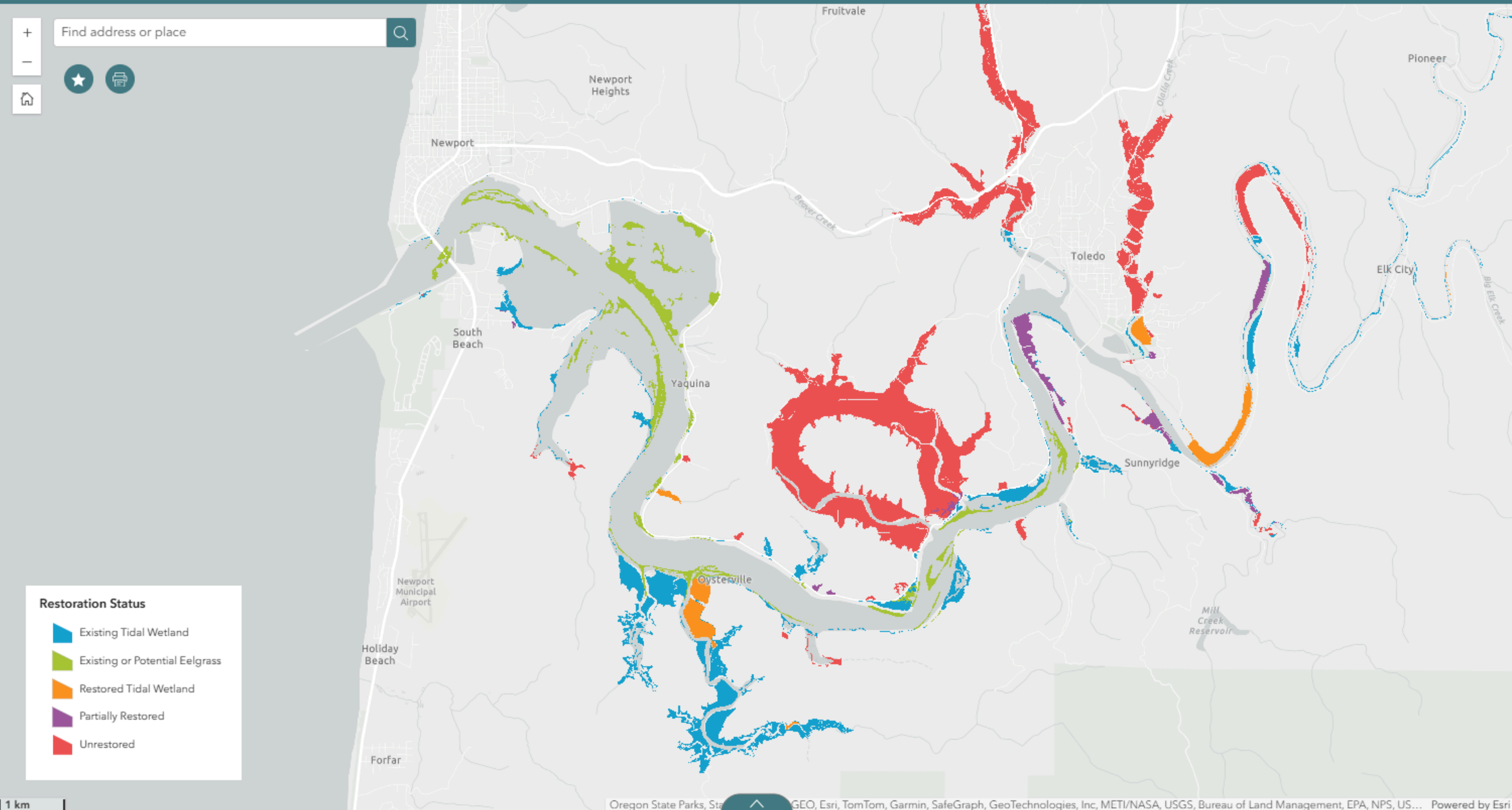
Carbon Flux

Average Carbon Flux per Acre, 50 years

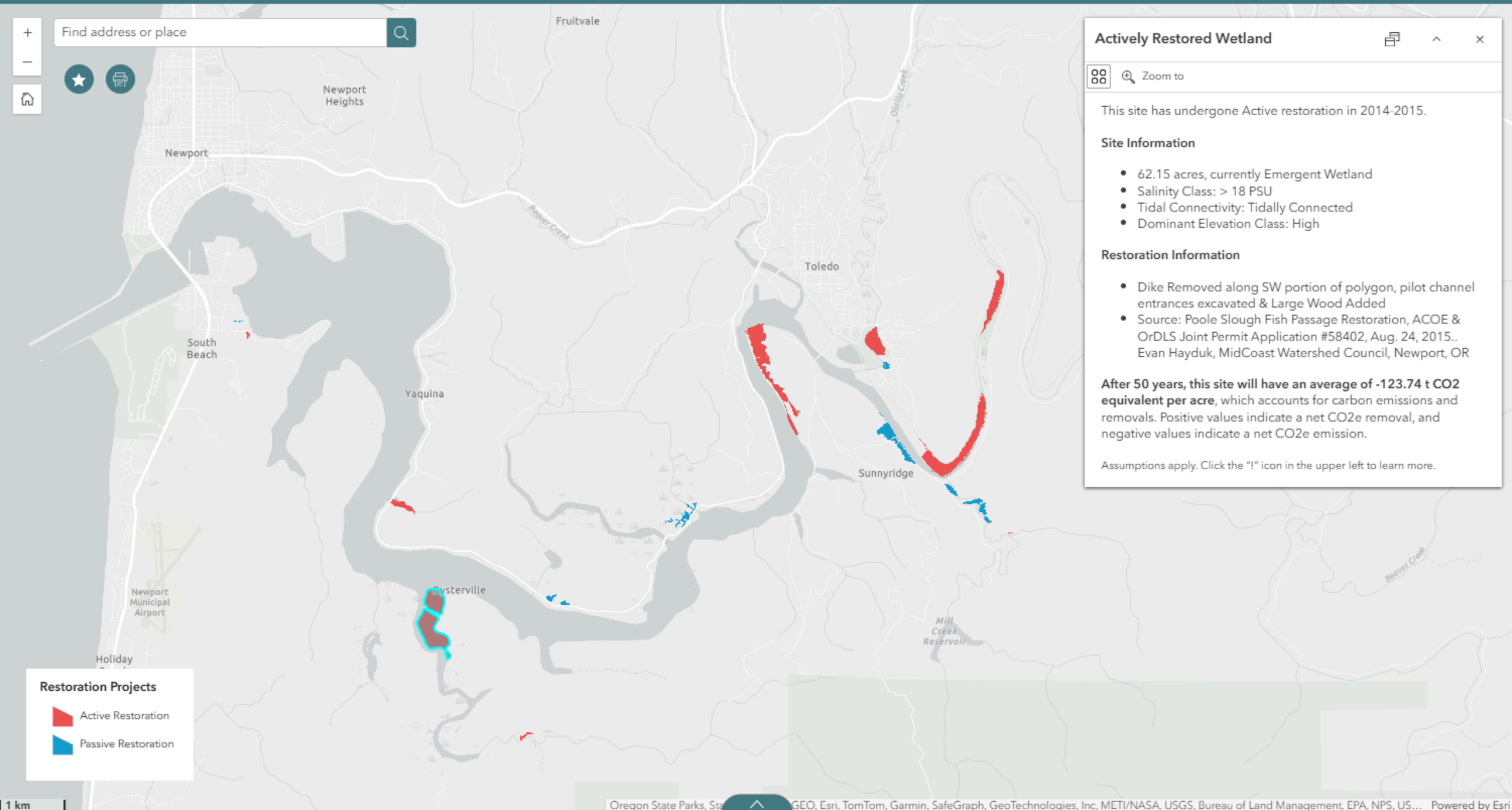
- > 10,000 t CO2e sequestered
- 0 - 10,000 t CO2e sequestered
- -10,000 - 0 t CO2e emitted
- > - 10,000 t CO2e emitted

1 km

Blue Carbon in Yaquina Estuary



Blue Carbon in Yaquina Estuary



Actively Restored Wetland

Zoom to

This site has undergone Active restoration in 2014-2015.

Site Information

- 62.15 acres, currently Emergent Wetland
- Salinity Class: > 18 PSU
- Tidal Connectivity: Tidally Connected
- Dominant Elevation Class: High

Restoration Information

- Dike Removed along SW portion of polygon, pilot channel entrances excavated & Large Wood Added
- Source: Poole Slough Fish Passage Restoration, ACOE & OrDLS Joint Permit Application #58402, Aug. 24, 2015.. Evan Hayduk, MidCoast Watershed Council, Newport, OR

After 50 years, this site will have an average of -123.74 t CO2 equivalent per acre, which accounts for carbon emissions and removals. Positive values indicate a net CO2e removal, and negative values indicate a net CO2e emission.

Assumptions apply. Click the "!" icon in the upper left to learn more.

2

ASSESS THE IMPACT OF A RESTORATION PROJECT

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SCENARIO

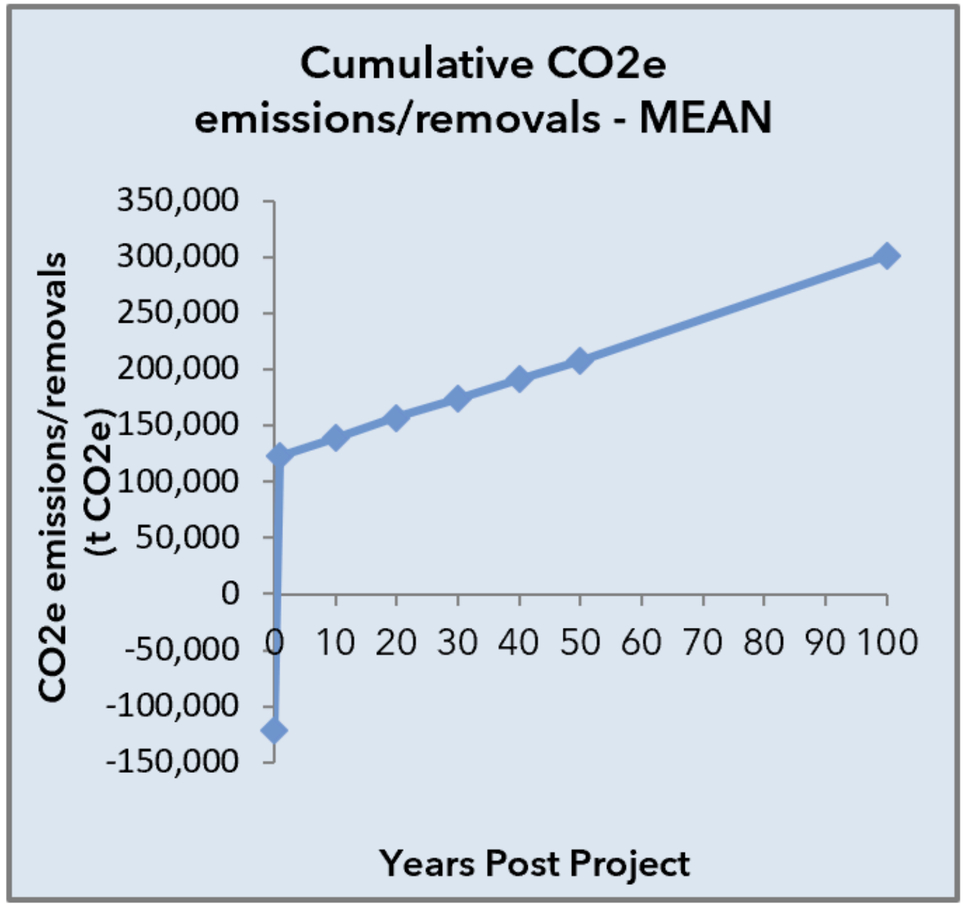
A restoration project is already planned, ongoing, or completed. Blue carbon may not be the goal of this project, but you are interested in assessing its impact on blue carbon resources. This information may inform reporting or be used to bolster the benefits of restoration.

TOOL

Blue Carbon Calculator

PROCESS

1. Enter project name, salinity range, and emissions method
2. Enter acres of wetlands (tidal & non-tidal) disturbed, restored, enhanced, and conserved
3. View results!



Example figure output

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1. Enter a project name	**Enter your project name here**
2. Select a salinity range for the project site	**Range 1** 0.0-0.5 PSU / **Range 2** 0.5 -5.0 PSU / **Range 3** >5.0 PSU
3. Select an elevation for the project site	**Below MHHW** / **Above MHHW**
4. Select method for calculating CO2 equivalents	**Sustained Global Warming Potential** *[Default]* / **IPCC AR5 Global Warming Potential** ☐

Legend

Grey cell - data cannot be entered in this cell

Red Indicator - hover over these cells to see relevant guidance or reference infromation

Physical Setting			Land Management Actions							
			Tidal Wetland Disturbance			Tidal Wetlands Restoration/ Enhancement/ Conservation				
						Restoration		Enhancement		Conservation
Location	Hydrology	Land Cover Category	Wetland area to be excavated (acres)	Wetland area to be diked & drained (acres)	Wetland area to be filled (acres)	*Area prior to project* (acres)	*Area post project* (acres)	*Area prior to project* (acres)	*Area post project* (acres)	*Area conserved* (acres)
Tidal Wetlands	Tidal	Tidal Forested Wetland								
		Tidal Scrub-Shrub Wetland								
		Tidal Emergent Wetland								
		Seagrass								
		Tide Flat								
		Open water								
Non-Tidal	Wet	Reed canarygrass								
		Wet Forest								
		Wet Scrub-Shrub								
		Wet Pastureland								
		Wet Cropland								
	Dry	Dry Forest								
		Dry Scrub-shrub								
		Dry Pastureland								
		Dry Cropland								
Total:			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: Due to current data limitations, this calculator is not yet able to quantify emissions changes associated with enhancing degraded tidal wetlands.

1. Enter a project name	**Scenario 2**
2. Select a salinity range for the project site	**Range 1** 0.0-0.5 PSU; **Range 2** 0.5 -5.0 PSU; **Range 3** >5.0 PSU
3. Select an elevation for the project site	**Below MHHW**; **Above MHHW**
4. Select method for calculating CO2 equivalents	**Sustained Global Warming Potential** *[Default]*; **IPCC AR5 Global Warming Potential** ☐

Legend

Grey cell - data cannot be entered in this cell

Red Indicator - hover over these cells to see relevant guidance or reference infromation

Physical Setting			Land Management Actions							
			Tidal Wetland Disturbance			Tidal Wetlands Restoration/ Enhancement/ Conservation				
						Restoration		Enhancement		Conservation
Location	Hydrology	Land Cover Category	Wetland area to be excavated (acres)	Wetland area to be diked & drained (acres)	Wetland area to be filled (acres)	*Area prior to project* (acres)	*Area post project* (acres)	*Area prior to project* (acres)	*Area post project* (acres)	*Area conserved* (acres)
Tidal Wetlands	Tidal	Tidal Forested Wetland	0	0	0		90		20	0
		Tidal Scrub-Shrub Wetland	0	0	0		30	0	0	0
		Tidal Emergent Wetland	0	0	0		0	0		0
		Seagrass	0	0	0		0		0	0
		Tide Flat	0	0	0		0	0		0
		Open water		0	0		0			0
Non-Tidal	Wet	Reed canarygrass				15		*Note: Due to current data limitations, this calculator is not yet able to quantify emissions changes associated with enhancing degraded tidal wetlands.*		
		Wet Forest				0				
		Wet Scrub-Shrub				0				
		Wet Pastureland				75				
		Wet Cropland				0				
	Dry	Dry Forest				0				
		Dry Scrub-shrub				0				
		Dry Pastureland				30				
		Dry Cropland				0				
Total:			**0.00**	**0.00**	**0.00**	**120.00**	**120.00**	**0.00**	**20.00**	**0.00**

Total Cumulative Emissions/Removals for:

Scenario 2 - Salinity Range 0.5-5 PSU - Elevation Above MHHW

See Cumulative Emissions/Removals by Land Management Action below

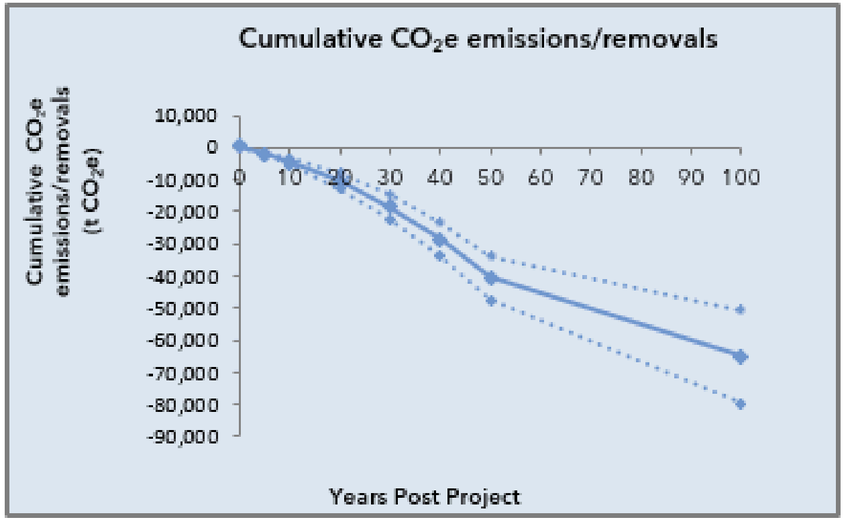
	Years Post Project							
	0	5	10	20	30	40	50	100
All Management Activities								
Cumulative CO_2e emissions/removals - MIN	71	-1,668	-3,380	-8,038	-14,698	-23,291	-33,785	-50,699
Cumulative CO_2e emissions/removals - MEAN	**285**	**-2,159**	**-4,498**	**-10,411**	**-18,586**	**-28,694**	**-40,702**	**-65,192**
Cumulative CO_2e emissions/removals - MAX	498	-2,610	-5,577	-12,744	-22,435	-34,057	-47,581	-79,646
Cumulative CH_4 emissions - MIN	-512	16	33	66	351	637	923	2,632
Cumulative CH_4 emissions - MEAN	**611**	**57**	**115**	**229**	**1,213**	**2,196**	**3,180**	**9,058**
Cumulative CH_4 emissions - MAX	1,817	80,271	160,541	321,083	323,905	326,728	329,551	346,440
Total GHG emissions/removals - MIN	-441	-1,652	-3,347	-7,973	-14,347	-22,653	-32,861	-48,067
Total GHG emissions/removals - MEAN	**896**	**-2,101**	**-4,383**	**-10,181**	**-17,373**	**-26,497**	**-37,523**	**-56,134**
Total GHG emissions/removals - MAX	2,315	77,660	154,964	308,338	301,471	292,671	281,970	266,794

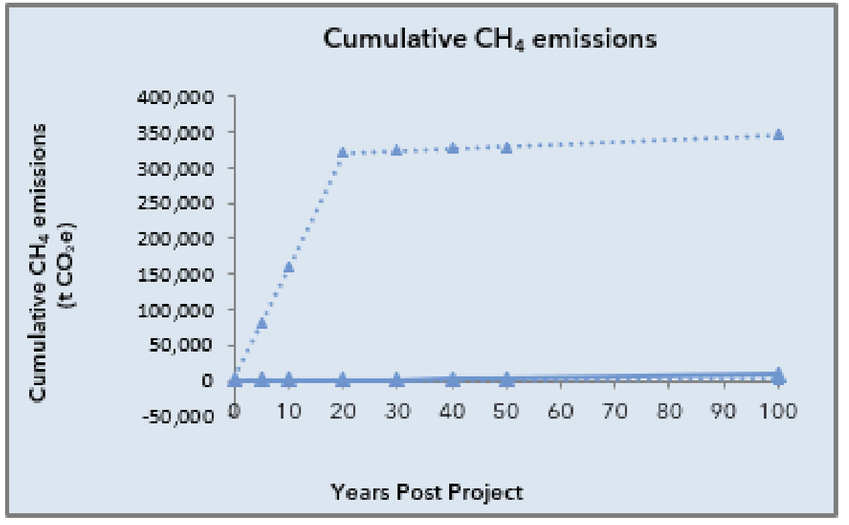
Total Annual Emissions/Removals for:

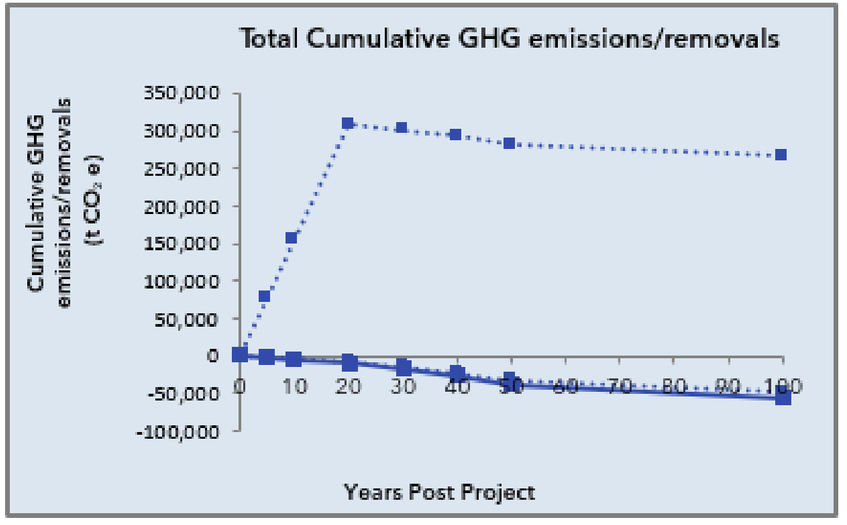
Scenario 2 - Salinity Range 0.5-5 PSU - Elevation Above MHHW

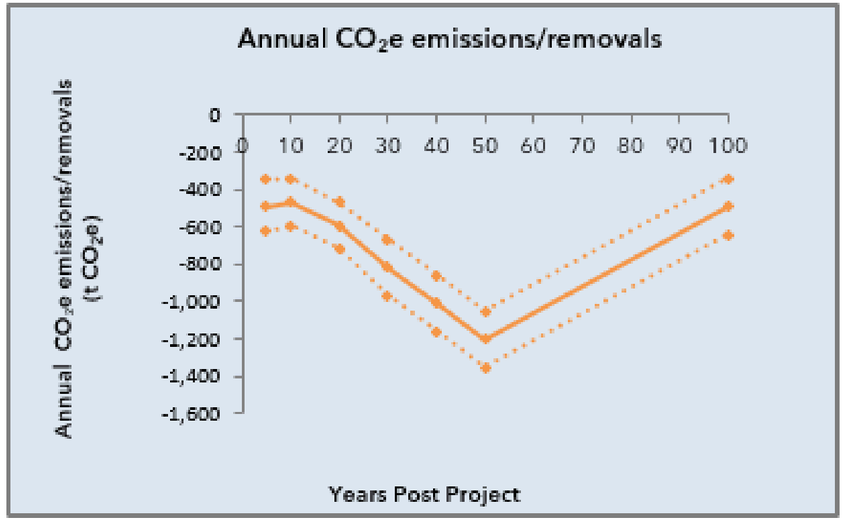
	Years Post Project							
	0	5	10	20	30	40	50	100
All Management Activities								
Annual CO2e emissions/removals - MIN		-348	-342	-466	-666	-859	-1,049	-338
Annual CO2e emissions/removals - MEAN		-489	-468	-591	-818	-1,011	-1,201	-490
Annual CO2e emissions/removals - MAX		-622	-593	-717	-969	-1,162	-1,352	-641
Annual CH4 emissions - MIN		106	3	3	29	29	29	34
Annual CH4 emissions - MEAN		-111	11	11	98	98	98	118
Annual CH4 emissions - MAX		15,691	16,054	16,054	282	282	282	338
Total Annual GHG emissions/removals - MIN		-242	-339	-463	-637	-831	-1,021	-304
Total Annual GHG emissions/removals - MEAN		-599	-456	-580	-719	-912	-1,103	-372
Total Annual GHG emissions/removals - MAX		15,069	15,461	15,337	-687	-880	-1,070	-304

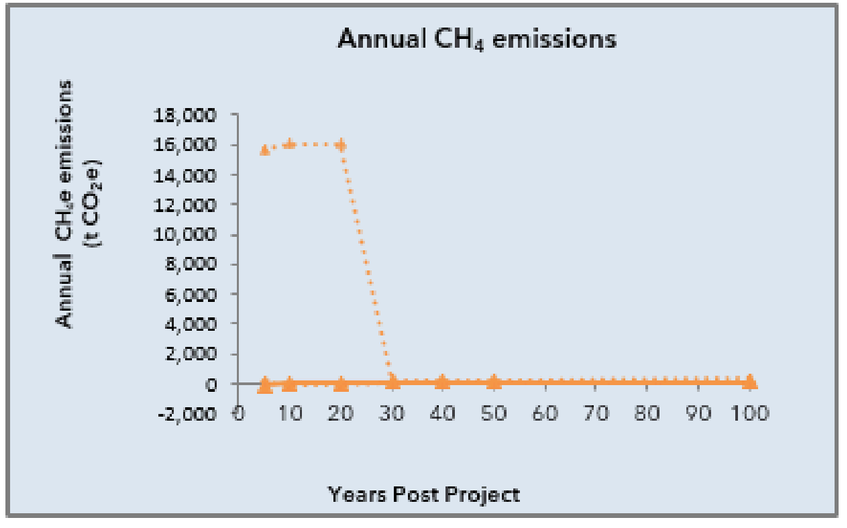
Negative value = net carbon removals

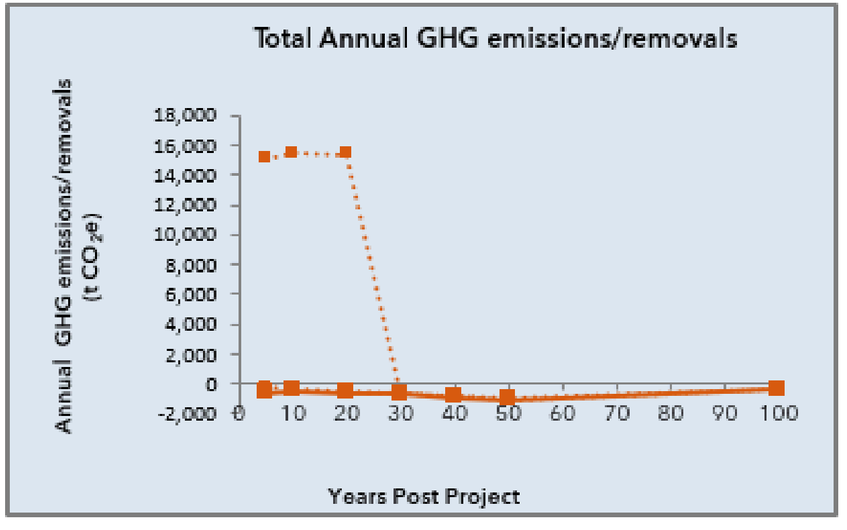

Cumulative CO_2e emissions/removals
Cumulative CO_2e emissions/removals ($t\ CO_2e$)
10,000
0
-10,000
-20,000
-30,000
-40,000
-50,000
-60,000
-70,000
-80,000
-90,000
0 10 20 30 40 50 60 70 80 90 100
Years Post Project

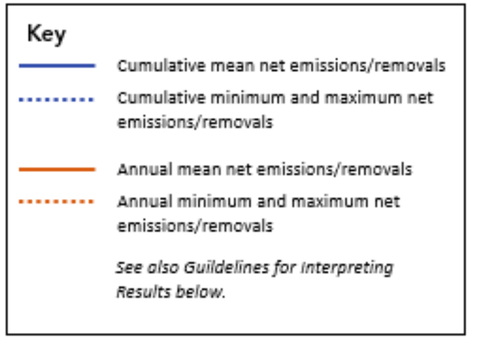

Cumulative CH_4 emissions
Cumulative CH_4 emissions ($t\ CO_2e$)
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
-50,000
0 10 20 30 40 50 60 70 80 90 100
Years Post Project


Total Cumulative GHG emissions/removals
Cumulative GHG emissions/removals ($t\ CO_2e$)
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
-50,000
-100,000
0 10 20 30 40 50 60 70 80 90 100
Years Post Project


Annual CO_2e emissions/removals
Annual CO_2e emissions/removals ($t\ CO_2e$)
0
-200
-400
-600
-800
-1,000
-1,200
-1,400
-1,600
0 10 20 30 40 50 60 70 80 90 100
Years Post Project


Annual CH_4 emissions
Annual CH_4e emissions ($t\ CO_2e$)
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
-2,000
0 10 20 30 40 50 60 70 80 90 100
Years Post Project


Total Annual GHG emissions/removals
Annual GHG emissions/removals ($t\ CO_2e$)
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
-2,000
0 10 20 30 40 50 60 70 80 90 100
Years Post Project


Key
Cumulative mean net emissions/removals
Cumulative minimum and maximum net emissions/removals
Annual mean net emissions/removals
Annual minimum and maximum net emissions/removals
See also Guildelines for Interpreting Results below.

Welcome to the PNW Blue Carbon Calculator

The Pacific Northwest Blue Carbon Calculator enables users to calculate estimates of greenhouse gas (GHG) emissions and removals over 1 to 100-year timeframes resulting from specific land management actions, including:

- Tidal wetland restoration, conservation, and enhancement
- Tidal wetland excavation and filling
- Tidal wetland diking and draining
- Tidal wetland impoundment

Results from the calculator are designed to be used by restoration practitioners, land managers and others to inform restoration, conservation and enhancement project siting and design; by permitters to evaluate emissions associated with coastal shoreline development project options; and by coastal planners and policymakers to help track progress towards achieving local and state emissions goals. The calculator relies on blue carbon data mainly from Oregon and Washington estuaries, but can be used with caution (provisionally?) for projects in northern California and southern British Columbia estuaries.

Step 1
Step 2
Step 3
Step 4
Step 5
Step 6
Step 7
Results

What types of habitat(s) are present at the project site?

The calculator can account for **Tidal Wetlands** and **Non-Tidal** habitats.

- **Tidal wetlands** include a variety of wetland types which are tidally influenced .
- **Non-tidal** habitats are defined as an area inside an estuarine footprint, or in the upland watershed of an estuary, but that are not influenced by regular tidal inundation.

Select Tidal or Non-tidal Wetlands, or both

Please make your initial selection(s) and fill in the options requested:

Tidal wetlands | Non-tidal wetlands

Tidal wetlands

Non-tidal wetlands

3

COMPARE RESTORATION SCENARIOS TO IDENTIFY THE MOST EFFECTIVE APPROACH

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SCENARIO

You are planning a restoration project, but are torn between a couple of different sites. A comparison of sites is needed to determine the best approach for your goals.

TOOL

Blue Carbon in Yaquina Estuary & Blue Carbon Calculator

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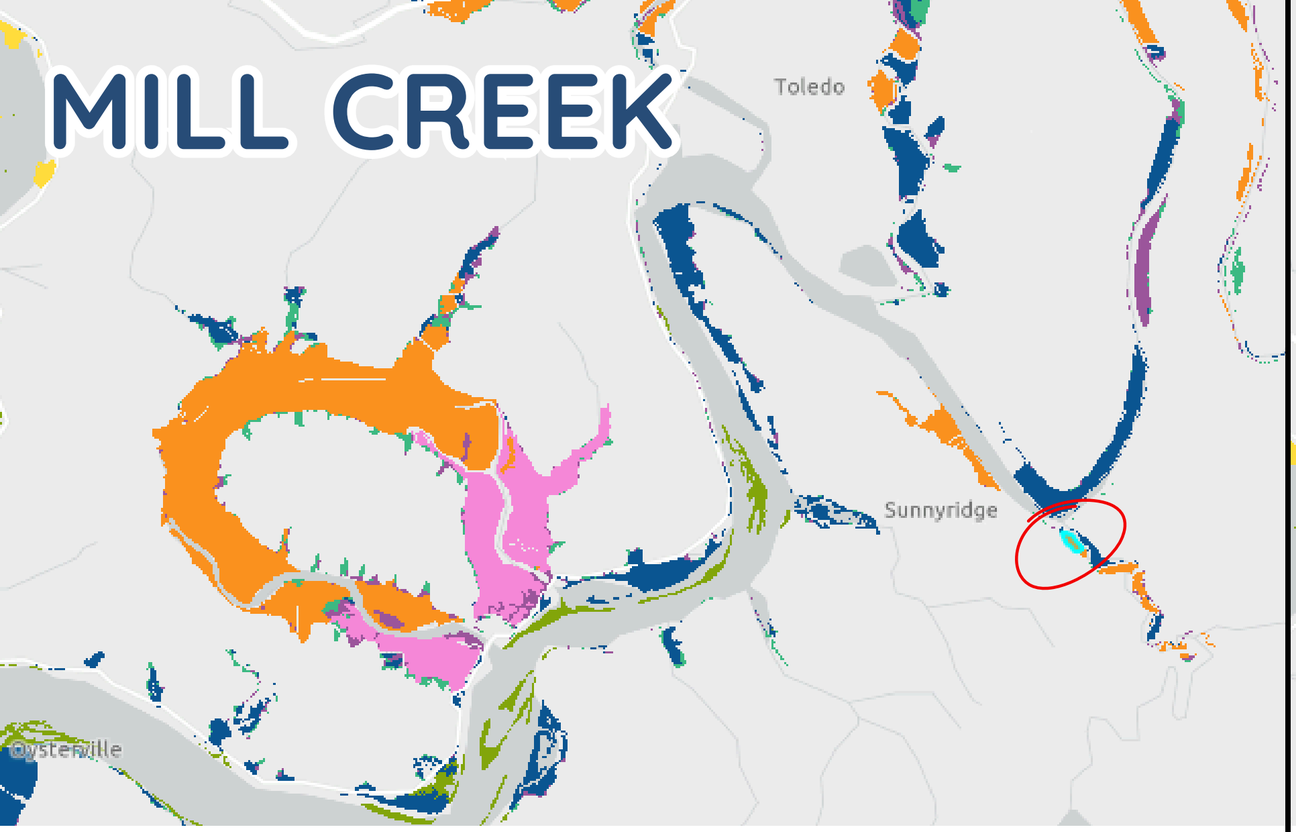
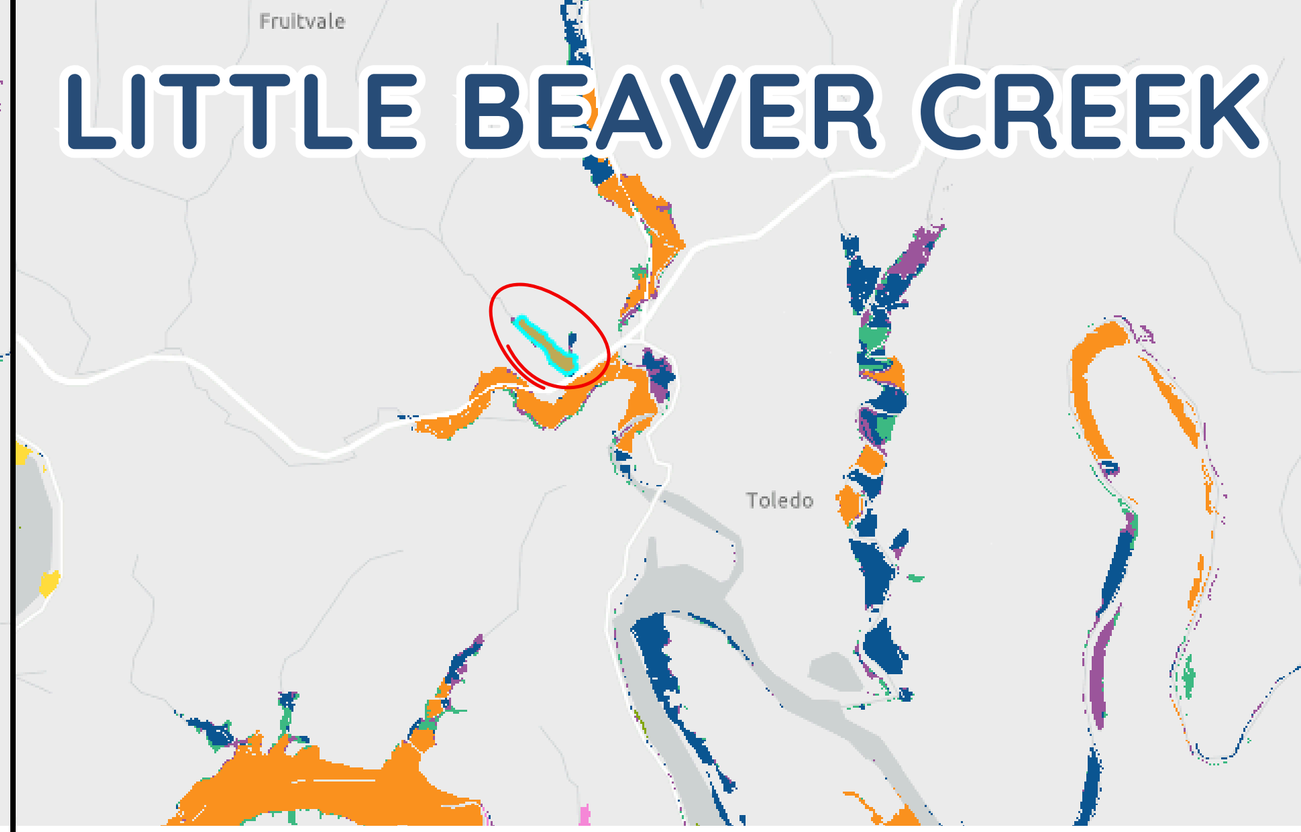
MILL CREEK



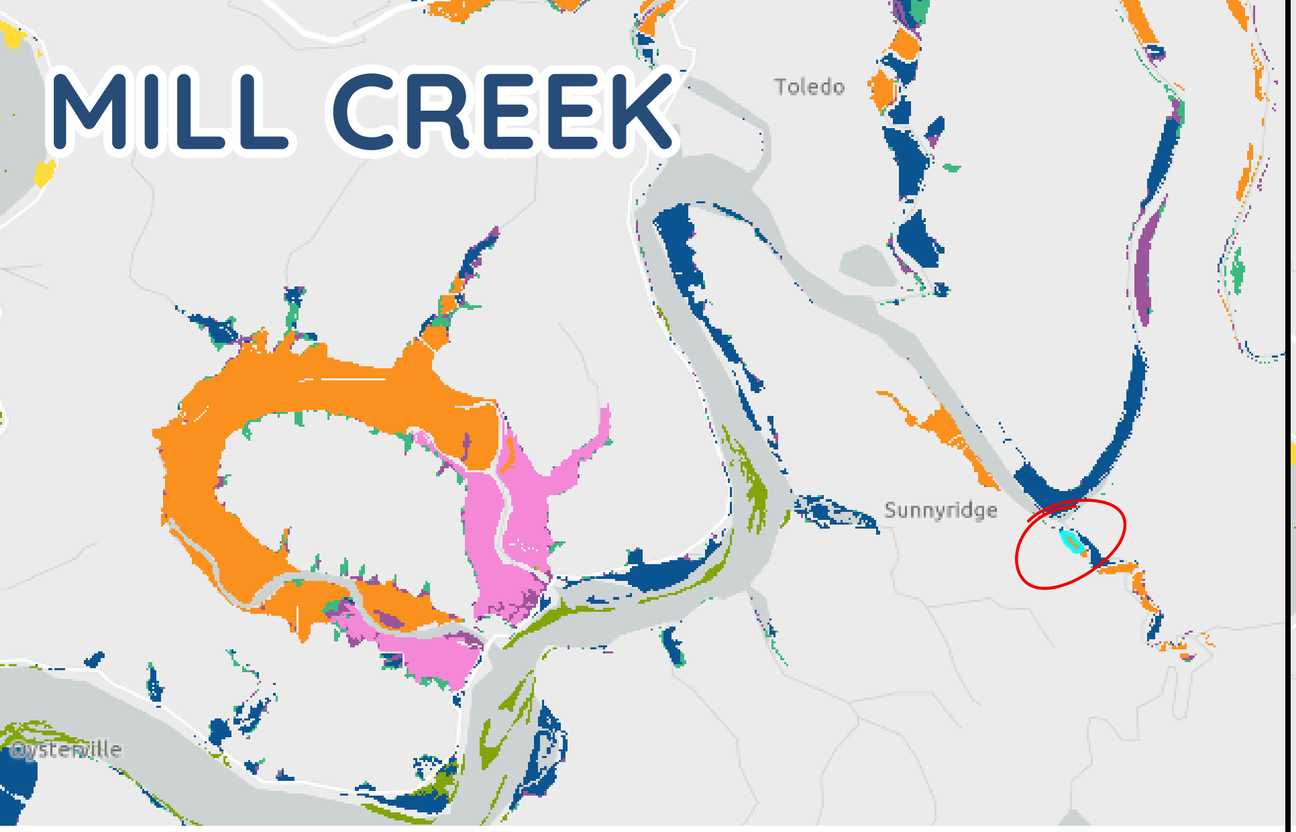
- Currently agricultural land
- Salinity Class: 5 - 18 PSU
- Dominant Elevation Class: High
- Tidally Connected
- Partially Restored
- Without restoration, would remove 123.74 t CO2/acre in 50 years

LITTLE BEAVER CREEK



- Currently agricultural land
- Salinity Class: <0.5 PSU
- Dominant Elevation Class: High
- Tidally Disconnected
- Unrestored
- Without restoration, would remove 178.22 t CO2/acre in 50 years

MILL CREEK

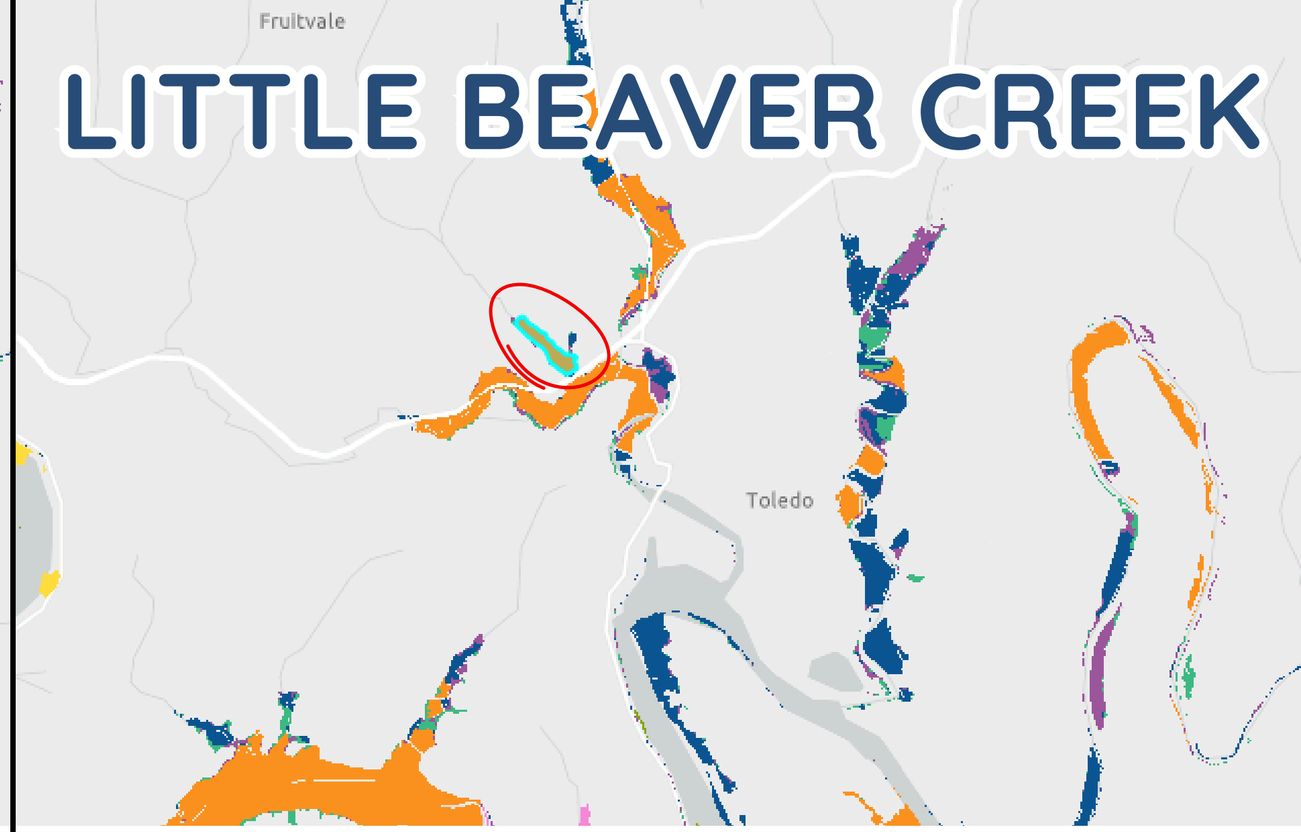


2.8 acres of wet cropland

↓

2.8 acres of emergent wetland

LITTLE BEAVER CREEK



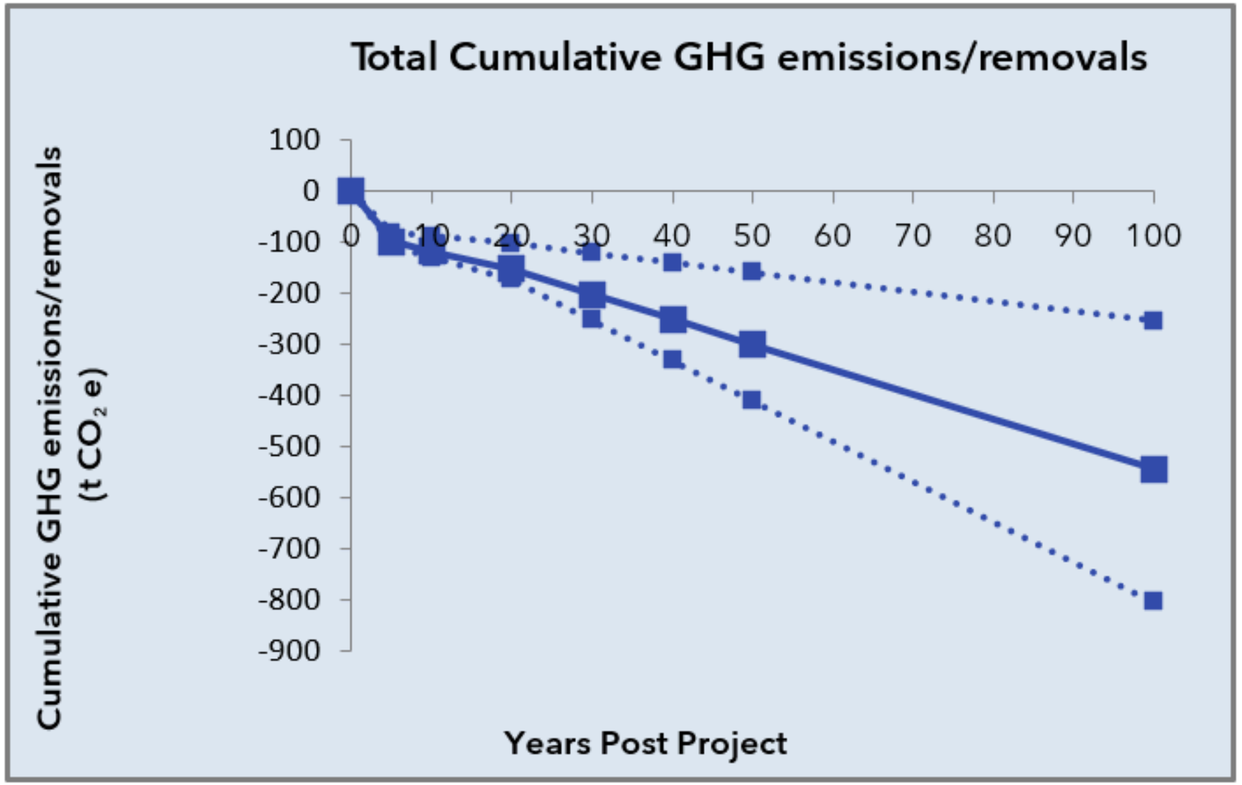
14.71 acres of dry pastureland

↓

10 acres of Tidal Forested Wetland &

4.71 acres of Tidal Scrub-Shrub Wetland

MILL CREEK



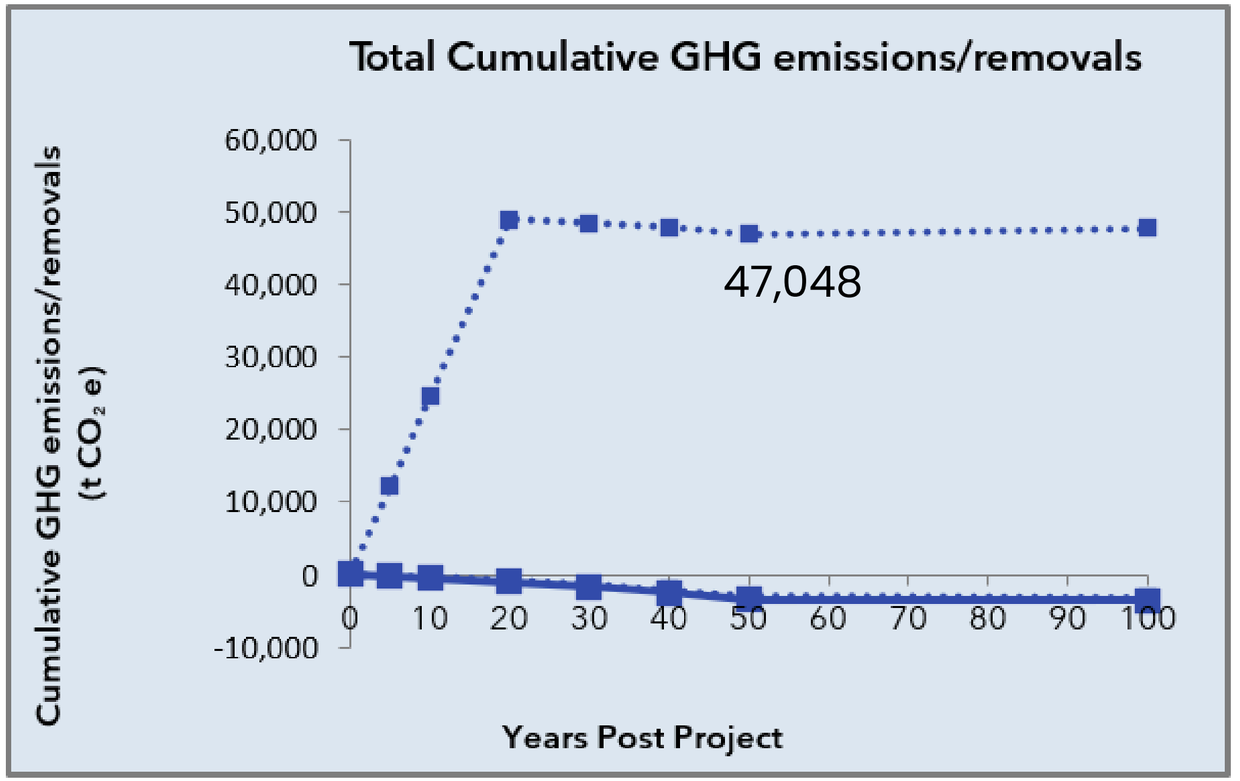
50 years post project...

- Cumulative Removal: 410 t CO2e

50 years without restoration...

- Cumulative Removal: 346 t CO2e

LITTLE BEAVER CREEK



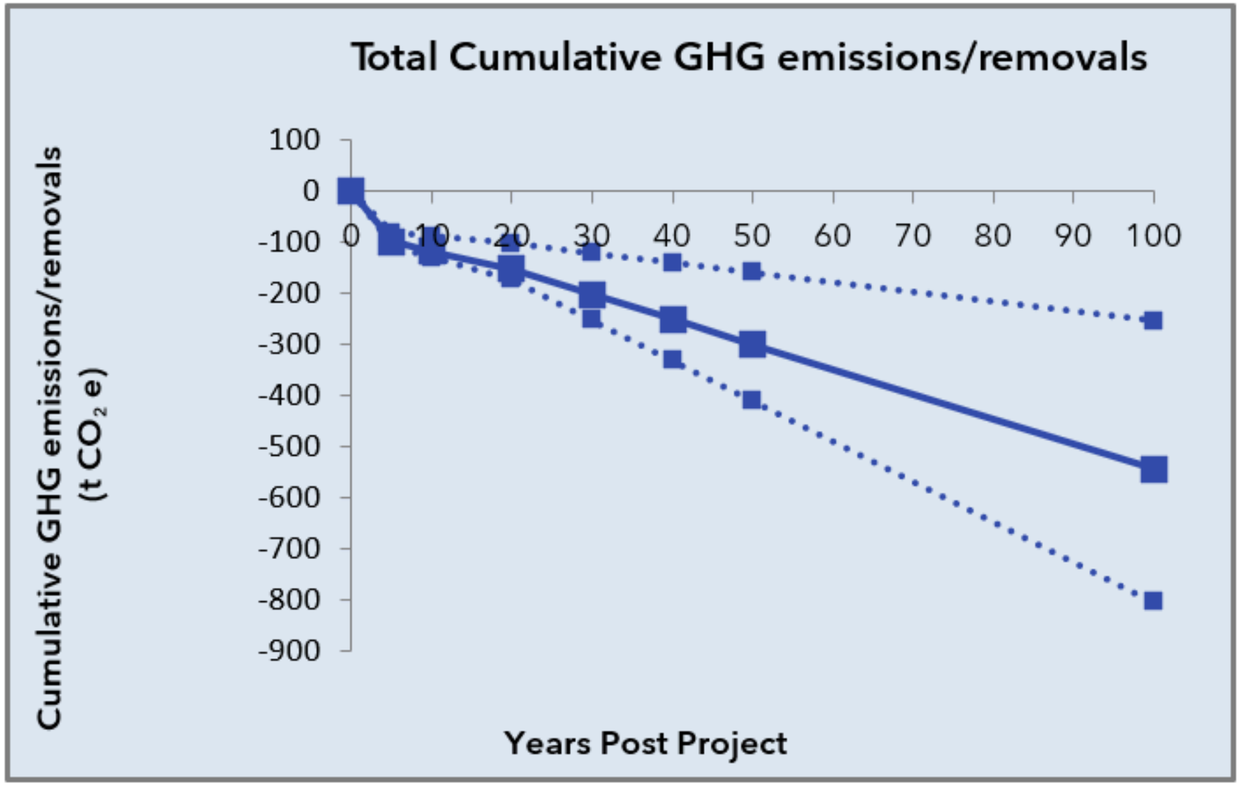
50 years post project...

- Cumulative Removal: 3,441 t CO2e

50 years without restoration...

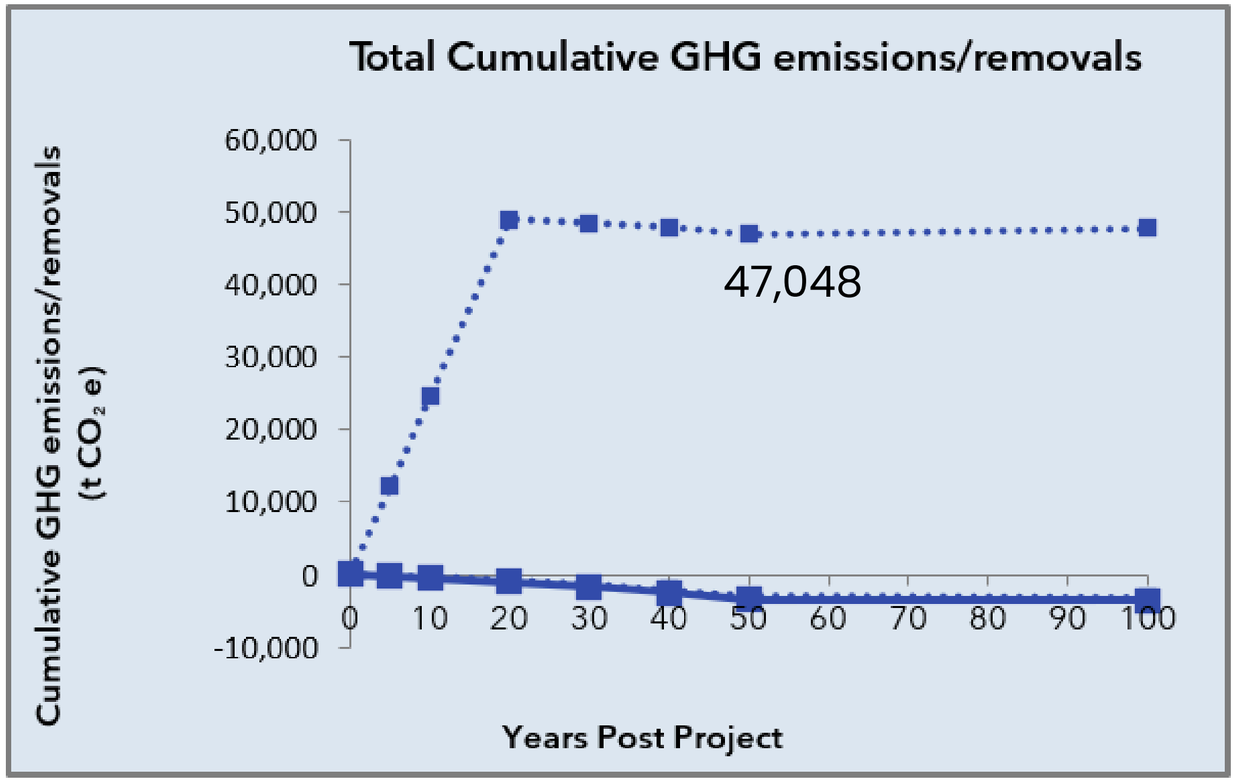
- Cumulative Removal: 2,622 t CO2e

MILL CREEK



Increase sequestration by 22.86 t CO2/acre

LITTLE BEAVER CREEK



Increase sequestration by 55.68 t CO2/acre

Blue Carbon
in Yaquina
Estuary

Blue Carbon Calculator
Coming Soon!

Sea & Shore
SOLUTIONS

THANK YOU

adrian@sea-shoresolutions.com