# The Vermont Functioning Floodplain Initiative (FFI)

**Restoring floodplain function**

**in Vermont's Lake Champlain Basin**

August 2, 2022

First National
STREAM RESTORATION
Conference

**https://dec.vermont.gov/rivers/ffi**

# Project Team

## Government

VERMONT
AGENCY OF NATURAL RESOURCES
Department of Environmental Conservation

VERMONT RIVERS PROGRAM

VERMONT FISH & WILDLIFE

## Consultants

SLR

Fitzgerald Environmental Associates, LLC

Fluvial Matters, LLC

South Mountain Research & Consulting

STONE ENVIRONMENTAL

## Non-Profit

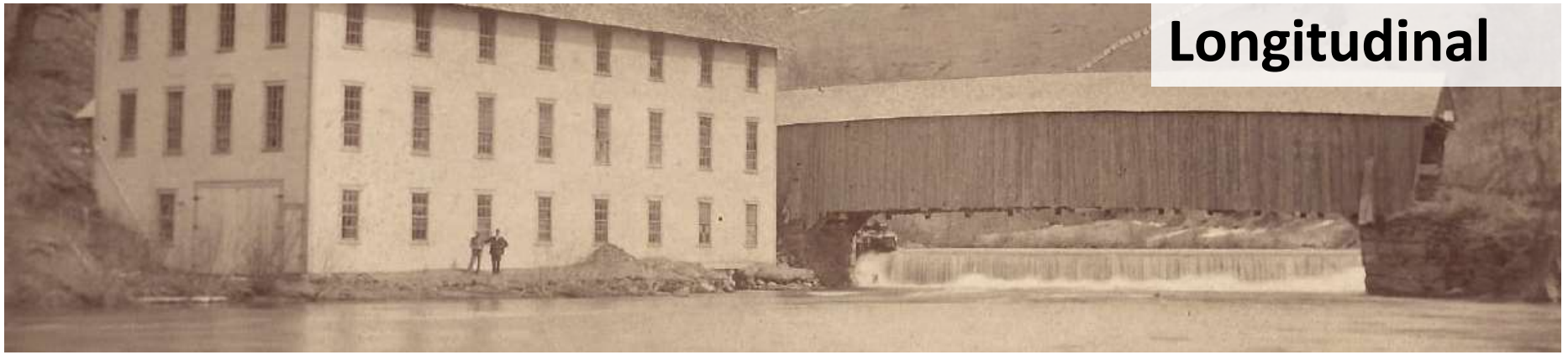
The Nature Conservancy

## Academia

The UNIVERSITY of VERMONT

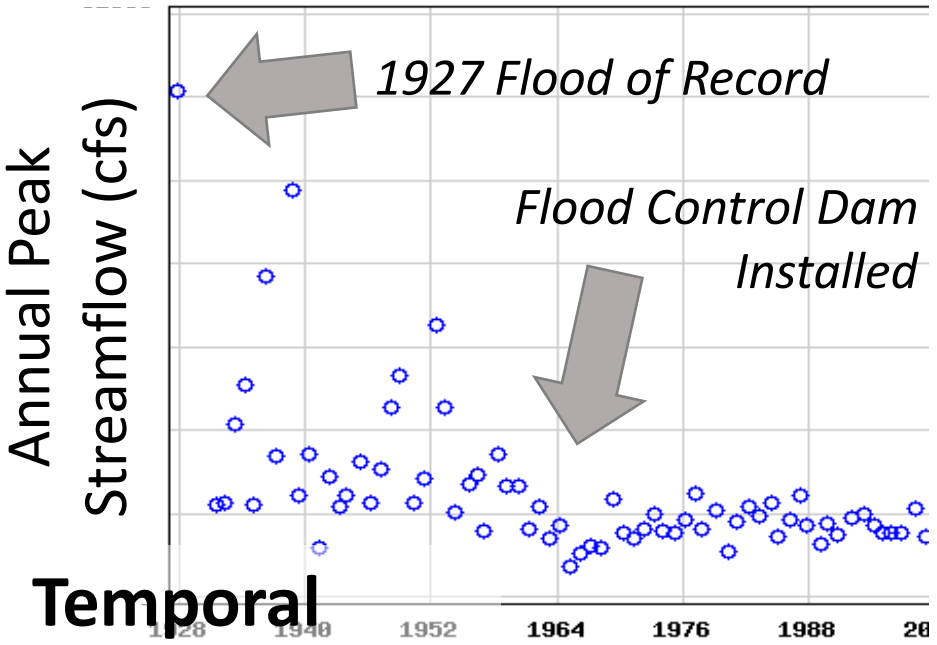
# Historic land uses have disconnected rivers and floodplains

Lateral



Longitudinal


Vertical




Temporal

# Disconnection has increased sediment/nutrient export

*LCBP*

*Mansfield Heliflight*

# Early Floodplain Reconnection Example

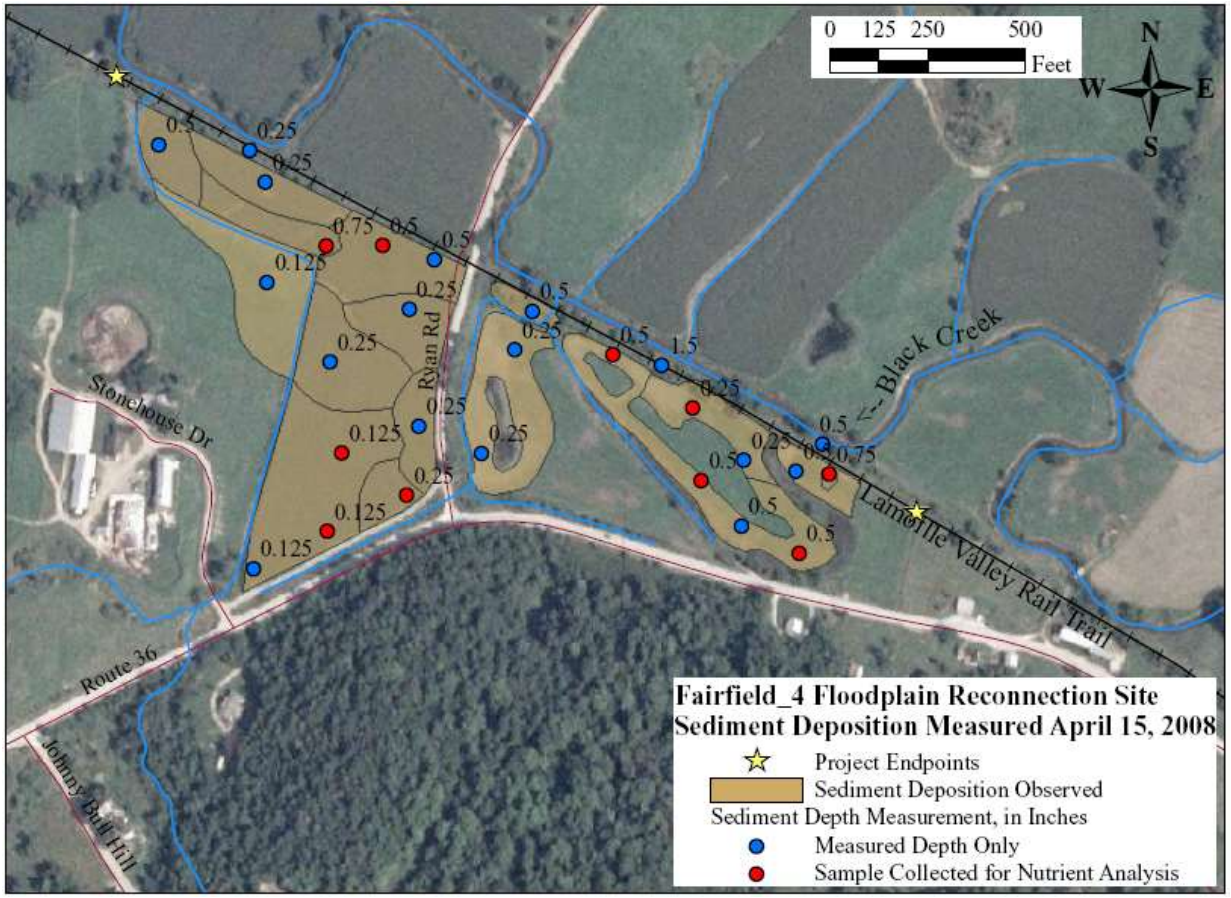
Reconnecting the Black Creek Floodplain Along the Lamoille Valley Rail Trail in 2007

**Railroad Embankment Disconnecting Floodplain**

Embankment removal in Fletcher, VT
Photos by R. Schiff
2007

**Lowered Railroad Embankment to Connect Floodplain**

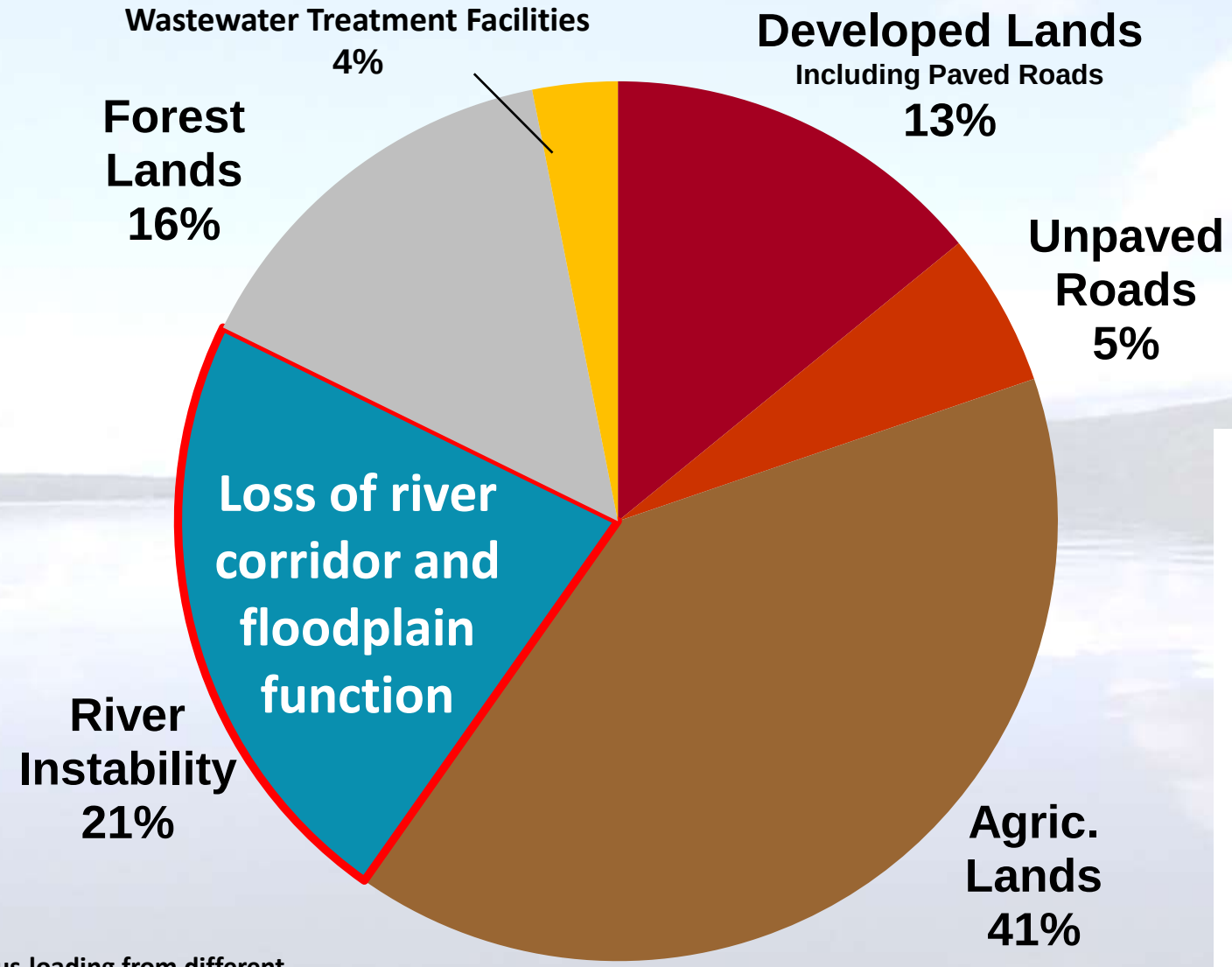
# Early Floodplain Reconnection Example





(MMI, 2008)

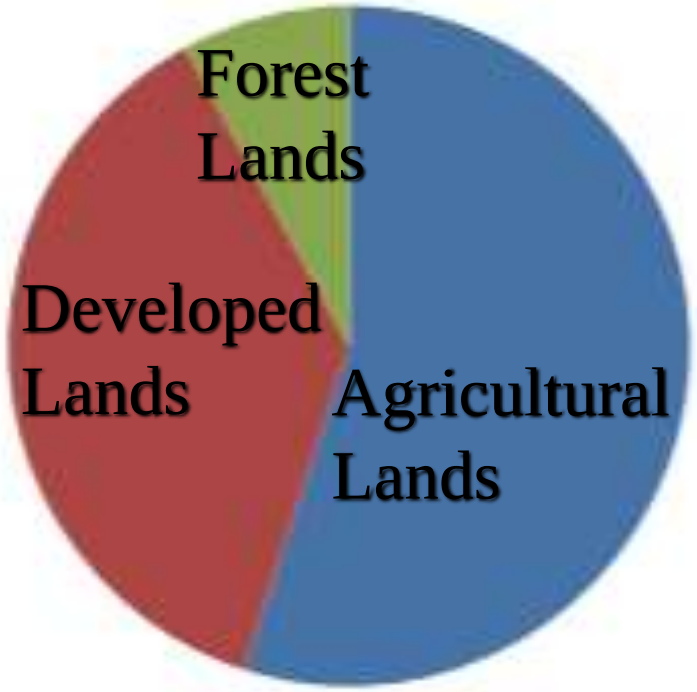
# Lake Champlain TMDL



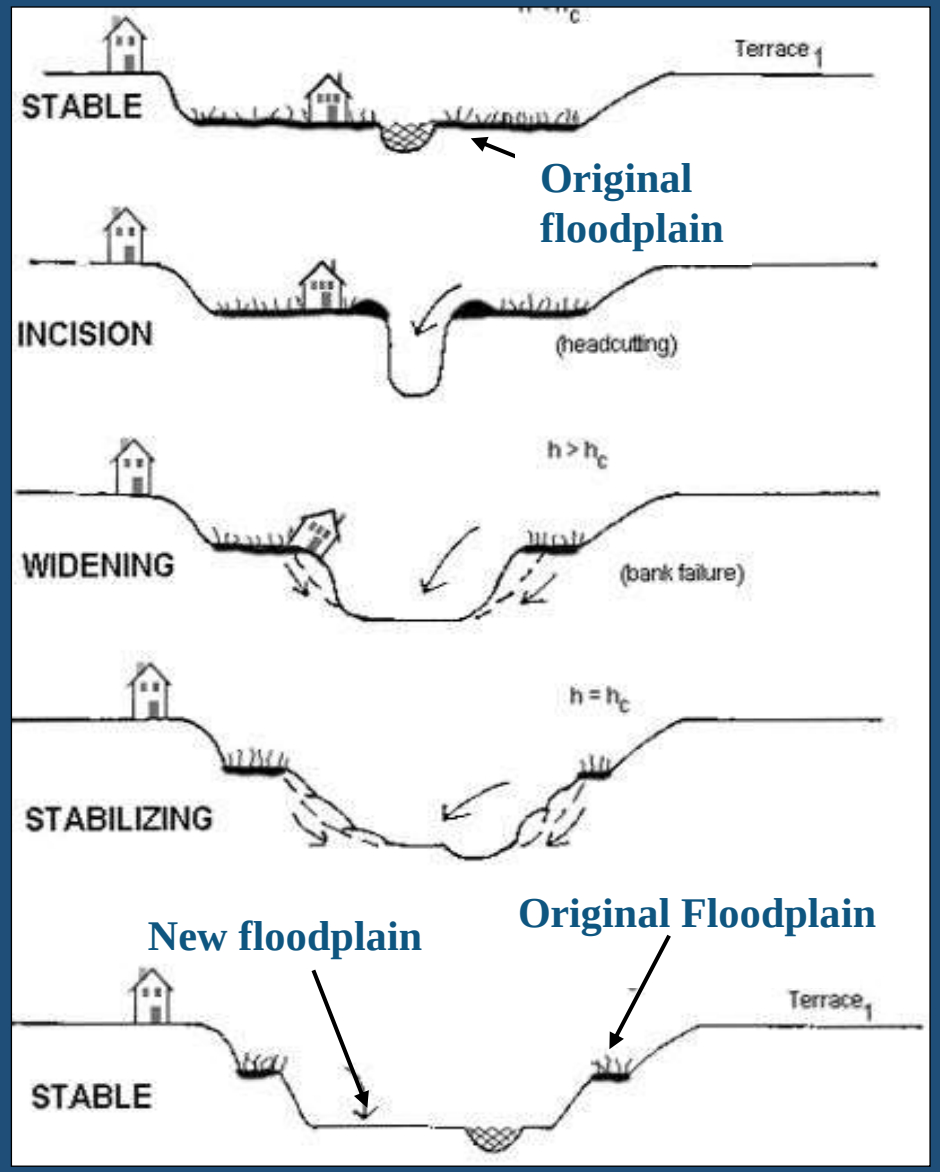

Estimated phosphorus loading from different sources in the Vermont portion of the Lake Champlain watershed

Excess Phosphorus causing algal blooms in the Lake

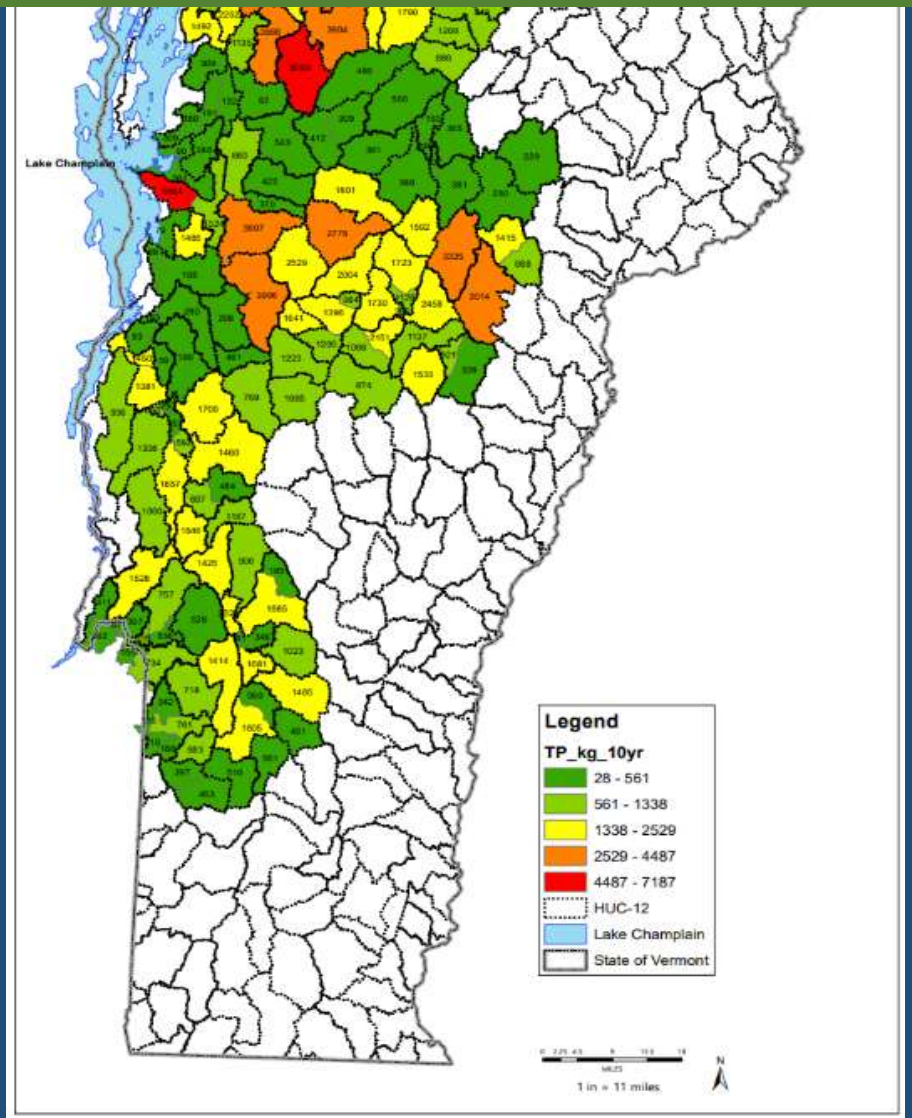
2002 L. Champlain TMDL Loadings



# The TMDL quantifies P loading from unstable streams

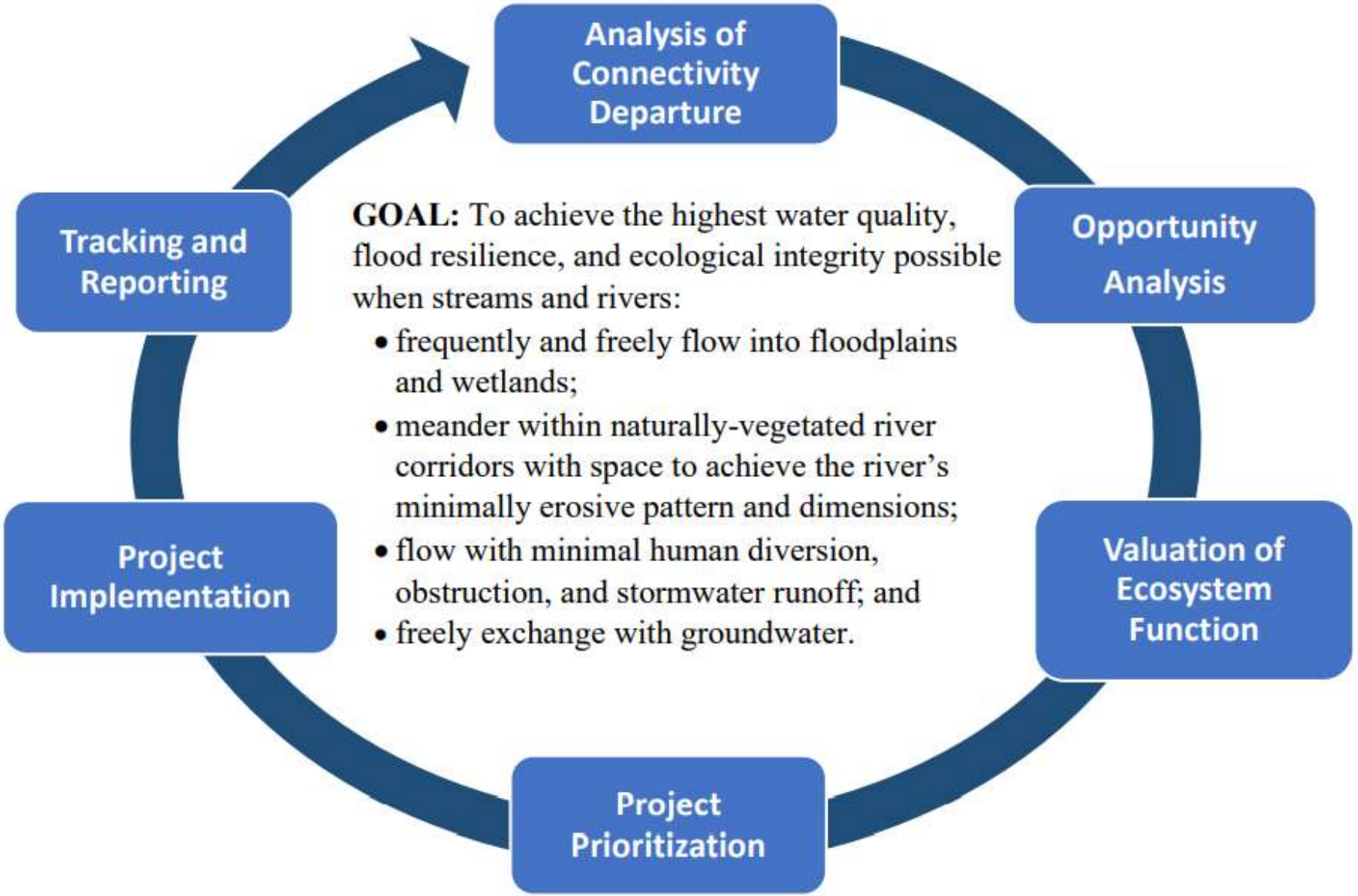



.....and assigns an allocation to each Lake Champlain watershed based on stage of evolution toward floodplain function.



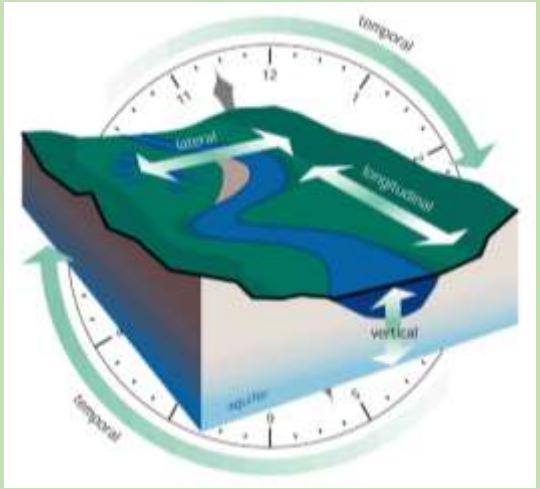

Lake Champlain Sub-basin phosphorus load allocations (Source: VTANR).

# Vermont's Functioning Floodplain Initiative



# Floodplain Reconnection Projects

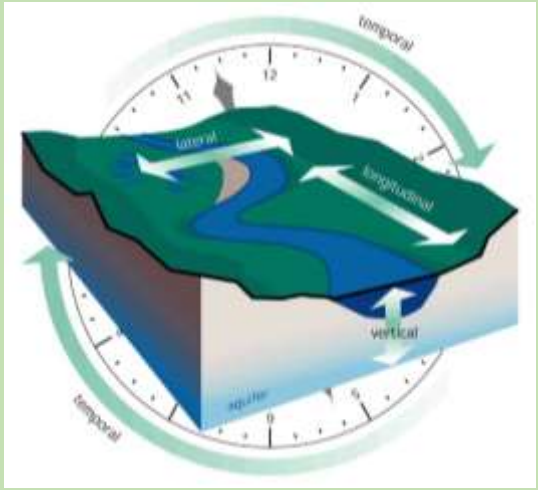
## Lateral – Vertical Reconnection




| APPROACH | PROJECT |
|---|---|
| No Action | No Action |
| Restore Connectivity | Lower floodplain[a] |
| | Reconnect flood chute[b] |
| | Create flood bench[c] |
| | Restore channel slope and pattern[d] |
| | Restore channel roughness[e] |
| | Raise channel[f] |
| | Remove berm[g] |
| | Restore wetland[h] |
| Remove Constraints | Remove major constraint[i] |
| | Remove minor constraint[j] |
| Protection | Implement river corridor easement |
| | Conserve wetlands (e.g., NRCS Wetland Reserve) |
| | Adopt river corridor bylaws |
| Re-vegetation | Plant woody 50-foot buffer |
| | Plant woody river corridor / floodplain |

# Stream Reconnection Projects

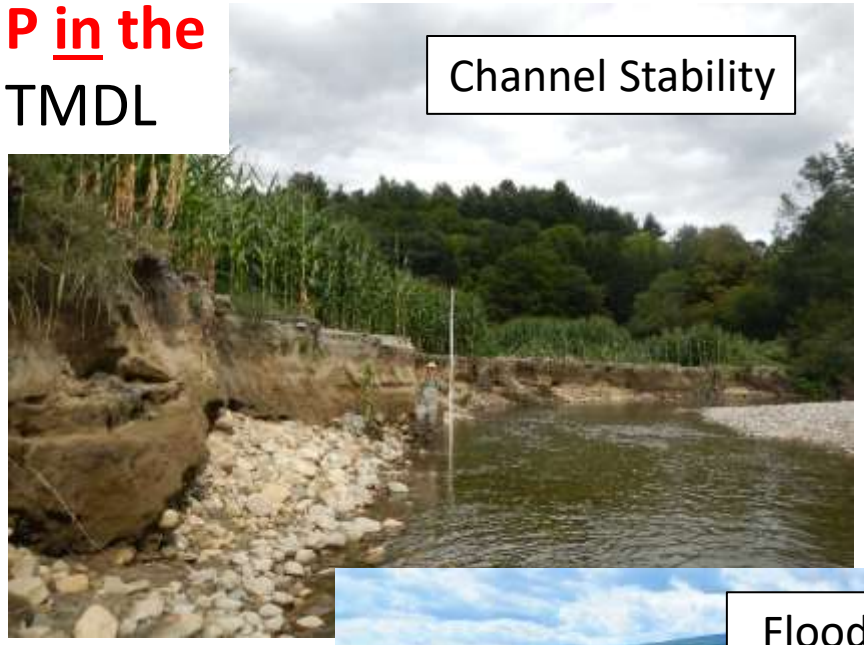
## Longitudinal – Temporal Reconnection




| APPROACH | PROJECT |
|---|---|
| Remove Dams | Remove Large Flood Control Dam |
| | Remove/Convert Large Peaking Hydro Dam |
| | Remove Large Run of River (ROR) Dam |
| | Remove/Convert Medium Peaking Hydro Dam |
| | Remove Medium ROR Dam |
| | Remove Medium Breached Dam |
| | Remove Small Intact ROR Dam |
| | Remove Small Breached Dam |
| Replace Bridges & Culverts | Replace Bridge (Wbkf>100%) |
| | Replace Bridge (50%>Wbkf>100%) |
| | Replace Bridge (Wbkf<50%), shallow channel (< 2%) |
| | Replace Bridge (Wbkf<50%), steep channel (> 2%) |
| | Replace Culvert (Wbkf>100%) |
| | Replace Culvert (50%>Wbkf>100%), shallow |
| | Replace Culvert (50%>Wbkf>100%), steep |
| | Replace Culvert (Wbkf<50%), shallow |
| | Replace Culvert (Wbkf<50%), steep |
| Mitigate Hydrologic Alterations | Remove Re-Permit Diversion / Withdrawal |
| | Remove Groundwater Extraction (commercial, wells) |
| | Stabilize Headcut in Perennial Streami |
| | Stabilize Gully |
| | Stabilize Gully w-Treatment of Stormwater |
| | Disconnect Municipal or Private Road Ditch |
| | Treat Legacy Forest Trail/Road Drainage |
| | Backwater Culvert with Weir or Other Approach |
| | Place Baffles in Culvert |

# Lake Champlain TMDL Context

**P in the** TMDL



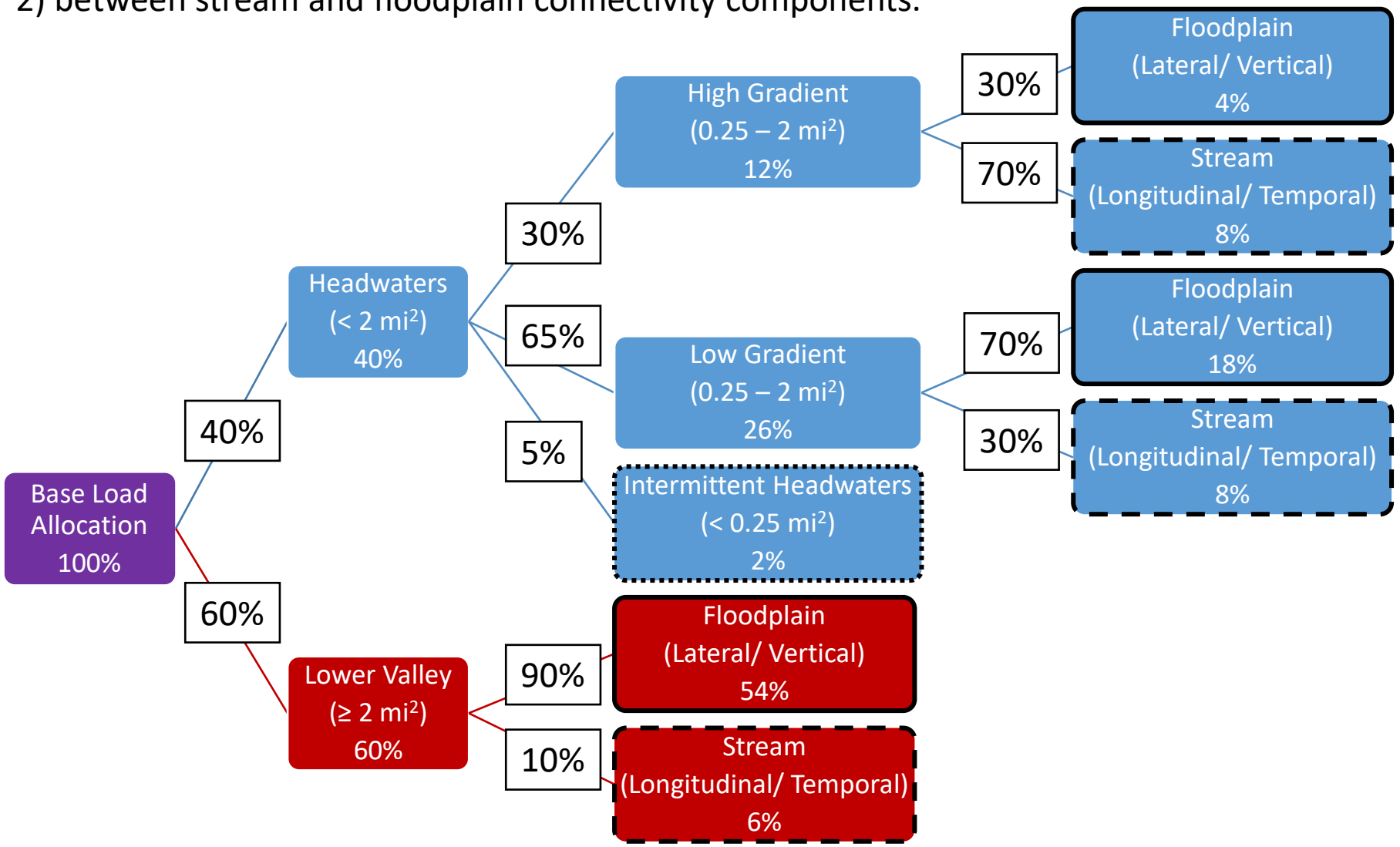


**P not in** TMDL


# Departure Analysis and P Crediting

HUC 12 stream stability allocations are distributed:

1) between headwaters and lower valley stream and rivers
2) between stream and floodplain connectivity components.



# Example #1 - Dog River Floodplain Restoration

# Dog River Floodplain Restoration Example

**FFI Project Crediting - Floodplain Connectivity**
**12/20/2021**
**Project Example**

| Project Reach, Segment or Subunit | | |
|---|---|---|
| ID | M13, M12B | |
| Area (Acres) | 78.6 | RC(x) (acres) |
| 50' Buffer Area (Acres) | 24 | BFR50 (acres) |
| TMDL P Base Load Allocation | (kg/yr) | (lb/yr) |
| Total Connectivity Allocation | **71.2** | **156.9** |
| Lateral | **29.7** | **65.5** |
| Vertical | **41.5** | **91.4** |

| | |
|---|---|
| Proposed Connectivity Credit (Score): | 2.4 |
| Proposed Lateral Connectivity Credit (% of EX): | 6% |
| Proposed Vertical Connectivity Credit (% of EX): | 3% |
| Lateral P Reduction Credit (kg/yr): | 1.8 |
| Vertical P Reduction Credit (kg/yr): | 1.3 |
| P Reduction Credit (kg/yr): | **3.1** |
| P Reduction Credit (lb/yr): | **6.8** |

**Project Description:** Berm removal/floodplain lowering reconnecting 3.1 acres of floodplain, with easement, hard constraint removal, and buffer.

| | Connected Corridor (Acres) | Robust Protection (Acres) | Moderate Protection (Acres) | Low Protection (Acres) | No Protection (Acres) | Naturally Veg Buffer (Acres) | Incision Ratio |
|---|---|---|---|---|---|---|---|
| Existing | 25 | 5 | 30 | 28.6 | 15 | 12 | 1.9 |
| Project | 3.1 | 3.1 | 0 | 0 | -3.1 | 1 | 1.2 |
| Proposed (Post-Project) | 28.1 | 8.1 | 30 | 28.6 | 11.9 | 13 | 1.87 |

# Dog River Floodplain Restoration Example

**FFI Project Crediting - P Storage**
**8/3/2021**

(Dog River Floodplain Restoration Example)

| **Project reach, segment or subunit** | |
|---|---|
| ID | M13, M12B |
| Connectivity project | Floodplain restoration |
| Project Area (acres) | 3.1 |
| Existing connectivity in Project Area | Low |
| Proposed connectivity in Project Area | High |

| **Estimated TP Storage Credit (lb/yr)** | |
|---|---|
| **Year 1** | **Year 2+** |
| 62 | 31 |

| **Default TP Storage Credits (lb/ac/yr)*** | | |
|---|---|---|
| **Low to High** | **Low to Moderate** | **Moderate to High** |
| **20** | **15** | **10** |
| **10** | **7** | **5** |

*To be updated by project specific measurements or future research.

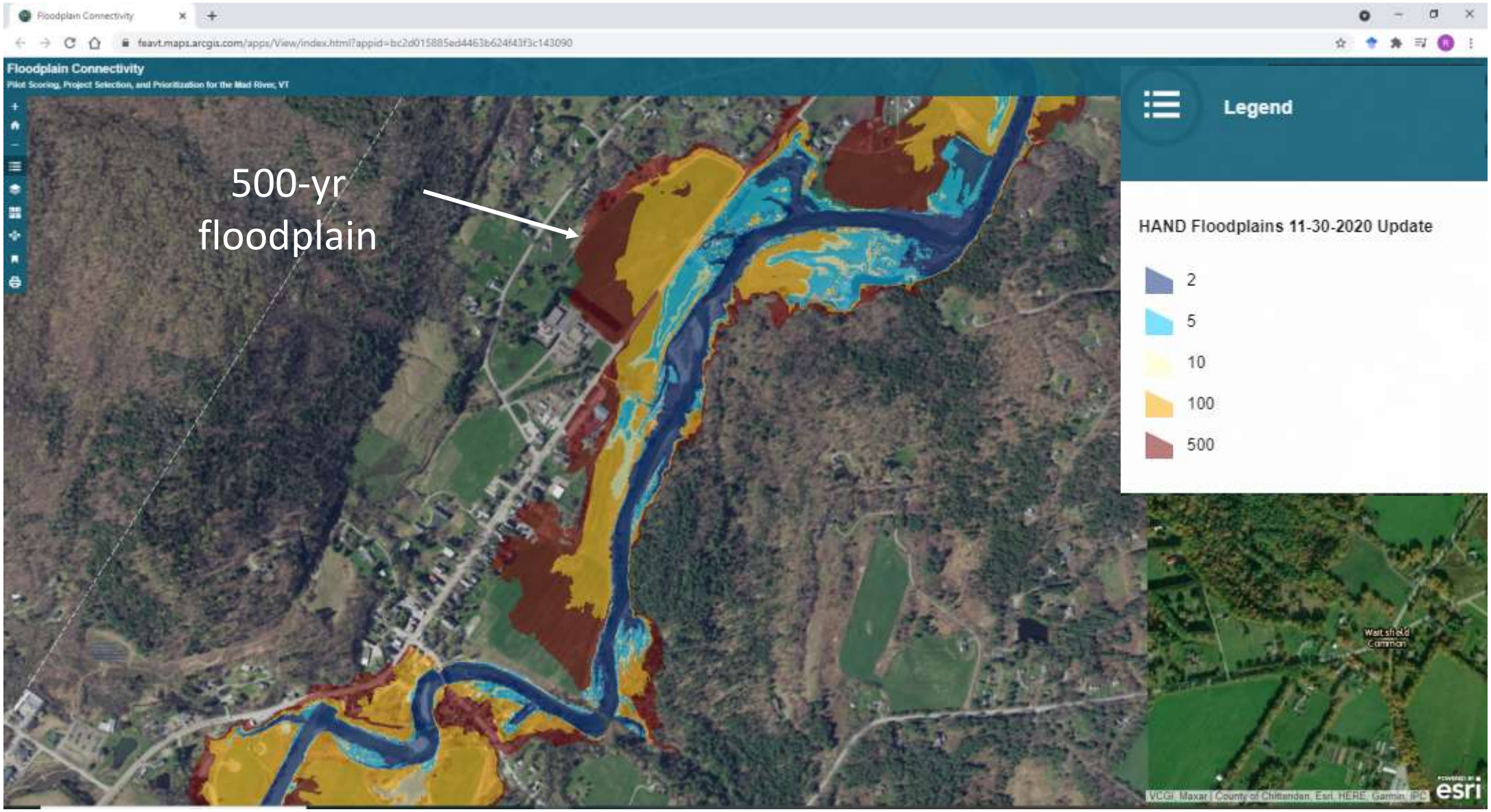
# Dog River Floodplain Restoration Example

**FFI Project Crediting - Summary**
**12/20/2021**
**Case 5a Project:** Lateral/vertical on the same footprint (Case 2a) + longitudinal/temporal (Case 4)

| | | | | | |
|---|---|---|---|---|---|
| Project Name | Dog River Floodplain Restoration Project | | **ESTIMATED PHOSPHORUS CREDITING** | | |
| River | Dog River and Union Brook | | | | |
| Town | Northfield, VT | | | | |
| Location | Water Street | | | **Year 1** | **Years 2+** |
| Project reach, segment or subunit ID(s) | **M13, M12B** | | **Floodplain (lb/yr)** | 6.8 | 6.8 |
| Project reach, segment or subunit(s) Area (acres) | 78.6 | | **Stream (lb/yr)** | 0.1 | 0.1 |
| Connectivity project components | Area (acres) | | **Storage (lb/yr)** | 62.0 | 31.0 |
| Constraint (house) removal | 3.1 | | **TOTAL** | **69.0** | **38.0** |
| Floodplain lowering / berm removal | 3.1 | | | | |
| Buffer planting | 3.1 | | | | |
| River Corridor easement | 3.1 | | | | |

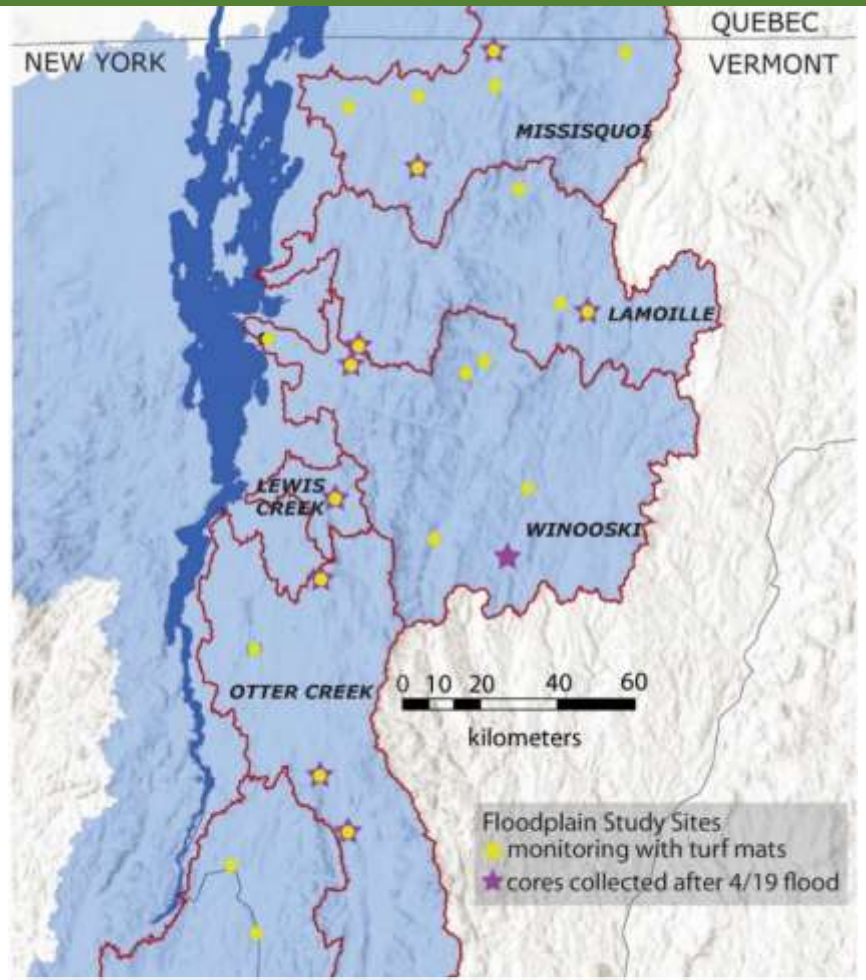
- Floodplain credit of 6.8 LB TP/ YR
- Stream credit of 0.1 LB TP / YR
- Storage credit Low to High connectivity; 62 LB TP / YR1;  31 LB TP / YR2+
- $14,378 / LB TP (Total project cost / annual year 2+ TP credit)

# Floodplain Mapping for the Lake Champlain Basin




Diehl, R., J. Gourevitch, S. Drago, B. Wemple, 2021. Improving flood hazard datasets using a low-complexity, probabilistic floodplain mapping approach, PLOS ONE, p1-20.

# Empirical data set of sediment and P floodplain deposition




+ 170 plots at 24 sites
+ Measure event-scale sedimentation

Flood events in 2018 and 2019 captured between 0.2 and 30 lb phosphorus / acre / year.

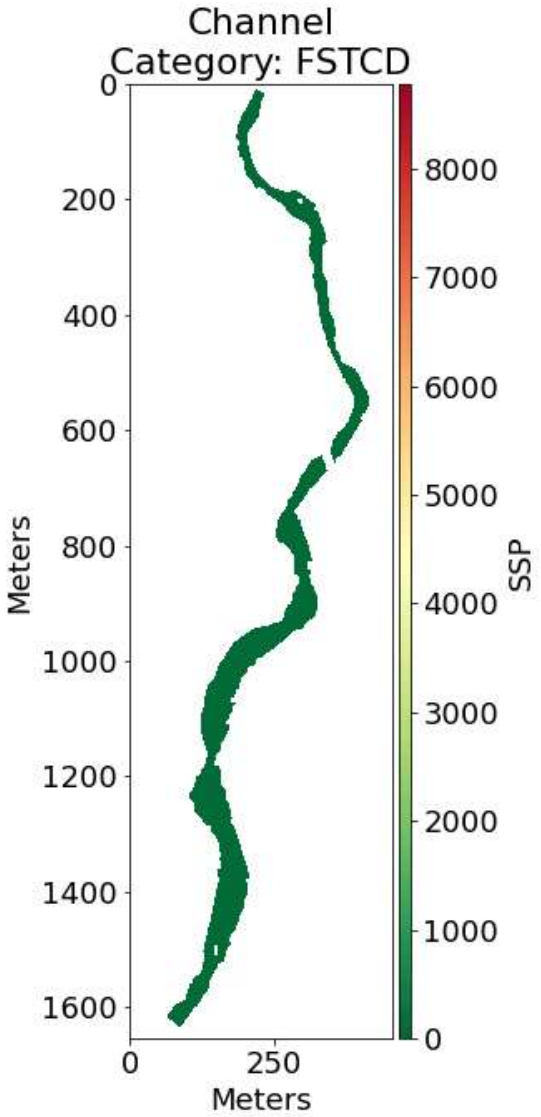


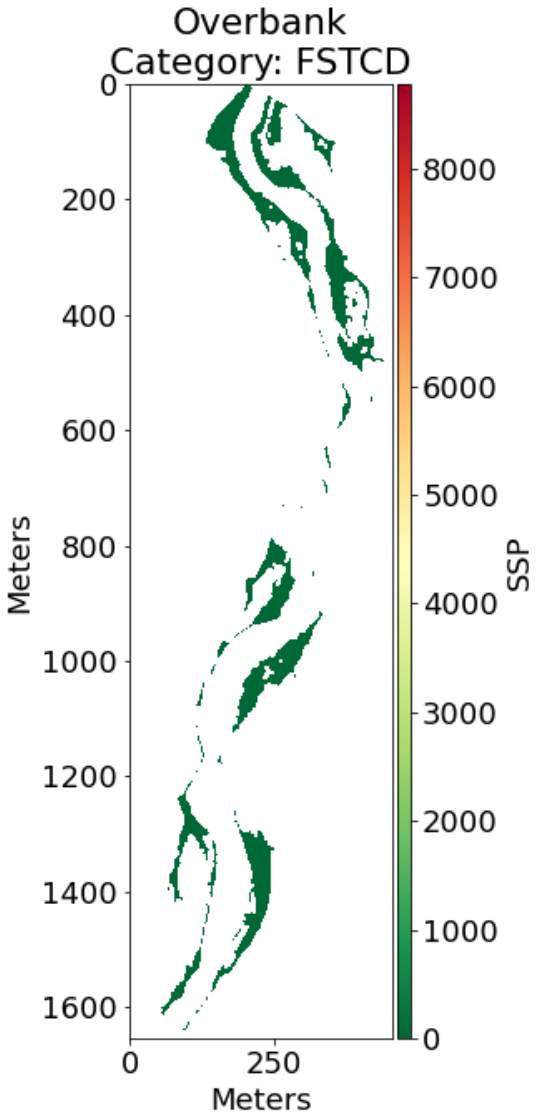

Water Street Park, Dog River, Northfield

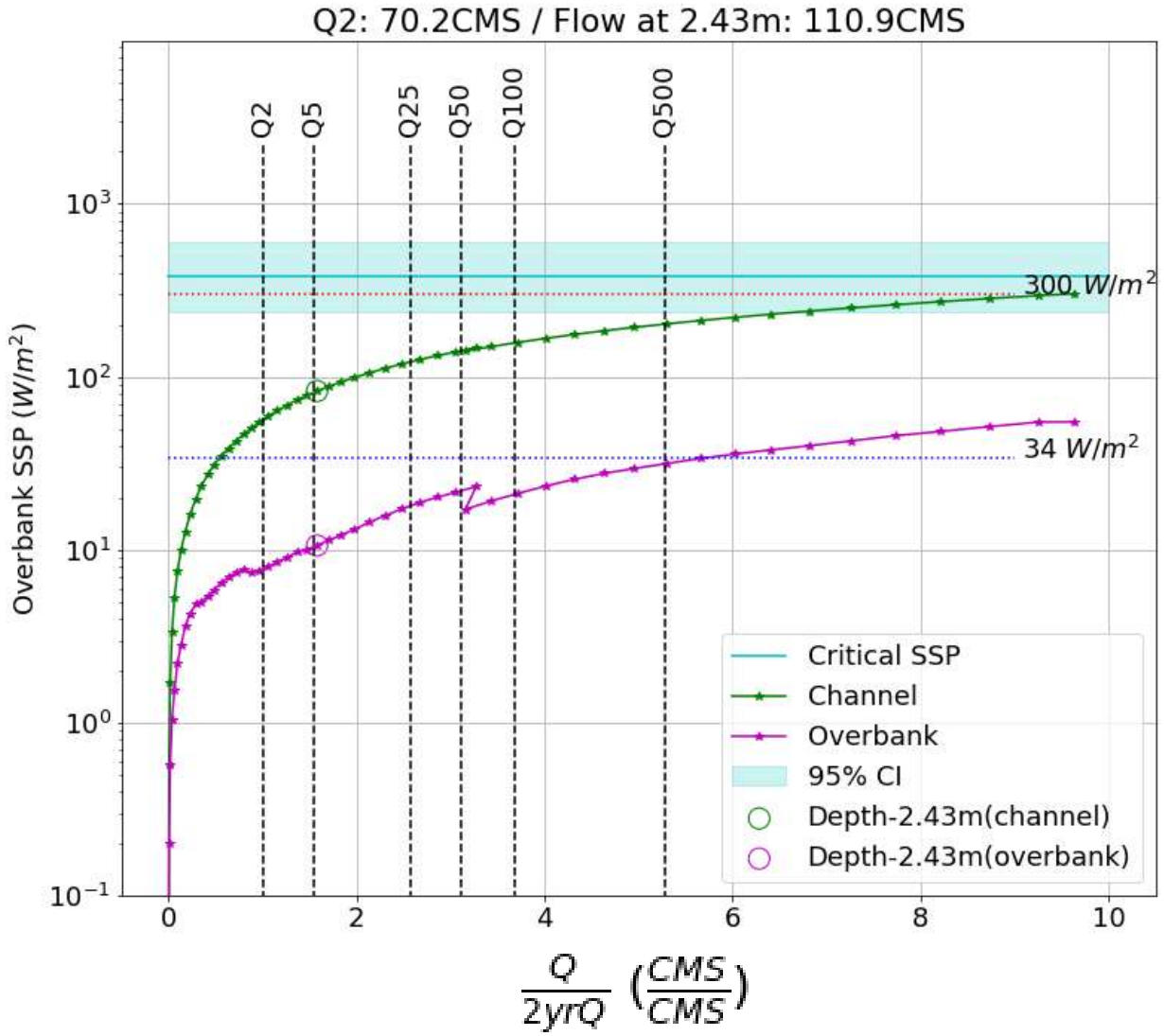
Diehl, R.M., Wemple, B.C., Underwood, K.L., Ross, D. (2021). Evaluating floodplain potential for sediment and phosphorus deposition: Development of a framework to assist in Lake Champlain Basin planning. Lake Champlain Basin Technical Report.

Lake Champlain Basin Program
Gund Institute for Environment
The University of Vermont
The Nature Conservancy

# Stream Power v Resistance to Evaluate Erosion Potential



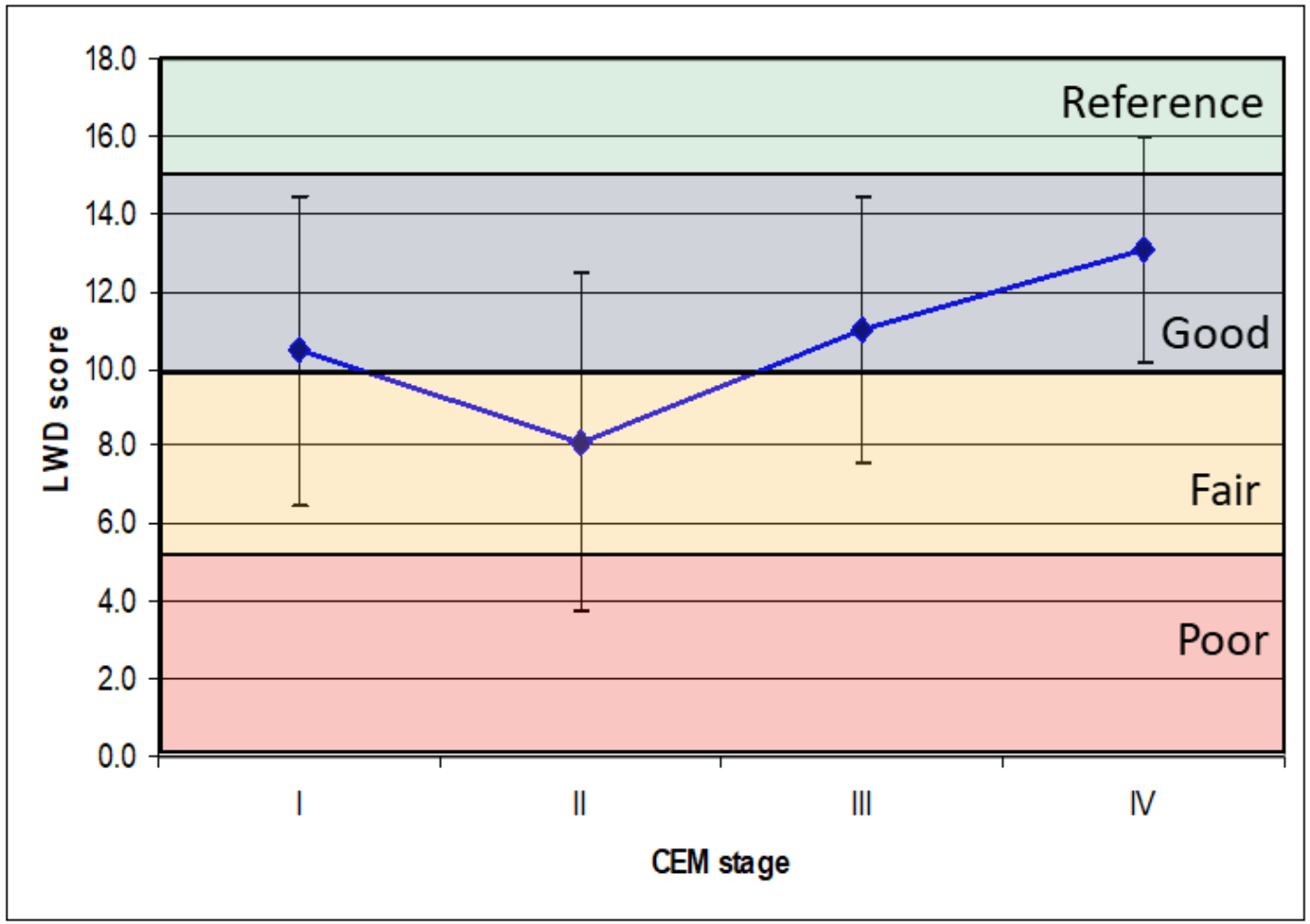



# Habitat

**Understanding Floodplain Function/Connectivity through the Lens of Habitat**

- **Three scales:**
  - In-channel
  - Near-bank riparian area
  - Floodplain and upland connections

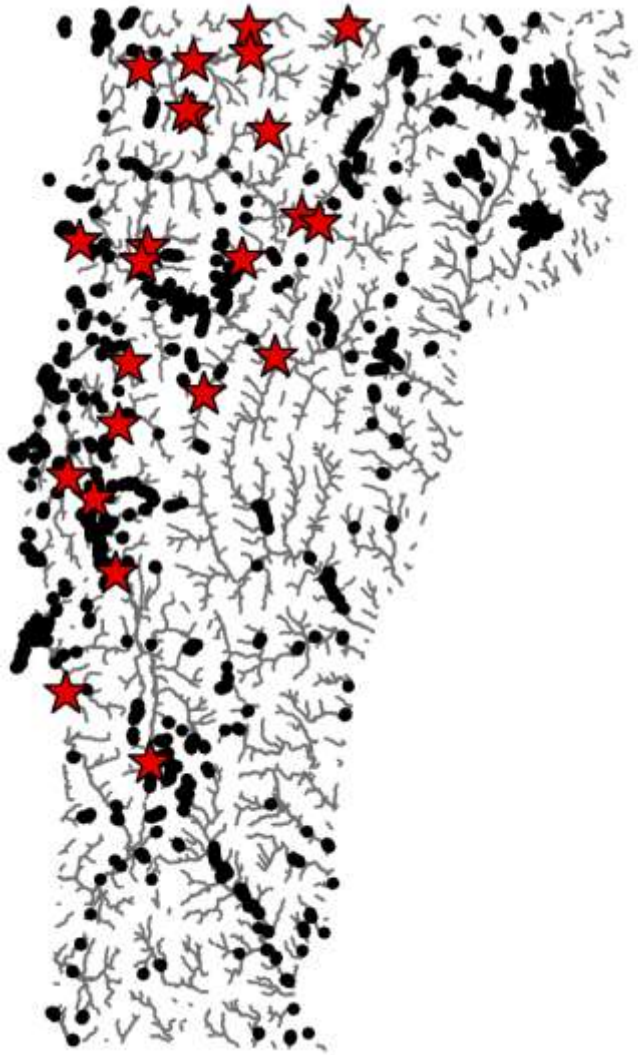

# Instream Habitat




**CEM Stage II**

- Incised condition
- Increased power
- Reduced LWD retention

# Floodplain Habitat




Cattail Marsh

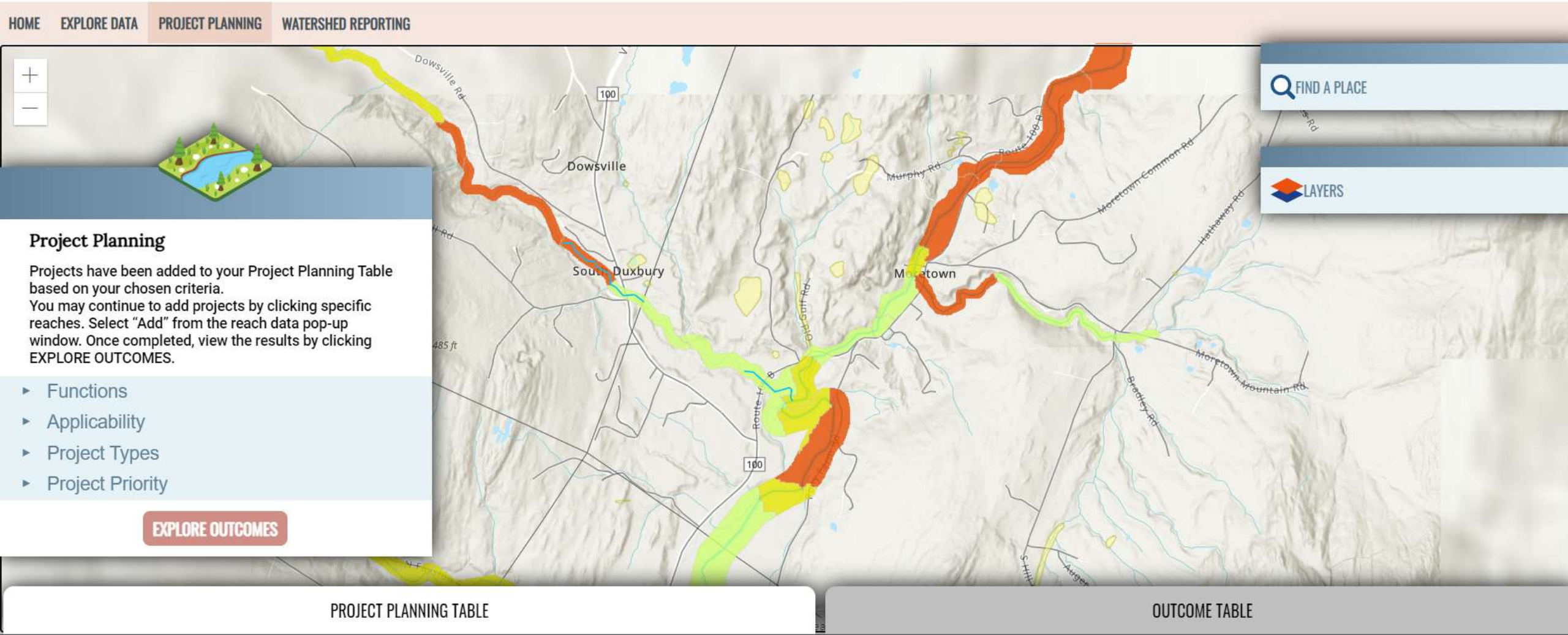
Silver Maple-Ostrich Fern Floodplain

Example of mapped natural communities on the Winooski River floodplain near Lake Champlain

# Treatment Cost-Effectiveness

| Projcet Class | Project Type | Practice | Cost-Effectiveness ($USD/lb TP/yr) |
|---|---|---|---|
| Natural Resource / Re-Connection Project | Floodplain Restoration | Berm Removal | $ 2,050 |
| Natural Resource / Re-Connection Project | Buffers | Buffers | $ 2,786 |
| Natural Resource / Re-Connection Project | Corridor easement | Corridor easement | $ 5,944 |
| Natural Resource / Re-Connection Project | Floodplain Restoration | Create Flood Bench | $ 12,351 |
| Stormwater Best Management Practice | Infiltration Practices | Surface Infiltration | $ 12,500 |
| Natural Resource / Re-Connection Project | Dam removal | Medium ROR Dam | $ 13,438 |
| Natural Resource / Re-Connection Project | Floodplain Restoration | Lower Floodplain | $ 14,017 |
| Stormwater Best Management Practice | Infiltration Practices | Subsurface Infiltration | $ 15,000 |
| Stormwater Best Management Practice | Infiltration Practices | Infiltration Trench | $ 15,000 |
| Natural Resource / Re-Connection Project | Floodplain Restoration | Raise Channel | $ 16,224 |
| Stormwater Best Management Practice | Infiltration Practices | Rain Garden (no underdrain) | $ 17,500 |
| Natural Resource / Re-Connection Project | Dam removal | Medium Breached Dam | $ 19,814 |
| Natural Resource / Re-Connection Project | Dam removal | Small ROR Dam | $ 20,519 |
| Stormwater Best Management Practice | Filtering Practices | Constructed Wetlands | $ 30,000 |
| Stormwater Best Management Practice | Ponds | Wet Pond | $ 30,000 |
| Stormwater Best Management Practice | Filtering Practices | Gravel Wetland | $ 35,000 |
| Stormwater Best Management Practice | Filtering Practices | Rain Garden (with underdrain) | $ 40,000 |
| Stormwater Best Management Practice | Filtering Practices | Sand Filter | $ 52,500 |
| Stormwater Best Management Practice | Filtering Practices | Grass Conveyance Swale | $ 60,000 |
| Stormwater Best Management Practice | Ponds | Extended Dry Detention Pond | $ 135,000 |

# Web Application – Project Planning



# Web Application – Project Planning


## Total Phosphorus Credit for Stream Stability and Storage

**SubUnit(s) IDs:** **36_M12-_3_C00, 36_T7.01_1_C00, 36_M12-**
**Town:** Waitsfield
**Projects Included:** River corridor easment, riparian buffer planting, floodplain planting, culvert replacement

### Stream Stability and Storage Credit Summary

| | Year 1 Credit (kg/yr) | Years 2+ Credit (kg/yr) | Estimated 15-yr Lifespan Credit (kg/yr) |
|---|---|---|---|
| **Floodplain Connectivity (Lateral-Vertical)** | | | |
| **Stream Stability** | 6.84 | 6.84 | 102.65 |
| **Storage** | 62.00 | 31.00 | 465.00 |
| **Stream Connectivity (Longitudinal-Temporal)** | | | |
| **Stream Stability** | 0.13 | 0.13 | 1.92 |
| **TOTAL** | **68.97** | **37.97** | **569.58** |

# Web Application – User Groups


- VTDEC River Scientist/Clean Water Initiative Analysts focused on river and floodplain restoration will track progress towards achieving TMDL to improve water quality.
- VTrans Planner focused on the transportation network will identify resiliency projects along roads that also have water quality and habitat co-benefits.

# Thank You

**https://dec.vermont.gov/rivers/ffi**

Source: Lars Gange & Mansfield Heliflight, August 31, 2011

# Extra Slides

# Dog River Floodplain Restoration Example

**FFI Project Crediting - Stream Connectivity**
**10/18/2021**

| Project reach, segment or subunit | | | Web Map Variable Name: | Project Description: and Erosion Deduction + LONG IR Deduction | TEMP Structure and Erosion Deduction + TEMP IR Deduction | TEMPexisting-dev-rds | TEMPexisting-ag % | IR |
|---|---|---|---|---|---|---|---|---|
| | | | | Longitudinal Deductions (Structures and IR) | Temporal Deductions (Structures and IR) | HUC12 roads/dev LU (mi/mi$_2$) | HUC12 ag LU/DA (%)_Tile | Incision Ratio |
| ID | M13, M12B | | Existing | -40 | -60 | 5 | 50 | 1.9 |
| | | | Project | 0 | 0 | 0 | 0 | 1.2 |
| | | | IR | 0.8 | 0.3 | | | |
| TMDL P Base Load Allocation | (kg/yr) | (lb/yr) | Proposed (Post-Project) | -39.2 | -59.7 | 5.00 | 50.00 | 1.2 |
| | | | Maximum Values in Basin | | | 7.7 | 108.6 | |
| Stream | 5.21 | 11.49 | | | | | | |

| Column | |
|---|---|
| yes | |
| no | |
| | |
| | |

***Will the project disconnect tile drains or ditches in an agricutural setting?*** no

Land Use Change Area (Acres) 0.0

***Is the incision ratio changing?*** yes

| | |
|---|---|
| Corridor Area for Segment/Reach (acres) | 78.6 |
| Area (Acres) with Vertical Change | 3.1 |
| Percent Area with Vertical Change | 3.9% |

| | Longitudinal Score | Temporal Deductions Score | Temporal Roads Score | Temporal Ag Score |
|---|---|---|---|---|
| Existing | 60.0 | 40.0 | 35.1 | 54.0 |
| Proposed (Post-Project) | 60.8 | 40.3 | 35.1 | 54.0 |

| | Longitudinal | Temporal |
|---|---|---|
| Existing IR deduction | -20.0 | -8.0 |
| Proposed IR deduction | 0.0 | 0.0 |
| Area Weighted IR deduction | -19.2 | -7.7 |
| Change in score | 0.8 | 0.3 |

| | Longitudinal | Temporal | Stream |
|---|---|---|---|
| Existing Connectivity Score: | 60 | 42.7 | 53.09 |
| Existing Connectivity Departure: | 40 | 57.3 | 46.9 |
| Proposed Connectivity Score: | 60.8 | 42.9 | 53.61 |
| Proposed Connectivity Departure: | 39.2 | 57.1 | 46.4 |
| Proposed Connectivity Credit (Score): | | | 0.52 |
| Proposed Connectivity Credit (% of EX): | | | 1.1% |
| Stream Connectivity P Credit (kg/yr): | | | **0.058** |
| Stream Connectivity P Credit (lb/yr): | | | **0.128** |

| Incision | Incision Ratio[1] | Longitudinal Score Deduction | Temporal Score Deduction |
|---|---|---|---|
| Minor | IR < 1.3 | 0 | 0 |
| Moderate | 1.3 ≤ IR < 1.5 | -10 | -5 |
| High | 1.5 ≤ IR < 2.0 | -20 | -8 |
| Severe | IR ≥ 2.0 | -30 | -10 |

# Simulated P Crediting

| Simulated Project | Median P Reduction Credit | P Credit Units |
|---|---|---|
| Floodplain Restoration with buffer revegetation | 1.6 | lb/ac/yr |
| Floodplain Restoration with buffer revegetation and easement | 2.1 | lb/ac/yr |
| Large/medium dam removal with floodplain restoration | 2.0 | lb/ac/yr |
| Small/medium intact ROR or breached dam removal with floodplain restoration | 2.1 | lb/ac/yr |
| Wood addition in 1st and 2nd order streams with vertical reconnection | 1.7 | lb/ac/yr |
| Wood addition in 3rd and 4th order streams with vertical reconnection | 0.6 | lb/ac/yr |
| Remove hard constraint | 1.1 | lb/ac/yr |
| Passive restoration - easement and buffer revegetation | 0.8 | lb/ac/yr |
| Adopt corridor bylaws | 0.2 | lb/ac/yr |
| Buffer revegetation | 0.6 | lb/ac/yr |
| Replace culverts - undersized with shallow slope | 2.0 | lb/culvert/yr |
| Stabilize gully on perennial stream | 2.6 | lb/project/yr |

# Treatment Cost-Effectiveness

| NR Project Type | NR Practice | NR Practice Cost ($US/lb TP) | Stormwater BMP Cost Comparison to Natrual Resource Projects (Stormwater $US/lb TP - NR $US/lb TP) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Infiltration Practices | | | | Filtering Practices | | | | | Ponds | |
| | | | Surface Infiltration | Subsurface Infiltration | Infiltration Trench | Rain Garden (no underdrain) | Gravel Wetland | Constructed Wetlands | Grass Conveyance Swale | Rain Garden (with underdrain) | Sand Filter | Wet Pond | Extended Dry Detention Pond |
| Floodplain Restoration | Berm Removal | $ 2,050 | $ 10,450 | $ 12,950 | $ 12,950 | $ 15,450 | $ 32,950 | $ 27,950 | $ 57,950 | $ 37,950 | $ 50,450 | $ 27,950 | $ 132,950 |
| | Lower Floodplain | $ 14,019 | -$ 1,517 | $ 983 | $ 983 | $ 3,483 | $ 20,983 | $ 15,983 | $ 45,983 | $ 25,983 | $ 38,483 | $ 15,983 | $ 120,983 |
| | Raise Channel | $ 16,455 | -$ 3,724 | -$ 1,224 | -$ 1,224 | $ 1,276 | $ 18,776 | $ 13,776 | $ 43,776 | $ 23,776 | $ 36,276 | $ 13,776 | $ 118,776 |
| | Create Flood Bench | $ 12,351 | $ 149 | $ 2,649 | $ 2,649 | $ 5,149 | $ 22,649 | $ 17,649 | $ 47,649 | $ 27,649 | $ 40,149 | $ 17,649 | $ 122,649 |
| Dam removal | Small ROR Dam | $ 20,519 | -$ 8,019 | -$ 5,519 | -$ 5,519 | -$ 3,019 | $ 14,481 | $ 9,481 | $ 39,481 | $ 19,481 | $ 31,981 | $ 9,481 | $ 114,481 |
| | Medium ROR Dam | $ 13,438 | -$ 938 | $ 1,562 | $ 1,562 | $ 4,062 | $ 21,562 | $ 16,562 | $ 46,562 | $ 26,562 | $ 39,062 | $ 16,562 | $ 121,562 |
| | Medium Breached Dam | $ 19,892 | -$ 7,314 | -$ 4,814 | -$ 4,814 | -$ 2,314 | $ 15,186 | $ 10,186 | $ 40,186 | $ 20,186 | $ 32,686 | $ 10,186 | $ 115,186 |
| Buffers | | $ 2,786 | $ 9,714 | $ 12,214 | $ 12,214 | $ 14,714 | $ 32,214 | $ 27,214 | $ 57,214 | $ 37,214 | $ 49,714 | $ 27,214 | $ 132,214 |
| Corridor easement | | $ 8,321 | $ 6,556 | $ 9,056 | $ 9,056 | $ 11,556 | $ 29,056 | $ 24,056 | $ 54,056 | $ 34,056 | $ 46,556 | $ 24,056 | $ 129,056 |

# Resiliency

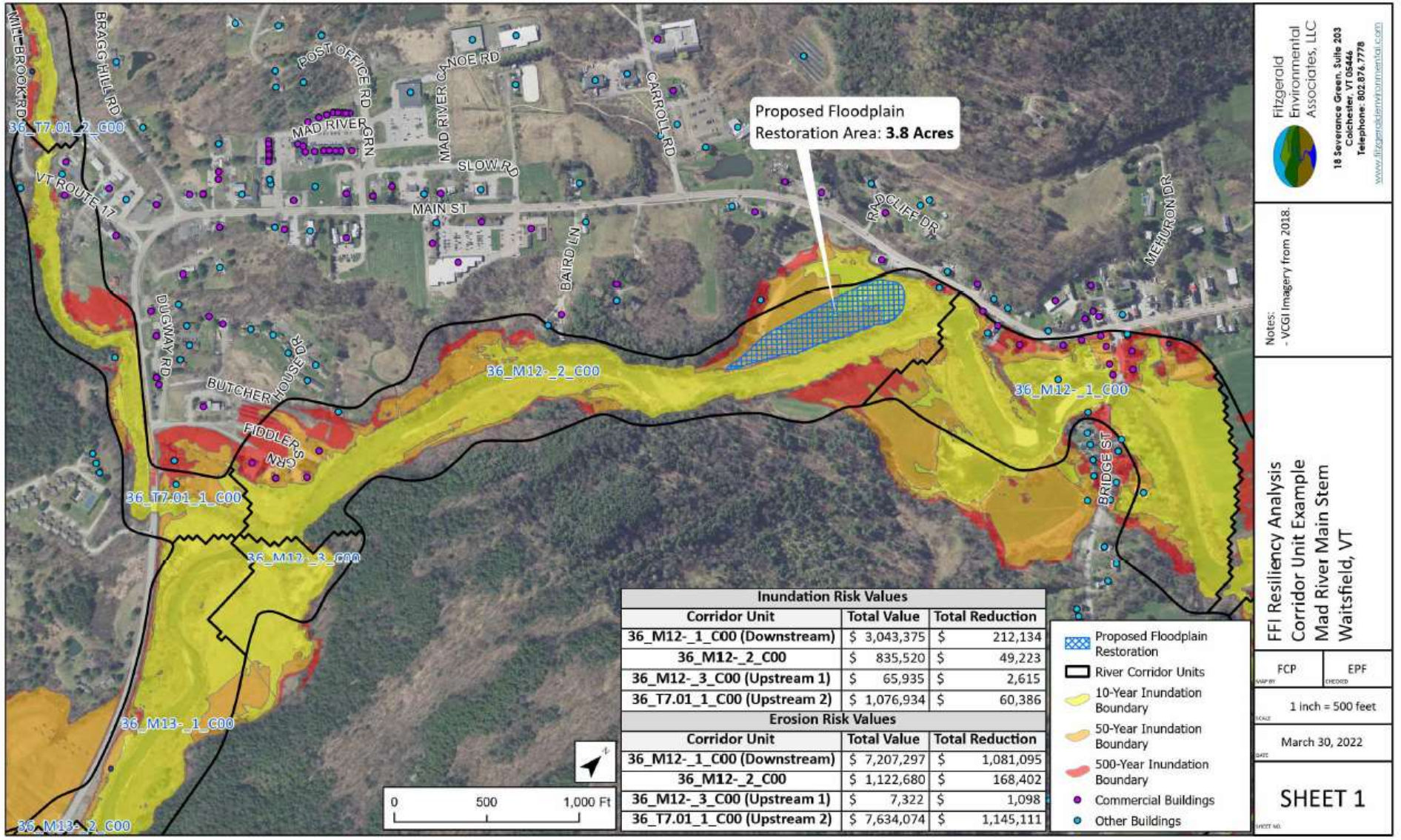

PROJECT SCREENING | CALCULATION INPUTS | WATER QUALITY BENEFIT | RESILIENCY BENEFIT | HABITAT BENEFIT | BENEFIT SUMMARY | COST EFFECTIVENESS

## Predicted Resiliency Benefit

| Inundation Risk Exposure and Potential Benefit | | | | | | |
|---|---|---|---|---|---|---|
| **Location** | **Corridor Unit** | **Building Value** | **Transportation Value** | **Agriculture Value** | **Total Value** | **Potential Benefit** |
| Downstream | 36_M12-_1_C00 | $ 3,575,383 | $ 192,443 | $ 33,924 | $ 3,801,750 | $ 321,282 |
| Local | 36_M12-_2_C00 | $ 724,795 | $ 92,697 | $ 9,268 | $ 826,759 | $ 48,872 |
| Upstream 1 | 36_M12-_3_C00 | $ - | $ - | $ 12,319 | $ 12,319 | $ 471 |
| Further Upstream 2 | 36_T7.01_1_C00 | $ 861,189 | $ 275,239 | $ 5,537 | $ 1,141,965 | $ 62,987 |
| **Project Totals** | n/a | $ 5,161,366 | $ 560,379 | $ 61,048 | **$ 5,782,794** | **$ 433,612** |

| Erosion Risk Exposure and Potential Benefit | | | | | | |
|---|---|---|---|---|---|---|
| **Location** | **Corridor Unit** | **Building Value** | **Transportation Value** | **Agriculture Value** | **Total Value** | **Potential Benefit** |
| Downstream | 36_M12-_1_C00 | $ 4,042,918 | $ 3,148,225 | $ 16,154 | $ 7,207,297 | $ 1,081,095 |
| Local | 36_M12-_2_C00 | $ 1,011,699 | $ 99,550 | $ 11,431 | $ 1,122,680 | $ 168,402 |
| Upstream 1 | 36_M12-_3_C00 | $ - | $ - | $ 7,233 | $ 7,233 | $ 1,085 |
| Further Upstream 2 | 36_T7.01_1_C00 | $ 1,082,609 | $ 6,548,812 | $ 2,654 | $ 7,634,074 | $ 1,145,111 |
| **Project Totals** | n/a | $ 6,137,226 | $ 9,796,588 | $ 37,472 | **$15,971,285** | **$ 2,395,693** |

# Resiliency


Proposed Floodplain Restoration Area: 3.8 Acres
MILL BROOK RD
BRAGG HILL RD
POST OFFICE RD
MAD RIVER GRN
MAD RIVER CANOE RD
SLOW RD
CARROLL RD
VT ROUTE 17
MAIN ST
BAIRD LN
RADCLIFF DR
MEHURON DR
DUGWAY RD
BUTCHER HOUSE RD
FIDDLERS GRN
BRIDGE ST
36_T7.01_2_C00
36_M12-_2_C00
36_M12-_1_C00
36_T7.01_1_C00
36_M12-_3_C00
36_M13-_1_C00
36_M13-_2_C00
0
500
1,000 Ft
Inundation Risk Values
Corridor Unit | Total Value | Total Reduction
36_M12-_1_C00 (Downstream) | $ 3,043,375 | $ 212,134
36_M12-_2_C00 | $ 835,520 | $ 49,223
36_M12-_3_C00 (Upstream 1) | $ 65,935 | $ 2,615
36_T7.01_1_C00 (Upstream 2) | $ 1,076,934 | $ 60,386
Erosion Risk Values
Corridor Unit | Total Value | Total Reduction
36_M12-_1_C00 (Downstream) | $ 7,207,297 | $ 1,081,095
36_M12-_2_C00 | $ 1,122,680 | $ 168,402
36_M12-_3_C00 (Upstream 1) | $ 7,322 | $ 1,098
36_T7.01_1_C00 (Upstream 2) | $ 7,634,074 | $ 1,145,111
Proposed Floodplain Restoration
River Corridor Units
10-Year Inundation Boundary
50-Year Inundation Boundary
500-Year Inundation Boundary
Commercial Buildings
Other Buildings
Fitzgerald Environmental Associates, LLC
18 Severance Green, Suite 203
Colchester, VT 05446
Telephone: 802.876.7778
www.fitzgeraldenvironmental.com
Notes:
- VCGI Imagery from 2018.
FFI Resiliency Analysis
Corridor Unit Example
Mad River Main Stem
Waitsfield, VT
FCP
EPF
1 inch = 500 feet
March 30, 2022
SHEET 1