SLRCONSULTING.COM

Melrose Terrace Floodplain Restoration

Jessica Louisos, PE, MS
Senior Water Resource Engineer

Prepared for Senate Committee on Economic Development, Housing & General Affairs

October 19, 2023

SLR

Damage from Tropical Storm Irene

Housing flooded & evacuation needed

- Water jumped river bank and travelled behind and between buildings

Damage from Tropical Storm Irene

Significant damage to buildings, roads, property

- Volume & velocity of water caused erosion and scour
- The most damage was not closest to the river

Flood Mitigation Analysis / Project Identification

2012 – Whetstone Brook Flood Analysis

- Examined broad mitigation alternatives at Melrose Terrace, Hayes Court, Glen Park, and Mountain Home
- Sketch level alternatives for Melrose Terrace

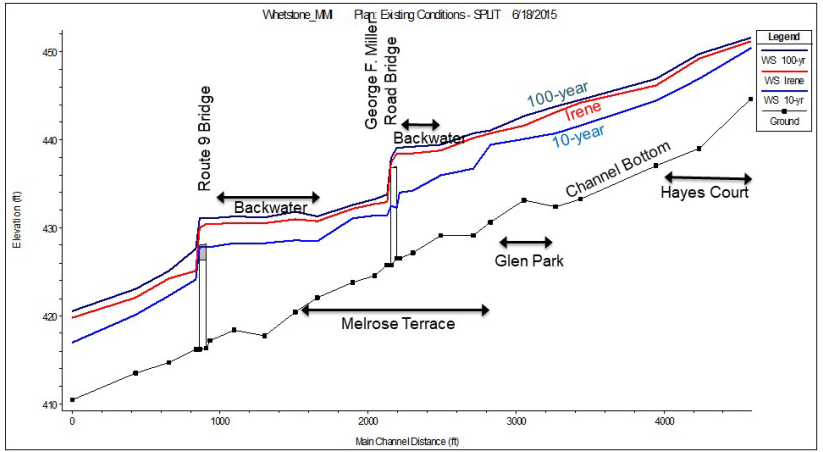
2015 – Vermont Economic Resilience Initiative (VERI)

- Examined broad mitigation alternatives across many municipalities
- Melrose Terrace project described / recommended

2015 – Hydraulic Modelling & Alternatives Analysis

- Detailed hydrologic and hydraulic modelling
- Alternatives for flood reduction
- Concept design

Profile: Existing Conditions



CHALLENGE

Who spearheads these efforts?

How are they paid for?

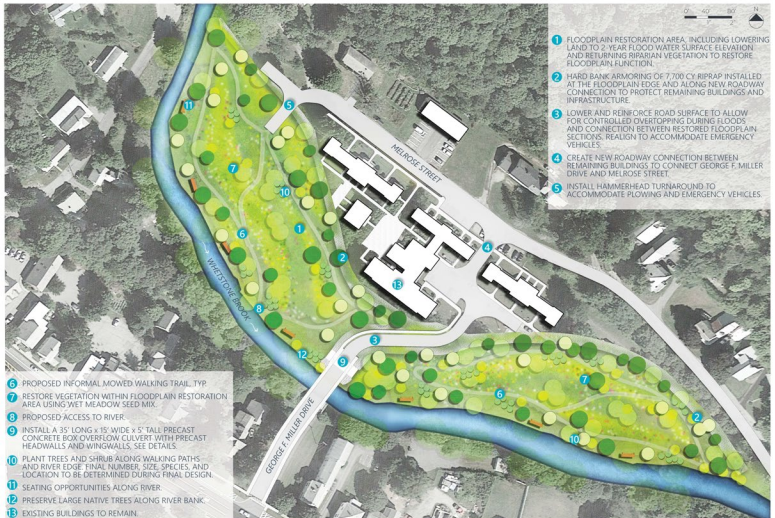
Melrose Terrace Floodplain Restoration

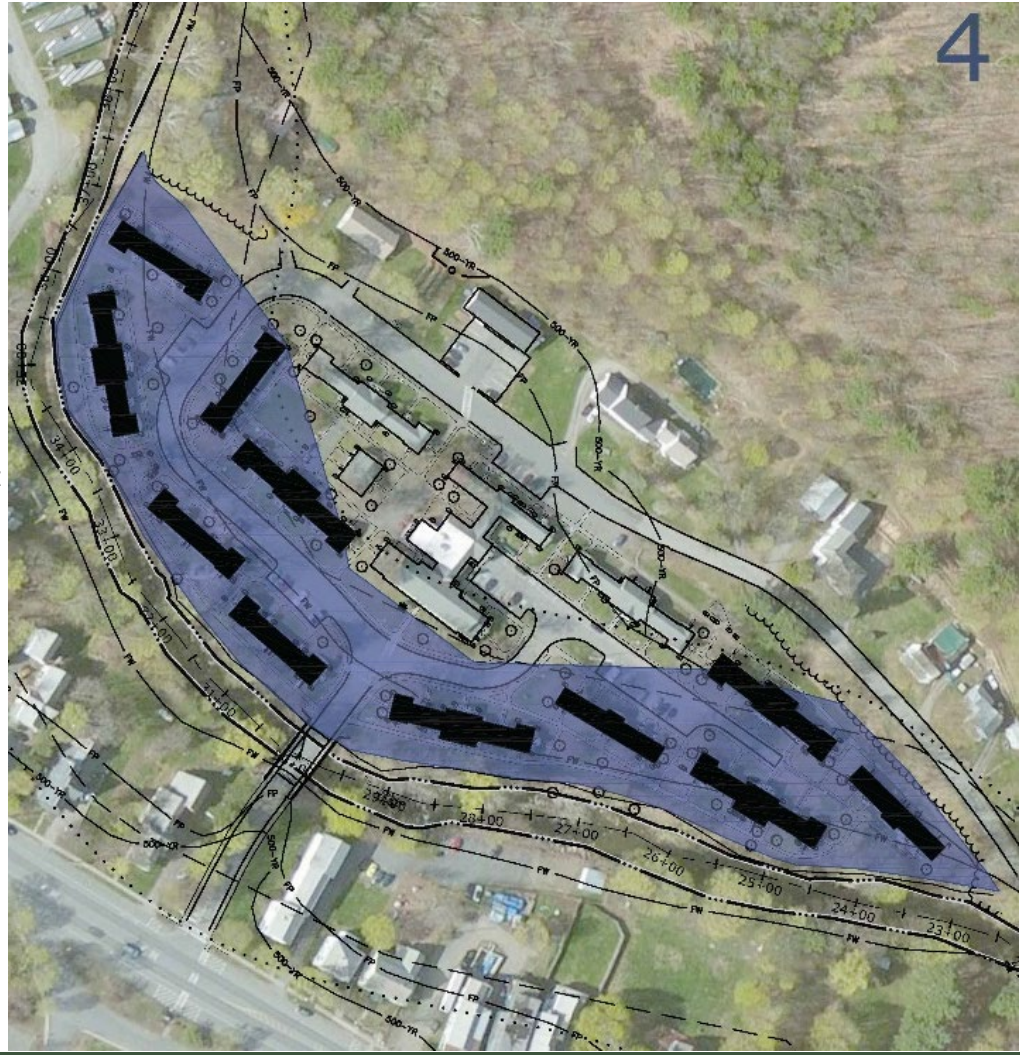
Removing buildings & people & infrastructure from most vulnerable locations

- Remove 11 buildings
- Relocate road
- Relocate sewer main / utilities

Increase floodplain storage capacity

- Remove 28,000 CY fill in floodplain & lower land average 5 feet
- Plant restored 4.4-acre floodplain with native vegetation

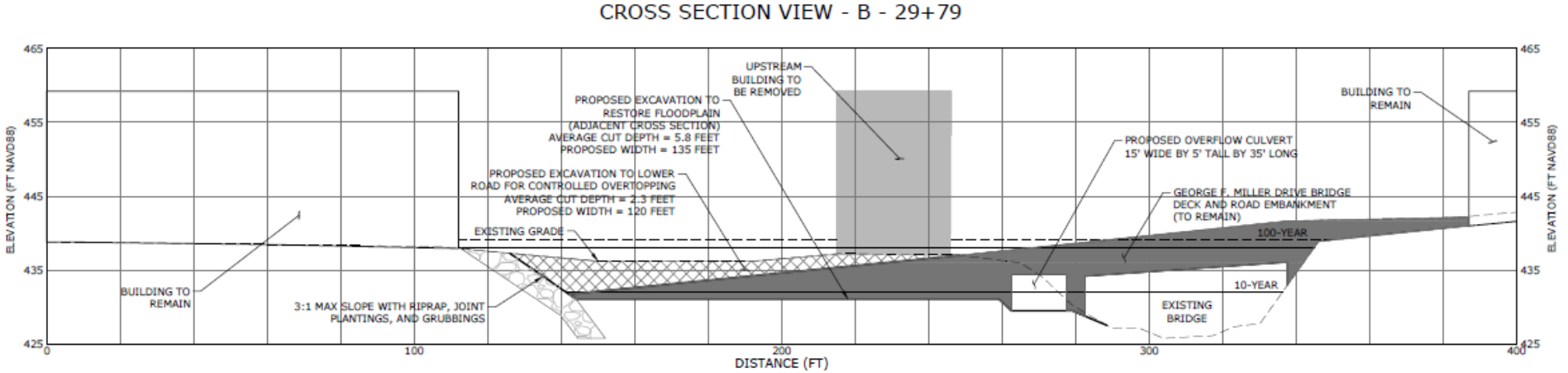


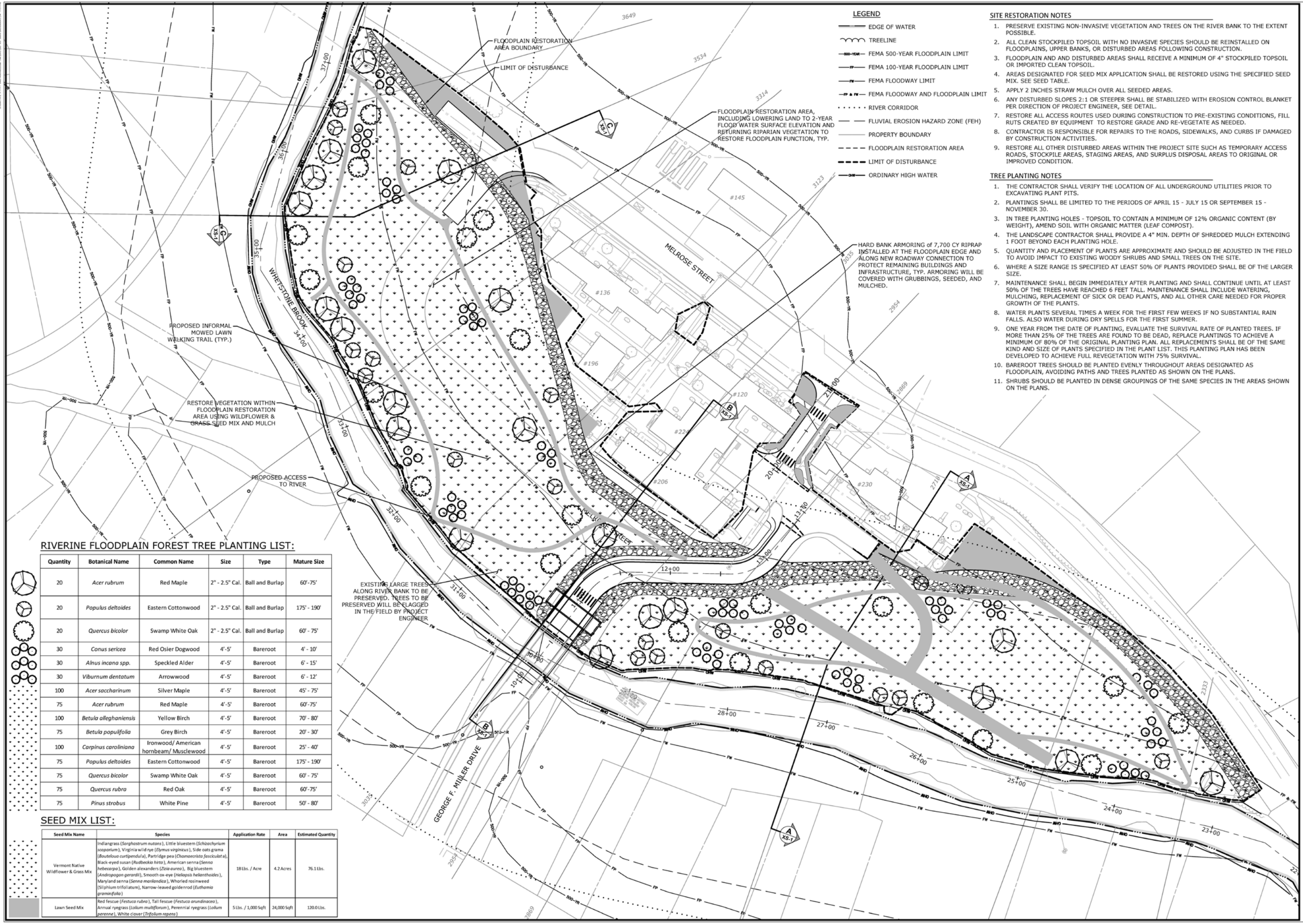


Melrose Terrace Floodplain Restoration

Bridge capacity improved

- Overflow culverts
- Lower road embankment to allow to overtop – road will flood before buildings and before bridge damaged
- Storms >25-year flood had overtopped
- Backwatering raised water 5.5 feet upstream for Irene flood





SITE RESTORATION NOTES

1. PRESERVE EXISTING NON-INVASIVE VEGETATION AND TREES ON THE RIVER BANK TO THE EXTENT POSSIBLE.
2. ALL CLEAN STOCKPILED TOPSOIL WITH NO INVASIVE SPECIES SHOULD BE REINSTALLED ON FLOODPLAINS, UPPER BANKS, OR DISTURBED AREAS FOLLOWING CONSTRUCTION.
3. FLOODPLAIN AND AND DISTURBED AREAS SHALL RECEIVE A MINIMUM OF 4" STOCKPILED TOPSOIL OR IMPORTED CLEAN TOPSOIL.
4. AREAS DESIGNATED FOR SEED MIX APPLICATION SHALL BE RESTORED USING THE SPECIFIED SEED MIX. SEE SEED TABLE.
5. APPLY 2 INCHES STRAW MULCH OVER ALL SEEDED AREAS.
6. ANY DISTURBED SLOPES 2:1 OR STEEPER SHALL BE STABILIZED WITH EROSION CONTROL BLANKET PER DIRECTION OF PROJECT ENGINEER, SEE DETAIL.
7. RESTORE ALL ACCESS ROUTES USED DURING CONSTRUCTION TO PRE-EXISTING CONDITIONS, FILL RUTS CREATED BY EQUIPMENT TO RESTORE GRADE AND RE-VEGETATE AS NEEDED.
8. CONTRACTOR IS RESPONSIBLE FOR REPAIRS TO THE ROADS, SIDEWALKS, AND CURBS IF DAMAGED BY CONSTRUCTION ACTIVITIES.
9. RESTORE ALL OTHER DISTURBED AREAS WITHIN THE PROJECT SITE SUCH AS TEMPORARY ACCESS ROADS, STOCKPILE AREAS, STAGING AREAS, AND SURPLUS DISPOSAL AREAS TO ORIGINAL OR IMPROVED CONDITION.

TREE PLANTING NOTES

1. THE CONTRACTOR SHALL VERIFY THE LOCATION OF ALL UNDERGROUND UTILITIES PRIOR TO EXCAVATING PLANT PITS.
2. PLANTINGS SHALL BE LIMITED TO THE PERIODS OF APRIL 15 - JULY 15 OR SEPTEMBER 15 - NOVEMBER 30.
3. IN TREE PLANTING HOLES - TOPSOIL TO CONTAIN A MINIMUM OF 12% ORGANIC CONTENT (BY WEIGHT), AMEND SOIL WITH ORGANIC MATTER (LEAF COMPOST).
4. THE LANDSCAPE CONTRACTOR SHALL PROVIDE A 4" MIN. DEPTH OF SHREDDED MULCH EXTENDING 1 FOOT BEYOND EACH PLANTING HOLE.
5. QUANTITY AND PLACEMENT OF PLANTS ARE APPROXIMATE AND SHOULD BE ADJUSTED IN THE FIELD TO AVOID IMPACT TO EXISTING WOODY SHRUBS AND SMALL TREES ON THE SITE.
6. WHERE A SIZE RANGE IS SPECIFIED AT LEAST 50% OF PLANTS PROVIDED SHALL BE OF THE LARGER SIZE.
7. MAINTENANCE SHALL BEGIN IMMEDIATELY AFTER PLANTING AND SHALL CONTINUE UNTIL AT LEAST 50% OF THE TREES HAVE REACHED 6 FEET TALL. MAINTENANCE SHALL INCLUDE WATERING, MULCHING, REPLACEMENT OF SICK OR DEAD PLANTS, AND ALL OTHER CARE NEEDED FOR PROPER GROWTH OF THE PLANTS.
8. WATER PLANTS SEVERAL TIMES A WEEK FOR THE FIRST FEW WEEKS IF NO SUBSTANTIAL RAIN FALLS. ALSO WATER DURING DRY SPELLS FOR THE FIRST SUMMER.
9. ONE YEAR FROM THE DATE OF PLANTING, EVALUATE THE SURVIVAL RATE OF PLANTED TREES. IF MORE THAN 25% OF THE TREES ARE FOUND TO BE DEAD, REPLACE PLANTINGS TO ACHIEVE A MINIMUM OF 80% OF THE ORIGINAL PLANTING PLAN. ALL REPLACEMENTS SHALL BE OF THE SAME KIND AND SIZE OF PLANTS SPECIFIED IN THE PLANT LIST. THIS PLANTING PLAN HAS BEEN DEVELOPED TO ACHIEVE FULL REVEGETATION WITH 75% SURVIVAL.
10. BAREROOT TREES SHOULD BE PLANTED EVENLY THROUGHOUT AREAS DESIGNATED AS FLOODPLAIN, AVOIDING PATHS AND TREES PLANTED AS SHOWN ON THE PLANS.
11. SHRUBS SHOULD BE PLANTED IN DENSE GROUPINGS OF THE SAME SPECIES IN THE AREAS SHOWN ON THE PLANS.

RIVERINE FLOODPLAIN FOREST TREE PLANTING LIST:

Quantity	Botanical Name	Common Name	Size	Type	Mature Size
20	*Acer rubrum*	Red Maple	2" - 2.5" Cal.	Ball and Burlap	60'-75'
20	*Populus deltoides*	Eastern Cottonwood	2" - 2.5" Cal.	Ball and Burlap	175' - 190'
20	*Quercus bicolor*	Swamp White Oak	2" - 2.5" Cal.	Ball and Burlap	60' - 75'
30	*Conus sericea*	Red Osier Dogwood	4'-5'	Bareroot	4' - 10'
30	*Alnus incana spp.*	Speckled Alder	4'-5'	Bareroot	6' - 15'
30	*Viburnum dentatum*	Arrowwood	4'-5'	Bareroot	6' - 12'
100	*Acer saccharinum*	Silver Maple	4'-5'	Bareroot	45' - 75'
75	*Acer rubrum*	Red Maple	4'-5'	Bareroot	60'-75'
100	*Betula alleghaniensis*	Yellow Birch	4'-5'	Bareroot	70' - 80'
75	*Betula populifolia*	Grey Birch	4'-5'	Bareroot	20' - 30'
100	*Carpinus caroliniana*	Ironwood/ American hornbeam/ Musclewood	4'-5'	Bareroot	25' - 40'
75	*Populus deltoides*	Eastern Cottonwood	4'-5'	Bareroot	175' - 190'
75	*Quercus bicolor*	Swamp White Oak	4'-5'	Bareroot	60' - 75'
75	*Quercus rubra*	Red Oak	4'-5'	Bareroot	60'-75'
75	*Pinus strobus*	White Pine	4'-5'	Bareroot	50' - 80'

SEED MIX LIST:

Seed Mix Name	Species	Application Rate	Area	Estimated Quantity
Vermont Native Wildflower & Grass Mix	Indiangrass (*Sorghastrum nutans*), Little bluestem (*Schizachyrium scoparium*), Virginia wild rye (*Elymus virginicus*), Side oats grama (*Bouteloua curtipendula*), Partridge pea (*Chamaecrista fasciculata*), Black-eyed susan (*Rudbeckia hirta*), American senna (*Senna hebecarpa*), Golden alexanders (*Zizia aurea*), Big bluestem (*Andropogon gerardii*), Smooth ox-eye (*Heliopsis helianthoides*), Maryland senna (*Senna marilandica*), Whorled rosinweed (Silphium trifoliatum), Narrow-leaved goldenrod (*Euthamia graminifolia*)	18 Lbs. / Acre	4.2 Acres	76.1 Lbs.
Lawn Seed Mix	Red fescue (*Festuca rubra*), Tall fescue (*Festuca arundinacea*), Annual ryegrass (*Lolium multiflorum*), Perennial ryegrass (*Lolium perenne*), White clover (*Trifolium repens*)	5 Lbs. / 1,000 Sqft	24,000 Sqft	120.0 Lbs.

SLR
1 SOUTH MAIN STREET
WATERBURY, VT 05676
802.882.8335
SLRCONSULTING.COM

DESCRIPTION	DATE	BY

FINAL DESIGN

PR - RESTORATION

FLOODPLAIN RESTORATION PROJECT
WHETSTONE BROOK AT MELROSE TERRACE

BRATTLEBORO HOUSING PARTNERSHIPS
BRATTLEBORO, VERMONT

DESIGNED	DRAWN	CHECKED
JCL	JCL	RKS

SCALE: 1"=40'

DATE: JULY 23, 2021

PROJECT NO. 5696-02

SHEET NO. 05 OF 18

SHEET NAME: PR-3

Copyright Milone & MacBroom, Inc - 2018

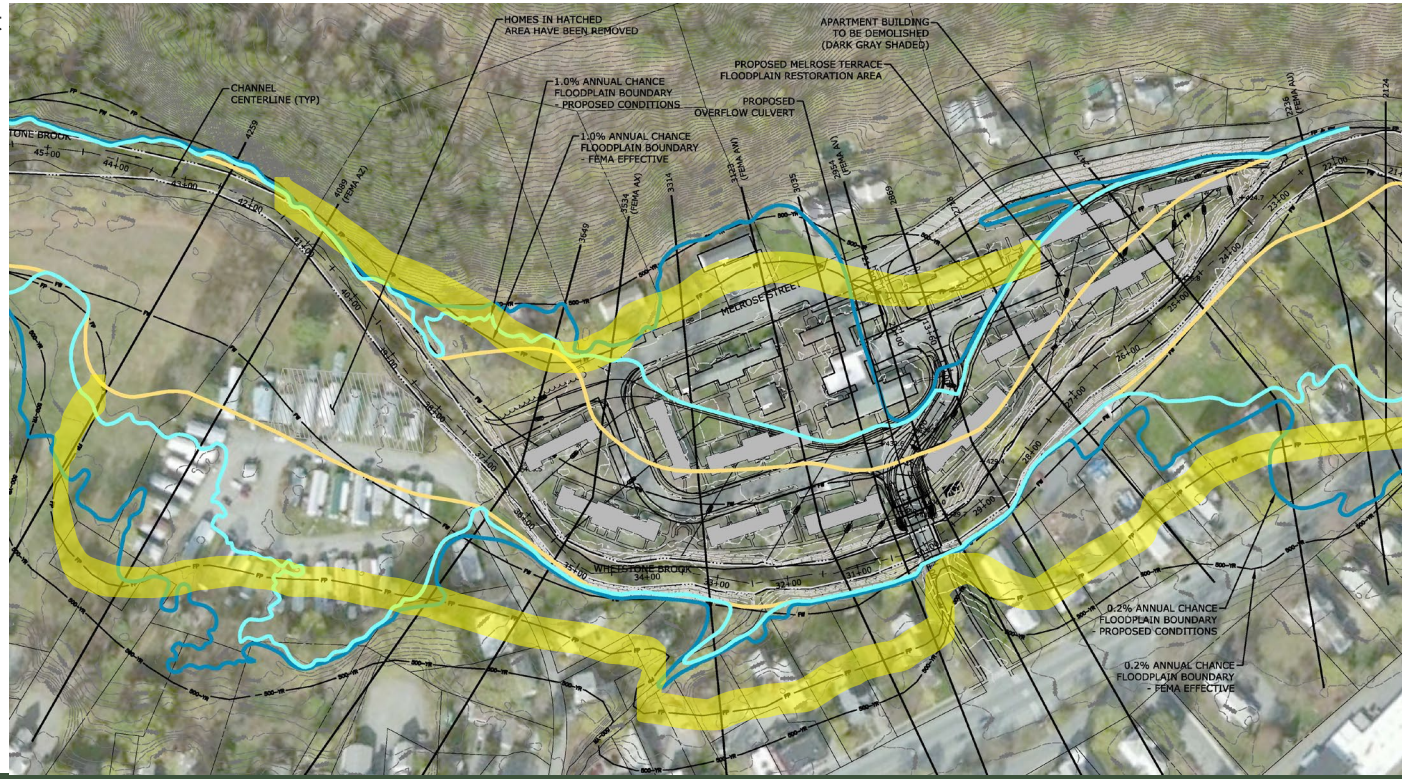
Melrose Terrace Project Benefits

2017 – FEMA Benefit-Cost Analysis

- Building acquisition
- Modelled flood elevation reduction at buildings
- Floodplain ecosystem benefits
- Benefit-Cost Ratio = 2.5

Flood Reduction

- Remaining onsite buildings removed from floodplain
- Reduced flooding across river and upstream
- Irene flood size water elevation reduced:
  - Glen Park = 1.9’
  - Upstream GF Miller = 2.9’
  - Downstream GF Miller = 1.1’
  - Melrose Street = 3.0’ - 7.0’
- Flood storage and debris catchment may reduce damages downstream



Melrose Terrace – Completed Project 2022

Pre-construction (Hartgen)

Post-construction

Melrose Terrace – Completed Project

10/28/2020

Pre-construction

6/19/2023

Post-construction

Melrose Terrace – Flooding Post-Construction

River using floodplain

- Meander bend created on upper floodplain, where previously straightened
- River accessed floodplain 4 times
- Flows are slowed, depositing sediment and reducing erosion capacity

7-12-2023

12-23-2022

Melrose Terrace – Flooding Post-Construction

Remaining buildings and infrastructure safe

- Water stayed within the designated onsite areas
- 4.4 acres floodplain covered with feet of water
- Buildings not flooded
- Road overtopped as planned

Flood elevations reduced

- July 10, 2023 estimated approximately 10-year flood based on rainfall (not gauged)
- Modelling predicts this flood had 1.0-2.5 feet lower flood elevations than if project not completed

10-17-2023

10-17-2023