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# River Road Stabilization Lincoln, VT

Transportation Advisory Committee Meeting  
Addison County Regional Planning Commission

September 2023

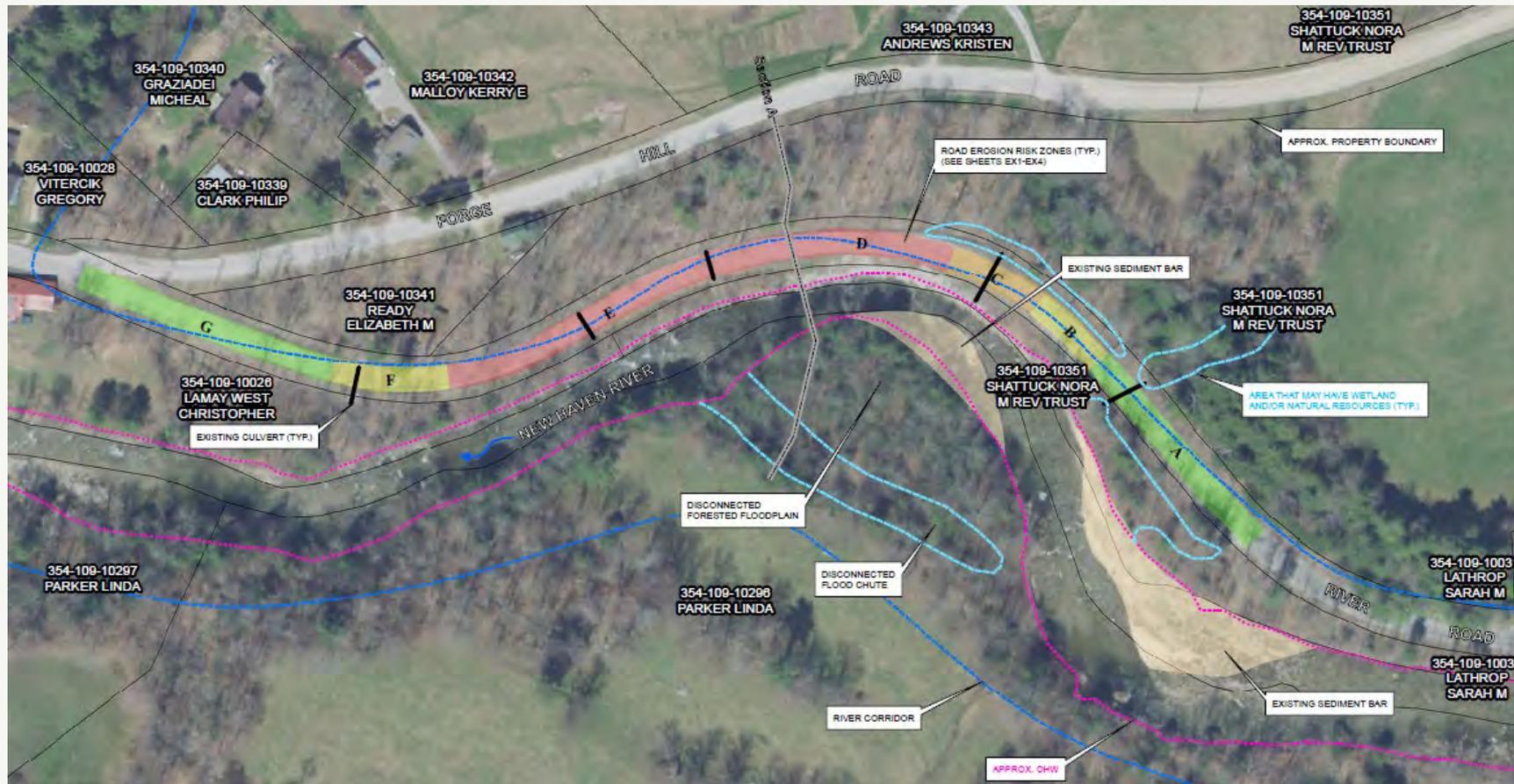




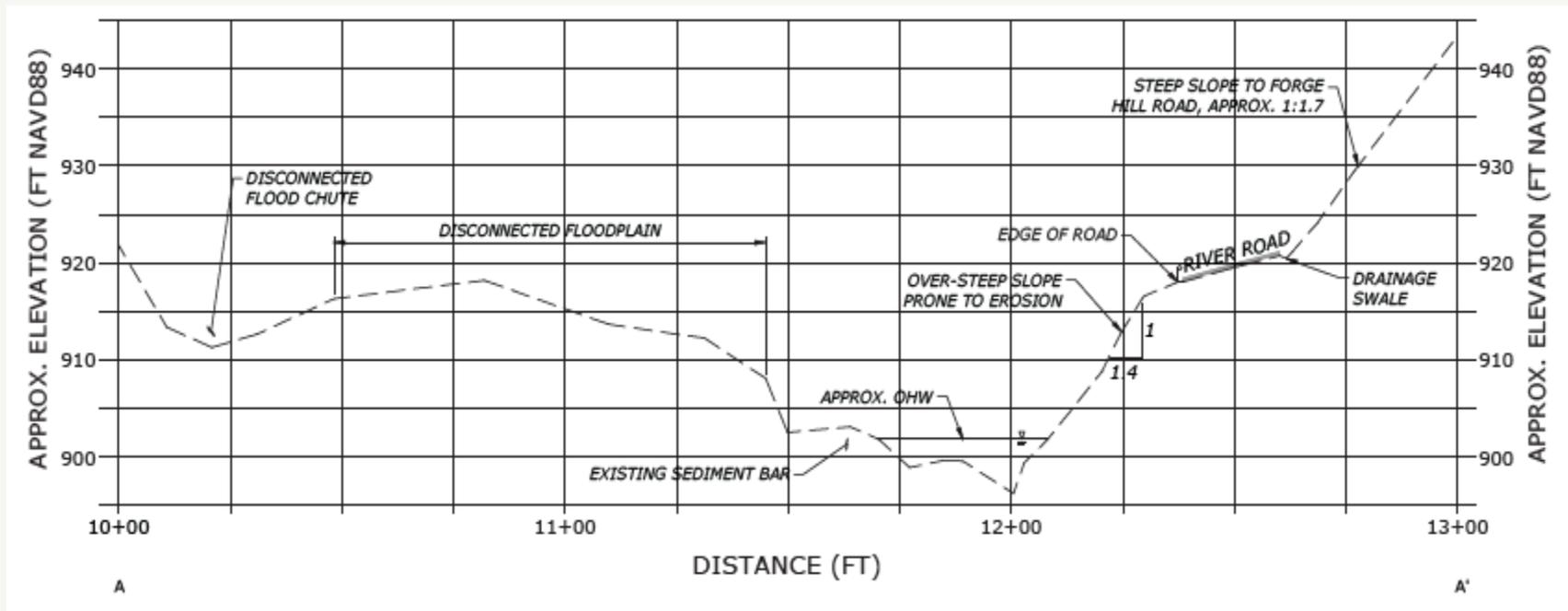
# Existing Conditions



# Project Area

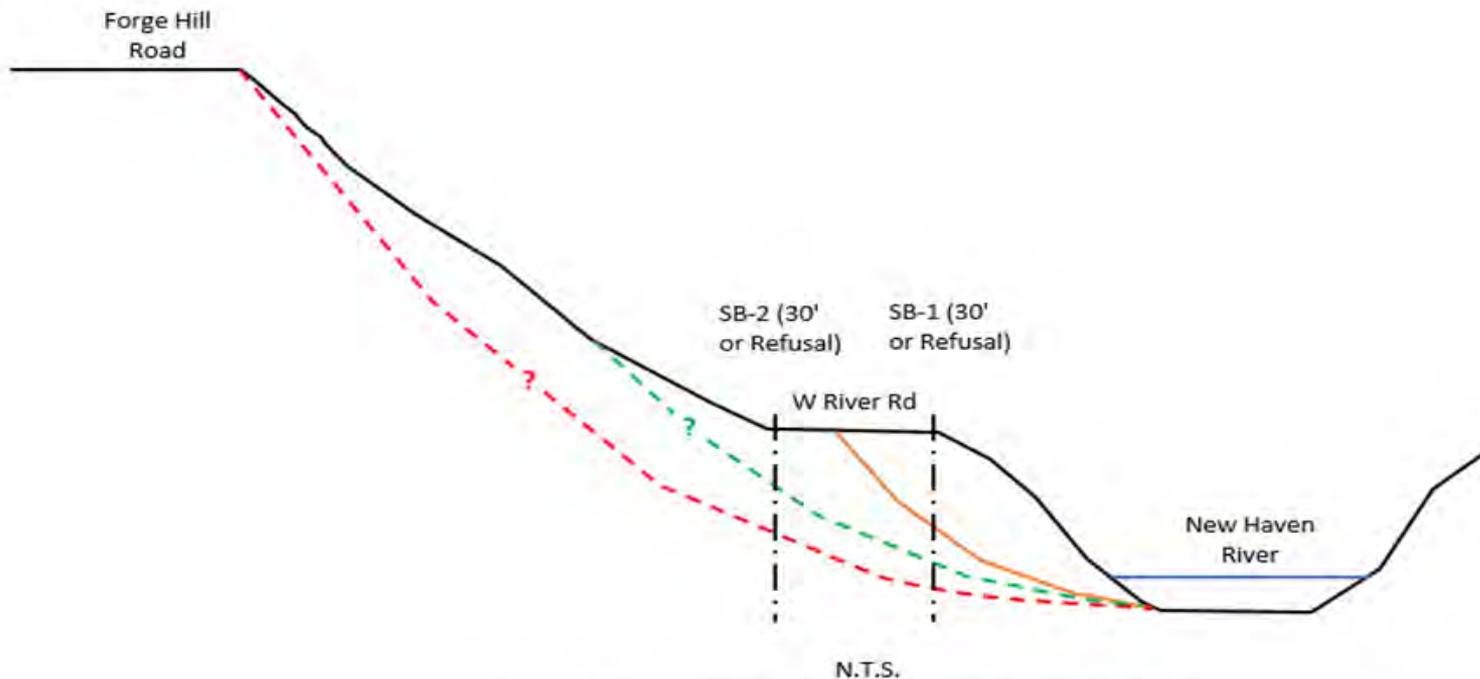


# Cross Section





# Slope Stability Scenarios



NOTES: Inclinator and Observation Well are Planned in Each Borehole  
Boring Locations and Depths Will Vary Based on Field Conditions



# Conceptual Alternatives

Road Embankment



# Alternatives Matrix – Road Embankment

Alternative ID	Reduce flood and erosion risks to road	Stabilize river bank to improve water quality and habitat	Minimize construction costs	Minimize future maintenance needs	Total Score	Approximate Construction Cost
1 - No Action	1	1	3	1	6	n/a
2 - Repair Stone Armoring	2	2	3	1	8	\$800,000
3 - Rebuild Stone Armoring with Pinning	3	2	2	3	10	\$1,500,000
4 - Concrete Flood Wall	3	1	1	3	8	\$2,500,000
5 - MSE Wall	3	1	1	3	8	\$1,200,000

Scoring based on 0 – 3 scale, 0 = not applicable, 1 = lowest goal achievement, 3 = highest goal achievement

- Construction Cost based on repairing / rebuilding full extent shown on conceptual plan (30% Design) using Recent Bid Results (past 3 years)
- Cost represents an upper limit to be refined as design advances.



# Alternative 1– No Action

## PROS

- No Construction Costs

## CONS

- Repairs / Maintenance Needed Now
- 5-10 year Repair Cycle





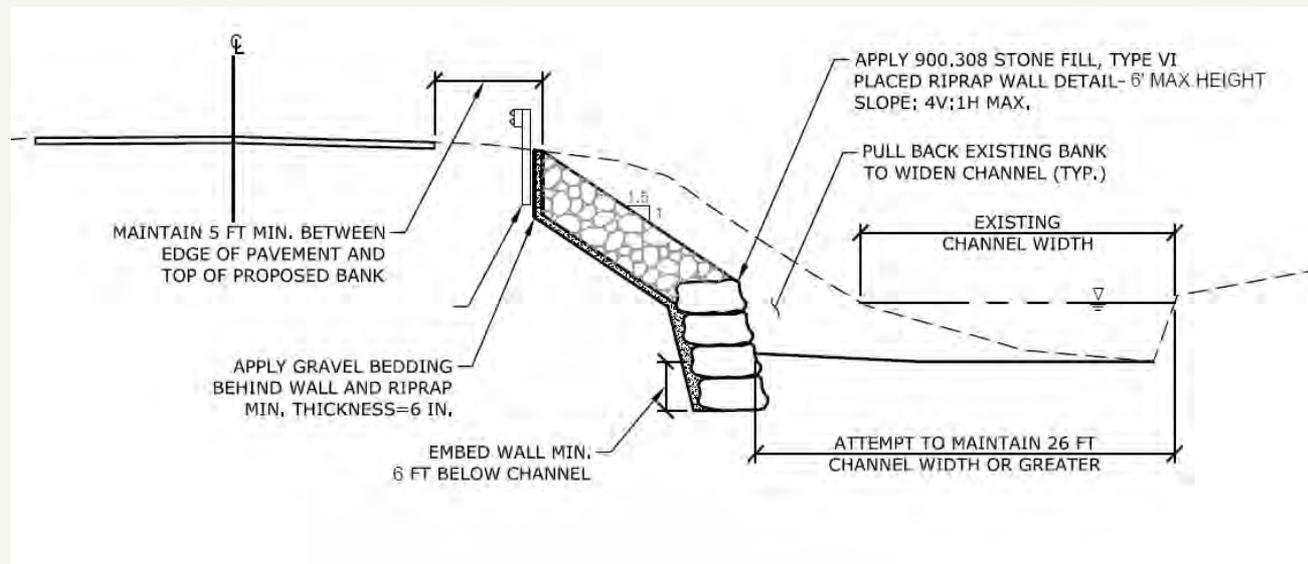
# Alternative 2 – Repair Armoring - Dry Stacked Wall

## PROS

- Least Expensive Construction Costs

## CONS

- 5-10 year Repair Cycle
- Height Limitations





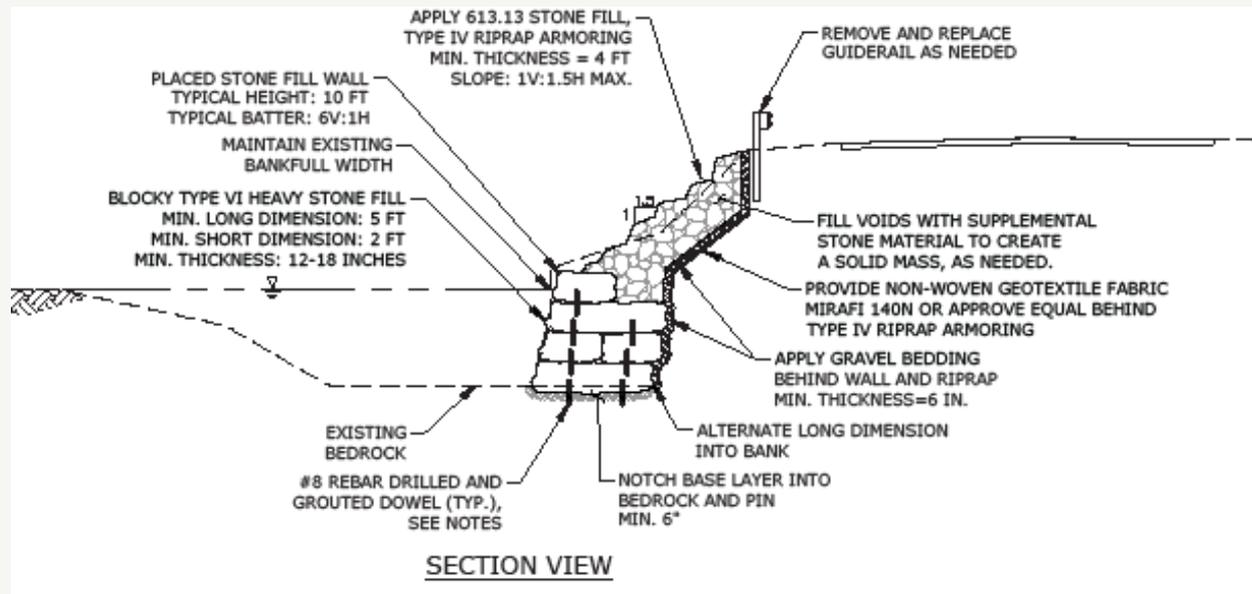
# Alternative 3 – Rebuild Armoring - Stacked Wall with Pinning

## PROS

- Increased Height
- Increased Durability
- Increased Longevity

## CONS

- Labor Intensive
- Higher Construction Costs
- Pinned to Bedrock





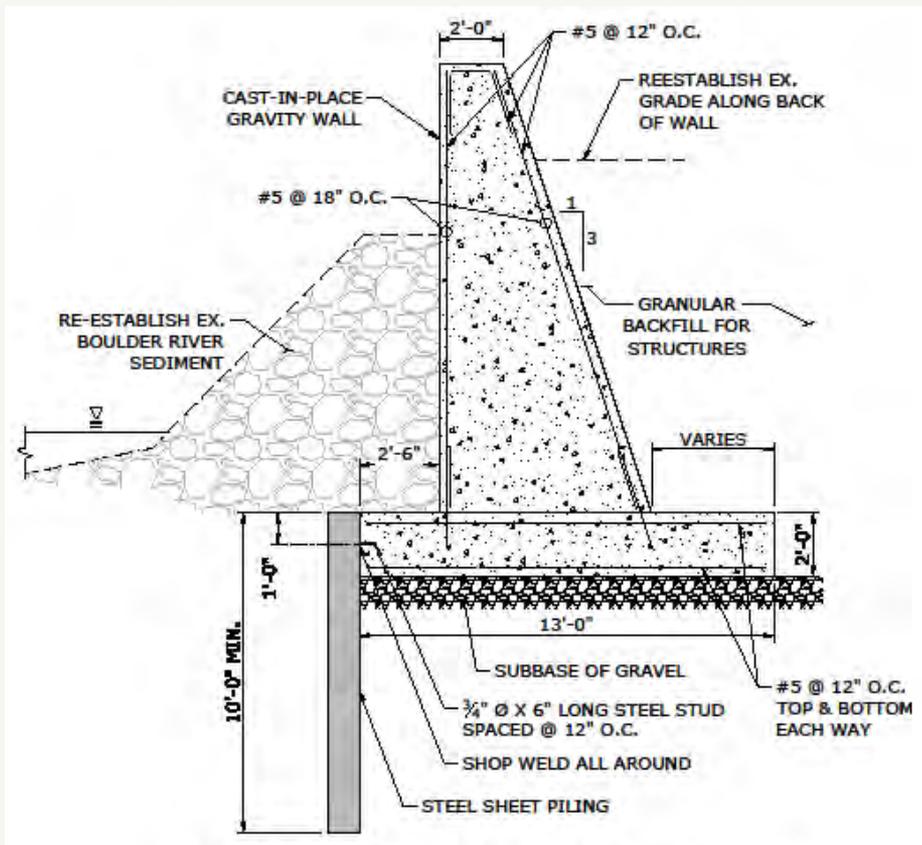
# Alternative 4 – Concrete Floodwall

## PROS

- Increased Durability
- Increased Longevity
- Increased Height

## CONS

- Doesn't fit setting
- Labor Intensive
- Highest Construction Costs
- Constructability
- Pinned to Bedrock





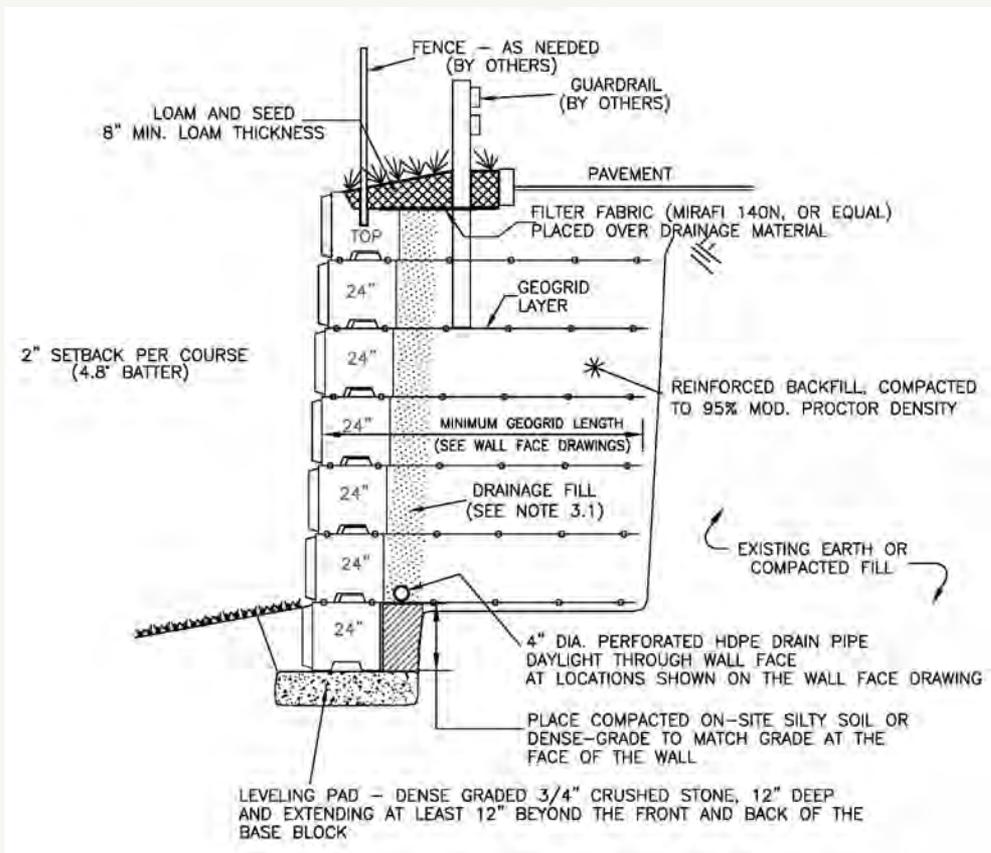
# Alternative 5 – MSE Floodwall

## PROS

- Increased Height

## CONS

- Doesn't fit setting
- Labor Intensive
- High Construction Costs
- Constructability
- Durability in River Setting





# Conceptual Alternatives

River Channel & Drainage Improvements



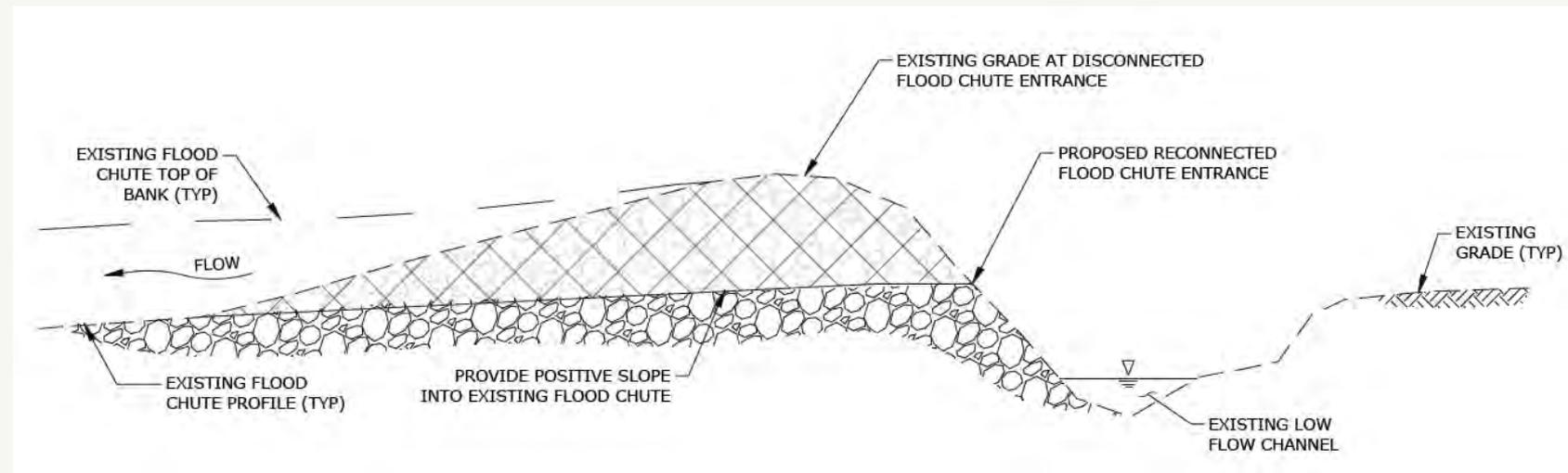
# Alternative RC1– Flood Chute Reconnection

## PROS

- Relieves Pressure on Roadway
- Restores Natural Function

## CONS

- Private Landowner Cooperation
- Easement Required





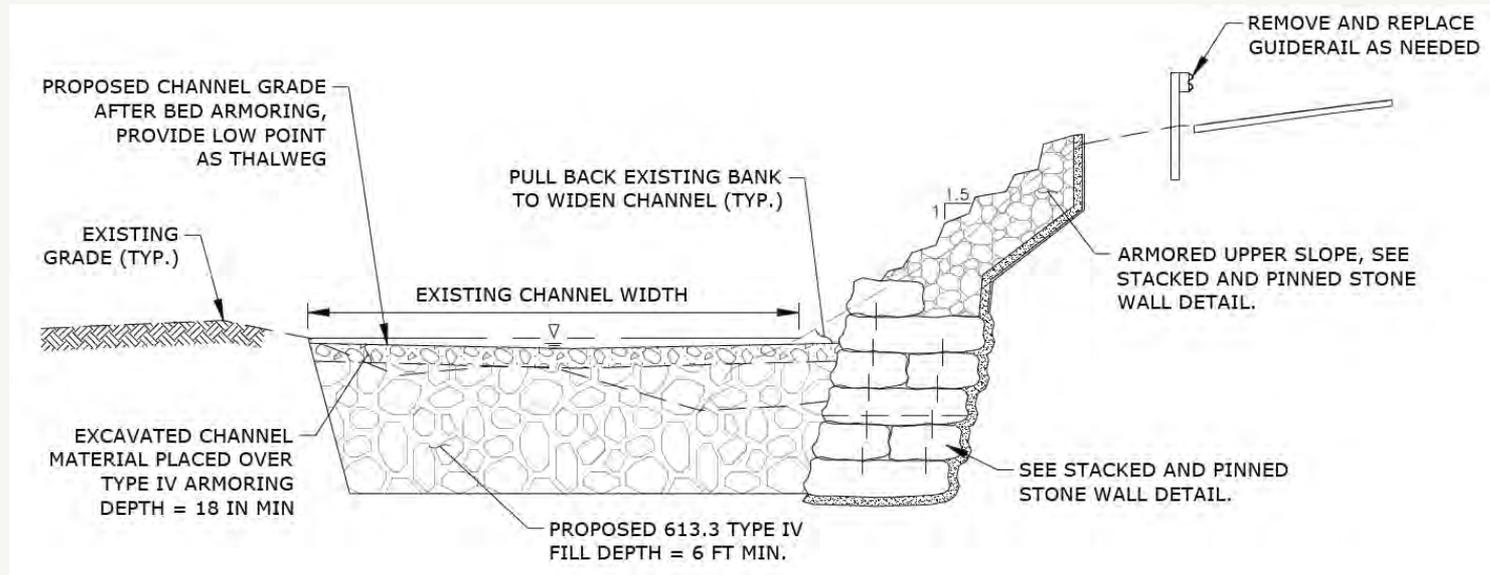
# Alternative RC2– Channel Bed Armoring & Raising

## PROS

- Reduces Incision / Undermining Risk
- May Restore Floodplain Connectivity

## CONS

- Requires Additional Evaluation
- Impacts during Construction





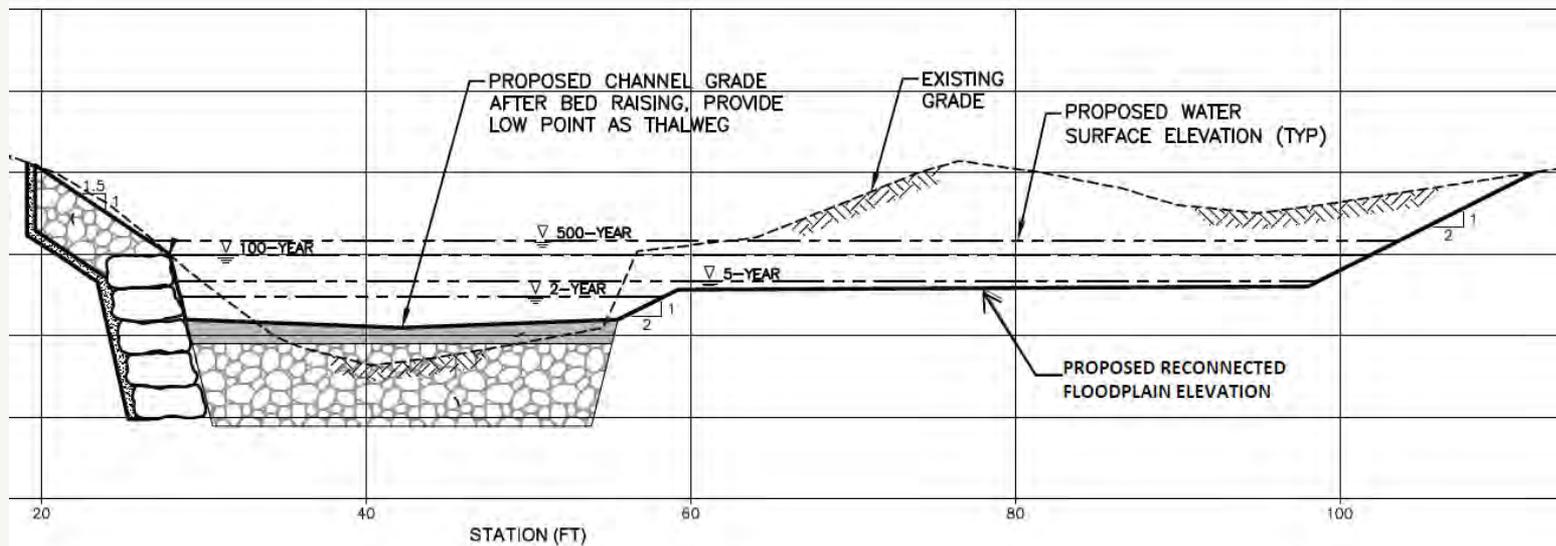
# Alternative RC3– Floodplain Reconnection

## PROS

- Restore Floodplain Connectivity
- Reduces Pressure on Embankment
- Deposition of Sediment & Debris

## CONS

- Loss of Riparian Buffer
- Private Landowner Cooperation
- Easement Required





# Drainage Improvements- Benefits

## D1 – Road Profile & Crown Improvements

- Reshape road surface and/or adjust profile to redirect runoff

## D2 – Swale Reconnection / Repair

- Evaluate swale capacity, increase size where needed
- Stabilize swale and toe of tall slope to decrease erosion & maintenance

## D3 – Flow Distribution / Culvert Sizing

- Evaluate culvert size, increase as needed
- Consider additional culverts to help distribute flow

## D4 – Stabilized Flow Paths

- Increase inlet efficiency (help with winter freeze up)
- Protected inlets and outlets



# Conceptual Design, Recommendations, & Next Steps



# Recommendations

## Recommended Alternatives (estimated \$1,500,000)

- Alternative 3 – Rebuild Stone Armoring with Pinning
- Alternative D1 – Road Profile & Crown Adjustment
- Alternative D2 – Swale Reconnection & Improvements
- Alternative D3 - Flow Distribution / Culvert Sizing
- Alternative D4 – Stabilized Flow Paths

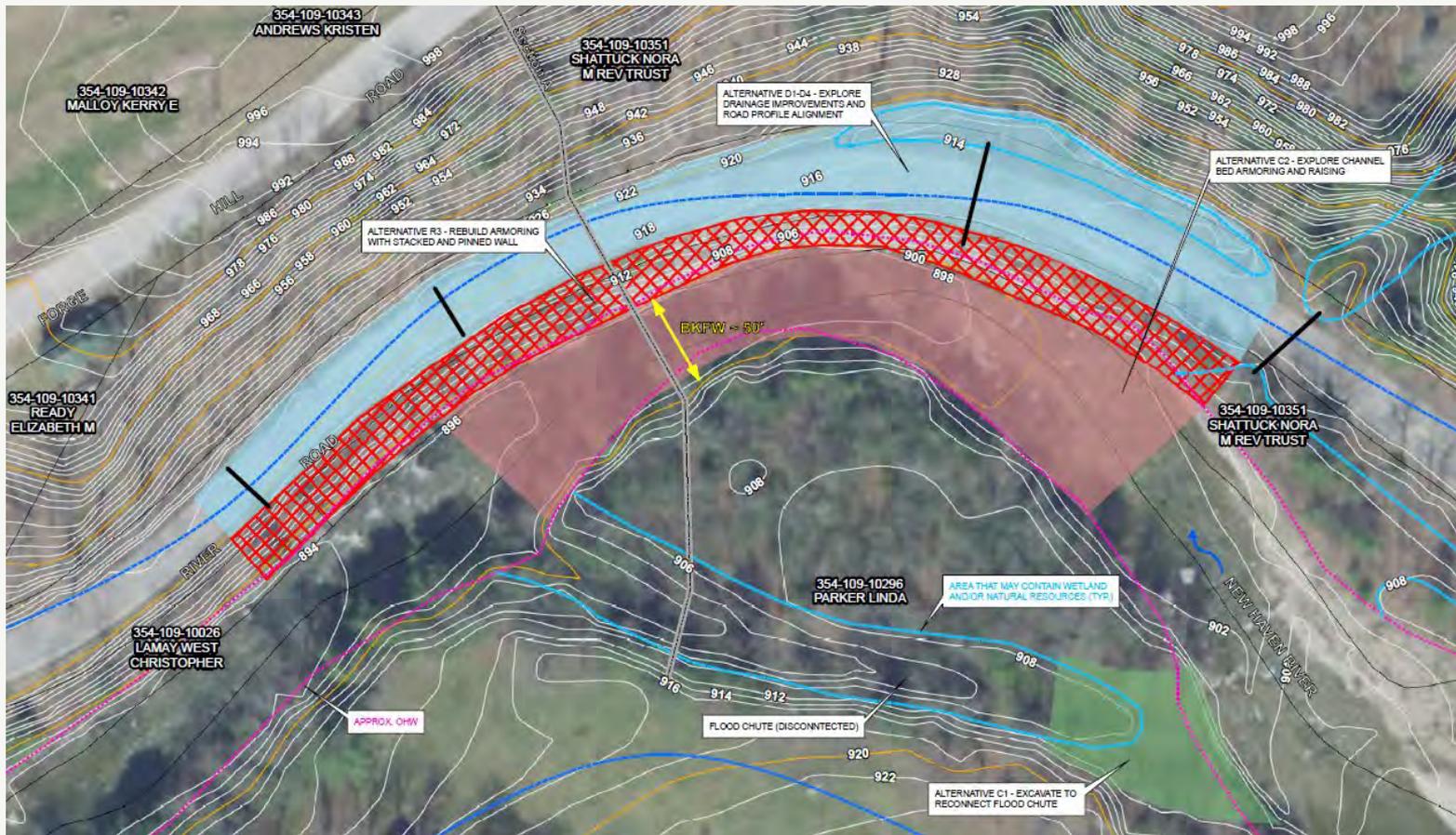
## Evaluate Further during Final Design

- Alternative RC1 – Flood Chute Reconnection (estimated \$50,000 - \$100,000)
- Alternative RC2 – Channel Bed Armoring and Raising (estimated \$300,000 - \$400,000)

## Estimated Total – Construction Costs

- *\$1,500,000 to \$1,900,000*

# Conceptual Design





# Next Steps

## Data Needs for Final Design

- Topographic Survey – estimated \$10,000
- Boundary Survey – estimated \$8,000
- Wetland Delineation & Assessment – estimated \$4,000
- Deep Soil Investigation and Geotechnical Analysis – estimated \$25,000

(Deep Soil Investigation and Geotechnical Analysis will determine if potential measures are needed to address stability of the slope between River Road and Forge Hill Road)

## Advanced Design

- Final Design & Permitting – estimated \$50,000 - \$60,000

## Estimated Total - Professional Services

- *\$100,000 to \$110,000*



# Questions?



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# Extra Slides



# Conceptual Alternatives

Drainage Improvements



# Drainage Improvements- Benefits

## D1 – Road Profile & Crown Improvements

- Reshape road surface to redirect runoff
- Consider profile adjustment while rebuilding roadway

## D2 – Swale Reconnection / Repair

- Evaluate swale capacity, increase size where needed
- Stabilize swale and toe of slope to decrease erosion & maintenance requirements

## D3 – Flow Distribution / Culvert Sizing

- Evaluate culvert size, increase as needed
- Consider additional culverts to help distribute flow

## D4 – Stabilized Flow Paths

- Increase inlet efficiency (help with winter freeze up)
- Protected inlets and outlets



# Drainage Improvements– Potential Limitations

## D1 – Road Profile & Crown Improvements

- Changes must follow safe roadway design standards
- Horizontal and vertical alignment may limit potential options

## D2 – Swale Reconnection / Repair

- Limited space to increase swale capacity
- Frequent maintenance requirements continue

## D3 – Flow Distribution / Culvert Sizing

- Limited on how large culverts can become
- Additional culverts increase maintenance

## D4 – Stabilized Flow Paths

- Inlet efficiency limited by culvert alignment and shallow cover

