

AASHTO Extreme Weather Events Symposium

**Vermont's Road and Rivers -
Managing for the Future**



May 22, 2013

PLANET EARTH



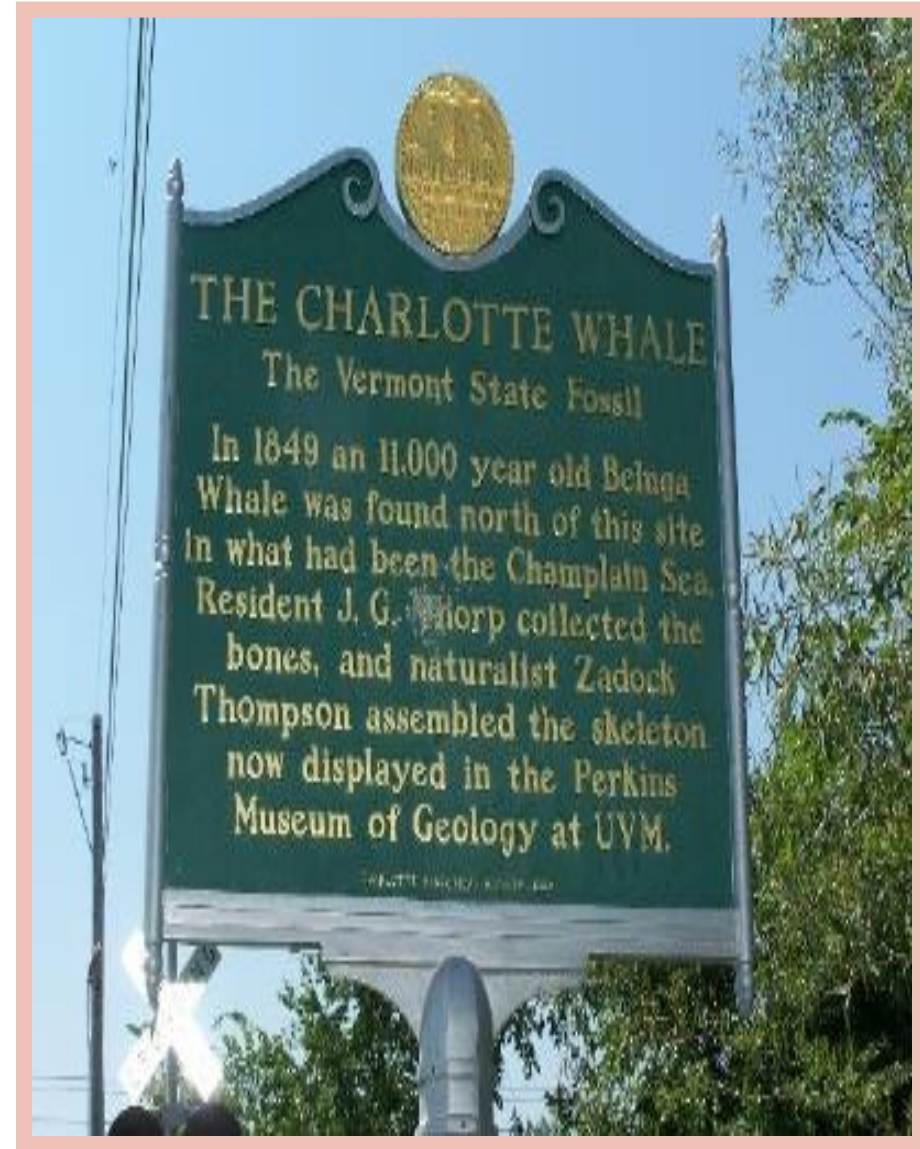
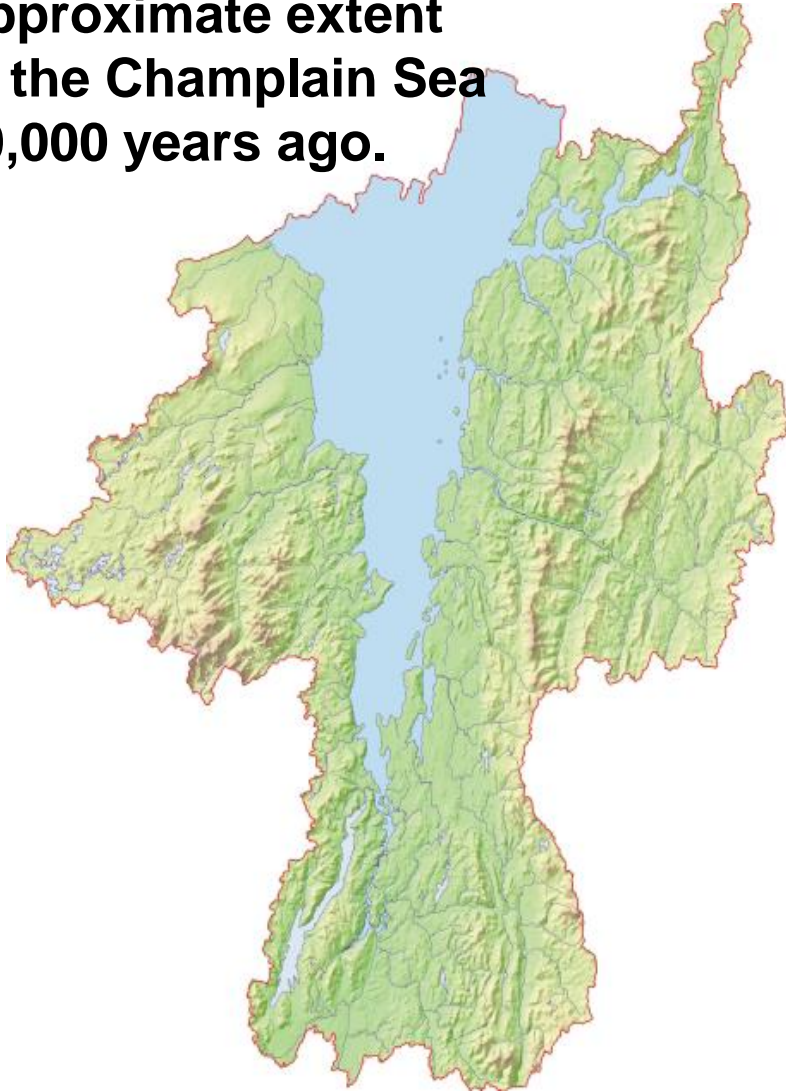
MANY MANY YEARS AGO



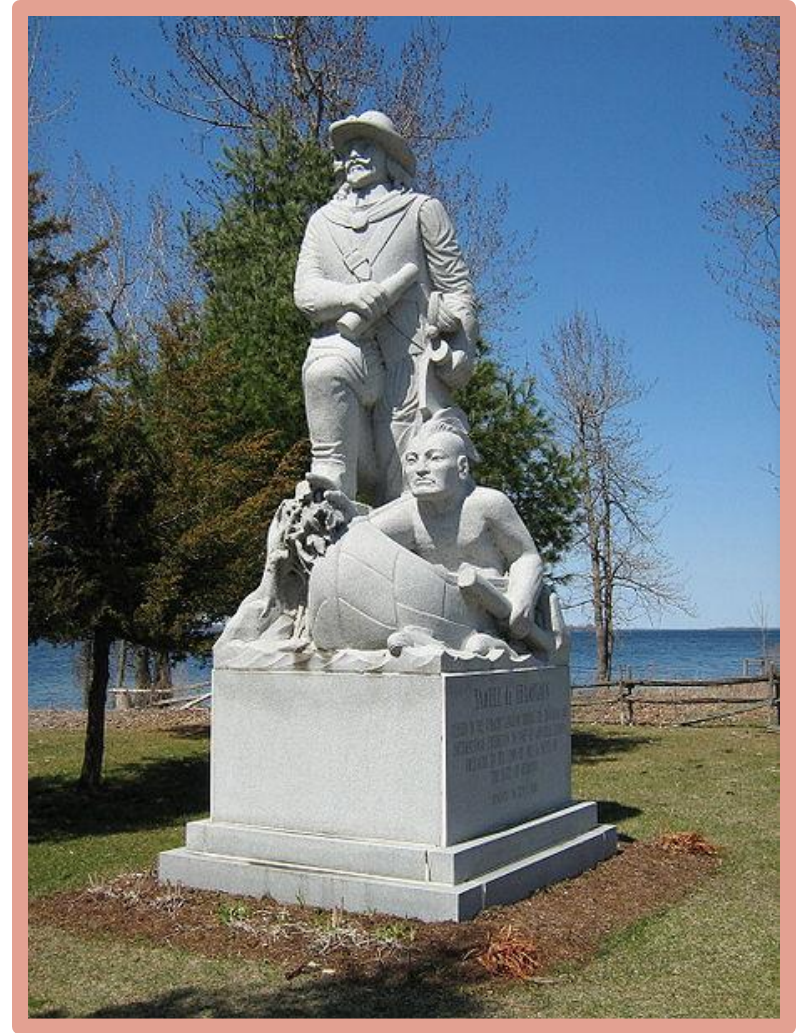
23,000
years ago
there was
more than
8,000 feet
of glacier
over
Vermont

MANY YEARS AGO

Approximate extent
of the Champlain Sea
10,000 years ago.



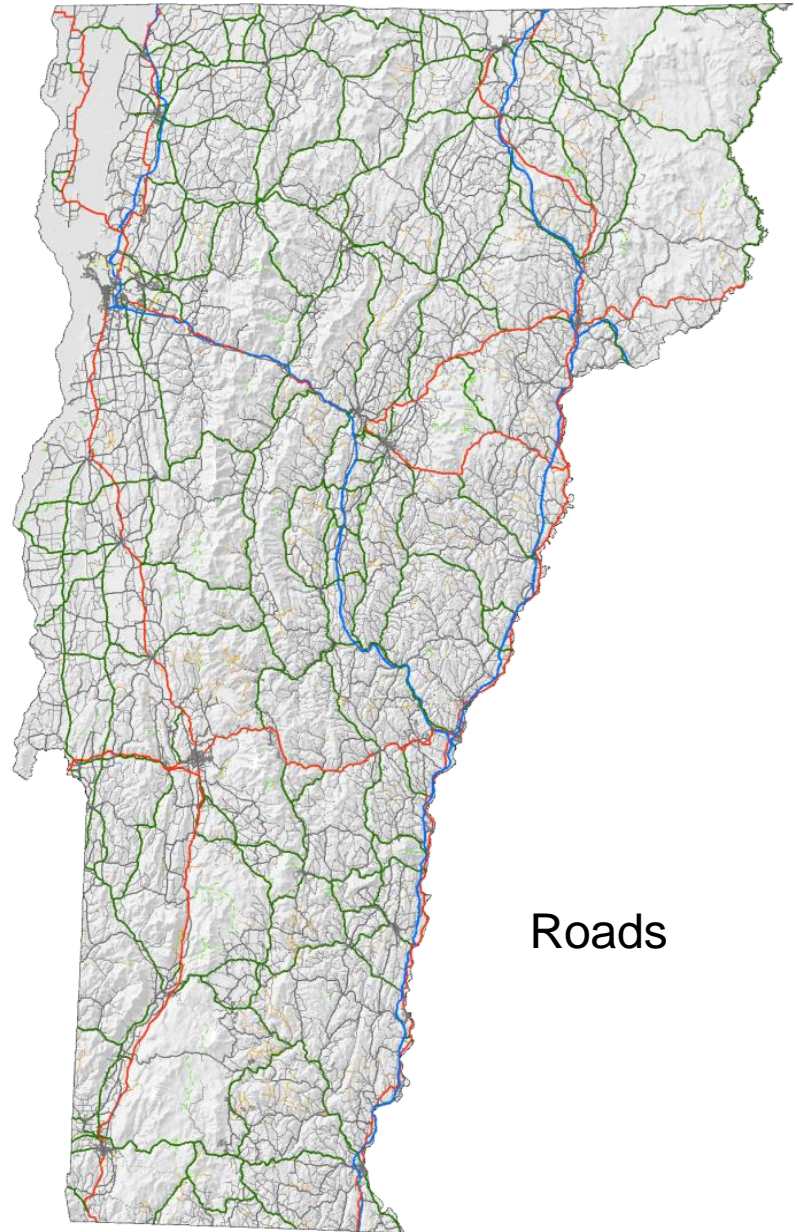
1609 – Samuel de Champlain EXPLORES THE LAKE



RIVERS LONG BEFORE ROADS



Rivers



Roads

VERMONT'S LANDSCAPE HAS

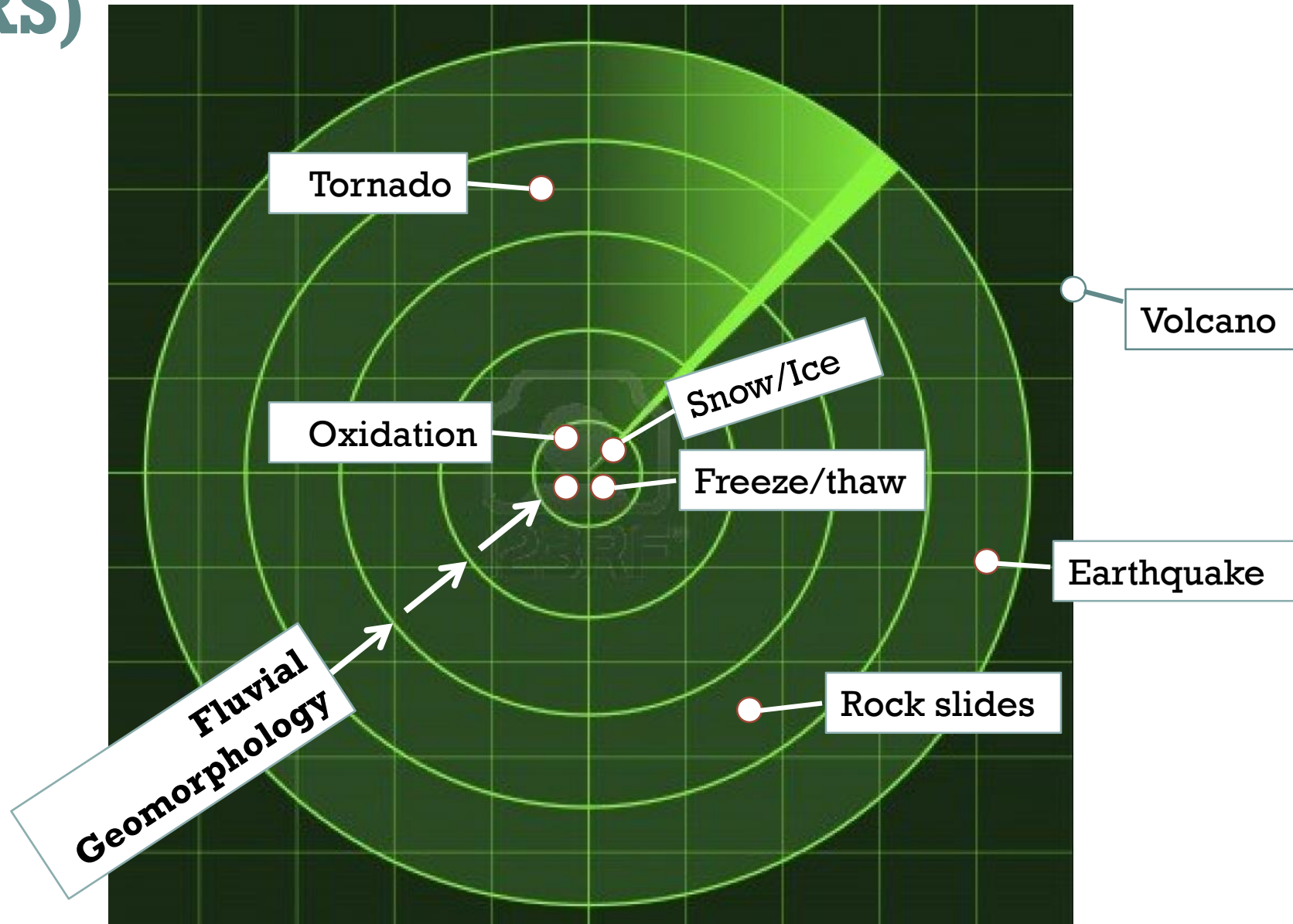
REFORESTED OVER THE PAST 100 YEARS



Topsham, VT
1907 vs. 2007



VT's RESILIENCY RADAR SYSTEM (RRS)



VTrans HYDRAULICS MANUAL UPDATES

- Vermont's old manual focused on hydraulic capacity of structure (water only). The new manual will employ a "river science" approach and consider hydraulic capacity, sediment and debris.
- The new manual will likely allow for more risk based design in terms of roadway safety and stream stability. A structure on town road with an ADT of 2000 over a unstable channel will be designed differently than a town road structure with and ADT of 20 over a stable channel.
- The new manual will parallel language in the latest stream alteration permit. This will make the process more clear to people unfamiliar with the design and permitting process (FEMA).

Buels Gore, Chittenden County, VT



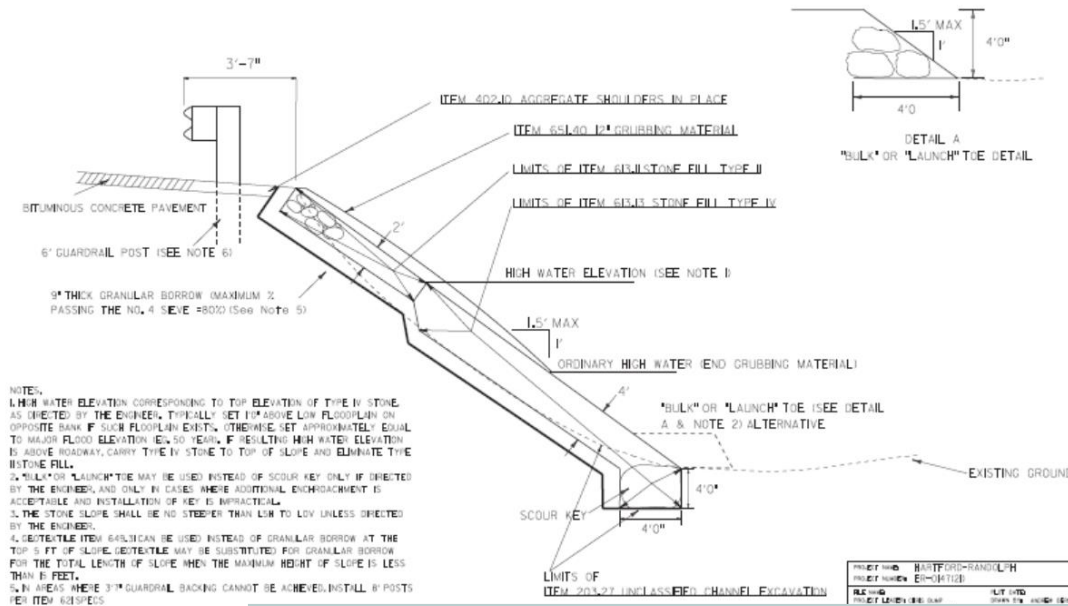
2003

2007

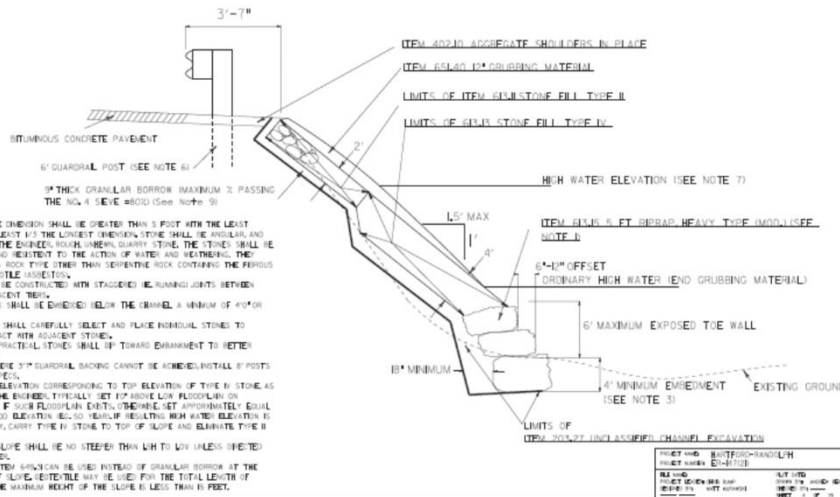


SIDE SLOPE DESIGN

STONE FILL SLOPE PROTECTION



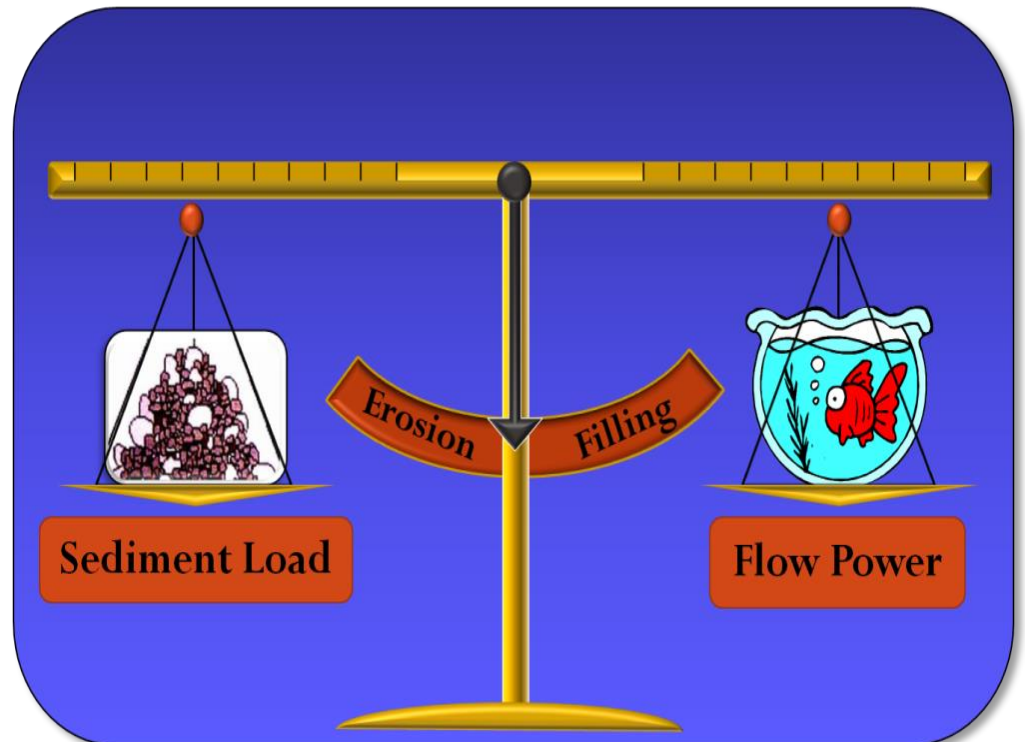
STONE FILL SLOPE PROTECTION WITH STONE TOE WALL



- New typical sections used by OPS on slope repairs adjacent to rivers.
- In the past they had dumped stone down the slope, lots of time further constricting the river channel.
- Now they are working backwards. With the help of fluvial geomorphologists we are defining a stable channel dimensions and building the slope to match that as best possible.

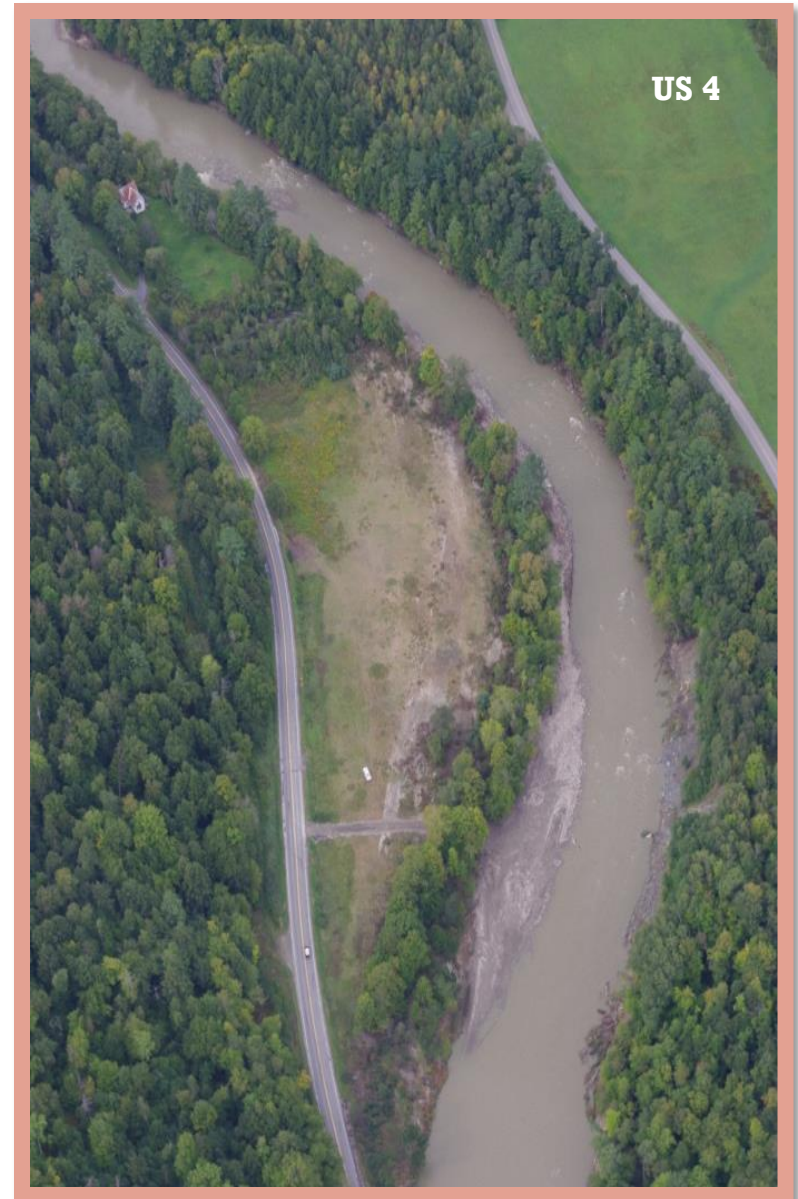
FLOOD AND EROSION HAZARDS

The **flood-related processes**, **erosion** and **deposition**, are the physical adjustments by which rivers maintain an equilibrium condition



FLOOD AND EROSION HAZARDS

Ironically, those **flood processes**, which erode and deposit sediment, form level lands that are the most easily developed for roads and buildings, and, at the same time, are the most hazardous.

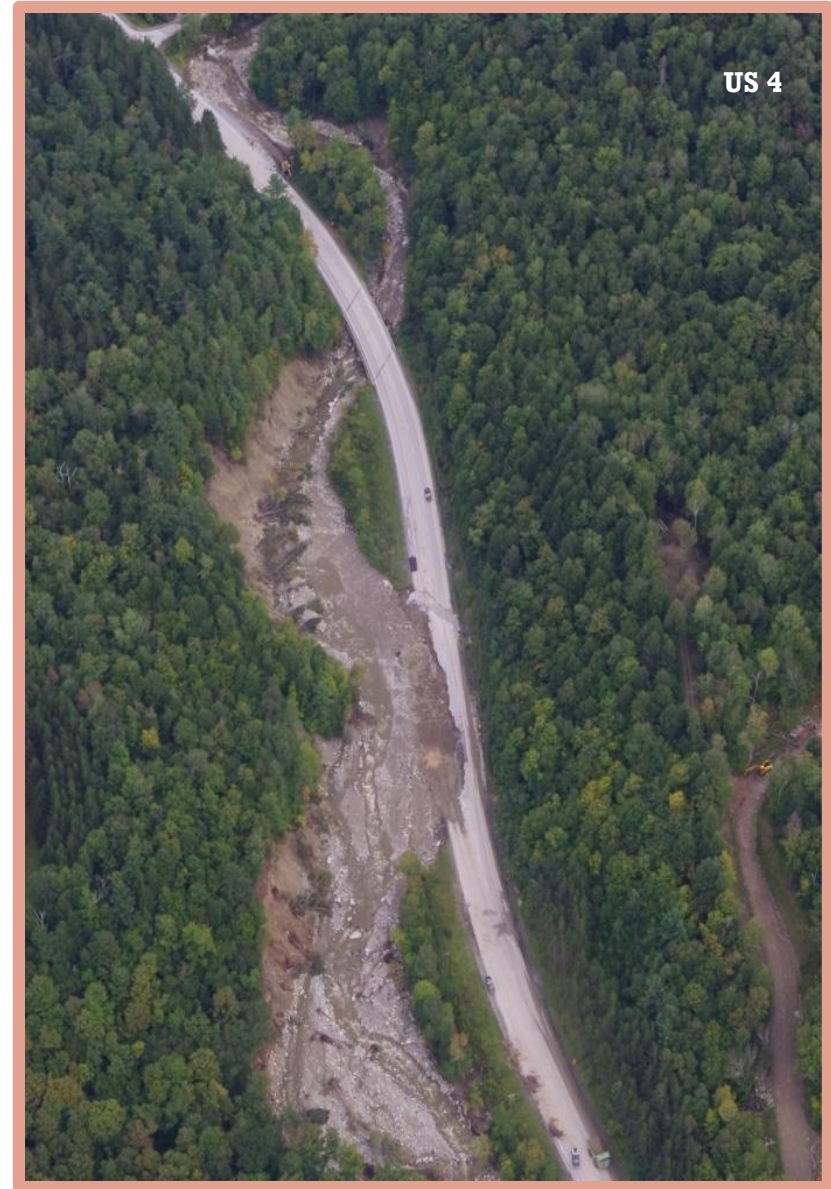


FLOOD AND EROSION HAZARDS

Managing public infrastructure in erodible, hazardous areas requires the knowledge to minimize conflicts with the channel adjustment processes imperative to the maintenance of equilibrium conditions.

For instance:

How does road and bridge infrastructure change flow and sediment regimes or channel slope, depth, and roughness and cause disequilibrium, where severe erosion hazards may follow?



A History of River Management

TRAINING TOOLS



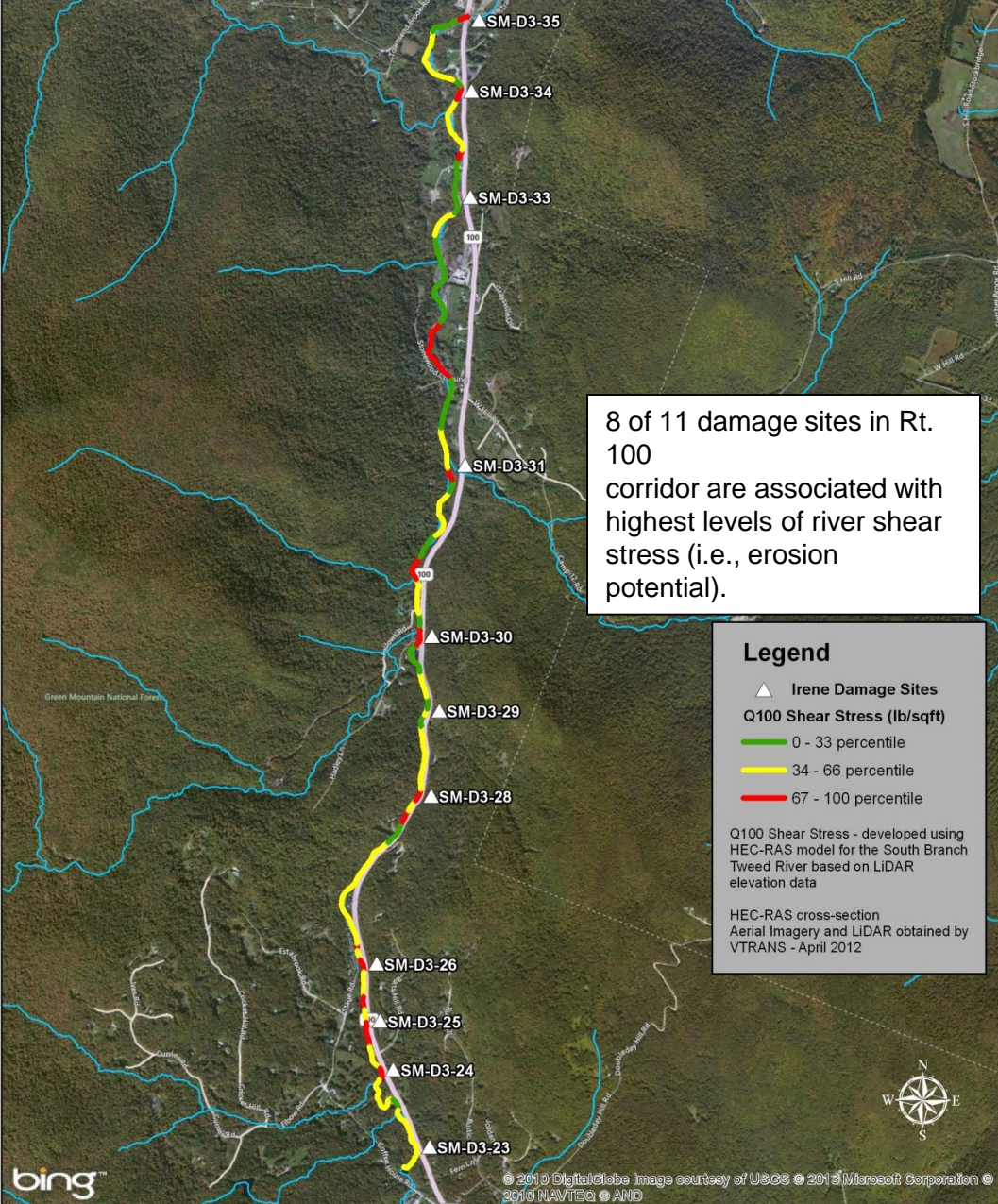
TRAINING TOOLS



FORCASTING: Flood Vulnerability Mapping Using LiDAR Data

Process-based approach to identify and prioritize risk in river-roadway corridors:

1. Hydrologic and hydraulic modeling (HEC-RAS) to quantify river and floodplain erosion potential.
2. LiDAR slope mapping to identify slopes $>100\%$ in between roadway and river.
3. Identify areas of roadway with limited relief from river that are susceptible to erosion during flood events.





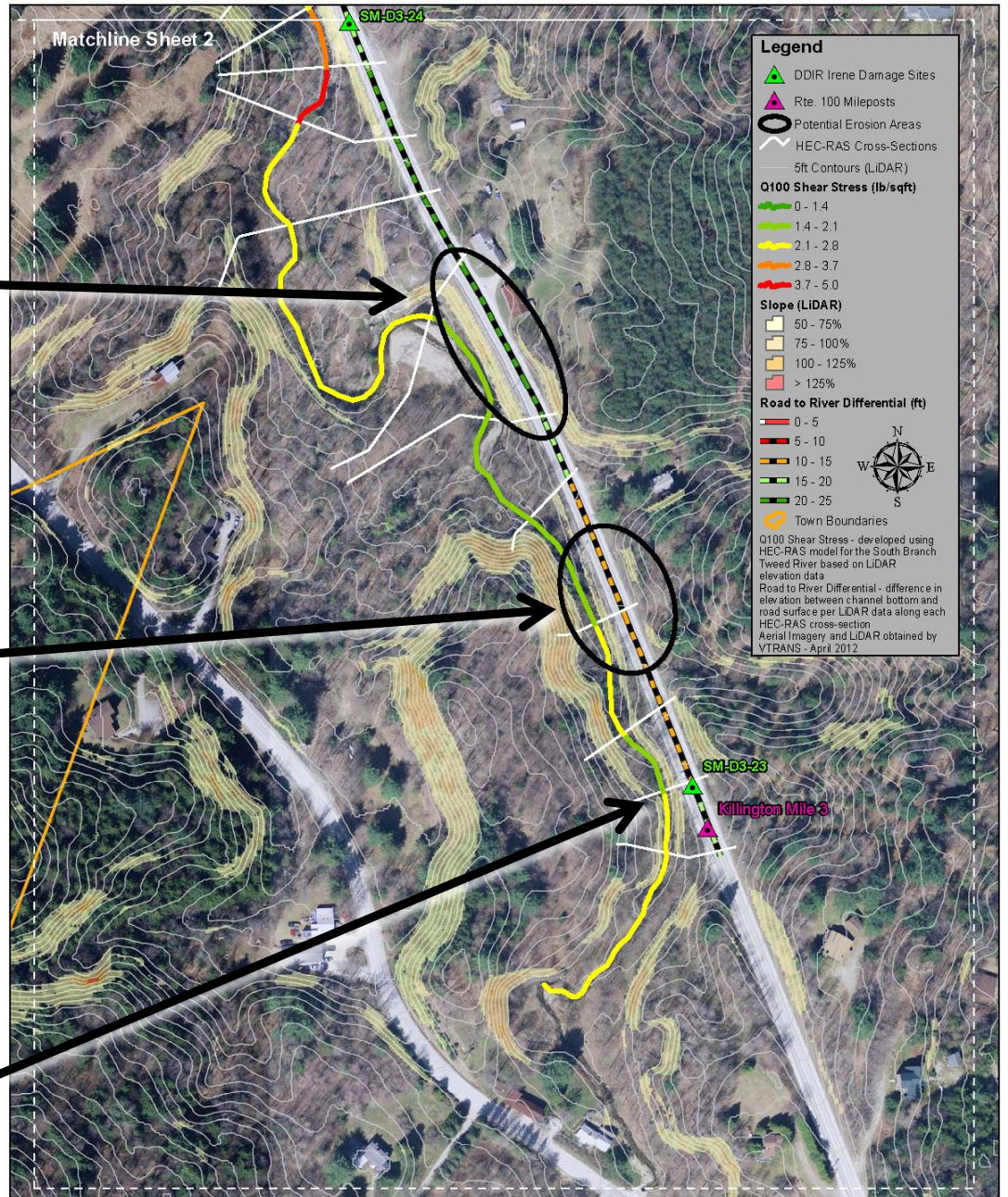
Previously armored site



Unknown erosion site



Known damage site



US 4



VT RTE 107 STOCKBRIDGE



TRANSPORTATION UPDATE

Irene has fundamentally changed how VTrans operates and that change process – focused on *innovation* – is ongoing.



ROADS AND RIVERS TRAINING PROGRAM

- The Tier One training module can be accessed through the following link:
<http://wsmd.vt.gov/rivers/roadstraining/>
- The class is expected to take approximately 1.5 to 2 hours to complete, and it is free of charge.
- This training is recommended for engineers, technicians, equipment operators, highway foreman and others. Please feel free to share it with anybody who might be interested in learning more about how river systems work.