

To Dig or Not to Dig: Vermont's Rivers Following Irene

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As the immediate crisis of the flood following Tropical Storm Irene lessens, growing public debate about gravel mining our State's rivers has emerged. Many in the most impacted communities suggest that gravel mining and armoring our rivers is necessary to ensure stability and safety, and believe it is the lack of gravel mining over the past decade that has led to the destruction during this flood. Meanwhile, there are those that strongly caution against the removal of sediment from the rivers. These individuals and groups refer to current river science that shows that removal of sediment from rivers usually leads to a more unstable river and destroys aquatic habitat. What is the best way forward?

We all cherish Vermont's rivers and rely on the infrastructure in the state, and thus we all have a stake in evaluating how best to recover and plan for the future. A balanced and deliberate approach is now needed to move Vermont's flood recovery forward. To achieve a pre-flood level of safety in developed areas, the removal of an appropriate amount of sediment to protect permanent infrastructure will be a necessary response in some locations. At the same time, the goal of recovery should not be the wholesale removal of gravel and trees from rivers. Many rivers should remain untouched allowing the channel to naturally redistribute sediment, form habitat, and take its course where infrastructure is not at risk. Although the urge to act immediately can be powerful and with good intent, the decisions about where and how to manage our rivers must be considered carefully following a large and damaging flood.

The rivers of Vermont have been forever changed by Irene. We need to take a path toward recovery that involves the State, Towns, and public, and that considers a broad range of science-based, prioritized alternatives. We must first pause to evaluate where our villages, schools, businesses, homes, roads, and bridges are located now and where they should be in the future, so that the communities of Vermont will remain sustainable in the long-run.

Irene has confirmed that giving a river space to meander in floodplains, wherever possible, is the easiest and most cost-effective way to reduce flooding and erosion hazards. Floodplains must continue to be preserved across Vermont to provide rivers ample space to move, store water, and store sediment during floods.

We can all agree that it is humbling to see areas in the state where flooding was most destructive. As crisis moves towards long-term recovery, the path forward will be much more complicated than the question to dig or not to dig. Here are some guidelines to help the process moving forward:

Flood Recovery Guidelines

Strategize Flood Recovery – Consider the needs of both the built and the natural environment in evaluating a range of alternatives for both the short and long term, including: public safety, infrastructure protection, floodplain agriculture, water quality, aquatic habitat, cost-effectiveness, and longevity. Seek a preferred alternative that will benefit multiple objectives, aiding both the river and people.

Floodplain Protection – Where space allows, move away from rivers to reduce risks of future flood and erosion damage and protect aquatic habitat. Seek financial incentives through River Corridor Easements from the Vermont Rivers Program, Vermont River Conservancy, Vermont Land Trust, and others that support risk reduction by limiting new permanent infrastructure in floodplains.

Community Planning – Recognize that flowing water does not respect political boundaries, and therefore it is essential to have discussions that involve both individual towns and all those within a watershed about a range of alternatives for long-term flood recovery and avoidance. Consider past and future flooding and how best to reduce risks from inundation, channel movement, sediment deposition, and woody debris. Think about watershed neighbors and how to minimize downstream risks.

Stay Committed – Whether actively engaged in the ongoing recovery or working to prevent future damage, successfully reducing flood and erosion hazards and protecting Vermont’s river corridors is a challenging and long-term process. This task is an essential part of our future if we are to create safer communities amongst healthier rivers in a mountainous state with many Village Centers located in floodplains.

Common Flood Recovery Myths

1. You can dig yourself out of a flood.

Rivers move water, sediment, and woody debris. The shape of a natural river channel reflects a balance between the flow of water and the amount of sediment and woody debris that the stream carries. The wider and deeper a channel is, the slower the water moves, making it more likely that excessively large sediment bars will form in the future. As water gets pushed around growing sediment bars, gravel extraction often has the unintended consequence of increasing the likelihood of channel movement and therefore increasing the risk of flooding.

In channels in a narrow valley, digging deeper usually leads to more down-cutting and collapse of the banks increasing the risks to nearby infrastructure.

2. *No removal of sediment from river channels should occur after large floods.*

In mountainous areas, there are many locations where flood and erosion risks are high due to the presence of areas that are prone to large amounts of sediment deposition. For example, alluvial fans are the flat areas located at the base of the mountains that are prone to sediment deposition during small to large floods. These areas are often characterized by naturally unstable stream channels flowing over loose sediment. Towns were historically set up in these areas because of the availability of water power. Early settlers were, however, more mobile than our current towns with fixed infrastructure. In these areas, some sediment removal is likely needed following flooding to protect this permanent infrastructure.

For example, the Town of Bennington is located on an alluvial fan. It is estimated that 3,500 dump truck loads of sediment (500,000 cubic yards) was deposited over a few miles of the Roaring Branch of the Walloomsac River in Bennington as a result of Irene. The cobbles and boulders eroded from the upstream mountains filled bridge openings, formed 10-foot tall bars in the channel, and caused the river channel to move side to side destroying homes, garages, part of a levee, and bridges. Sediment removal and bank armoring to protect existing homes and roads in these most vulnerable areas is required to return a pre-flood acceptable level of safety.

3. *It is possible to ensure against future flood damage by straightening and armoring stream channels.*

There is no way of completely avoiding future flood damages beyond moving all permanent infrastructure out of river corridors and above historic and predicted flood levels. Armoring banks and straightening channels provide short-term fixes that will be effective until the next large flood. In addition, these approaches often have the unintended consequence of increasing downstream flooding and erosion risks during moderate flood events.

4. *Cutting trees down in the floodplain will prevent debris jams during the next flood.*

Large numbers of trees were carried down river channels during the Irene flood clogging bridges and culverts, depositing on islands, and making local flooding worse in some areas. However, post-flood surveys indicate that wide forested floodplains stayed intact and the trees captured and retained flood debris. Tree loss was most abundant along narrow buffers and thin stands in floodplains. Wider forested buffers provide more space to slow water and store sediment and other wood.

Trees play vital roles in river ecosystems and are a natural component of all rivers in New England. Design and planning is needed to consider the expected load of trees that will be coming down the river channels during future floods.

5. *Irene was the 100-year flood so we will never see another flood like this during our lifetime.*

Recent data from assessments, design projects, and studies are all showing that Vermont is seeing larger and more frequent flooding. Several counties had disaster declarations for severe flooding in both May and August this year alone. It seems likely that we will experience more floods in the future.

The gauge data indicate that flooding from Irene ranged from a 25-year to 500-year flood, with many gauges landing near the 100-year event. Several gauges experienced the highest flood since they were installed (post 1927 flood). Over the past several years more large storms have taken place than the gauge statistics suggest should be happening.

The intensity of the rain event in the mountains and the resulting torrent of water, sediment, and woody debris seem to have led to higher flood stages than the predicted 100-year level. Localized blockages of sediment and debris likely increased local flood stages beyond what stream gauges predict.

6. *It is ok to fill in widened channels and floodplains.*

Many channels expanded two to ten times the pre-flood width, effectively forming floodplains during the flood. It is tempting to fill in some or all of these areas to reclaim land. However, the post-flood river channel has shown the space it needs to convey the water, sediment, and debris during a large flood. This same area will likely be active river area during the next large flood. Filling should be as limited as possible to minimize future flood and erosion risks.

7. *All of the aquatic life is dead after such a large flood so it does not matter what we do to our rivers now.*

Fish and insects that live in streams have amazing survival instincts given how dynamic their home is. When floods or droughts take place fish find safe areas to hide behind rocks, under logs, along the channel edges, or in small tributaries. Insects burrow into the streambed and hide from the turbulent flow. Although mortality does happen during stressful times such as floods or droughts, these disturbances are actually an essential part of the aquatic ecosystem. Floods regenerate the bed by moving large amounts of sediment, clean the channel of waste and decayed material, and create new habitat features.

8. *The rapid replacement of failed culverts and bridges with structures of the same size is suitable.*

Countless culverts and bridges failed during tropical storm Irene due to high flows, plugging with sediment and trees, and water flowing around the structure. Many of the failed structures were designed using best practices at the time of installation; unfortunately

traditional design methods were based on a flow rate without consideration of channel characteristics, sediment load and woody debris. We now know that the ideal structure imitates natural channel conditions and is invisible to the stream. At a minimum the structure should span the full channel width, and consider the sediment load and woody debris that may be washing through the structure during flooding. Paying once for a larger structure that fits the stream channel is more economical than replacing smaller structures that repeatedly fail.

9. All sediment should be scraped off of floodplains.

River flooding into flat floodplains on valley bottoms is responsible for the historic formation of the fertile fields of many of Vermont's most productive farms. The size and quality of newly deposited river sediment can widely vary. Whenever possible, deposited sediment should be left on fallow land or incorporated into active fields to grow food, build soil, and protect water quality by limiting soil and nutrient export to Lake Champlain or the other receiving waters of the state. Selective removal of the coarser or contaminated parts of the deposited sediment could be performed while leaving the finer clean sediment often associated with nutrients on the fields for the next growing season.

10. FEMA or the State will pay for flood damages.

The unfortunate reality is that federal and state funding is not adequate to cover all of the damages. It is likely that many towns and people are going to shoulder some of the financial burden of Irene for a long time. This harsh reality makes it more critical to engage in planning to minimize vulnerability to future flooding. Planning, proactive flood protection, and risk avoidance are more cost-effective than crisis response.

11. Proper river management is new to Vermont and we must look elsewhere for answers.

Vermont responds to flood disasters every year. The Vermont Rivers Program, scientific community, watershed groups, and conservation districts have helped establish and successfully implement current river science, channel management, and floodplain protection approaches. The methods used in Vermont today that have developed from this experience in reducing flood and erosions risks, improving water quality, and protecting aquatic habitat are being explored and implemented throughout the United States.