Minimizing Flood Risks and Habitat Impacts Due to Post-Flood Recovery Efforts

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Source: Lars Gange & Mansfield Heliflight, August 31, 2011
INVERT METRIC RESPONSE - Richness

Source: VTDEC, 2012
77 miles of dredging after Irene (VTDFW)

176 miles of historic straightening in the same watersheds (VTDEC)

<table>
<thead>
<tr>
<th>Vulnerability Level</th>
<th>2011</th>
<th>1976</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less Vulnerability</td>
<td>20%</td>
<td>0%</td>
</tr>
<tr>
<td>Same Vulnerability</td>
<td>40%</td>
<td>40%</td>
</tr>
<tr>
<td>More Vulnerability</td>
<td>40%</td>
<td>60%</td>
</tr>
</tbody>
</table>

Source: VTDFW, 2011
1. Perform an alternatives analysis based on risk minimization, limiting habitat impacts, and controlling project cost. Consider the no-action alternative first.
2. Link flood damages to river processes for proper problem identification.
3. Consider scale.

- **Catchment**
- **Corridor**
- **Reach**
- **Barform**
- **Bedform**
- **Grain**

**Spatial scale**

- **Sediment Transport**
  - Woody Debris
- **Hydraulic Roughness**
  - Recruitment
- **Bar Growth**
  - Local Succession Processes
- **Meander Dynamics**
  - Patch Dynamics, Processes Affecting Community Structure
- **Aggradation/Incision**
  - Inter-Population Dynamics
- **Climate**
  - Hydrologic / Sediment Regimes
  - Adaptation

**Time scale (years)**

- $10^{-1}$
- $10^0$
- $10^1$
- $10^2$
- $10^3$+

Manage toward Least Erosive Condition
Minimize actions that lead to aggradation and incision to decrease vulnerability of the human infrastructure.

Within a decade the river will begin creating habitat for native communities.
4. Follow the principles of fluvial geomorphology and current best engineering practice.

Source: Landslide Natural Resources Planning, 2013
5. Restore reference geometry. Evaluate stream power v. resistance to erosion.
6. **Restore floodplain connection to limit future in-channel work.**

[Images of historic fill and restored floodplain]
- Total Power decreases range 100-700 W/m² (948 to 167)
- Flood velocity decreases 1-4 feet per second
- Flood depth decreases 0.2-1.0 feet
7. Manage channels towards a least erosive, vertically stable equilibrium.

Source: Lane, 1955; Rosgen and Silvey, 1996
8. Dredge only where infrastructure and buildings are vulnerable to damage.
9. Properly size bridges and culverts so that they are geomorphically compatible and maintain AOP.

**VT Stream Alteration General Permit (GP) Design Requirements**

- \( W_{\text{structure}} = 1.0 \times W_{\text{bankfull channel}} \)
- \( H_{\text{opening}} = 4 \times D_{\text{bankfull channel}} \)
- \( D_{\text{embed}} = 30\% \times H_{\text{opening}} \) or \( D_{84} \) for boulder bed, whichever larger

• Match channel profile and create uniform longitudinal transitions at inlet and outlet.

• Structure shall not obstruct aquatic organism passage.
10. Conserve river corridors to provide space for the river to reduce flood risks and the need for flood recovery.