

# Catalog of Risk Reduction Measures

## Chelan County Comprehensive Flood Hazard Management Plan

### Background Information

Risk is defined as being a function of the:

- Hazard
- Exposure
- Vulnerability and
- Capability

Risk can be reduced through mitigation by manipulating the hazard, reducing exposure to the hazard, reducing the vulnerability and/or increasing capability. And, where mitigation is not yet possible, the risk can be reduced through preparation, response or/and recovery. This list is not meant to be exhaustive, but to inspire thought.

### Flood:

FLOOD – PERSONAL SCALE			
Manipulate Hazard	Reduce Exposure	Reduce Vulnerability	Increase Capability
<ol style="list-style-type: none"> <li>1. Clear stormwater drains and culverts</li> <li>2. Increase water conservation efforts</li> <li>3. Install local stormwater capture systems</li> </ol>	<ol style="list-style-type: none"> <li>1. Locate outside of hazard area</li> <li>2. Elevate utilities above Base Flood Elevation (BFE)</li> <li>3. Institute low impact development techniques on property</li> <li>4. Assess projects to determine if they may inadvertently increase flood risk</li> </ol>	<ol style="list-style-type: none"> <li>1. Retrofit structure (elevate house above BFE)</li> <li>2. Elevate items within house above BFE</li> <li>3. Build new homes above BFE</li> <li>4. Floodproof non-residential structures</li> </ol>	<ol style="list-style-type: none"> <li>1. Comply with National Flood Insurance Program (NFIP)</li> <li>2. Buy flood insurance</li> <li>3. Develop household mitigation plan, such as retrofit savings, communication capability with outside, 72 hr self-sufficiency during and after an event</li> <li>4. Be aware of evacuation routes</li> </ol>

**FLOOD – PERSONAL SCALE**

<b>Manipulate Hazard</b>	<b>Reduce Exposure</b>	<b>Reduce Vulnerability</b>	<b>Increase Capability</b>
			5. Educate yourself on flood risk from related hazards, such as wildfire  6. Participate in CERT training

**FLOOD - CORPORATE SCALE**

<b>Manipulate Hazard</b>	<b>Reduce Exposure</b>	<b>Reduce Vulnerability</b>	<b>Increase Capability</b>
1. Clear stormwater drains and culverts  2. Increase water conservation efforts  3. Install local stormwater capture systems	1. Locate business critical facilities or functions outside hazard area  2. Institute low impact development techniques on property  3. Assess projects to determine if they may inadvertently increase flood risk	1. Build redundancy for critical functions/ retrofit critical buildings  2. Provide flood-proofing measures when new critical infrastructure must be located in floodplains	1. Increase capability by having cash reserves for reconstruction  2. Support and implement hazard disclosure for the sale/re-sale of property in identified risk zones  3. Solicit 'cost-sharing" through partnerships with private sector stake holders on projects with multiple benefits

**FLOOD – GOVERNMENT SCALE**

<b>Manipulate Hazard</b>	<b>Reduce Exposure</b>	<b>Reduce Vulnerability</b>	<b>Increase Capability</b>
1. Clear stormwater drains and culverts  2. Dredging, levee construction, providing retention areas.  3. Structural flood control: levee's, dams, channelization, revetments	1. Locate/re-locate critical facilities outside of hazard area 2. Acquire or relocate identified repetitive loss properties 3. Promote open space uses in identified high hazard areas via techniques such as: PUD's, easements, setbacks, greenways, sensitive area tracks	1. Strengthen existing infrastructure (i.e. bridge modifications) 2. Provide redundancy for critical functions and infrastructure 3. Adopt appropriate regulatory standards such as cumulative substantial improvement/damage, freeboard, lower substantial damage threshold, compensatory storage	1. Produce more accurate flood hazard maps or identify areas for further study.  2. Provide technical information and guidance  3. Enact tools to help manage development in hazard areas (stronger controls, tax incentives, information, enforcement of the NFIP)

**FLOOD – GOVERNMENT SCALE**

<b>Manipulate Hazard</b>	<b>Reduce Exposure</b>	<b>Reduce Vulnerability</b>	<b>Increase Capability</b>
<p>4. Construct regional stormwater control facilities</p> <p>5. Harden areas with significant erosion concerns</p> <p>6. Promote/retain natural vegetation in areas with significant erosion concerns</p> <p>7. Identify and implement sediment management strategies</p> <p>8. Increase water conservation efforts</p> <p>9. Continue to pursue holistic floodplain management and opportunities for promoting or preserving natural floodplain function</p> <p>10. Develop and promote local stormwater capture systems</p> <p>11. Floodplain reconnections projects</p> <p>12. Sedimentation/debris control</p>	<p>4. Adopt land development criteria such as PUD's, Density transfers, clustering</p> <p>5. Institute low impact development techniques on property</p> <p>6. Acquire vacant land or promote open space uses in developing watersheds to control increases in runoff</p> <p>7. Perform a buildable lands analysis to determine areas where exposure may increase</p> <p>8. Comply and work with provisions protecting endangered species within the County</p>	<p>4. Stormwater management regulations and master planning</p> <p>5. Adopt "no-adverse impact" floodplain management policies that strive to not increase the flood risk on down-stream communities</p> <p>6. Encourage mitigation of private property</p> <p>7. Perform regular inspections/assessments of locally owned or maintained flood control infrastructure</p> <p>8. Replace undersized culverts</p> <p>9. Provide permanent protection for pump stations at risk of flooding</p> <p>10. Identify/mitigate drainage issues resulting in ponding</p> <p>11. Enhance road drainage programs.</p>	<p>4. Incorporate retrofitting/replacement of critical system elements in CIP</p> <p>5. Develop strategy to take advantage of post disaster opportunities</p> <p>6. Warehouse critical infrastructure components</p> <p>7. Develop and adopt a Continuity of Operations Plan (COOP)</p> <p>8. Improve and build on Community Rating System (CRS) program classification</p> <p>9. Maintain existing data as well as gather new data needed to define risks and vulnerability</p> <p>10. Provide training for staff and decision-makers in floodplain management</p> <p>11. Create a building and elevation inventory of structures in the floodplain</p>

<b>FLOOD – GOVERNMENT SCALE</b>			
<b>Manipulate Hazard</b>	<b>Reduce Exposure</b>	<b>Reduce Vulnerability</b>	<b>Increase Capability</b>
		<p>12. Ensure permitting process is consistent with the adopted floodplain management ordinance</p> <p>13. Elevate/relocate roads subject to frequent flooding</p> <p>14. Develop guideline for floodplain fringe protections</p> <p>15. Increase freeboard regulations</p> <p>16. Find ways to account for climate change in relevant codes</p> <p>17. Develop/Maintain emergency warning systems</p>	<p>12. Develop and implement a public information strategy</p> <p>13. Charge a hazard mitigation fee on all new permits to create a hazard mitigation funding source for initiatives or grant cost share requirements</p> <p>14. Develop a Flood Task Force</p> <p>15. Integrate floodplain management policies into other planning mechanisms within the planning area</p> <p>16. Develop/maintain system for perishable data collection after a flood event occurs</p> <p>17. Develop framework/continue efforts for cooperation between agencies/districts in flood mitigation activities (e.g. sand and sand bag deployment)</p> <p>18. Retain good standing in National Flood Insurance Program</p> <p>19. Integrate flood mitigation opportunities into capital improvement programs</p> <p>20. Create a fund/earmark funds for in kind contributions as grant opportunities become available</p> <p>21. Produce after action reports on flood events</p> <p>22. Develop/update evacuation routes</p>

<b>FLOOD – GOVERNMENT SCALE</b>			
<b>Manipulate Hazard</b>	<b>Reduce Exposure</b>	<b>Reduce Vulnerability</b>	<b>Increase Capability</b>
			<p>23. Participate in information sharing with other agencies (e.g. USACE, NWS)</p> <p>24. Develop and update MOUs with other local jurisdictions and continue to coordinate emergency response and preparedness activities</p> <p>25. Identify sources of nuisance flooding</p> <p>26. Review and update floodplain damage prevention ordinances</p> <p>27. Require/encourage rapid damage assessment training</p> <p>28. Map locations of storm drains, catch basins and dry wells so that they may be located and cleared</p> <p>29. Identify lake debris collection sites</p> <p>30. Continue to develop post-fire outreach strategies for impacted residents</p> <p>31. Develop and diversify public outreach materials</p> <p>32. Educate residents on types of projects that may inadvertently increase flood risk.</p> <p>33. Educate residents on nexus between water conservation, drought and flood</p> <p>34. Continue to identify opportunities for partnerships</p> <p>35. Increase FCD taxing authority to generate additional funding or identify sustainable funding solutions</p>

<b>FLOOD – GOVERNMENT SCALE</b>			
<b>Manipulate Hazard</b>	<b>Reduce Exposure</b>	<b>Reduce Vulnerability</b>	<b>Increase Capability</b>
			<p>36. Support and implement hazard disclosure for the sale/re-sale of property in identified risk zones and increase enforcement of disclosure provisions</p> <p>37. Put an emphasis on "flash" floods as a way to clarify desert conditions, and provide mapping</p> <p>38. Map and complete an inventory of open spaces with potential for beneficial functions</p> <p>39. Explore ways to incorporate invasive species management into floodplain management activities.</p> <p>40. Increase emergency services capabilities and increase public awareness of emergency preparedness.</p> <p>41. Sponsor/encourage/promote local CERT activities</p> <p>42. Identify and monitor hotspots</p> <p>43. Post Fire education/outreach</p> <p>44. Refine warning through post-data collection &amp; analyses</p> <p>45. Stakeholder collaboration for capital solutions/partnerships</p>