

CHAPTER 21.

REVIEW OF MITIGATION ALTERNATIVES

21.1 SWOO SESSIONS

The planning team generated a comprehensive list of hazard mitigation alternatives that meet the following objectives:

- Use information obtained from the public involvement strategy
- Use information provided in the risk assessment
- Seek alternatives consistent with the goals and objectives for the Humboldt Operational Area Hazard Mitigation Plan
- Create catalogs of mitigation alternatives to be used as a tool by the Planning Partners in selection of mitigation strategies

On April 4, 2007, a Strengths, Weaknesses, Opportunities, and Obstacles (SWOO) session was held with the Steering Committee and members of the Planning Partnership. The purpose of this session was to review information garnered from the risk assessment and the public involvement strategy to identify strengths, weaknesses, opportunities and obstacles associated with hazard mitigation within the Humboldt Operational Area. This was accomplished through a facilitated brainstorming session on risks, vulnerabilities, and capabilities. All information shared during this session was recorded by the planning team and used to prepare catalogs of mitigation alternatives to be used by the Planning Partners in preparing their individual jurisdictional annexes. Many of the strategies identified in the catalogs (such as community outreach) could be applied to multiple hazards. This plan identifies strategies for multiple hazards in each jurisdictional annex even though a separate catalog for multiple hazards is not presented.

21.2 CATALOGS OF MITIGATION ALTERNATIVES

Based on information garnered during the SWOO sessions, catalogs of mitigation alternatives were created that list initiatives that could manipulate the hazard, reduce exposure to the hazard, reduce vulnerability to the hazard, and increase the ability to respond to or be prepared for a hazard. These catalogs are separated by responsibility for implementation (in other words, who would most likely implement the initiative: personal property owners, private sector business, or government). The hazards addressed by the catalogs were deemed to be those to which the planning area is most vulnerable based on the risk assessment.

The catalogs are not meant to be exhaustive or site-specific but rather to inspire thought and provide each Planning Partner a baseline of initiatives backed by a planning process, consistent with the goals and objectives of the planning area, and within the capabilities of the Partners. The Partners are not bound to these alternatives in preparing their own annexes for this hazard plan. Initiatives from the catalogs that were not selected by the Partners in their jurisdictional annexes were rejected based on the following:

- Initiative is currently outside the scope of capabilities (funding),
- The jurisdiction is not vulnerable to the hazard, or
- Initiative is already being implemented.

21.2.1 Mitigation Alternatives Catalog—Dam Failure

Table 21-1 is the catalog of mitigation alternatives for the dam failure hazard.

TABLE 21-1. CATALOG OF RISK REDUCTION MEASURES—DAM FAILURE			
	Personal Scale	Corporate Scale	Government Scale
Manipulate Hazard	None	1. Remove dams 2. Remove levees	1. Remove dams 2. Remove levees
Reduce Exposure	Relocate out of dam failure inundation areas.	Replace earthen dams with hardened structures	1. Replace earthen dams with hardened structures 2. Relocate critical facilities out of dam failure inundation areas.
Reduce Vulnerability	Elevate home to appropriate levels.	Flood-proof facilities within dam failure inundation areas	1. Adopt higher regulatory floodplain standards in mapped dam failure inundation areas. 2. Retrofit critical facilities within dam failure inundation areas.
Increase Capability	1. Learn about risk reduction for the dam failure hazard. 2. Learn the evacuation routes for a dam failure event.	1. Educate employees on the probable impacts of a dam failure. 2. Develop a Continuity of Operations Plan (COOP).	1. Map dam failure inundation areas. 2. Enhance emergency operations plan to include a dam failure component. 3. Institute monthly communications checks with dam operators. 4. Inform the public on risk reduction techniques 5. Adopt real-estate disclosure requirements for the re-sale of property located within dam failure inundation areas.

21.2.2 Mitigation Alternatives Catalog—Drought

Table 21-2 is the catalog of mitigation alternatives for the drought hazard.

TABLE 21-2. CATALOG OF RISK REDUCTION MEASURES—DROUGHT			
	Personal Scale	Corporate Scale	Government Scale
Manipulate Hazard	None	None	<ol style="list-style-type: none"> 1. Groundwater recharge through stormwater management. 2. Implement cloud seeding techniques during dry seasons.
Reduce Exposure	Consider stored water/captured water techniques during dry seasons.	Consider stored water/captured water techniques during dry seasons.	<ol style="list-style-type: none"> 1. Identify and create groundwater backup sources 2. Create or identify new impounded water supply points.
Reduce Vulnerability	<ol style="list-style-type: none"> 1. Drought-resistant landscapes 2. Reduce water system losses 3. Modify plumbing systems (through water saving kits) 	<ol style="list-style-type: none"> 1. Drought-resistant landscapes 2. Reduce private water system losses 	<ol style="list-style-type: none"> 1. Water use conflict regulations 2. Reduce water system losses 3. Distribute water saving kits 4. Identify sites ideally suited for groundwater recharge. 5. Implement stormwater retention in regions ideally suited for groundwater recharges. 6. Use drought resistant landscapes on community-owned facilities.
Increase Capability	Practice active water conservation	<ol style="list-style-type: none"> 1. Practice active water conservation 2. Develop a water conservation plan. 3. Develop a COOP 	<ol style="list-style-type: none"> 1. Public education on drought resistance 2. Identify alternative water supplies for times of drought; mutual aid agreements with alternative suppliers 3. Develop drought contingency plan 4. Develop criteria “triggers” for drought-related actions 5. Improve accuracy of water supply forecasts 6. Modify rate structure to influence active water conservation techniques 7. Establish protocol for salt water desalinization to be implemented during conditions of severe drought. 8. Consider providing incentives to property owners who use drought resistant landscapes at their homes.

21.2.3 Mitigation Alternatives Catalog—Earthquake

Table 21-3 is the catalog of mitigation alternatives for the earthquake hazard.

TABLE 21-3. CATALOG OF RISK REDUCTION MEASURES—EARTHQUAKE			
	Personal Scale	Corporate Scale	Government Scale
Manipulate Hazard	None	None	None
Reduce Exposure	Locate outside of hazard area (off soft soils)	Locate or relocate mission-critical functions outside hazard area where possible	Locate critical facilities or functions outside hazard area where possible
Reduce Vulnerability	<ol style="list-style-type: none"> 1. Retrofit structure (anchor house structure to foundation) 2. Secure household items that can cause injury or damage (such as water heaters, bookcases, and other appliances) 3. Build to higher design 	<ol style="list-style-type: none"> 1. Build redundancy for critical functions and facilities 2. Retrofit critical buildings and areas housing mission-critical functions 	<ol style="list-style-type: none"> 1. Harden infrastructure 2. Provide redundancy for critical functions 3. Higher regulatory standards 4. Adopt the IBC once ratified by the State as the State Building Code.
Increase Capability	<ol style="list-style-type: none"> 1. Practice “drop, cover, and hold” 2. Develop household mitigation plan, such as creating a retrofit savings account, communication capability with outside, 72-hour self-sufficiency during an event 3. Increase capability by having cash reserves for reconstruction 4. Become informed on the hazard and risk reduction alternatives available. 5. develop a post-disaster action plan for your household 	<ol style="list-style-type: none"> 1. Adopt higher standard for new construction; consider “performance-based design” when building new structures 2. Increase capability by having cash reserves for reconstruction 3. Inform your employees on the possible impacts of earthquake and how to deal with them at your work facility. 4. Develop a COOP 	<ol style="list-style-type: none"> 1. Provide better hazard maps 2. Provide technical information and guidance 3. Enact tools to help manage development in hazard areas (e.g., tax incentives, information) 4. Include retrofitting and replacement of critical system elements in capital improvement plan (CIP) 5. Develop strategy to take advantage of post-disaster opportunities 6. Warehouse critical infrastructure components such as pipe, power line, and road repair materials 7. Develop and adopt a Continuity of Operations Plan (COOP) 8. Initiate triggers guiding improvements (such as < 50% substantial damage or improvements) 9. Further enhance seismic risk assessment to target high hazard buildings for mitigation opportunities. 10. Develop a post disaster action plan that includes a grant funding and debris removal components.

21.2.4 Mitigation Alternatives Catalog—Fish Losses

Table 21-4 is the catalog of mitigation alternatives for fish losses.

TABLE 21-4. CATALOG OF RISK REDUCTION MEASURES—FISH LOSSES			
	Personal Scale	Corporate Scale	Government Scale
Manipulate Hazard	None	Remove dams	Remove dams
Reduce Exposure	None	None	<ol style="list-style-type: none"> 1. Establish stream corridor set-backs along streams with listed species. 2. Establish land use policies that will minimize its impact on habitat.
Reduce Vulnerability	None	Restore critical habitat at those facilities that have impacted these habitats.	Implement regulatory programs with multiple objectives, one of which is habitat conservation.
Increase Capability	<ol style="list-style-type: none"> 1. Educate yourself on the importance of habitat conservation. 2. Reduce your negative impacts on habitat that are within your capability. 	Educate employees on the importance of habitat conservation.	<ol style="list-style-type: none"> 1. Educate the public on habitat conservation 2. Develop a Habitat Conservation Plan. 3. Create partnerships with habitat conservation Agencies

21.2.5 Mitigation Alternatives Catalog—Flood

Table 21-5 is the catalog of mitigation alternatives for the flood hazard.

TABLE 21-5. CATALOG OF RISK REDUCTION MEASURES—FLOOD			
	Personal Scale	Corporate Scale	Government Scale
Manipulate Hazard	<ol style="list-style-type: none"> 1. Clear stormwater drains and culverts 2. Institute low-impact development techniques on property 	<ol style="list-style-type: none"> 1. Clear stormwater drains and culverts 2. Institute low-impact development techniques on property 	<ol style="list-style-type: none"> 1. Drainage system maintenance 2. Institute low-impact development techniques on property 3. Dredging, levee construction, and providing regional retention areas 4. Structural flood control, levees, channelization, or revetments. 5. Stormwater management regulations and master planning 6. Acquire vacant land or promote open space uses in developing watersheds to control increases in runoff
Reduce Exposure	<ol style="list-style-type: none"> 1. Locate outside of hazard area 2. Elevate utilities above base flood elevation (BFE) 3. Institute low impact development techniques on property 	<ol style="list-style-type: none"> 1. Locate business critical facilities or functions outside hazard area 2. Institute low impact development techniques on property 	<ol style="list-style-type: none"> 1. Locate or relocate 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: public utility districts (PUDs), easements, setbacks, greenways, sensitive area tracks. 4. Adopt land development criteria such as PUDs, Density transfers, clustering 5. Institute low impact development techniques on property 6. Acquire vacant land or promote open space uses in developing watersheds to control increases in runoff
Reduce Vulnerability	<ol style="list-style-type: none"> 1. Retrofit structures (elevate structures above BFE) 2. Elevate items within house above BFE 3. Build new homes above BFE 4. Flood-proof existing structures 	<ol style="list-style-type: none"> 1. Build redundancy for critical functions or retrofit critical buildings 2. Provide flood-proofing measures when new critical infrastructure must be located in floodplains 	<ol style="list-style-type: none"> 1. Harden infrastructure,(bridge replacement program) 2. Provide redundancy for critical functions and infrastructure 3. Adopt appropriate regulatory standards, such as: increased freeboard standards, cumulative substantial improvement or damage, lower substantial damage threshold; compensatory storage, non-conversion deed restrictions. 4. Stormwater management regulations and master planning. 5. Adopt “no-adverse impact” floodplain management policies that strive to not increase the flood risk on down-stream communities.

**TABLE 21-5 (continued).
CATALOG OF RISK REDUCTION MEASURES—FLOOD**

	Personal Scale	Corporate Scale	Government Scale
Increase Capability	<ol style="list-style-type: none"> 1. Enforce National Flood Insurance Program (NFIP) 2. Buy flood insurance 3. Develop household mitigation plan, such as retrofit savings, communication capability with outside, 72 hr self-sufficiency during and after an event 	<ol style="list-style-type: none"> 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 stakeholders on projects with multiple benefits. 	<ol style="list-style-type: none"> 1. Produce better hazard maps 2. Provide technical information and guidance 3. Enact tools to help manage development in hazard areas (stronger controls, tax incentives, and information) 4. Incorporate retrofitting or replacement of critical system elements in CIP 5. Develop strategy to take advantage of post-disaster opportunities 6. Warehouse critical infrastructure components 7. Develop and adopt a COOP 8. Improve Community Rating System (CRS) Classification 9. Maintain existing data as well as gather new data needed to define risks and vulnerability 10. Train emergency responders 11. Create a building and elevation inventory of structures in the floodplain 12. Develop and implement a public information strategy 13. Charge a hazard mitigation fee 14. Integrate floodplain management policies into other planning mechanisms within the planning area.

21.2.6 Mitigation Alternatives Catalog—Landslide

Table 21-6 is the catalog of mitigation alternatives for the landslide hazard.

TABLE 21-6. CATALOG OF RISK REDUCTION MEASURES—LANDSLIDE			
	Personal Scale	Corporate Scale	Government Scale
Manipulate Hazard	<ol style="list-style-type: none"> 1. Stabilize slope (dewater, armor toe) 2. Reduce weight on top of slope 3. Minimize vegetation removal and the addition of impervious surfaces. 	<ol style="list-style-type: none"> 1. Stabilize slope (dewater, armor toe) 2. Reduce weight on top of slope 	<ol style="list-style-type: none"> 1. Stabilize slope (dewater, armor toe) 2. Reduce weight on top of slope
Reduce Exposure	Locate structures outside of hazard area (off unstable land and away from slide-run out area)	Locate structures outside of hazard area (off unstable land and away from slide-run out area)	<ol style="list-style-type: none"> 1. Acquire properties located in high risk landslide areas. 2. Adopt land use policies that prohibit the placement of habitable structures in high risk landslide areas.
Reduce Vulnerability	Retrofit home.	Retrofit at-risk facilities.	<ol style="list-style-type: none"> 1. Adopt higher regulatory standards for new development within unstable slope areas. 2. Armor/retrofit critical infrastructure from the impact of landslides.
Increase Capability	<ol style="list-style-type: none"> 1. Institute warning system, and develop evacuation plan 2. Increase capability by having cash reserves for reconstruction 3. Educate yourself on risk reduction techniques for landslide hazards. 	<ol style="list-style-type: none"> 1. Institute warning system, and develop evacuation plan 2. Increase capability by having cash reserves for reconstruction 3. Develop a COOP 4. Educate your employees on the potential exposure to landslide hazards and your emergency response protocol. 	<ol style="list-style-type: none"> 1. Produce better hazard maps 2. Provide technical information and guidance 3. Enact tools to help manage development in hazard areas: better land controls, tax incentives, information 4. Develop strategy to take advantage of post-disaster opportunities 5. Warehouse critical infrastructure components 6. Develop and adopt a Continuity of Operations Plan (COOP) 7. Educate the public on the landslide hazard and appropriate risk reduction alternatives.

21.2.7 Mitigation Alternatives Catalog—Severe Weather

Table 21-7 is the catalog of mitigation alternatives for the severe weather hazard.

TABLE 21-7. CATALOG OF RISK REDUCTION MEASURES—SEVERE WEATHER			
	Personal Scale	Corporate Scale	Government Scale
Manipulate Hazard	None	None	None
Reduce Exposure	None	None	None
Reduce Vulnerability	<ol style="list-style-type: none"> 1. Insulate house 2. Provide redundant heat and power 3. Insulate structure 4. Plant appropriate trees near home and power lines (“Right tree, right place” National Arbor Day Foundation Program) 	<ol style="list-style-type: none"> 1. Relocate critical infrastructure (such as power lines) underground 2. Reinforce or relocate critical infrastructure such as power lines to meet performance expectations 3. Install tree wire 	<ol style="list-style-type: none"> 1. Harden infrastructure such as locating utilities underground 2. Trim trees back from power lines 3. Designate snow routes and strengthen critical road sections and bridges
Increase Capability	<ol style="list-style-type: none"> 1. Trim or remove trees that could affect power lines 2. Promote 72-hour self-sufficiency 3. Obtain a NOAA weather radio. 4. Obtain an emergency generator. 	<ol style="list-style-type: none"> 1. Trim or remove trees that could affect power lines 2. Create redundancy 3. Equip your facilities with a NOAA weather radio 4. Equip vital facilities with emergency power sources. 	<ol style="list-style-type: none"> 1. Support programs such as “Tree Watch” that proactively manage problem areas through use of selective removal of hazardous trees, tree replacement, etc. 2. Establish and enforce building codes that require all roofs to withstand snow loads 3. Increase communication alternatives 4. Modify land use and environmental regulations to support vegetation management activities that improve reliability in utility corridors. 5. Modify landscape and other ordinances to encourage appropriate planting near overhead power, cable, and phone lines 6.) Provide NOAA weather radios to the public

21.2.8 Mitigation Alternatives Catalog—Tsunami

Table 21-8 is the catalog of mitigation alternatives for the tsunami hazard.

TABLE 21-8. CATALOG OF RISK REDUCTION MEASURES—TSUNAMI			
	Personal Scale	Corporate Scale	Government Scale
Manipulate Hazard	None	None	Build wave abatement structures (e.g. the “Jacks” looking structure designed by the Japanese)
Reduce Exposure	Locate outside of hazard area	Locate structure or mission critical functions outside of hazard area whenever possible.	<ol style="list-style-type: none"> 1. Locate structure or functions outside of hazard area whenever possible. 2. Harden infrastructure for Tsunami impacts. 3. Relocate identified critical facilities located in Tsunami high hazard areas.
Reduce Vulnerability	Apply personal property mitigation techniques to your home such as anchoring your foundation and foundation openings to allow flow through.	Mitigate personal property for the impacts of Tsunami	<ol style="list-style-type: none"> 1. Adopt Higher regulatory standards that will provide higher levels of protection to structures built in a Tsunami Inundation area. 2. Utilize Tsunami mapping once available, to guide development away from high risk areas through land use planning.
Increase Capability	<ol style="list-style-type: none"> 1. Develop and practice a household evacuation plan. 2. Support/participate in the Redwood Coast Tsunami Working Group. 3. Educate your self on the risk exposure from the Tsunami hazard and ways to minimize that risk. 	<ol style="list-style-type: none"> 1. Develop and practice a corporate evacuation plan. 2. support/participate in the Redwood Coast Tsunami Working Group. 3. Educate your employees on the risk exposure from the Tsunami hazard and ways to minimize that risk. 	<ol style="list-style-type: none"> 1. Create a probabilistic Tsunami map for the Humboldt County planning area. 2. Provide incentives to guide development away from hazard areas. 3. Develop a tsunami warning and response system. 4. Provide residents with tsunami inundation maps 5. Join NOAA’s Tsunami Ready program 6. Develop and communicate evacuation routes 7. Enhance the public information program to include risk reduction options for the tsunami hazard

21.2.9 Mitigation Alternatives Catalog—Wildfire

Table 21-9 is the catalog of mitigation alternatives for the wildfire hazard.

TABLE 21-9. CATALOG OF RISK REDUCTION MEASURES—WILDFIRE			
	Personal Scale	Corporate Scale	Government Scale
Manipulate Hazard	Clear potential fuels on property such as dry overgrown underbrush and diseased trees	Clear potential fuels on property such as dry underbrush and diseased trees	<ol style="list-style-type: none"> 1. Clear potential fuels on property such as dry underbrush and diseased trees 2. Implement best management practices on public lands.
Reduce Exposure	<ol style="list-style-type: none"> 1. Create and maintain defensible space around structures 2. Locate outside of hazard area 3. Mow regularly 	<ol style="list-style-type: none"> 1. Create and maintain defensible space around structures and infrastructure 2. Locate outside of hazard area 	<ol style="list-style-type: none"> 1. Create and maintain defensible space around structures and infrastructure 2. Locate outside of hazard area 3. Enhance building code to include use of fire resistant materials in high hazard area.
Reduce Vulnerability	<ol style="list-style-type: none"> 1. Create and maintain defensible space around structures and provide water on site 2. Use fire-retardant building materials 3. Create defensible spaces around home 	<ol style="list-style-type: none"> 1. Create and maintain defensible space around structures and infrastructure and provide water on site 2. Use fire-retardant building materials 	<ol style="list-style-type: none"> 1. Create and maintain defensible space around structures and infrastructure 2. Use fire-retardant building materials 3. Consider higher regulatory standards (such as class A roofing) 4. Biomass Reclamation initiatives
Increase Capability	<ol style="list-style-type: none"> 1. Employ Firewise techniques to safeguard home 2. Identify alternative water supplies for fire fighting 3. Install/replace roofing material with non-combustible roofing materials. 	<ol style="list-style-type: none"> 1. Support Firewise community initiatives. 2. Create /establish stored water supplies to be utilized for fire fighting. 	<ol style="list-style-type: none"> 1. More public outreach and education efforts, including an active Firewise program 2. Possible weapons of mass destruction funds available to enhance fire capability in high-risk areas 3. Identify fire response and alternative evacuation routes 4. Seek alternative water supplies 5. Become a Firewise community 6. Utilize academia to study impacts/solutions to wildfire risk 7. establish/maintain mutual aid agreements between Fire Service Agencies. 8. Create/implement fire plans