

Table 11. Summary of strategies and suggested actions (SA) for watershed flood risk reduction

SA #	CRS	SUGGESTED ACTION	Responsible Party	Existing or Potential Funding Partner	
PROTECT FLOODPLAIN NATURAL FUNCTION AND VALUE (1-8)	1	320 420 510	Maintain Living River approach to retain river system in a more natural state that allows the river to access its floodplain. Recognize that not all areas of the river system can be allowed to migrate freely due to special designation (i.e., Superfund area) and/or existing infrastructure.	All entities	N/A
	2	350 410	Develop, support and implement a good neighbor floodplain management policy that recognizes cumulative impacts and actions by one property owner can impact upstream, adjacent and downstream property owners.	All entities	N/A
	3	420	Investigate, identify, and implement areas where stream zone buffers would provide multi-objective benefits for river system and downstream communities. (Previously SA # 4)	Local and tribal governments	NDWR Clearing and Snagging Fund; FEMA; State Lands; NDEP
	4	310 410 530	Manage development in special flood hazard areas and other flood hazard areas (those known flood hazard areas not included on most current FIRMs) to provide public safety and protect the natural functions and benefits of floodplain lands. (Previously SA # 6)	Local and tribal governments; CWSD	Local Governments
	5	320 450	Promote and utilize best management practices as a means of protecting riparian habitat. (Previously SA #10)	All entities	NDEP, FEMA, USBR, Local Governments
	ECOSYSTEM SERVICES IMPORTANT to MAINTAINING LIVING RIVER APPROACH				
	6	350 420	Consider Floodplain and flood hazards ecosystem service objectives which preserve open floodplain lands when selecting acquisition targets and establishing management strategies for open spaces. (Previously SA #3)	Local and tribal governments, NGOs, CWSD	FEMA, Local Governments, NDEP
	7	520	Identify and promote options for landowner incentive programs, such as floodplain leasing program and conservation easements that provide compensation to landowners providing ecosystem services and seek funding mechanisms. (Previously SA# 9)	Local & tribal governments, NGOs, CWSD, CRC, landowners	Federal, State and local sources, , Question 1, SNPLMA
8	420 520	Retain lands that preserve floodplain storage which maintain and/or restore connection of river with floodplain through land acquisition, conservation easements, local open space programs, TDR and PDR Programs, and other protection methods. Pursue protection of additional acreage in flood prone areas (See UNCE 2015, Floodplain Protection Inventory for the Carson River). (Previously SA #7)	Local and tribal governments, NGOs, landowners	Question 1; SNPLMA; NGOs; local governments	

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HIGHER REGULATORY STANDARDS (9-11)					
HIGHER REGULATORY STANDARDS (9-11)	9	430	Periodically review county ordinances that include floodplain protection as a purpose, account for the loss of floodplain storage volume, and mitigate losses through a variety of methods. (Previously SA # 11)	Local governments	FEMA, Local Governments
	10	430	Investigate, promote, and implement of additional flood protection measures that go beyond minimum FEMA requirements, such as improving community rating system. (Previously SA # 12)	Local governments	Local Governments
	11	430	Development and adoption of consistent floodplain management ordinance language and consistent use of hydraulic model of Carson River system. (Previously SA # 13)	CWSD, CRC, local governments	FEMA, CWSD, Local Governments
FLOOD DATA INFORMATION AND MAINTENANCE (12-21)					
FLOOD DATA INFORMATION AND MAINTENANCE (12-21)	12	410 440	Establish and adopt funding source, and protocol / procedures to consistently update watershed-wide unsteady state modeling to identify flood water storage requirements and to look at the cumulative effects of watershed development. (Previously SA #14)	Local & state governments, CWSD	FEMA, CWSD, NDEP, other local & state entities
	13	440	Support FEMA's Map Modernization Program and encourage FEMA to update FIRMs with current and future conditions. Significant verification of topography and other variables should be conducted prior to release of draft FIRMs. (Previously # SA 15)	Local governments, FEMA, CWSD	FEMA, CWSD, Local Governments
	14		Participate in FEMA's Cooperating Technical Partner Program. (Previously SA#16)	CWSD, FEMA	CWSD
	15	410 440	Collect and Maintain up-to-date and consistent data collection which includes updating flood studies as needed and conducting new studies for significant water courses and alluvial fan areas. This data should be used to update FEMA maps and/or fill local data gaps. Complete delineation of the floodway throughout river system and incorporate into FIRMs. (Previously SA #17)	Local governments, CWSD, FEMA	All Federal, state and local funding sources
	16	410 440	Update flood studies and maps after significant flooding events. (Previously SA #18)	Local governments	FEMA, CWSD, Local Governments
	17	410 440	Update and Maintain Elevation Reference Marks (ERM) as- permanent monuments using NAVD88 Datum which matches base flood elevations on FEMA FIRMs. (Previously SA #19& 20)	Local governments	All Federal, state and local funding sources
	18	410 440	Develop and maintain master list of ERMs provide-to interested parties. (Previously SA #21)	Local governments, CWSD	All Federal, state and local funding sources

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FLOOD DATA INFORMATION AND MAINTENANCE (12-21)				
FLOOD DATA INFORMATION AND MAINTENANCE (19-21)	19	350 410 440	Develop and coordinate photo-monitoring program (on-the-ground and aerial) on a watershed level to consistently document flooding and flood hazards. (Previously SA #22)	CWSD All Federal, state and local funding sources
	20	350 410 440	Establish and maintain rain gage data network in each local jurisdiction.	Federal, State and Local governments, CWSD All Federal, state and local funding sources
	21		Evaluate potential impacts due to climate variability which could include changing storm patterns, rainfall amounts, and snow levels, adding uncertainty to future conditions.	Federal, State and Local governments, CWSD All Federal, state and local funding sources
CHANNEL MIGRATION AND BANK EROSION MONITORING (22-29)				
CHANNEL MIGRATION AND BANK EROSION MONITORING (22-29)	22	410	Document/map and update known and projected hazard areas including channel migration hazards and incorporated into planning processes. (Previously SA #23)	Conservation Districts, CWSD, NDEP, FEMA, local & tribal governments FEMA, CWSD, NDEP, NDWR, BIA, Conservation Districts, local & tribal governments
	23	440	Conduct LiDAR and/or aerial photography (on a watershed level) on a 5-year basis, or as needed, to provide updated information on channel movement and floodplain condition. (Previously SA #24)	CWSD, NDEP, CVCD, DVCD, NGOs, BOR, local governments All Federal, state and local funding sources
	24	430	Conduct research and establish appropriate building set-backs in flood hazard areas to reduce severe hazards from channel migration. (Previously SA #25)	Local and state entities, CWSD All Federal, state and local funding sources
	25	410 440	Conduct and document channel cross-sectional surveys to track long term changes in river channel. (Previously SA #26)	CWSD, conservation districts All Federal, state and local funding sources
	26	410 440	Identify unstable stream banks and areas with high potential for erosion. (Previously SA #27)	Conservation districts, NDEP, CWSD All Federal, state and local funding sources
	27	510	Promote the use of non-structural, bio-engineering (soft-engineering utilizing natural materials) techniques in river restoration projects in combination with other proven methods. (Previously SA #28)	All entities FEMA, NDEP, CWSD
	28	440 510	Update the 1996 Fluvial Geomorphic Assessment and create a sediment transport model of the Carson River. (Previously SA #29)	CWSD, NDEP, conservation districts FEMA Pre-Disaster Mitigation grants; USACE: UNR Graduate Grants; DRI; NSF
	29	440 510	Create a baseline study that informs management and project decisions regarding flood risks, damages, and ecosystem impacts.	CWSD, NDEP, conservation districts FEMA Pre-Disaster Mitigation grants; USACE: UNR Graduate Grants; DRI; NSF

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FLOODPLAIN AND FLOOD HAZARD OUTREACH AND EDUCATION (30-34)					
FLOODPLAIN AND FLOOD HAZARD OUTREACH AND EDUCATION (30-34)	30	330	Continued implementation of watershed-wide outreach and education program about floodplain importance and flooding hazards.	FAW Working group which includes CWSD, Federal, State and Local Jurisdictions	FEMA; NDWR, and Federal, state and local partners
	31	330	Promote and participate in Annual Flood Awareness Week (FAW) and events throughout the year with the objective of providing information about protection of floodplains, flooding and flood hazards to the general public.	FAW Working group which includes CWSD, Federal, State and Local Jurisdictions	All Federal, state and local funding sources
	32	330	Develop and update media in conjunction with FAW working group (social media, videos, brochures, web content, press releases etc.) for distribution throughout watershed with consistent messages and information for the general public.	FAW Working group which includes CWSD, Federal, State and Local Jurisdictions	CWSD, NDWR, USACE
	33	330	Promote FAW partner websites (e.g., NevadaFloods.org, National Weather Service, CWSD, and county websites) which provide information on the Regional Floodplain Management Plan, floodplain protection, flood risk, emergency preparedness, and emergency contact information. Link to one another's websites and social media sites to amplify message.	In conjunction with Flood Awareness Campaign led by NDWR, CWSD, NOAA -NWS Reno specifically address flood risk and local jurisdictions have websites as well which also link to these websites.	CWSD, NDWR, NOAA -NWS Reno
	34	330	Utilize special Events, River Work Days, and other outreach opportunities in conjunction with FAW working group to raise awareness of flooding hazards and importance of floodplains.	FAW Working group which includes CWSD, Federal, State and Local Jurisdictions	All Federal, state and local funding sources
REDUCE INFRASTRUCTURE IMPACTS (35-39)					
REDUCE INFRASTRUCTURE IMPACTS (35-39)	35	510 540	Investigate opportunities and implement actions when feasible to remove existing restrictions, such as berms or uncertified levees, to allow flood waters to access floodplain.	Local & tribal government organizations, landowners	All Federal, state and local funding sources
	36	510	Limit the use of future management measures such as dams, levees, and floodwalls.	Local & tribal government organizations, landowners	All Federal, state and local funding sources
	37	540	Design future bridges and roads to protect floodplain and accommodate rather than restrict river course changes, and minimize back up of flood water.	NDOT, local governments	All Federal, state and local funding sources
	38		Investigate opportunities to enhance grade control structures.	Local governments, CWSD	FEMA, NDEP, CWSD, and local governments
	39		Inventory, categorize, and house data regarding public and private drainage and flood control infrastructure in the Carson River Watershed.	Local governments, CWSD	FEMA, NDEP, CWSD, and local governments

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ALLUVIAL FAN HAZARD REDUCTION (40-43)					
ALLUVIAL FAN HAZARD REDUCTION (40-43)	40	440	Investigate extent of potential alluvial fan flood damage and include on maps.	Local governments, CWSD	FEMA, USACE, CWSD, and all other Federal, state, and local funding sources
	41	440	Conduct Area Drainage Master Plans for alluvial fans which examines infrastructure, land use, sediment transport & identify alternative to mitigate and/or reduce risk.	Local governments, CWSD	FEMA, CWSD, and all other Federal, state, and local funding sources
	42	440 530	Implement studies to inform and motivate land use planning & development which protects high risk areas, and/or allows flood waters and debris flows to safely move through fan flood zones;	CWSD, Local governments	FEMA, CWSD, and all other Federal, state, and local funding sources
	43		Define and implement means to protect existing open alluvial fans, implement recommendations associated with SA#'s 38-40 to limit further development and/or alleviate hazards in high risk areas.	CWSD, Local governments	FEMA, CWSD, and all other Federal, state, and local funding sources
MINIMIZE STORMWATER IMPACTS (44-48)					
MINIMIZE STORMWATER IMPACTS (44-48)	44	450	Promote stormwater infiltration rather than direct outflow to urban infrastructure, ditches, creeks, rivers to capture groundwater, improve water quality, and reduce flood risk.	State, CWSD, Local Governments	FEMA, CWSD, and all other Federal, state, and local funding sources
	45	450	Plan for and mitigate cumulative effects of watershed urbanization, including stormwater runoff, to reduce flood hazards. (Previously SA #5)	All entities	FEMA, Local Governments, NDEP
	46	450	Encourage and incorporate low impact development (LIDs) principles into all development proposals to decrease stormwater run-off, improve water quality, and promote groundwater recharge. (Edited from Former SA #8)	Local governments	Incentives to Development (fee waivers, credits?;
	47	450	Encourage adoption of model LID ordinances created for Watershed.	CWSD/Local governments	Local Governments/CWSD
	48	320 450	Promote and utilize best management practices to reduce urban runoff (Refer to SA #5)	All entities	NDEP, FEMA, USBR, Local Governments