CENTRAL VALLEY FLOOD MANAGEMENT PLANNING PROGRAM

FloodSAFE CALIFORNIA

Central Valley Flood Protection Plan

Round 1 Management Action Workshops
Draft Initial Management Actions

A management action is a specific structural or nonstructural strategy, action, or tactic that contributes to the Central Valley Flood Protection Plan (CVFPP) goals and addresses identified flood management problems in the Systemwide Planning Area, including any identified deficiencies in the State Plan of Flood Control (refer to *CVFPP Interim Progress Summary No.1*). Management actions may range from potential policy or institutional changes, to recommendations for operational and physical changes to the flood management system. Management actions may address one or more CVFPP goals and are the "building blocks" for regional solutions and eventually systemwide solutions.

An initial set of management actions was developed by consolidating a large number of compiled actions and recommendations from published studies and reports, and input from Regional Conditions and Topic Work Groups during CVFPP Phase 1 activities. DWR subject-matter experts provided a preliminary evaluation of the environmental, economic, technical, and social consideration of the identified management actions. Each management action was evaluated against a uniform set of criteria to allow for a consistent comparative analysis.

Management Actions Workshops will refine the initial management actions and develop additional actions to augment this initial set of management actions. For information on Phase 2 Workshops, refer to *Attendee's Guide to Phase 2 Workshops* available at www.water.ca.gov/cvfmp/.

Each management action is evaluated using the *Management Actions Evaluation Form*. For description of the form sections refer to the *Reader's Guide to the Management Actions Evaluation Form* available at www.water.ca.gov/cvfmp/.

To provide detailed written comments on the management action description and evaluation, use the fillable PDF *Comments Form* available at www.water.ca.gov/cvfmp/.

Draft Additional Floodplain and Reservoir Storage Management Actions

ID	Management Actions Title
MA-001	Enlarge existing transitory floodplain storage.
MA-002	Construct new transitory floodplain storage.
MA-003	Increase on-stream flood storage capacity by building new storage facilities.
MA-004	Update/modify existing flood storage facilities.
MA-005	Create new storage in existing reservoirs via dredging activities.
MA-006	Increase flood control allocation by expanding existing, on-stream reservoirs.
MA-007	Increase foothill and upper watershed storage.
MA-008	Increase flood control allocation by using Spillway Surcharge.
MA-009	Increase flood control allocation at existing reservoirs by building new, off-stream storage.
MA-010	Increase flood control allocation at existing reservoirs by expanding existing off-stream storage.

DRAFT Management Action Evaluation

Management Action Title: MA-001

Enlarge existing transitory floodplain storage.

Description:

Problem:

Currently, there is insufficient flood management storage available in some existing flood management reservoirs to regulate flood flows to the extent needed/desired. Transitory floodplain storage areas can help regulate flood flows by attenuating or reducing the magnitude of flood peaks occurring in downstream channels.

Desired Outcome:

Reduce or attenuate flood peaks by increasing available transitory flood management storage downstream from the flood management reservoirs.

Methodology:

Transitory storage occurs when peak flows in a river are diverted to adjacent off-stream storage areas. Once flow in the river decreases, water in the transitory storage area flows back into the river channel. Transitory storage measures could be attained by natural means, such as flows overtopping a bank and flowing into a wetland, or could be engineered using weirs and bypasses to direct flows onto adjacent lands. Transitory storage measures may involve flood attenuation both locally and downstream from the storage area. Enlargement of existing transitory storage areas may involve new or modified outfall structures and weirs, or modifications to berms or training dikes to increase available storage area. Transitory storage could also provide opportunities to restore ecosystem functions or habitats. For example, allowing overland flows could promote natural erosion and deposition processes and provide opportunities for riparian habitat restoration; wetland, shallow water, or terrestrial habitats.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☑ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained; requires further evaluation to identify existing transitory storage areas with potential for enlargement or reoperation

Advantages:

- Works well in conjunction with other MAs that increase system capacity and/or strengthen levees.
- Promotes multiple benefits in addition to flood flow reduction (ecosystem functions, habitat, groundwater recharge).
- Increased storage provides greater flexibility to adapt to changing climate conditions.
- Moderate cost.

Disadvantages:

- Few existing transitory storage sites may be suitable or socially acceptable for expansion.
- Cost of additional land may be high.
- Potential aquatic or terrestrial environmental impacts in expanded storage area.
- Potential impacts to existing land uses within expanded transitory storage area.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Moderate to low initial investment, depending on location and extent of required modifications to enlarge existing transitory storage (cost factors include real estate acquisitions, relocations, mitigations cost, and complexity of any structural

modifications)

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Potential for small increase in O&M costs in existing transitory storage areas

Potential for Cost-Sharing?

Potential for Federal cost sharing via contributions to existing federal project purposes (flood management, water supply, and/or environmental restoration)

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce the frequency (and long-term cost) of flooding.

Effect on Damage to Critical Public Infrastructure?

Location-specific, but may reduce damage to infrastructure in rivers and tributary areas. However, damage in existing transitory floodplain may increase.

Effect on Floodplain and Economic Development?

No significant direct effects; however, reduces the frequency of flooding and increases level of flood protection, which may encourage development in floodplain areas receiving benefits

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Could help rehabilitate physical processes and ecological functions if transitory storage is located in historical floodplains or flood basins (enhancing floodplain forming processes, increasing salmonid rearing and Sacramento splittail spawning habitat)

Adverse Environmental Impact?

If transitory floodplain storage is expanded into areas that are not active or historical floodplains or floodbasins, could result in moderate to substantial permanent impacts to terrestrial, agricultural, and potentially seasonal wetland habitats (including potential loss of habitat for special-status species)

Permitting Considerations?

Expansion of existing transitory storage areas would require new or modified permits

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

Lower flows downstream would result in decrease in required O&M and attendant environmental impacts.

Social Considerations:

Public Safety?

Reduces frequency of flooding and improves level of flood protection; no residual risk (as would be associated with similar benefits provided by levees or other downstream features)

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to contribute to restoration of floodplain functions and habitats. Potential to contribute to groundwater recharge. Possibility for creating new recreational or open space areas.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Expanding existing transitory storage would generally have a higher likelihood of implementation than constructing other types of new on- or off-stream storage, but some institutional and political challenges exist

Technical Considerations:

Redirected Hydraulic Impacts?

No redirected downstream impacts; potential local hydraulic impacts within transitory storage inundation area

Residual Risk?

Reduces the frequency of flooding, reducing residual risk to existing development

Climate Change Adaptability:

Increased transitory floodplain storage would enhance hydrologic adaptability by increasing water management flexibility; could enahnce biological adaptability if transitory storage is located in historical floodplains or floodbasins (increasing the ability of aquatic and floodplain species to adjust to changing climate conditions)

Urban, Small Community, and Non-Urban Considerations:

Existing transitory storage is in non-urban areas

Regional Applicability:

Varies by region; more applicable upstream from Delta Region.

Integration with Other Programs:

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study;

DRAFT Management Action Evaluation

Management Action Title: MA-002

Construct new transitory floodplain storage.

Description:

Problem:

Currently, there is insufficient flood management storage available in some existing flood management reservoirs to regulate flood flows to the extent needed/desired. Transitory floodplain storage can areas help regulate flood flows by attenuating or reducing the magnitude of flood peaks occurring in downstream channels.

Desired Outcome:

Reduce or attenuate flood peaks by increasing available transitory flood management storage downstream from the flood management reservoirs.

Methodology:

Transitory storage occurs when peak flows in a river are diverted to adjacent off-stream storage areas; once flow in the river decreases, water in the transitory storage area flows back into the river channel. Transitory storage measures could be attained by natural means, such as flows overtopping a bank and flowing into a wetland, or could be engineered using weirs and bypasses to direct flows onto adjacent lands. Transtiory storage measures may involve flood attenuation both locally and downstream for the storage area. There may be opportunities to establish new transitory storage in existing floodplains or areas that experience frequent flooding. Wildlife refuges, certain types of rural or agricultural lands, and certain Delta islands may be suitable for use as transitory storage. Transitory storage could also provide opportunities to restore ecosystem functions or habitats. For example, allowing overland flows could promote natural erosion and deposition processes and provide opportunities for riparian habitat restoration; wetland, shallow water, or terrestrial habitats. New transitory storage would likely include control facilities such as weirs to control the stage in the river at which the storage begins to operate, and also controls the flow rate into the storage area.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained; requires further evaluation to identify locations where it is feasible to develop new transitory storage

Advantages:

- Works well in conjunction with other MAs that increase system capacity and/or strengthen levees, restore floodplain functions.
- Promotes multiple benefits in addition to flood flow reduction (ecosystem functions, habitat, groundwater recharge).
- Increased storage provides greater flexibility to adapt to changing climate conditions
- Moderate cost.

Disadvantages:

- New transitory storage sites may be scarce/limited due to social acceptability and cost.
- Potential aquatic or terrestrial environmental impacts in new storage area.
- Potential impacts to existing land uses within new storage area.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Moderate to low initial investment, depending on location and extent of construction required to develop new transitory storage (cost factors include real estate acquisitions, relocations, mitigations cost, and complexity of new facilities)

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

O&M costs would be assoicated with any new transitory storage facility; cost would likely be low compared with other actions providing similar benefits.

Potential for Cost-Sharing?

Potential for Federal cost sharing via contributions to existing federal project purposes (flood management, water supply, and/or environmental restoration)

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce the frequency (and long-term cost) of flooding

Effect on Damage to Critical Public Infrastructure?

Infrastructure in the new storage area will be affected.

Effect on Floodplain and Economic Development?

No significant direct effects; reduces the frequency of flooding and increases level of flood protection, which may encourage development in floodplain areas receiving these benefits; potential to change existing uses of land within the new storage area

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Could help rehabiliate physical processes and ecological functions if new transitory storage is located in historical floodplains or flood basins (enhancing floodplain forming processes, increasing salmonid rearing and Sacramento splittail spawning habitat)

Adverse Environmental Impact?

If new transitory floodplain storage is created in areas that are not active or historical floodplains or floodbasins, could result in moderate to substantial permanent impacts to terrestrial, agricultural, and potentially seasonal wetland habitats (including potential loss of habitat for special-status species)

Permitting Considerations?

Potentially extensive or complex permitting, depending on location.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Reduces frequency of flooding and improves level of flood protection; no residual risk (as would be associated with similar benefits provided by levees or other downstream features)

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to contribute to restoration of floodplain functions and habitats.Potential to contribute to groundwater recharge.Possibility for creating new recreational or open space areas.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Developing new transitory storage would generally have a higher likelihood of implementation than constructing other types of new on- or off-stream storage, but some institutional and political challenges exist (land use changes, O&M responsibilities, others)

Technical Considerations:

Redirected Hydraulic Impacts?

No redirected downstream impacts; potential local hydraulic impacts within transitory storage inundation area

Residual Risk?

Reduces the frequency of flooding, reducing residual risk to existing development

Climate Change Adaptability:

New transitory floodplain storage would enhance hydrologic adaptability by increasing water management flexibility; could enahnce biological adaptability if transitory storage is located in historical floodplains or floodbasins (increasing the ability of aquatic and floodplain species to adjust to changing climate conditions)

Urban, Small Community, and Non-Urban Considerations:

New transitory storage facilities will need to be sited in non-urban areas such as wildlife refuges or agricultural areas.

Regional Applicability:

Varies by region; more applicable upstream from Delta Region.

Integration with Other Programs:

Flood Corridors Program (Projects Office)

References:

Comment on Regional Conditions Report; Yolo Bypass Management Strategy; Delta Risk Management Strategy; Hegedus and Shibatani, 2009; Independent Review Panel to the California Department of Water Resources, 2007;

DRAFT Management Action Evaluation

Management Action Title: MA-003

Increase on-stream flood storage capacity by building new storage facilities.

Description:

Problem:

There is insufficient flood management storage available in some existing flood management reservoirs to regulate flood flows. The addition of new on-stream flood management storage capacity in appropriate watersheds could reduce downstream flood releases.

Desired Outcome:

Increase available flood management storage capacity by constructing a new on-stream reservoir.

Methodology:

A new flood management reservoir could be constructed on an uncontrolled stream in a watershed, such as the South Fork of the Yuba River, that already contains a flood management reservoir; it could be constructed upstream or downstream from an existing flood management reservoir; or it could be constructed in a watershed that has no existing flood management reservoirs. Constructing a new flood management reservoir in any of these locations would provide additional flood management storage to allow better management of flood flows to decrease the probability of releasing damaging flows downstream.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained, but requires further evaluation to identify candidate on-stream sites where developing a new flood management reservoir is feasible.

Advantages:

- Will work well in conjunction with other MAs that increase downstream system capacity and/or strengthen levees.
- May promote multiple benefits in addition to flood flow reduction (water supply, cold water pool for fisheries management, recreation).
- Increased storage provides greater flexibility to adapt to changing climate conditions.

Disadvantages:

- Potentially very high capital cost.
- Potentially high impacts to terrestrial and other environmental resources in reservoir inundation area.

Economic Considerations:

Capital Cost? (High, Medium, Low)

High initial investment, depending on location and size of new on-stream storage (cost factors include real estate acquisitions, relocations, mitigations cost, and complexity of dam facilities)

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

O&M costs from new dam facilities must be considered.

Potential for Cost-Sharing?

Potential for Federal cost sharing via contributions to existing federal project purposes (flood management and/or water supply).

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding.

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce the frequency (and long-term cost) of flooding

Effect on Damage to Critical Public Infrastructure?

Potential to reduce damage.

Effect on Floodplain and Economic Development?

No direct effects; however, reduces the frequency of flooding and increases level of flood protection, which may encourage development in the floodplain

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Negative impact likely.

Adverse Environmental Impact?

Substantial permanent impacts to aquatic and riparian habitat including loss of habitat and habitat connectivity (e.g. fish migration) for special-status species; substantial alteration of physical processes, including flow regime (e.g., seasonality, magnitude, and duration of flows) and sediment transport, that would result in permanent impacts to habitat for aquatic and riparian species.

Permitting Considerations?

Extensive and complex permitting required.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Reduces frequency of flooding and improves level of flood protection; no residual risk (as would be associated with similar benefits provided by levees or other downstream features)

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to contribute to water supply, hydropower, recreation, and fisheries management if storage is maintained after flood season.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Developing new on-stream storage would generally have a much lower likelihood of implementation than expanding existing on- or off-stream storage. Institutional and political challenges would be severe.

Technical Considerations:

Redirected Hydraulic Impacts?

No redirected downstream impacts; potential hydraulic impacts within reservoir inundation area.

Residual Risk?

Reduces the frequency of flooding, reducing residual risk to existing development.

Climate Change Adaptability:

This action would enhance hydrologic adaptability by increasing water management flexibility; and it could reduce biological adaptibility by reducing the quantity and connectivity of habitat, which would reduce the ability of species to handle and adjust to the consequences of climate change.

Urban, Small Community, and Non-Urban Considerations:

Non-urban area for location.

Regional Applicability:

Not applicable in Delta Region, but may be used to reduce hydraulic impacts to Delta.

Integration with Other Programs:

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study; RCR; Boyle & Associates, 2008. Madera County Integrated Regional Water Management Plan; Mokelumne/Amador/Calaveras IRWMP - Draft. November, 2006; Colusa Basin IRWMP;

DRAFT Management Action Evaluation

Management Action Title: MA-004

Update/modify existing flood storage facilities.

Description:

Problem:

Certain existing dams may have been built to different standards and sizes or for different purposes than those required today, or they may be aging to the point that O&M and safety considerations suggest retrofit or replacement. Replacement of an existing dam can provide increased safety, storage, and operational flexibility for flood operations. Retrofit of an existing dam can provide operational flexibility.

Desired Outcome:

Increase public safety, flood management storage, and systemwide operational flexibility by replacing or retrofitting aging or obsolete dams.

Methodology:

The Central Valley has a long history of replacing obsolete dams (i.e. New Bullards Bar, New Melones, etc.). Replacing a dam could be done by constructing a new dam either upstream or downstream from the existing dam, and then decommissioning or removing the old dam when the new one is completed. The new dam is often significantly larger than the existing dam, thus providing additional flood management storage to improve the operations and reduce flood flows. Retrofitting a dam could include a new spillway, such as the one at Folsom Dam that allows release of larger inflows before it is necessary to start storing water prior to flood operations.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained, but requires further evaluation to identify candidate reservoirs where additional storage could be provided by replacing an aging or obsolete dam.

Advantages:

- Will work well in conjunction with other MAs that increase downstream system capacity and/or strengthen levees
- Promotes multiple benefits in addition to flood flow reduction (water supply, cold water pool for fisheries management)
- Increased storage provides greater flexibility to adapt to changing climate conditions

Disadvantages:

- Potentially high capital cost.
- Potential terrestrial environmental impacts in reservoir inundation area.
- Potential to reduce downstream floodplain habitat by reducing peak flows.

Economic Considerations:

Capital Cost? (High, Medium, Low)

High initial investment, depending on location and size of replacement dam (cost factors include real estate acquisitions, relocations, mitigations cost, and complexity of replacing existing dam facilities with new)

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Potential to reduce O&M costs by relacing aging or obsolete dam

Potential for Cost-Sharing?

Potential for Federal cost sharing via contributions to existing federal project purposes (flood management and/or water supply).

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding.

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce the frequency (and long-term cost) of flooding

Effect on Damage to Critical Public Infrastructure?

Region specific (cannot determine at this time)

Effect on Floodplain and Economic Development?

No direct effects; however, reduces the frequency of flooding and increases level of flood protection, which may encourage development in the floodplain

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

Substantial temporary impacts to aquatic and riparian habitat would result from dam replacement. Increasing the storage (flooding additional area) would result in substantial permanent impacts to upland and potentially seasonal and/or freshwater marsh wetland habitat including loss of habitat for special-status species; and would result in moderate alteration of physical processes, including flow regime (e.g., seasonality, magnitude, and duration of flows) and sediment transport, that could result in permanent impacts to habitat for aquatic and riparian species.

Permitting Considerations?

Extensive and complex permitting required.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Reduces frequency of flooding and improves level of flood protection; no residual risk (as would be associated with similar benefits provided by levees or other downstream features)

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to contribute to water supply, hydropower, recreation, and fisheries management

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Replacing an existing dam would generally have a higher likelihood of implementation than constructing a new on-stream storage, but institutional and political challenges still exist.

Technical Considerations:

Redirected Hydraulic Impacts?

No redirected downstream impacts; potential hydraulic impacts within reservoir inundation area.

Residual Risk?

Reduces the frequency of flooding, reducing residual risk to existing development.

Climate Change Adaptability:

An increase to the water storage would enhance hydrologic adaptability by increasing water management flexibility.

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified.

Regional Applicability:

May be applied in regions where dams exist. May be used to reduce hydraulic impacts to Delta.

Integration with Other Programs:

References:

Mokelumne/Amador/Calaveras IRWMP - Draft. November, 2006;

DRAFT Management Action Evaluation

Management Action Title: MA-005

Create new storage in existing reservoirs via dredging activities.

Description:

Problem:

Due to location and/or watershed characteristics, many reservoirs have reduced capacity resulting from sediment accumulation within the reservoir.

Desired Outcome:

Increase available flood management storage allocation in existing reservoirs.

Methodology:

Additional flood management storage could be created/restored in an existing reservoir by dredging accumulated sediments; this dredged material could be used elsewhere in the system for flood maintenance activities. Dredging operations would be properly permitted and monitored so that potential water quality impacts are minimized.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained, but requires further evaluation to identify candidate reservoirs where flood management storage has been compromised and dredging to get some of it back is feasible.

Advantages:

- Will work well in conjunction with other MAs that increase downstream system capacity and/or strengthen levees.
- Promotes multiple benefits in addition to flood flow reduction (water supply, cold water pool for fisheries management).
- Increased storage provides greater flexibility to adapt to changing climate conditions.

Disadvantages:

- Potentially high capital cost for small increase in flood storage.
- Potential severe aquatic and terrestrial environmental impacts in reservoir inundation area.
- Potential aquatic environmental impacts downstream.
- Disposal of dredged materials might be hampered by the presence of hazardous wastes such as methyl mercury in the sediment. Also, if there is no good use for the sediment within reasonable distance (reasonable transportation cost), a location for disposal needs to be found.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Moderate initial investment, depending on location and extent of dredging and availability of disposal sites (cost factors include real estate acquisitions for disposal, transportation of dredged materials, and environmental mitigation costs).

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Little or no change to O&M costs from modifications to existing dam facilities once dredging is complete.

Potential for Cost-Sharing?

Potential for Federal cost sharing via contributions to existing federal project purposes (flood management and/or water supply); may be reduced due to high cost and limited benefits.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding.

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce the frequency (and long-term cost) of flooding.

Effect on Damage to Critical Public Infrastructure?

Region specific (cannot determine at this time)

Effect on Floodplain and Economic Development?

No direct effects; however, reduces the frequency of flooding and increases level of flood protection, which may encourage development in the floodplain.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Will impact existing reservoir ecology.

Adverse Environmental Impact?

This action would result in moderate to substantial temporary impacts to reservoir aquatic habitat and associated species. This action would also result in moderate alteration of downstream physical processes, including flow regime (e.g., seasonality, magnitude, and duration of flows) and sediment transport, that could result in permanent impacts to habitat for aquatic and riparian species.

Permitting Considerations?

Substantial but less complex than permitting for a new reservoir.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Reduces frequency of flooding and improves level of flood protection commensurate with increase in storage; no residual risk (as would be associated with similar benefits provided by levees or other downstream features)

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to contribute to water supply, hydropower, recreation, and fisheries management

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Conducting dredging in an existing dam to increase storage would generally have a higher likelihood of implementation than constructing new on- or off-stream storage, but environmental, institutional, and political challenges still exist.

Technical Considerations:

Redirected Hydraulic Impacts?

No redirected downstream impacts; potential hydraulic impacts within reservoir inundation area.

Residual Risk?

Reduces the frequency of flooding commensurate with increase in storage, reducing residual risk to existing development.

Climate Change Adaptability:

Enhances hydrologic adaptability by increasing water management flexibility.

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified.

Regional Applicability:

May be applied in regions where dams exist. May be used to reduce hydraulic impacts to Delta.

Integration with Other Programs:

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study;

DRAFT Management Action Evaluation

Management Action Title: MA-006

Increase flood control allocation by expanding existing, on-stream reservoirs.

Description:

Problem:

There is insufficient flood management storage available in some existing flood management reservoirs to regulate flood flows. From a flood control perspective, maintaining sufficient flood reservation space within reservoirs becomes critical during the rainy season. In the San Joaquin Valley, for example, the first flood can fill some reservoirs, and flood releases are limited by the downstream channel capacities. This increases the likelihood of spilling large flood flows during the latter part of storm events (Independent Review Panel to the California Department of Water Resources, 2007).

Desired Outcome:

Increase available flood management storage allocation in existing reservoirs.

Methodology:

Expansion of existing on-stream reservoirs may be easier and more effective to accomplish than building a new reservoir because of the lack of feasible sites for new on-stream reservoirs. Raising an existing dam and thereby enlarging the existing flood management reservoir could provide additional flood management storage allocation while at the same time maintaining or increasing conservation storage. Increasing flood management storage allocation in an existing reservoir usually comes at the expense of conservation storage, except when the existing dam is raised to increase the total storage behind the dam. The additional storage in the reservoir can be divided between conservation storage and flood management storage as needed, but the entire storage of the reservoir will be available for water supply storage after the flood season.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained, but requires further evaluation to identify candidate reservoirs where additional storage is needed and feasible.

Advantages:

- Will work well in conjunction with other MAs that increase downstream system capacity and/or strengthen levees.
- Promotes multiple benefits in addition to flood flow reduction (water supply, cold water pool for fisheries management).
- Increased storage provides greater flexibility to adapt to changing climate conditions.

Disadvantages:

- Potentially high capital cost.
- Potential aquatic and terrestrial environmental impacts in reservoir inundation area.

Economic Considerations:

Capital Cost? (High, Medium, Low)

High initial investment, depending on location and extent of expansion (cost factors include real estate acquisitions, relocations, mitigations cost, and complexity of structural modifications to existing dam facilities)

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Little or no change to O&M costs from modifications to existing dam facilities

Potential for Cost-Sharing?

Potential for Federal cost sharing via contributions to existing federal project purposes (flood management and/or water supply).

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding.

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce the frequency (and long-term cost) of flooding

Effect on Damage to Critical Public Infrastructure?

Region specific (cannot determine at this time)

Effect on Floodplain and Economic Development?

No direct effects; however, reduces the frequency of flooding and increases level of flood protection, which may encourage development in the floodplain

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

More operational flexibility with increased storage, including wider range of possible downstream flow regimes.

Adverse Environmental Impact?

Expanding existing on-stream reservoirs would result in permanent impacts to aquatic and riparian habitat in the reservoir inundation area, including loss of habitat and habitat connectivity (e.g., fish migration) for special-status species. This action also would result in moderate to substantial alteration of physical processes, including flow regime (e.g., seasonality, magnitude, and duration of flows) and sediment transport, that could result in permanent impacts to habitat for aquatic and riparian species.

Permitting Considerations?

Extensive and complex permitting required.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Reduces frequency of flooding and improves level of flood protection; no residual risk (as would be associated with similar benefits provided by levees or other downstream features)

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to contribute to water supply, hydropower, recreation, and fisheries management if storage is maintained after flood season.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Raising an existing dam would generally have a higher likelihood of implementation than constructing new on-stream storage, but significant environmental, institutional, and political challenges still exist.

Technical Considerations:

Redirected Hydraulic Impacts?

No redirected downstream impacts; potential hydraulic impacts within reservoir inundation area.

Residual Risk?

Reduces the frequency of flooding, reducing residual risk to existing development.

Climate Change Adaptability:

Enhances hydrologic adaptability by increasing water management flexibility, could reduce biological adaptibility if new storage area interrupts wildlife migration corridors.

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified.

Regional Applicability:

Not applicable in Delta Region, but may be used to reduce hydraulic impacts to Delta.

Integration with Other Programs:

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study;Environmental Sustainability Summary; Mokelumne/Amador/Calaveras IRWMP - Draft. November, 2006;

DRAFT Management Action Evaluation

Management Action Title: MA-007

Increase foothill and upper watershed storage.

Description:

Problem:

There is insufficient flood management storage available in some existing flood management reservoirs to regulate flood flows. The deep empty space requirements often drive mandated releases during the flood season to maintain flood storage within the operational flood encroachment curve (Hegedus and Shibatani, 2009). The availability of additional flood storage in upper watershed reservoirs can reduce the required flood storage in the foothill flood management reservoir.

Desired Outcome:

Increase available storage in upper watershed reservoirs, upstream from flood management reservoirs.

Methodology:

When storage is available in reservoirs upstream from a flood management reservoir, that storage can often be counted as available flood storage (i.e., French Meadows and Ice House for Folsom Dam and Mammoth Pool for Friant Dam). Available storage in existing upper watershed reservoirs could be increased by allowing surcharging of the spillways, to increase the storage in the reservoir prior to spills. The use of surcharging is dependent on the design of the dam and spillway, but if it does not reduce the safety of the dam, it could be achieved through the use of temporary or permanent flashboards on top of the spillway of the upstream reservoir.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained, but requires further evaluation to identify candidate reservoirs where it is feasible to add additional storage by allowing surcharging on spillways.

Advantages:

- Will work well in conjunction with other MAs that increase downstream system capacity and/or strengthen levees.
- Promotes multiple benefits in addition to flood flow reduction (water supply, cold water pool for fisheries management).
- Increased storage provides greater flexibility to adapt to changing climate conditions.
- Low cost.

Disadvantages:

- Dams safety considerations.
- Potential aquatic and terrestrial environmental impacts in reservoir inundation area.
- Potential impact to shoreline recreation facilities in surcharged reservoirs.
- Similar storage volumes in upstream reservoirs are less effective because they affect a smaller portion of the watershed than the downstream reservoir, and because upstream reservoirs are not configured for flood operations and it is not possible to control the rate of filling of the flood pool.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Moderat to low initial investment, depending on location and extent of spillway modifications (cost factors include real estate

acquisitions, relocations, mitigations cost, and complexity of structural modifications to existing dam facilities)

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Little or no change to O&M costs from modifications to existing dam facilities

Potential for Cost-Sharing?

Potential for Federal cost sharing via contributions to existing federal project purposes (flood management and/or water supply).

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding.

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce the frequency (and long-term cost) of flooding

Effect on Damage to Critical Public Infrastructure?

Region specific (cannot determine at this time)

Effect on Floodplain and Economic Development?

No direct effects; however, reduces the frequency of flooding and increases level of flood protection, which may encourage development in the floodplain

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

Increasing foothill and upper watershed storage would result in moderate to substantial temporary or permanent impacts (dependent on actions) to terrestrial, wetland, and riparian, including potential loss of habitat for special-status species. Other potential impacts include: change in flow regime (e.g., seasonality, magnitude, and duration of flows), sediment transport, and habitat for aquatic and riparian species.

Permitting Considerations?

Extensive and complex

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Reduces frequency of flooding and improves level of flood protection; no residual risk (as would be associated with similar benefits provided by levees or other downstream features)

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to contribute to water supply, hydropower, and fisheries management

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Providing additional storage in an existing dam through spillway surcharging would generally have a higher likelihood of implementation than constructing new on-stream storage, but institutional and political challenges still exist.

Technical Considerations:

Redirected Hydraulic Impacts?

No redirected downstream impacts; potential hydraulic impacts within reservoir inundation area.

Residual Risk?

Reduces the frequency of flooding, reducing residual risk to existing development.

Climate Change Adaptability:

Increasing use of available upstream storage would enhance hydrologic adaptability by increasing water management flexibility, but could reduce biological adaptibility downstream by reducing the complexity of habitats.

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified.

Regional Applicability:

Not applicable in Delta Region, but may be used to reduce hydraulic impacts to Delta.

Integration with Other Programs:

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study;

DRAFT Management Action Evaluation

Management Action Title: MA-008

Increase flood control allocation by using Spillway Surcharge.

Description:

Problem:

There is insufficient flood management storage available in some existing flood management reservoirs to regulate flood flows. Some of the reservoirs on the Sacramento and San Joaquin rivers have insufficient storage capacity to fully capture average annual unimpaired runoff if no releases are made. From a flood management perspective, maintaining sufficient flood reservation space within reservoirs becomes critical during the rainy season. The deep empty space requirements often drive mandated releases during the flood season to maintain flood storage within the operational flood encroachment curve (Hegedus and Shibatani, 2009). In the San Joaquin Valley, the first part of a flood can fill some reservoirs, and flood operationsare limited by the downstream channel capacities. This increases the likelihood of spilling large flood flows during the latter part of storm events (Independent Review Panel to the California Department of Water

Desired Outcome:

Increase storage in upper watershed reservoirs, upstream from flood management reservoirs.

Methodology:

When storage is available in reservoirs upstream from a flood management reservoir, that storage can often be counted as available flood storage (i.e., French Meadows and Ice House for Folsom Dam and Mammoth Pool for Friant Dam). It may be possible to increase the available storage in existing upper watershed reservoirs by allowing surcharging of the spillways, to increase the storage in the reservoir prior to spills. The use of surcharging is dependent on the design of the dam and spillway, but if it does not reduce the safety of the dam, it could be achieved through the use of temporary or permanent flashboards on top of the spillway of the upstream reservoir.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained, but requires further evaluation to identify candidate reservoirs where it is feasible to add additional storage by allowing surcharging on spillways.

Advantages:

- Will work well in conjunction with other MAs that increase downstream system capacity and/or strengthen levees.
- Promotes multiple benefits in addition to flood flow reduction (water supply, cold water pool for fisheries management).
- Increased storage provides greater flexibility to adapt to changing climate conditions.
- Low cost.

Disadvantages:

- Dams safety considerations.
- Potential aquatic and terrestrial environmental impacts in reservoir inundation area.
- Potential impact to shoreline recreation facilities in surcharged reservoirs.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Moderate to low initial investment, depending on location and extent of spillway modifications (cost factors include real estate acquisitions, relocations, mitigations cost, and complexity of structural modifications to existing dam facilities)

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Little or no change to O&M costs from modifications to existing dam facilities

Potential for Cost-Sharing?

Potential for Federal cost sharing via contributions to existing federal project purposes (flood management and/or water supply).

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding.

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce the frequency (and long-term cost) of flooding

Effect on Damage to Critical Public Infrastructure?

Region specific (cannot determine at this time)

Effect on Floodplain and Economic Development?

No direct effects; however, reduces the frequency of flooding and increases level of flood protection, which may encourage development in the floodplain

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

Increasing foothill and upper watershed storage would result in moderate to substantial temporary or permanent impacts (dependent on actions) to terrestrial, wetland, and riparian, including potential loss of habitat for special-status species. Other potential impacts include: change in flow regime (e.g., seasonality, magnitude, and duration of flows), sediment transport, and habitat for aquatic and riparian species.

Permitting Considerations?

Extensive and complex

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Reduces frequency of flooding and improves level of flood protection; no residual risk (as would be associated with similar benefits provided by levees or other downstream features)

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to contribute to water supply, hydropower, recreation, and fisheries management

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Providing additional storage in an existing dam through spillway surcharging would generally have a higher likelihood of

implementation than constructing new on-stream storage, but institutional and political challenges still exist.

Technical Considerations:

Redirected Hydraulic Impacts?

No redirected downstream impacts; potential hydraulic impacts within reservoir inundation area.

Residual Risk?

Reduces the frequency of flooding, reducing residual risk to existing development.

Climate Change Adaptability:

Increasing use of available upstream storage would enhance hydrologic adaptability by increasing water management flexibility, but could reduce biological adaptibility downstream by reducing the complexity of habitats.

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified.

Regional Applicability:

Not applicable in Delta Region, but may be used to reduce hydraulic impacts to Delta.

Integration with Other Programs:

References:

DRAFT Management Action Evaluation

Management Action Title: MA-009

Increase flood control allocation at existing reservoirs by building new, off-stream storage.

Description:

Problem:

There is insufficient flood management storage available in some existing flood management reservoirs to regulate flood flows. From a flood management perspective, maintaining sufficient flood reservation space within reservoirs becomes critical during the rainy season. The deep empty space requirements often drive mandated releases during the flood season to maintain flood storage within the operational flood encroachment curve (Hegedus and Shibatani, 2009). In the San Joaquin Valley, the first part of a flood can fill some reservoirs, and flood operations are limited by the downstream channel capacities. This increases the likelihood of spilling large flood flows during the latter part of storm events (Independent Review Panel to the California Department of Water Resources, 2007).

Desired Outcome:

Increase available flood management storage allocation in existing reservoirs.

Methodology:

Construct a new off-stream storage reservoir. This reservoir would likely need to be built in relatively close proximity to the existing reservoir so that water could be transferred from the flood management reservoir to the off-stream reservoir. Prior to and during flood season, the availability of storage in the off-stream reservoir could allow water to be diverted from the conservation pool in the flood management reservoir to the off-stream storage reservoir. This would increase the flood management storage in the flood management reservoir while at the same time saving the water diverted from the conservation pool into the off-stream reservoir to be used to replace or augment regular water supply releases later in the year. Storage in the off-stream reservoir would not be creditable or usable as flood management storage, and diversions to the off-stream reservoir would have to occur prior to the beginning of any flood events so that the additional flood storage would be available in the flood management reservoir during flood operations.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained, but requires further evaluation to identify candidate off-stream sites where developing new storage is feasible.

Advantages:

- Will work well in conjunction with other MAs that increase downstream system capacity and/or strengthen levees.
- May promote multiple benefits both as standalone reservoir or in conjuction with existing reservoirs in addition to flood flow reduction (water supply, cold water pool for fisheries management, recreation) if storage is maintained after flood season is over.
- Increased storage provides greater flexibility to adapt to changing climate conditions.

Disadvantages:

- Potentially high capital cost
- Potential terrestrial environmental impacts in reservoir inundation area
- Offstream stoarage potentially less effective than on-stream storage for flood management.

Economic Considerations:

Capital Cost? (High, Medium, Low)

High initial investment, depending on location and size of off-stream reservoir (cost factors include real estate acquisitions, relocations, mitigations cost, and complexity and size of required dam and conveyance facilities)

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

O&M costs from new dam facilities must be considered.

Potential for Cost-Sharing?

Potential for Federal cost sharing via contributions to existing federal project purposes (flood management and/or water supply).

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding.

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce the frequency (and long-term cost) of flooding

Effect on Damage to Critical Public Infrastructure?

Region specific (cannot determine at this time)

Effect on Floodplain and Economic Development?

Direct effects would includeboost to economy during construction of the new reservoir. Indirectly reduces the frequency of flooding and increases level of flood protection, which may encourage new development in the floodplain

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

Substantial permanent impacts to terrestrial and potentially wetland habitat, including potential loss of habitat for special-status species; moderate to substantial alteration of physical processes, including flow regime (e.g., seasonality, magnitude, and duration of flows) and sediment transport, that could result in permanent impacts to habitat for aquatic and riparian species.

Permitting Considerations?

Extensive and complex

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Reduces frequency of flooding and improves level of flood protection; no residual risk (as would be associated with similar benefits provided by levees or other downstream features)

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to contribute to water supply, hydropower, recreation, and fisheries management if storage is maintained after flood

season.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Developing new off-stream storage would generally have a higher likelihood of implementation than constructing new on-stream storage, but institutional and political challenges exist.

Technical Considerations:

Redirected Hydraulic Impacts?

No redirected downstream impacts; potential hydraulic impacts within reservoir inundation area.

Residual Risk?

Reduces the frequency of flooding, reducing residual risk to existing development.

Climate Change Adaptability:

This action would enhance hydrologic adaptability by increasing water management flexibility; and it could reduce biological adaptibility by reducing the quantity and connectivity of habitat, which would reduce the ability of species to handle and adjust to the consequences of climate change.

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified.

Regional Applicability:

Not applicable in Delta Region, but may be used to reduce hydraulic impacts to Delta.

Integration with Other Programs:

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study ; Mokelumne/Amador/Calaveras IRWMP - Draft. November, 2006;

DRAFT Management Action Evaluation

Management Action Title: MA-010

Increase flood control allocation at existing reservoirs by expanding existing off-stream storage.

Description:

Problem:

There is insufficient flood management storage available in some existing flood management reservoirs to regulate flood flows. From a flood management perspective, maintaining sufficient flood reservation space within reservoirs becomes critical during the rainy season. The deep empty space requirements often drive mandated releases during the flood season to maintain flood storage within the operational flood encroachment curve (Hegedus and Shibatani, 2009). In the San Joaquin Valley, the first part of a flood can fill some reservoirs, and flood operations are limited by the downstream channel capacities. This increases the likelihood of spilling large flood flows during the latter part of storm events (Independent Review Panel to the California Department of Water Resources, 2007).

Desired Outcome:

Increase available flood management storage allocation in existing reservoirs.

Methodology:

This management action requires an existing off-stream storage reservoir that is available within reasonable proximity of a flood management reservoir. It is likely that the off-stream reservoir would need to be enlarged to provide space for diverted water from the conservation pool of the flood management reservoir. Prior to and during flood season, the availability of storage in the off-stream reservoir would allow water to be diverted from the conservation pool in the flood management reservoir to the off-stream storage reservoir. This would increase the flood management storage in the flood management reservoir while at the same time saving the water diverted from the conservation pool into the off-stream reservoir to be used to replace or augment regular water supply releases later in the year. Storage in the off-stream reservoir would not be creditable or usable as flood management storage, and diversions to the off-stream reservoir would have to occur prior to the beginning of any flood events so that the additional flood storage would be available in the flood management reservoir during flood operations.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained, but requires further evaluation to identify candidate off-stream sites where expanding storage is feasible and the off-stream reservoir is able to work in conjuction with existing flood management reservoir.

Advantages:

- Will work well in conjunction with other MAs that increase downstream system capacity and/or strengthen levees.
- May promote multiple benefits in addition to flood flow reduction (water supply, cold water pool for fisheries management, recreation).
- Increased storage provides greater flexibility to adapt to changing climate conditions.
- Recreation benefits if storage is maintained after flood

Disadvantages:

- Potentially high capital cost.
- Potential terrestrial environmental impacts in reservoir inundation area.
- There is limited existing off-stream storage in the Sacramento and San Joaquin Flood Management System.

season is over.

Economic Considerations:

Capital Cost? (High, Medium, Low)

High initial investment, depending on location and extent of expansion (cost factors include real estate acquisitions, relocations, mitigations cost, and complexity of structural modifications to existing dam facilities).

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Little or no change to O&M costs from modifications to existing off-stream dam facilities

Potential for Cost-Sharing?

Potential for Federal cost sharing via contributions to existing federal project purposes (flood management and/or water supply).

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding.

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce the frequency (and long-term cost) of flooding

Effect on Damage to Critical Public Infrastructure?

Region specific (cannot determine at this time)

Effect on Floodplain and Economic Development?

No direct effects; however, reduces the frequency of flooding and increases level of flood protection, which may encourage development in the floodplain

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

Substantial permanent impacts to terrestrial, agricultural, and potentially to seasonal or freshwater marsh wetland habitats, including loss of habitat for special-status species; moderate alteration of physical processes, including flow regime (e.g., seasonality, magnitude, and duration of flows) and sediment transport, that could result in permanent impacts to habitat for aquatic and riparian species.

Permitting Considerations?

Extensive and complex

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Reduces frequency of flooding and improves level of flood protection; no residual risk (as would be associated with similar benefits provided by levees or other downstream features)

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to contribute to water supply, hydropower, recreation, and fisheries management if storage is maintained after flood season.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Expanding existing off-stream storage would generally have a higher likelihood of implementation than constructing new on- or off-stream storage, but institutional and political challenges still exist.

Technical Considerations:

Redirected Hydraulic Impacts?

No redirected downstream impacts; potential hydraulic impacts within reservoir inundation area.

Residual Risk?

Reduces the frequency of flooding, reducing residual risk to existing development.

Climate Change Adaptability:

This action would enhance hydrologic adaptability by increasing water management flexibility; and it could reduce biological adaptibility by reducing the quantity and connectivity of habitat, which would reduce the ability of species to handle and adjust to the consequences of climate change.

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified.

Regional Applicability:

Not applicable in Delta Region, but may be used to reduce hydraulic impacts to Delta.

Integration with Other Programs:

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study;