Federal Drought Mitigation Initiatives, Tools and Resources to Reduce Risk

September 18, 2019

In Partnership with:
AICPs are eligible for 1.25 CMs.

Enter your CM credits on your CM Log at planning.org/log

AICP members may view the recording to claim their CM credits
Logistics

- You can open and close your control panel using the Orange Arrow at the top left corner.

- To listen through your computer speakers or headphones, click the “Computer audio” option.

- To listen through your phone, choose the “Phone call” option, which will provide you with dial in information.

- If you are having audio difficulty, it may be due to your local connection. Use the “Phone call” option in this case.

- To submit a question or comment, simply use the Questions panel.
The recording of this webinar and all slides will be posted on APA’s website within one week.

Visit https://www.planning.org/nationalcenters/hazards/droughtmitigation/ to access the recording, or just Google “APA Drought”

Access last month’s webinar here as well
Presenters

Darion Mayhorn
Drought Coordinator,
Bureau of Reclamation

Nicole LaRosa, CFM
Senior Policy Specialist,
Federal Emergency Management Agency
Hazard Mitigation Assistance Branch
Federal Drought Mitigation Initiatives, Tools and Resources

Drought Mitigation Planning in a Multi-Hazards Context

• Drought Summit – Summer 2018
• Practitioner Survey and Annotated Bibliography
• Presentation at APA’s 2019 National Conference
• Planning Information Exchange Webinar
• Using Planning Tools to Reduce Drought Mitigation Impacts
• Planning for Drought and Cascading Hazards Guidebook
DROUGHT

Drought is a prolonged period of low precipitation severe enough to reduce soil moisture, water, and snow levels below the minimum necessary for sustaining plant, animal, and economic systems.

CAUSES

- A natural part of the climate cycle
- Higher temperatures
- Water demand exceeds availability
- Lack of rainfall
- Low winter snowpack

IMPACTS

- Increased likelihood of wildfires
- Reduced water supply
- Threats to hydroelectric power supply
- Possible economic and job losses in the energy, agricultural, mining, tourism and recreation, and fishing industries
- Increased cost of resources that require water for their production (electricity, fresh produce, etc.)
- Crop losses
Drought Mitigation Alternatives

• Local Plans and Regulations
• Structure and Infrastructure Projects
• Natural Resource Protection
• Education & Awareness
Drought Response Program

Federal Drought Mitigation Initiatives, Tools, and Resources to Reduce Risk Webinar
September 18, 2019
Reclamation’s Mission

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.
WaterSMART Program

Supports Reclamation’s mission through collaboration with stakeholders to improve water management, increase conservation, and stretch scarce water resources.
History of Drought Program

• Reclamation States Emergency Drought Relief Act of 1991 (Drought Act)

• Program reformulated in 2015 to support a proactive approach for non-Federal partners to prepare for and respond to drought
Objective of Drought Program

• Drought preparedness to:
  • Identify vulnerabilities and mitigation actions to reduce risks
  • Improve coordination and cooperation among key entities, and development of procedures for monitoring, assessing, and responding to drought
  • Reduce impacts of drought, and conflicts between water users
Drought Response Program

- Drought Contingency Planning
- Drought Resiliency Projects
- Emergency Response Actions
Drought Response Program
Program Requirements

Eligible Applicants
- States, Indian Tribes, Irrigation Districts, Water Districts, and other organizations with water or power delivery authority

Cost Share
- 50% non-Federal cost-share required

Drought Plans
- Up to $200,000 per plan, completed within 2 years

Drought Projects
- Funding Group I: Up to $300k and completed within 2 years
- Funding Group II: Up to $750k and completed within 3 years
Drought Response Program
Drought Contingency Plans

- Establish Diverse Task Force and Objectives
- Develop Monitoring Plan
- Conduct Vulnerability Assessment
- Identify Mitigation and Response Actions
- Develop Administrative Framework
- Identify Plan Update Process
Arbuckle-Simpson Aquifer DCP

Drought Contingency Plan

November 2017
current climate conditions and emerging drought stages. To accomplish this task, on behalf of the Task Force, the Oak Institute and Chickasaw Nation agreed to host and support an appropriate regional drought monitoring website, including relevant data and updated information pertaining to the current Drought Stage.

### Table 1: AAD DCP Recommended Drought Stages & Response Actions for Water Use Sectors

<table>
<thead>
<tr>
<th>Sector</th>
<th>Model/Region</th>
<th>Agriculture</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - ALERT</td>
<td>Mining</td>
<td>Mining</td>
</tr>
<tr>
<td></td>
<td>Fish &amp; Wildlife</td>
<td>Fish &amp; Wildlife</td>
</tr>
<tr>
<td></td>
<td>Recreation &amp; Tourism</td>
<td>Recreation &amp; Tourism</td>
</tr>
<tr>
<td>2 - WARNING</td>
<td>Mining</td>
<td>Mining</td>
</tr>
<tr>
<td></td>
<td>Fish &amp; Wildlife</td>
<td>Fish &amp; Wildlife</td>
</tr>
<tr>
<td></td>
<td>Recreation &amp; Tourism</td>
<td>Recreation &amp; Tourism</td>
</tr>
<tr>
<td>3 - EMERGENCY</td>
<td>Mining</td>
<td>Mining</td>
</tr>
<tr>
<td></td>
<td>Fish &amp; Wildlife</td>
<td>Fish &amp; Wildlife</td>
</tr>
<tr>
<td></td>
<td>Recreation &amp; Tourism</td>
<td>Recreation &amp; Tourism</td>
</tr>
</tbody>
</table>

### Table 3 (continued): AAD DCP Recommended Drought Stages & Response Actions for Water Use Sectors

<table>
<thead>
<tr>
<th>Sector</th>
<th>Model/Region</th>
<th>Agriculture</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - ALERT</td>
<td>Mining</td>
<td>Mining</td>
</tr>
<tr>
<td></td>
<td>Fish &amp; Wildlife</td>
<td>Fish &amp; Wildlife</td>
</tr>
<tr>
<td></td>
<td>Recreation &amp; Tourism</td>
<td>Recreation &amp; Tourism</td>
</tr>
<tr>
<td>2 - WARNING</td>
<td>Mining</td>
<td>Mining</td>
</tr>
<tr>
<td></td>
<td>Fish &amp; Wildlife</td>
<td>Fish &amp; Wildlife</td>
</tr>
<tr>
<td></td>
<td>Recreation &amp; Tourism</td>
<td>Recreation &amp; Tourism</td>
</tr>
<tr>
<td>3 - EMERGENCY</td>
<td>Mining</td>
<td>Mining</td>
</tr>
<tr>
<td></td>
<td>Fish &amp; Wildlife</td>
<td>Fish &amp; Wildlife</td>
</tr>
<tr>
<td></td>
<td>Recreation &amp; Tourism</td>
<td>Recreation &amp; Tourism</td>
</tr>
</tbody>
</table>
North Santiam Watershed Drought Contingency Plan

Prepared for
North Santiam Watershed Drought Contingency Plan Task Force
July 2017

Prepared by
GSI Water Solutions, Inc.
Bay Area Regional Reliability Drought Contingency Plan

Final
December 19, 2017
Bay Area Regional Reliability DCP

MMWD-EBMUD Intertie

CONTRA COSTA COUNTY AND MARIN COUNTY

To enable water transfers under emergency conditions, MMWD and EBMUD would build a bi-directional intertie pipeline (approximately 1 mile long) across the floor of the Richmond-San Rafael Bridge (adjacent to the bridge). While the pipeline would enable flows in both directions, transfers from EBMUD to MMWD are more likely to occur, because MMWD’s supplies are more vulnerable.

The pipeline would support a normal operating rate of 5-8 million gallons per day (mgd), allowing for operation at rates of up to 10-15 mgd. The pipeline would carry water at an average rate of 8-10 mgd (0.05-0.07 AF). The pipeline and associated improvements to existing facilities would increase the connection point from 8.0 mgd (2.00 AF) to 9.0 mgd (2.20 AF).

The intertie would be constructed in two phases. Phase 1 calls for approximately 21,400 linear feet (CI) of 24-inch diameter steel pipe to be installed on the Richmond-San Rafael Bridge. The pipeline would be constructed on the eastern side of the bridge to connect to EBMUD’s water distribution system.

Phase II would involve installing side connections to the EBMUD and MMWD systems at each end of the bridge and creating a new pumping station in Richmond. The connection point location must be suitable to allow conveyance of an adequate volume of water, while at the same time avoiding affecting EBMUD’s service. The new pumping system would allow water from the intertie to go to MMWD’s distribution system. At the bridge’s western end, the intertie would be connected to MMWD’s San Quentin Pump Station, which may receive water from a stream to deliver water effectively to MMWD’s distribution system.

AT A GLANCE

- **PROJECT TYPE**: Intertie
- **STATUS**: Construct
- **ENJOYED BAR**: MMWD and EBMUD
- **AVAILABILITY**: 4 years
- **POTENTIAL YIELD**: 5.000 to 10.000 AF
- **CO**: Direct $84M (DM USD 57.605, 2023)

**BENEFITS**
- **Environmental**: Significant reduction in seasonal transfers with minimal environmental impact
- **Economic**: Significant reduction in seasonal transfers with minimal environmental impact

**CHALLENGES**
- **Economic**: Significant reduction in seasonal transfers with minimal environmental impact
- **Environmental**: Significant reduction in seasonal transfers with minimal environmental impact

**TIMING**
- **Water Supply Yield and Availability**: 5.000 to 10.000 AF
- **Regional Resilience**: Significant reduction in seasonal transfers with minimal environmental impact
- **Efficiency**: Significant reduction in seasonal transfers with minimal environmental impact
- **Flexibility/Sustainability**: Significant reduction in seasonal transfers with minimal environmental impact
- **Water Quality Considerations**: Significant reduction in seasonal transfers with minimal environmental impact

**IMPLEMENTABILITY**
- **Social and Environmental Considerations**: Significant reduction in seasonal transfers with minimal environmental impact
- **Cost**: Significant reduction in seasonal transfers with minimal environmental impact
North American Basin RDCP

<table>
<thead>
<tr>
<th>Vulnerability Theme</th>
<th>Vulnerability Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Threats to Surface Water Availability</td>
<td>Climate Change/Physiographic Variability, Inability to Directly Use Reservoir Evaporation, Impact on Contamination</td>
</tr>
<tr>
<td>Institutional Threats to Groundwater Availability</td>
<td>New Drilling Well Standards, New State Well Quality Regulations, Public-Use Restrictions in SOCRA</td>
</tr>
<tr>
<td>Physical Threats to Groundwater Availability</td>
<td>Groundwater Contamination, Groundwater Production Capacity Limitations, Dewatering/Injection Limitations</td>
</tr>
<tr>
<td>Institutional Limitations on Ability to Share Water Supplies</td>
<td>State QCF/DMC/FAP Candidate Reservoirs, Evolving State and Federal Requirements for Transfers, Disparity in Cost of Water, State Agency Costs &amp; Incentives</td>
</tr>
<tr>
<td>Physical Limitations on Sharing Supplies</td>
<td>Difficult Distribution Functions, Limited Intake Capacities, Inadequate Pressure Zones, Diverting water quality, Lack of interagency on starters</td>
</tr>
<tr>
<td>Threats to Infrastructure Integrity</td>
<td>Aging Infrastructure, Lack of redundancy for critical facilities, Geologic hazards, Flooding hazards</td>
</tr>
<tr>
<td>Other Challenges</td>
<td>Inadequate or single-sourced reservoir, Unrealized received water potential, Limited capacity to serve growth, Lack of Real-time Data Sharing</td>
</tr>
</tbody>
</table>

**3.2.2 Drought-Specific Water Supply Sector Vulnerabilities**

Of the wide range of vulnerabilities identified by the agencies, four vulnerabilities within the institutional and physical threats to surface water availability themes surfaced as having the most significant impacts to drought resiliency. Additionally, flooding was identified as a potential vulnerability as it could represent a limitation in sharing supplies. These specific vulnerabilities are discussed below.

**Low Reservoir Storage**

This vulnerability could occur when reservoir levels drop to a point that intake structures for diverting water would be impacted, or when low storage or runoff projections result in reduced inflows. The primary vulnerability in the region is with storage at Folsom Reservoir as it reduces overall water supply reliability. Regional water suppliers are very concerned when...
Drought Response Program
Drought Resiliency Projects

Eligible Projects Include:

• Infrastructure Improvements
  • Modifying surface water intakes
  • New conveyance system components
  • Additional water storage
  • Aquifer Storage and Recovery
  • Capture and treat alternative supplies

• Decision Support Tools & Modeling
  • Tools to support water marketing
  • Tools to convey water supply information
  • Measurement

• Environmental Protection
  • Improve habitat
  • Install fish screens and ladders

Projects build resilience to drought
Projects supported by a drought plan are more competitive
Funding Level I: $300k
Funding Level II: $750k
Semitropic Water Storage District
Forecast of Average May-July Rainfall

- The Texas Water Development Board issues these May-July forecasts of seasonal rainfall using a statistical forecast technique (Fernando et al., 2013) based on large-scale atmospheric circulation patterns at approximately 5,000 meters above sea level, atmospheric stability influencing the development of convective weather systems, and soil moisture in April known to influence May-July rainfall.
- The statistical rainfall forecasts are issued from January through mid-April. The forecasts are updated every two weeks.
- The forecasts from January through March are based on predicted values of April atmospheric circulation patterns and soil moisture over Texas known to influence May-July rainfall. The predictions are obtained from the Climate Forecast System version 2 (CFSv2). Saha et al., 2014, which is the operational dynamical seasonal forecast model of the National Oceanic and Atmospheric Administration-National Centers for Environmental Prediction.
- The forecasts issued in April are based on actual observations of April atmospheric circulation patterns and soil moisture over Texas obtained from the Climate Forecast System Reanalysis dataset (Saha et al., 2010).
- The rainfall forecast provides information on whether the average rainfall for the May-July will be above normal, near normal or below normal. Red indicates chances for below-normal (dry) conditions, blue indicates chances for above normal (wet) conditions, green indicates chances for near-normal (average) conditions, and white indicates that we do not know which way the season might pan out. For more information on how to interpret the forecast, click here.

Disclaimer
The May-July seasonal rainfall forecast is an experimental forecast. It is primarily meant to be an information source to aid the implementation of drought contingency and emergency management plans. The TWDB provides information via this website as a public service. Neither the State of Texas nor the TWDB assumes any legal liability or responsibility or makes any guarantees or warranties as to the accuracy, completeness, or suitability of the information for any particular purpose.

This website is a product of the Texas Water Development Board.
WaterSMART Data Visualization Tool

Data visualization site is an interactive companion to the 2016 WaterSMART Progress Report:

- Interactive maps
- Featured project tours
- Program growth over time

https://www.usbr.gov/watersmart/

Data Visualization Tool: arcg.is/1TcT68S
Darion Mayhorn, PE
Reclamation Drought Coordinator
dmayhorn@usbr.gov
Drought Response Program
Federal Drought Mitigation Initiatives, Tools, and Resources to Reduce Risk Webinar
September 18, 2019
The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.
WaterSMART Program

Supports Reclamation’s mission through collaboration with stakeholders to improve water management, increase conservation, and stretch scarce water resources.
History of Drought Program

• Reclamation States Emergency Drought Relief Act of 1991 (Drought Act)

• Program reformulated in 2015 to support a proactive approach for non-Federal partners to prepare for and respond to drought
Objective of Drought Program

• Drought preparedness to:
  • Identify vulnerabilities and mitigation actions to reduce risks
  • Improve coordination and cooperation among key entities, and development of procedures for monitoring, assessing, and responding to drought
  • Reduce impacts of drought, and conflicts between water users
Drought Response Program

Drought Contingency Planning

Drought Resiliency Projects

Emergency Response Actions
Drought Response Program

Program Requirements

Eligible Applicants
- States, Indian Tribes, Irrigation Districts, Water Districts, and other organizations with water or power delivery authority

Cost Share
- 50% non-Federal cost-share required

Drought Plans
- Up to $200,000 per plan, completed within 2 years

Drought Projects
- Funding Group I: Up to $300k and completed within 2 years
- Funding Group II: Up to $750k and completed within 3 years
Drought Response Program

Drought Contingency Plans

- Establish Diverse Task Force and Objectives
- Develop Monitoring Plan
- Conduct Vulnerability Assessment
- Identify Mitigation and Response Actions
- Develop Administrative Framework
- Identify Plan Update Process

Drought Contingency Plan
Arbuckle-Simpson Aquifer DCP

Arbuckle-Simpson Aquifer DCP Drought Contingency Plan

Prepared by: The Choctaw and Chickasaw Nations
Pugh, Smith & Associates and AquaStrategies, Inc.

November 2017

Arbuckle-Simpson Aquifer DCP Drought Trigger Thresholds

- Antelope Springs Flow < 0.5 cfs
- Arboke Water Level < 867 feet
- Blue River Streamflow (USGS Connersville Gage) < 33 cfs
- Palmer Drought Severity Index (Climate Division 18) < 4.0
- Fittstown Monitoring Well Depth to Water (USGS) > 120 feet
current climate conditions and emerging drought stages. To accomplish this task, on behalf of the Task Force, the Okat Institute and Chickasaw Nation have agreed to host and support an appropriate regional drought monitoring website, including relevant data and updated information pertaining to the current Drought Stage.

Table 1: ASA DCP Recommended Drought Stages & Response Actions for Water Use Sectors

<table>
<thead>
<tr>
<th>Sector</th>
<th>Municipal/Industrial</th>
<th>Agriculture</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-ALERT</td>
<td>Continue with mitigation strategies and consider implementation of the following primarily voluntary conservation measures toward a goal of achieving a minimum 25 percent reduction in potable water use.</td>
<td>Continue with recommended conservation programs and mitigation strategies with the goal of achieving a voluntary reduction in potable water use of at least 25 percent.</td>
</tr>
</tbody>
</table>

Table 1 (continued): ASA DCP Recommended Drought Stages & Response Actions for Water Use Sectors

<table>
<thead>
<tr>
<th>Sector</th>
<th>Municipal/Industrial</th>
<th>Agriculture</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-WARNING</td>
<td>Reduce non-essential potable water use by 40 percent.</td>
<td>Reduce non-essential potable water use by 40 percent.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sector</th>
<th>Municipal/Industrial</th>
<th>Agriculture</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-EMERGENCY</td>
<td>Continue Stage 3 response actions.</td>
<td>Continue Stage 3 response actions.</td>
</tr>
</tbody>
</table>

Table 1 (continued): ASA DCP Recommended Drought Stages & Response Actions for Water Use Sectors

<table>
<thead>
<tr>
<th>Sector</th>
<th>Municipal/Industrial</th>
<th>Agriculture</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-EMERGENCY</td>
<td>Implement site-specific measures to utilize alternative supplies—such as wastewater, grey water and recycled water—to the maximum extent available to eliminate non-essential potable water use.</td>
<td>Implement site-specific measures to utilize alternative supplies—such as wastewater, grey water and recycled water—to the maximum extent available to eliminate non-essential potable water use.</td>
</tr>
</tbody>
</table>

Arbuckle-Simpson Aquifer Drought Contingency Plan, November 2017
North Santiam Watershed Drought Contingency Plan

Prepared for
North Santiam Watershed Drought Contingency Plan Task Force
July 2017

Prepared by
GSI Water Solutions, Inc.
Bay Area Regional Reliability DCP

MMWD-EBMUD Intertie
CONTRA COSTA COUNTY AND MARIN COUNTY

To enable water transfers under emergency conditions, MMWD and EBMUD would build a bi-directional intertie pipeline (approximately 7 miles long) over the Richmond-San Rafael Bridge or across the floor of the San Francisco Bay (adjacent to the bridge). While the pipeline would enable flows both directions, transfers from EBMUD to MMWD are more likely to occur because MMWD’s supplies are more vulnerable.

The pipeline would support a normal operating flow rate of 5 million gallons per day (mgd), allowing for transfers of up to 4,600 acre-feet (AF) per month or about 5,600 acre-feet per year (APY). The pipeline design would provide flexibility for future expansion to increase the maximum flow rate to 8.9 mgd (10,000 APY).

The intertie would be constructed in two phases. Phase I consists of approximately 21,400 linear feet (LF) of 24-inch diameter steel pipe installed on the Richmond San Rafael Bridge. Pipelines must be constructed on the eastern side of the bridge to connect to EBMUD’s water distribution system.

Phase II would involve installing pipe connections to the EBMUD and MMWD systems at each end of the bridge and constructing a new pumping station in Point Richmond. The connection point location must be suitable to allow conveyance of acceptable volume of water while also not adversely affecting EBMUD’s users. The pumping station would convert water from the connection point to MMWD’s distribution system. At the bridge’s western end, the intertie pipeline would extend to MMWD’s San Quentin Pump Station, which may require enhancements to deliver water effectively to MMWD’s distribution system.

AT A GLANCE

<table>
<thead>
<tr>
<th>PROJECT TYPE</th>
<th>Intertie</th>
</tr>
</thead>
<tbody>
<tr>
<td>STATUS</td>
<td>Conceptual</td>
</tr>
<tr>
<td>ENGAGED AGENCIES</td>
<td>MMWD and EBMUD</td>
</tr>
<tr>
<td>AVAILABILITY</td>
<td>All years</td>
</tr>
<tr>
<td>POTENTIAL YIELD</td>
<td>5,600 to 10,000 APY</td>
</tr>
<tr>
<td>COST</td>
<td>Capital: $45M (MM: $100/AF (low))</td>
</tr>
</tbody>
</table>

MMWD-EBMUD Intertie

- Water Supply Yield and Availability
  - Exceeds conveyance of 5,000 to 10,000 APY (normal operating flow rate of 5 mgd; future expansion maximum flow rate of 8.9 mgd).

- Regional Resilience
  - Facilitates water transfers between MMWD and EBMUD (both directions), increasing supply reliability and resilience to droughts, climate change impacts, planned outages, design life failures, and other emergencies.

- Efficiency
  - Conveys existing water system infrastructure, leveraging existing supply sources within the region.

- Flexibility/Sustainability
  - Increases flexibility to move water where needed.

- Water Quality Considerations
  - Requires evaluation to determine the impact of blending and ensure that water quality stability is not affected (e.g., ensure corrosion protection to transmission and distribution pipelines and delivered water quality, minimize potential taste and odor issues).

BENEFITS
- Leverages existing supply sources and connects existing infrastructure for exchange/transfers.
- Increases water supplies in emergencies, planned outages, and droughts.
- Increases resilience to climate change.

CHALLENGES
- Requires potential water rights modifications to enable transfers/exchanges.
- Involves construction in a highly urbanized area (adjacent to transportation and local community) and may involve coordination with many jurisdictions, property owners, and permitting agencies.

Timing
- This project is in the conceptual phase and implementation is expected to be long-term, greater than 10 years.

Implementability
- Constructing the intertie pipeline in an urban area necessitates complying with the California Environmental Quality Act (CEQA) coordinating with many jurisdictions, property owners, and permitting agencies securing permits establishing an agreement with Caltrans for access to and use of the Richmond-Rafael Bridges and developing traffic control plans. Water rights modifications may be required to execute transfers/exchanges through the intertie pipeline. Construction across the bridge would be challenging and disruptive to traffic flow.

Social and Environmental Considerations
- Constructions of this major infrastructure project will likely require mitigation of environmental impacts and community impacts (e.g., disruptive traffic conditions).
North American Basin RDCP
North American Basin RDCP

Table 3.1: Identified Vulnerability Themes and Categories

<table>
<thead>
<tr>
<th>Vulnerability Theme</th>
<th>Vulnerability Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <strong>Institutional threats to surface water availability</strong></td>
<td>Increasing constraints on CVP/Folsom Reservoir Operations</td>
</tr>
<tr>
<td></td>
<td>Evolving State and Federal Regulations</td>
</tr>
<tr>
<td></td>
<td>Agency Specific Water Rights/Contract Limitations</td>
</tr>
<tr>
<td></td>
<td>Allocation Shortages of CVP Supplies</td>
</tr>
<tr>
<td></td>
<td>Water Right Curtailments</td>
</tr>
<tr>
<td>2. <strong>Physical threats to surface water availability</strong></td>
<td>Climate Change/hydrologic Variability</td>
</tr>
<tr>
<td></td>
<td>Instability to Drought due to Low Storage/Flow Conditions</td>
</tr>
<tr>
<td></td>
<td>Source Contamination</td>
</tr>
<tr>
<td>3. <strong>Institutional threats to groundwater availability</strong></td>
<td>New Drinking Water Standards</td>
</tr>
<tr>
<td></td>
<td>New State Water Quality Regulations</td>
</tr>
<tr>
<td></td>
<td>Future Constraints Related to SGMA</td>
</tr>
<tr>
<td>4. <strong>Physical threats to groundwater availability</strong></td>
<td>Groundwater Contamination</td>
</tr>
<tr>
<td></td>
<td>Groundwater Production Capacity Limitations</td>
</tr>
<tr>
<td></td>
<td>Groundwater Injection Limitations</td>
</tr>
<tr>
<td>5. <strong>Institutional limitations on sharing supplies</strong></td>
<td>Existed ROI/Service Area Limitations</td>
</tr>
<tr>
<td></td>
<td>Evolving State and Federal Requirements for Transfers</td>
</tr>
<tr>
<td></td>
<td>Disparity in Cost of Water</td>
</tr>
<tr>
<td></td>
<td>Diverse Agency Goals &amp; Interests</td>
</tr>
<tr>
<td>6. <strong>Physical limitations on sharing supplies</strong></td>
<td>Defaulting/Rational Practices</td>
</tr>
<tr>
<td></td>
<td>Limited Intake Capacities</td>
</tr>
<tr>
<td></td>
<td>Incompatible Pressure Zones</td>
</tr>
<tr>
<td></td>
<td>Defaulting water quality</td>
</tr>
<tr>
<td></td>
<td>Lists of existing or intended</td>
</tr>
<tr>
<td>7. <strong>Threats to infrastructure integrity</strong></td>
<td>Aging Infrastructure</td>
</tr>
<tr>
<td></td>
<td>Lack of redundancy for critical facilities</td>
</tr>
<tr>
<td></td>
<td>Geologic Hazards</td>
</tr>
<tr>
<td></td>
<td>Flooding Hazards</td>
</tr>
<tr>
<td><strong>Other Challenges</strong></td>
<td>Reliance on single supply source</td>
</tr>
<tr>
<td></td>
<td>Limited and recycled water potential</td>
</tr>
<tr>
<td></td>
<td>Limited capacity to serve growth</td>
</tr>
<tr>
<td></td>
<td>Lack of real-time data sharing</td>
</tr>
</tbody>
</table>

Key:
- CVP = Central Valley Project
- ROI = piece of water
- SGMA = Sustainable Groundwater Management Act

3.2.2 Drought-Specific Water Supply Sector Vulnerabilities

Of the wide range of vulnerabilities identified by the agencies, four vulnerabilities within the institutional and physical threats to surface water availability themes surfaced as having the most significant impacts to drought resiliency. Additionally, institutionalization was identified as a potential vulnerability in that it could represent a limitation to sharing supplies. These specific vulnerabilities are discussed below.

**Low Reservoir Storage**

This vulnerability could occur when reservoir levels drop to a point that make structures for diverting water would be impacted, or when low storage or runoff projections result in reduction of deliveries. The primary vulnerability in the region is with storage at Folsom Reservoir as it reduces overall water supply reliability. Regional water suppliers are very concerned when...
Drought Response Program
Drought Resiliency Projects

Eligible Projects Include:

- Infrastructure Improvements
  - Modifying surface water intakes
  - New conveyance system components
  - Additional water storage
  - Aquifer Storage and Recovery
  - Capture and treat alternative supplies

- Decision Support Tools & Modeling
  - Tools to support water marketing
  - Tools to convey water supply information
  - Measurement

- Environmental Protection
  - Improve habitat
  - Install fish screens and ladders

Projects build resilience to drought
Projects supported by a drought plan are more competitive
Funding Level I: $300k
Funding Level II: $750k
Semitropic Water Storage District
Forecast of Average May–July Rainfall

- The Texas Water Development Board issues these May–July forecasts of seasonal rainfall using a statistical forecast technique (Fernando et al., 2015) based on large scale atmospheric circulation patterns at approximately 5,500 meters above sea level, atmospheric stability influencing the development of convective weather systems, and soil moisture in April known to influence May–July rainfall.
- The statistical rainfall forecasts are issued from January through end-April. The forecasts are updated every two weeks.
- The forecasts from January through March are based on predicted values of April atmospheric circulation patterns and soil moisture over Texas known to influence May–July rainfall. The predictions are obtained from the Climate Forecast System version 2 (CFSv2, Saha et al., 2014), which is the operational dynamical seasonal forecast model of the National Oceanic and Atmospheric Administration National Centers for Environmental Prediction.
- The forecasts issued in April are based on actual observations of April atmospheric circulation patterns and soil moisture over Texas obtained from the Climate Forecast System Reanalysis dataset (Saha et al., 2010).
- The rainfall forecast provides information on whether the average rainfall for the May–July will be above-normal, near-normal or below normal. Red indicates chances for below-normal (dry) conditions, blue indicates chances for above-normal (wet) conditions, green indicates chances for near-normal (average) conditions, and white indicates that we do not know which way the season might pan out. For more information on how to interpret the forecasts click here.

Disclaimer

The May–July seasonal rainfall forecast is an experimental forecast. It is primarily meant to be an information source to aid the implementation of drought contingency and emergency management plans. The TWDB provides information via this web site as a public service. Neither the State of Texas nor the TWDB assumes any legal liability or responsibility or makes any guarantees or warranties as to the accuracy, completeness, or suitability of the information for any particular purpose.
Data visualization site is an interactive companion to the 2016 WaterSMART Progress Report:

- Interactive maps
- Featured project tours
- Program growth over time

https://www.usbr.gov/watersmart/

Data Visualization Tool: arcg.is/1TcT68S
Hazard Mitigation Assistance
Mitigating the Impacts of Drought
Hazard Mitigation Assistance

- FEMA Hazard Mitigation Assistance programs applies mitigation as a sustained action taken to reduce or eliminate long-term risk to people and their property from hazards and their effects.

- The HMA programs seek to:
  - Create safer communities by reducing losses of life and property.
  - Enable individuals and communities to recover more rapidly from disasters.
  - Lessens the financial impact of disasters on individuals, state, local, and tribal communities, and the federal government.
Hazard Mitigation Assistance

- **Hazard Mitigation Grant Program**
  - Post-disaster funding to provide opportunities to incorporate mitigation actions during recovery
  - HMGP funds mitigation projects and plans that address all natural hazards
  - Funds available following a Presidential major disaster declaration

- **Pre-Disaster Mitigation**
  - National competitive grant program to reduce overall risk to people and property from future hazard events
  - PDM funds mitigation projects and plans that address all natural hazards
  - Funded by annual appropriation

- **Flood Mitigation Assistance**
  - To reduce or eliminate claims made under the NFIP through mitigation or planning for flood hazard
  - Can only be used for flood mitigation or flood portion of hazard mitigation plan
  - Funded out of the National Flood Insurance Fund by annual congressional appropriation
Hazard Mitigation Assistance

- Eligible Applicants: state agencies and federally recognized tribes
- Eligible Subapplicants: state agencies, tribal governments, local governments/communities
- Private non-profit organizations are eligible subapplicants under HMGP only
- Cost share is usually 75% federal funding, the remaining 25% funding is provided by the state, local, or tribe
- All projects must demonstrate a reduction of natural hazard risk and be cost effective
- All projects must be technically feasible and meet requirements for environmental and historic preservation
Drought and HMA

- September 2015, FEMA announced the eligibility of several new resources for activities addressing drought for hazard mitigation
  - Aquifer Storage and Recovery (ASR)
  - Floodwater Diversion, Storage, and Recovery
  - Floodplain and Stream Restoration
  - Green infrastructure methods for mitigation and designing projects to increase ecosystem service benefits
    - Improving water and air quality – vegetation and soil filters water and air
    - Bio-retention method can be used to restore natural wetland and native habitat for native vegetation and wildlife
    - May provide/restore habitat for pollinators
    - May provide dual-use for recreation or education space
Drought and HMA

Partnerships, Coordination and Outreach

Other Federal Agencies/Initiatives
- Environmental Protection Agency
- U.S. Forest Service
- Climate Resilient Toolkit, National Oceanic and Atmospheric Administration

Private/Industry
- U.S. Green Building Council
- The Nature Conservatory
- Living Shorelines

National Associations and Organizations
- Association of State Drinking Water Administrators
- Association of State Wetland Managers
- Association of State Floodplain Managers
Aquifer Storage and Recovery

- Subsurface storage of surface water runoff and groundwater in natural aquifer
  - Takes advantage of seasonal variations in surface water runoff and periods of high precipitation leading to more surface and ground water availability
  - Storage underground protects water from pollutants, evaporation, and extreme weather events
Salinas Puerto Rico Case Study
Aquifer Storage and Recover

- Drought and low water levels led to saltwater infiltration and other contamination
- Community had to use water rationing which had consequence for their 31,000 residents, schools, economy, and agriculture
- Received a FEMA PDM grant in 2016 for the first awarded Aquifer Storage and Recovery project. Funding was released in August 2017
- Project will divert freshwater from other sources to recharge the aquifer
- Puerto Rico is providing $714,053 and FEMA has awarded the remaining project costs of $2,142,159
- Salinas ASR Project Video: https://www.youtube.com/watch?v=EpmMXbuV2Go
Salinas Puerto Rico Case Study
Aquifer Storage and Recover
Flood Diversion and Storage

- Diverting storm or floodwaters into lakes, channels, floodplains, irrigation canals, wetlands, or other natural or manmade green infrastructure surface storage (e.g. bio-swales, bio-retention, bio-detention basins)
- Distinct from Aquifer Storage and Recovery because water is detained on surface, however can be complementary to aquifer recharge
- Floodwater is detained and released slowly to facilitate ground infiltration/seepage

Figure 4: The Buffalo Bayou Promenade in Houston, Texas, retrofitted a formerly impervious area and restored this major drainage way as green infrastructure. The Bayou now has improved floodwater conveyance, in addition to providing other community and environmental benefits. Photo courtesy of Tom Fox, [http://www.asla.org/2009awards/104.html](http://www.asla.org/2009awards/104.html).
Floodplain and Stream Restoration

- Restore original function of floodplains and associated wetlands of flood prone river and stream systems to pre-development conditions
  - Restore or increase connectivity and storage capacity
  - Restore or increase the physical stability, hydrology, and biological functions of impaired stream and river banks to restore a natural stable riparian system
  - Can take advantage of seasonal variations in water supply
    - Capture spring rain or snowmelt to recharge both surface water and groundwater supplies
  - Provide erosion mitigation to stabilize banks, avoid bank collapse
  - Projects lend themselves readily to green infrastructure methods maximizing ecosystem service benefits
Johnson Creek Floodplain Restoration

- **Location:** 10 mi east of Portland, Oregon city-center
  - 52 square mile watershed; 26 mile main stem

- **Project Goals:**
  - Restore natural floodplain function and increase flood storage
  - Improve water quality
  - Improve habitat for fish and wildlife

- **Highlights:**
  - Successful Willing Seller Program, over 250 acres
  - Created over 250 acre feet of flood storage
  - Planted over 200,000 native trees and shrubs
  - Over $59 million in land conservation and restoration
$2.7 million FEMA Pre-disaster mitigation grant

Reduces the frequency of flooding on Foster Rd. from 1.5 years to ~ 6 years.

Source: City of Portland BES (2009).
Johnson Creek Floodplain Restoration

**BEFORE**

**AFTER**

Source: City of Portland BES – before photo (2004); after photo (2008).
Johnson Creek Floodplain Restoration

Source: City of Portland BES – left photo (2002); right photo (2008).
Fairfax County, Virginia

- Located in Potomac River watershed
- Highly urbanized and densely populated area
- Floods from extreme precipitation and storm surge
- Flooding had resulted, high erosion rates, scour, channel incising, and bank failure
- Sanitary sewer junction box infrastructure threatened by erosion
- Project was to restore the stream function, mitigate scour and erosion, project the sewer junction box
- Construction costs were approximately $2 million
- Overall Fairfax County population is about one million
Example of mixing green infrastructure with “traditional” mitigation methods
- Riprap used to stabilize banks around junction box
- Rocks were used to direct stream flow to reduce erosion to banks around junction box
- Native vegetation was planted in backfill behind the riprap wall
- In-stream structures were installed providing bank stabilization and aquatic habitat
Green Infrastructure

- Sustainable approach to natural landscape preservation, water resources, and stormwater management
- Provides a framework and methodology for designing and implementing Climate Resilient Mitigation Activities, especially in high-density urban areas
- Uses ecosystem based approach to capture stormwater in localized bio-detention or bio-retention basins
  - Allows more stormwater to infiltrate ground and re-charge groundwater supplies
  - Attenuates stormwater peak flow to reduce inundation of stormwater system
- Most effective for higher frequency, lower impact events
- Can be scaled based on community need/site conditions
- Can be implemented in an interconnected system
Benefits include:

• Improved water quality
  ▪ Filters stormwater and urban runoff
  ▪ Alleviate Combined Sewer Overflow events and contamination of local water bodies
• Increase water supply by facilitating groundwater recharge
• Can be scaled to size and designed to fit urban conditions, retain space for dual-use recreation, pedestrian or vehicle traffic

Additional ecosystem services:

• Improved air quality
• Provide native habitat for pollinators or other wildlife
• Reduce urban heat island impacts
Green Infrastructure

Engineering with Nature
The FEMA Region X publication that provides examples of alternative bank stabilization projects in Western Washington that assimilate habitat protection into streambank protection
Ecosystem Services

- Hazard mitigation
- Livelihoods, commerce
- Poverty reduction
- Disaster recovery
- Improved air and water quality
- Recreation

The multiple benefits of ecosystem-based approaches to disaster risk reduction include:

- Biodiversity
- Climate change adaptation
- Carbon sequestration
- Poverty reduction
Ecosystem Services

FEMA allows the use of ecosystem services in benefit cost evaluation for HMA projects

Updated Ecosystem Service Matrix (USD 2014 per acre per year)

<table>
<thead>
<tr>
<th>Ecosystem Service</th>
<th>Green Open Space</th>
<th>Riparian</th>
<th>Forest</th>
<th>Wetland</th>
<th>Marine and Estuary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aesthetic Value</td>
<td>$1,707</td>
<td>$612</td>
<td></td>
<td>$3,640</td>
<td></td>
</tr>
<tr>
<td>Air Quality</td>
<td>$215</td>
<td>$226</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biological Control</td>
<td></td>
<td></td>
<td></td>
<td>$173</td>
<td></td>
</tr>
<tr>
<td>Climate Regulation</td>
<td>$61</td>
<td>$81</td>
<td>$153</td>
<td>$136</td>
<td>$63</td>
</tr>
<tr>
<td>Erosion Control</td>
<td>$68</td>
<td>$12,042</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flood Hazard Reduction</td>
<td></td>
<td></td>
<td></td>
<td>$4,215</td>
<td>$321</td>
</tr>
<tr>
<td>Food Provisioning</td>
<td></td>
<td></td>
<td></td>
<td>$641</td>
<td></td>
</tr>
<tr>
<td>Habitat</td>
<td>$878</td>
<td></td>
<td></td>
<td></td>
<td>$1,214</td>
</tr>
<tr>
<td>Nutrient Cycling</td>
<td></td>
<td></td>
<td></td>
<td>$536</td>
<td>$522</td>
</tr>
<tr>
<td>Pollination</td>
<td>$305</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recreation/Tourism</td>
<td>$5,644</td>
<td>$15,967</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stormwater Retention</td>
<td>$308</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water Filtration</td>
<td>$4,473</td>
<td></td>
<td></td>
<td></td>
<td>$1,406</td>
</tr>
<tr>
<td>Water Supply</td>
<td>$237</td>
<td>$80</td>
<td></td>
<td>$292</td>
<td></td>
</tr>
<tr>
<td><strong>Total Annual Value</strong></td>
<td><strong>$8,308</strong></td>
<td><strong>$39,535</strong></td>
<td><strong>$554</strong></td>
<td><strong>$6,010</strong></td>
<td><strong>$1,799</strong></td>
</tr>
</tbody>
</table>
BRIC Guiding Principles

- Support communities through capability & capacity building
- Encourage and enable innovation
- Promote partnerships
- Enable large projects
- Maintain flexibility
- Provide consistency

DRRA Section 1234: Building Resilient Infrastructure and Communities (BRIC)

- BRIC is designed to reduce costs and loss of human life from natural hazards by building a national culture of preparedness, encouraging investments to protect our communities and infrastructure, and building mitigation capabilities to foster resilience.
- Authorized by the Disaster Recovery and Reform Act, passed October 2018

Since 2009, FEMA has received approximately $1 billion in Pre-Disaster Mitigation grant appropriations, of which 48% has been in the last 2 years.

Average amount from 2009-2016: $56M/year.

Funds will vary based on disasters. FIMA estimates that annual funds will average $300M-$500M per year, with significantly greater amounts following years with catastrophic disasters.
PDM and BRIC: Path Forward

**PDM FY18**
- Total amount available: $249.2 million
- Resilient Infrastructure: New competitive funding project type with a maximum Federal share of $10 million

**PDM FY19**
- Total amount available: $250 million
- Follows same application timeline as FY18
- Resilient Infrastructure competitive funding will continue

**BRIC FY20**
- Total amount available: TBD
- Target application period is October 2020 – January 2021

**BRIC FY21 & beyond**
- Will ensure continuous improvement as the program evolves
- FEMA will communicate annual changes through the Notice of Funding Opportunity and program implementation documents

---

Research → Policy Development → Public Comment through Federal Register → NOFO Development → Grant Application Period Opens

FEMA Hazard Mitigation Assistance

Page 24
BRIC Program Design Process and Estimated Timing

* Timing is estimated as of September 2019 and subject to change.
Questions?

Questions or more information:
Please contact Nicole LaRosa, Grants Policy Branch
Nicole.LaRosa@fema.dhs.gov
Questions?

American Planning Association

Making Great Communities Happen