Drought Worksheet

For preliminary Benefit Cost Analysis conducted by the State Mitigation Technical Team

Applies for the following mitigation activities: **AQUIFER AND STORAGE RESTORATION, OTHER ACTIVITY RELATED.** For assistance, contact the State of Tennessee Mitigation Division.

IMPORTANT: This worksheet is required as part of your application. The State of Tennessee Mitigation Division will assist you with your Benefit Cost Analysis (BCA) for your project as well as review your BCA and the following information is needed to evaluate cost effectiveness. Once a preliminary BCA is completed, the reviewer will contact you to collect support documentation.

NOTE: A complete worksheet will expedite the Technical Review.

Requirements

To complete a successful project application, a minimum amount of technical information is required for review. Data collected in this worksheet will provide reviewers with preliminary information necessary to evaluate project eligibility, feasibility, and cost effectiveness. Carefully review and confirm that you are aware of the following information.

Drought Projects:

Aquifer Storage and Recovery (ASR) projects serve primarily as a drought management tool, but can also be used to reduce flood risk, mitigate saltwater intrusion, and restore aquifers that have been subject to overdraft. The concept is to capture water when there is an abundant supply, store the water in subsurface aquifers, and recover water from the storage aquifer if and when there is a need. Storing water underground can help protect it from pollutants, evaporation, and weather events; and to maintain stream flow during periods of low flow.

I confirm that I have reviewed the requirements listed above (signature):

For additional resources, please refer to FEMA Technical Review Job Aid for Aquifer Storage and Recovery projects.

Section I - Project General Information

Project Name:	*Worksheet completed by:* *Name:* _____ *Title:* _____
Sub-Applicant:	*Phone:* _____ *Email:* _____

Section II - Project Cost Information

Mitigation Project Cost:	*Annual Maintenance Cost:*

Section III - Project Specific Information

Project location (Address):	
Population being served by the project:	
What is the average Water Use Rate (gallons per day)?	
What is the maximum Volumetric Pumping Rate (millions of gallons per day)?	
What is the depth to recoverable water (feet)?	

Section IV - Before and After Mitigation

Based on current FEMA BCA guidance and practices, to evaluate a project that reduces the risk from drought, it would be necessary to determine the recurrence interval associated with the severity of scenario drought events. Establishing a traditional recurrence interval for drought may be difficult; however, the applicant should use the best available data and methodology deemed appropriate by a licensed professional engineer or similarly qualified professional to complete this section.

Before Mitigation			
Recurrence Interval (years)	*Potable Water Demand (mgd)*	*System Supply Yield (mgd)*	*Duration of Impact (days)*

After Mitigation	
System Supply Yield (mgd)	*Duration of Impact (days)*

Section V - Additional Information

Please use this page to expand on the information provided above or to include any additional information relevant to the proposed mitigation project.

DROUGHT WORKSHEET INSTRUCTIONS

Refer to the instructions below to complete the Drought Worksheet using the best available data.

Section I - Project General Information

Project Name: Enter the name of the project title. The title should be short but descriptive (e.g., City of Orlando, Vista Grande Community, Drought Mitigation Project).

Sub-Applicant: Enter your organization's legal name.

Worksheet completed by: Enter name, title, phone number, and email of the person completing this Worksheet. This person must have the knowledge and/or the resources to accurately answer all questions and provide supporting documentation, as needed. Information may come from multiple creditable sources.

Section II - Project Cost Information

Mitigation Project Cost: Enter the total cost of the project. A lump sum on this worksheet is acceptable for preliminary BCA, but a detailed breakdown attached to your application is required.

Annual Maintenance Cost: Enter the cost associated with maintaining the effectiveness of the components installed as part of the drought project.

Section III - Project Specific Information

Project Location: Provide a full description of the specific geographical location(s) of the project. May include address(es), latitude and longitude of each location, etc. For multiple locations, please provide information on Section V of the worksheet.

Population being served by the project: Enter the number of people who would be both impacted by drought and who would benefit. The economic value of loss of water (i.e., damages) is dependent upon the number of people impacted by drought.

What is the average Water Use Rate (gallons per day)? Enter the total annual production (in gallons), divided by population, divided by 365 days.

What is the maximum Volumetric Pumping Rate (millions of gallons per day)? Enter the maximum volumetric pumping rate value in millions of gallons per day. This value relates to the production pumping rate (not injection) that delivers stored water for drought mitigating purposes.

What is the depth to recoverable water (feet)? Enter the number of feet of the typical depth that stored water must be pumped from during production.

Section IV - Before and After Mitigation

BEFORE MITIGATION

Recurrence Interval (year): To improve the confidence of the calculation, enter three recurrence intervals (RIs) of varying magnitudes (i.e., 25-year, 50-year, and 100-year). At a minimum, a single RI must be provided. A licensed professional engineer or similarly qualified professional may use the best available data to establish recurrence intervals. Acceptable sources may include the USDA, NOAA, drought.gov, National Drought Mitigation Center, Universities, and other academic sources.

Potable Water Demand (mgd): Enter the total annual production (in millions of gallons) divided by 365 days under normal, non-drought conditions.

System Supply Yield (mgd): Enter the estimated yield for a given RI using the below equation. The yield is an estimated average and is expected to be less than the maximum volumetric pumping rate. (This parameter is not used directly in calculating the BCA or BCR but is complimentary data for FEMA to consider during application review).

Estimated Yield = P x AWU x (DLFpre – DLFpost) / 1,000,000

Where:

- P = Population impacted by drought and served by ASR project
- AWU = Average Water Use Rate, gallons per capita per day
- DLFpre = Drought Loss Factor, a system-specific adjustment of the economic value of the loss of water service due to the typical tiered reduction of potable water service under pre-mitigation drought conditions, unitless
- DLFpost = Drought Loss Factor, a system specific adjustment of LWS due to the typical tiered reduction of potable water service under drought conditions, unitless

Duration of Impact: (days): Enter the estimated number of impact days. The Duration of Impact (DOI) is different than the duration of a drought in that impacts of a drought may not affect the supply for a municipal water system immediately. Similarly, impacts of drought may be experienced by a municipal water supply system for a time after climatic and hydrologic drought conditions conclude. This is largely dependent upon the supply portfolio of a municipality and how quickly this portfolio returns to "normal" conditions. By its nature, DOI is associated with a

drought recurrence interval and must be included for each recurrence interval in the analysis.

AFTER MITIGATION

System Supply Yield (mgd): Enter the post-mitigation yield in millions of gallons per day. This is a system-specific value assuming that stored water will be recovered from the aquifer to supplement the system supply.

Duration of Impact: (days): Enter the estimated number of impact days post-mitigation. This is a system-specific value with the assumption that an aquifer and storage restoration project will decrease the duration of impact due to drought.