ATTACHMENT C
POTENTIAL EMERGENCY SITUATIONS TO CONSIDER WHEN DEVELOPING RESPONSE AND RECOVERY ACTIONS

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Natural Disasters

Historically, Ohio's public drinking systems have suffered damage from a number of natural phenomena. These events include those characterized by the rapid release of enormous quantities of energy, such as floods, severe storms, and earthquakes, and those which occur over long periods of time, such as droughts and temperature extremes. All such natural events may create an adverse effect upon a water supply, depending upon the severity of the occurrence.

Floods - Three types of flooding affect Ohio. Flash floods and urban flooding are associated with locally heavy rainfall or rapid snow melt and may occur at any time of the year. Local and regional floods along major rivers can occur throughout the year, but are most common during the winter and spring months. Flooding is also associated with long and short term fluctuations in the level of Lake Erie. Flooding is frequently one of the easiest types of natural disasters to predict, making it possible to provide the maximum advance warning. Major drinking water system problems created by flooding include:

1. Structural damage to treatment facilities and the distribution system caused by the high flow rates and debris associated with floods.
2. Loss of electrical power caused by flooding of power stations or wash-out of the electric distribution network.
3. Contamination of supply wells and treatment plant units (clear wells).
4. Water damage to water system components.
5. Additional loading on treatment works caused by high turbidity in surface water supplies.
6. Limited access to portions of system due to the presence of flood waters.
7. Potentially high demand for water needed for cleanup.

Severe Storms - Geographically, Ohio is situated in an area of moderate to high risk for the formation of severe storms, the peak period being April through July. These storms can produce strong winds, hail, lightning, torrential downpours, and tornadoes. Fortunately, weather conditions suitable for severe storm formation are readily predictable. Even though conditions leading to severe storm formation are predictable, dangerous conditions often strike quickly and without significant warning. Damage to water systems caused by such storms is potentially heavy. Physical damage to or destruction of facilities and infrastructure may severely limit the service capability of the system. Typical drinking water supply problems associated with severe storms include:

1. Structural damage to buildings, treatment units, storage tanks, electric power and control circuits, maintenance vehicles, material stockpiles, and communications.
2. Severe system leakage due to ruptured fire hydrants or service lines in

damaged buildings.
3. Limited access to portions of system caused by widespread debris or urban flooding.
4. Loss of life or severe injuries to waterworks personnel may impact a system's ability to respond.
5. Potential high demand for water due to firefighting needs.

Earthquakes - Ohio is considered to be in an area that could experience minor to moderate earthquake damage, on the periphery of the New Madrid Seismic Zone, an area in Missouri and adjacent states that was the site of the largest earthquake sequence to occur in the continental United States in historical times. Four great earthquakes in 1811 and 1812 were felt throughout the eastern United States and were sufficiently intense to topple chimneys in Cincinnati. Earthquakes are relatively uncommon in Ohio, but approximately 120 with epicenters in Ohio have been felt since 1776. Earthquakes generally occur with no prior warning and can damage underground and aboveground structures. Potential water system problems include:

1. Structural damage to buildings, treatment units, storage tanks, electric power and control circuits, maintenance vehicles, material stockpiles, and communications.
2. Severe system leakage and loss of pressure due to ruptured pipes, lines, fire hydrants, or service lines in damaged buildings.
3. Failure of or damage to dams, with the potential loss of all supply capability.
4. Fractured well casings or screens, creating the potential for contaminating the aquifer or even a total loss of the well.
5. Limited access to portions of system caused by widespread debris or road damage.
6. Loss of life or severe injuries to waterworks personnel may impact a system's ability to respond.
7. Potential high demand for water needed for firefighting.

Drought - A drought is a period of abnormally dry weather which persists long enough to produce a serious hydrologic imbalance. The severity of the drought depends upon the degree of moisture deficiency, its duration, the time of year, and the size of the affected area. Extended periods of drought provide problems of a long term nature; however, the resulting water supply crises may prove to be extremely critical. Operating
difficulties connected with long term dry weather are:

1. A general increase in system demand as water use for irrigation becomes widespread and privately owned wells fail.

2. A decrease in the ground water levels resulting in reduced well production or complete failure.
3. Diminished surface water supplies resulting from reduced stream flows, and limited replenishment of raw water storage reservoirs.
4. Increased contaminant levels in surface water as the ratio of contaminants

to water volume rises.

Winter Storms - Ohio can experience snow and ice storms anytime between late October and early April and blizzards between December and early March. These storms can produce strong winds, freezing rain, sleet and heavy snowfall. Fortunately, weather conditions suitable for winter storm formation are readily predictable, although storm systems can strengthen quickly and without significant warning. Damage to water systems caused by such storms is potentially heavy. Physical damage to facilities and infrastructure may severely limit the service capability of the system. Typical problems associated with severe storms include:

1. Structural damage to buildings, treatment units, storage tanks, electric power and control circuits, maintenance vehicles, material stockpiles, and communications.
2. Severe system leakage and loss of pressure due to ruptured pipes, lines, fire hydrants, or service lines.
3. Limited access to portions of system caused by impassable roads.
4. Loss of life or severe injuries to waterworks personnel may impact a system's ability to respond.
5. Loss of power to plants, booster stations, and wells due to downed electric lines.

Temperature Extremes - Several days of extreme temperatures may create water supply emergencies. Extreme heat or cold may increase demands on a local electric power system, reducing the power available to treatment and pumping installations. Heat waves result in much larger than normal water demand. Freezing weather results in broken mains and service connections, and may cause failures of unprotected equipment or facilities.

Wildfires - Ohio has not faced wide-spread wildfires in recent years. Dry weather has, however, caused large forest fires in neighboring states as recently as 1987. Wildfires may require the resources of several fire departments and specialized firefighting units. Incidents like these have the potential to impact public water systems throughout Ohio. If the fires occur near urban areas, demand for water may lead to a drop in pressure within the system or may stretch the water source to its limit of providing adequate supplies. Firefighting may introduce ash and other debris into reservoirs and other surface water sources or may limit access to remote facilities such as wellfields or intakes.

Operational Problems

A public water system's ability to supply its customers depends on the level of efficiency the utility is able to maintain. Peak efficiency is maintained with properly trained personnel, well maintained equipment, and up-to-date operational procedures. Failures in any of these may significantly reduce the quality and/or quantity of service; potentially to the point of shutting down the system. Failures which interrupt service can be classified into two categories; failures involving system components and indirect failures involving outside agencies, power facilities, or telephone equipment.

Mechanical or Equipment Failures - Many system breakdowns involve mechanical or equipment failures within the treatment or pumping system, such as intake pumps, chlorination units, chemical feeders, testing equipment, rapid mixers, clarifiers, and filter beds. Mechanical devices will not function indefinitely without attention and maintenance. Neglecting periodic maintenance invariably leads to reduced equipment operating life and sudden, unexpected failure. Even equipment that is relatively new or well-maintained can malfunction due to defects in workmanship or design. A utility that does not have standby equipment or replacement parts may be crippled by equipment failures, while utilities that do have the necessary standby equipment may still be forced to operate below their normal efficiency.

Storage - Finished water storage areas can fail. Over time, metallic reservoirs may develop leaks due to corrosion and poorly maintained standpipes commonly accumulate large volumes of sediment at the base of the tank. In cold temperatures, standpipes and elevated storage tanks can freeze and rupture the vessel. Without routine maintenance, vents may become plugged with debris. Foundations may crack, settle, or rotate, causing ruptures in the storage tank and resulting in the loss of the stored water.

Pipes and Lines - Line and main failures are fairly common occurrences and varying degrees of disruption can be expected. There are many causes of line ruptures. Leaks or ruptures may occur in metallic lines due to the electrochemical reactions between the line and water or soil. Major leaks may occur when improperly supported pipe separates under pressure or if the overlying load exceeds the design capacity of the piping. Pipes that do not have sufficient soil cover may rupture from ice expansion during extended periods of cold weather.

Telemetry and Computers - Faulty telemetry equipment can provide erroneous information about system reserves or other remotely monitored data.

Human Error - Although proper training can reduce the likelihood of human error during the normal operation of a utility, there is no way to prevent it. Human errors commonly occur when people become distracted, are attending to too many tasks, or are not feeling well. The most effective way to prepare for human error is to develop a contingency plan covering numerous anticipated emergency conditions.

External Infrastructure Failures - External failures are capable of crippling a water utility system, and can be more frustrating to deal with. The major power source for most systems is electricity furnished by an outside agency. If electrical power becomes unavailable to the water utility and no standby generating facilities exist, the result is almost complete operational shutdown, depending upon the volume of water contained in storage. Most power outages are of short duration; storage will normally handle system demand until power can be restored. Deficiencies in material supplies also create the possibility of system failures. If important chemicals such as chlorine, alum, lime, or soda ash become unavailable, high quality potable water is virtually impossible to produce. As a result, most water systems would be forced to cease operation. Few plants can shift to other treatment processes. Material supplies may be curtailed by transportation failures, strikes, or inclement weather, all of which are beyond the ability of the utility to control.

Dam Failure - Dam failures, though rare, could have an impact on public water systems throughout Ohio. Dam failure can result in loss of the public water system's source or flood damage to vital system facilities and resources.

Loss of Source Water - Loss of source water may occur for any of several reasons, including: prolonged drought; damage to wells or intakes; contamination of the water source; or loss of electricity to pumping equipment. The severity of the loss depends upon the cause and its duration. Extended loss provides problems of a long term nature; however, even short-term loss of the water source may prove to be extremely critical.

Harmful Algal Bloom - The occurrence of harmful algal blooms and associated cyanotoxins has been increasing in Ohio's surface waters in recent years. Cyanotoxin levels can quickly increase and overwhelm a public water system treatment capacity exceeding Ohio's cyanotoxin finished water thresholds and resulting in drinking water advisories and use restrictions. HABs can also produce taste & odor compounds, clog filters, require more frequent filter backwash, and increase the amount of treatment residuals. It may be necessary to quickly shift water sources, adjust treatment processes and chemicals, conduct reservoir treatment and collect/analyze emergency water quality samples. During a HAB there may also be additional NPDES monitoring requirements to discharge to surface water.

Man Made Crises

Humans, rather than nature, may cause major damage to a water system or seriously impair its ability to provide service. The creation of an emergency situation may be the deliberate result of certain individuals as in the case of acts of civil disorder, riot or vandalism. A crisis may also originate from specific non-actions as evidenced by labor strikes or slow-downs.

Vandalism - Acts of vandalism are a major problem in the United States. Water contamination, significant loss of water, and willful destruction of water system property and equipment are real threats to the continuity of service. Acts of vandalism may also disrupt services a water system needs to operate. Normal maintenance operations may be delayed and thrown off-schedule when water system personnel are required to take remedial action to counteract the acts of vandals.

Malicious Actions - Malicious acts go beyond vandalism. They are intended to cause contamination, significant loss of water, or destroy property and equipment. These acts may be perpetrated by disgruntled employees seeking revenge for perceived wrongs. These acts are crimes and will require intensive cooperation and coordination with local, state, and federal law enforcement agencies.

Terrorism - Terrorists seek to frighten or kill citizens and cause economic hardships at all levels of government. These acts are crimes and will require intensive cooperation and coordination with local, state, and federal law enforcement agencies.

Strikes - Strikes or slow-downs by system personnel could lead to system shut-down, even if sufficient supervisory personnel were available to provide some measure of service. Routine

system-wide maintenance would suffer from lack of manpower. Major equipment failures or water main breaks may go unrepaired. Such occurrences will impair the operation of the system, reduce the level of service, and could ultimately lead to complete system shut-down.

Riots - Riots generally include destruction of both private and public property. Water system facilities may be destroyed or their efficient operation interfered with. Personnel may be injured or killed, reducing the ability of the system to perform in a normal manner. Subsidiary services such as electric power companies, fuel companies, communications operations, and chemical suppliers may be unable to perform their normal functions. The loss of these necessary services could cripple the operations of the typical water system.

Accidental Contamination - Accidental spills of hazardous materials pose unusual problems to a water utility. Industrial spills containing highly toxic chemicals, which are not removed by normal treatment processes, can rapidly infiltrate a water supply's distribution system and render the water unfit for human consumption. Expensive and/or sophisticated techniques must be employed in many spill clean-ups. Considerable time may be required to mobilize appropriate response personnel to the affected area. The failure of a utility to act swiftly to obtain assistance could lead to serious consequences.

Public Panic - Public panic can be described as a short-lived hysteria, often spurred by rumors and inaccurate, misleading, or even false information. Although some members of the general public may panic in an emergency situation, widespread public panic is rare and may be preventable. Concerns about computer system failures associated with the Year 2000 were common and prompted action throughout the world, but public panic did not occur due to planning, preparation, and information sharing with the public. Should public panic grip a public water system’s customers, the primary consequence may be a lack of confidence in the safety or adequacy of the public water system’s supply.

Major Fire - Although it is unlikely that Ohio will face a major urban fire on the scale of the Great Chicago Fire of 1871, major fires still occur annually throughout Ohio. These range from multi-alarm blazes in small- to medium-sized communities that require support from surrounding communities to incidents like the BASF explosion in Cincinnati that required the attention of a large number of personnel for fire suppression and rescue operations. Incidents like these have the potential to impact public water systems throughout Ohio. The tremendous demand for water may lead to a drop in pressure within the system or may stretch the water source to its limit of providing adequate supplies.