Developing Water System Technical Capacity

Workshop Objectives

- An overview of technical capacity
- The methods for assessing technical capacity
- The importance of source water and infrastructure adequacy to technical capacity
- The benefits of assessing and maintaining technical capacity

Fundamental Goals of Capacity Development

- To ensure consistent compliance with drinking water standards
- To enhance water system performance
- To promote continuous improvement

- The **1996 Safe Drinking Water Act** (SDWA) emphasizes developing the capacity of water systems.
- The **fundamental goals** of capacity development are:
  - To protect public health by **ensuring consistent compliance** with drinking water standards, including federal and State regulations and other applicable standards of performance;
  - To **enhance performance** beyond compliance though measures that bring about efficiency, effectiveness, and service excellence; and
  - To **promote continuous improvement** through monitoring, assessment, and strategic planning. All water systems, regardless of size or other characteristics, can benefit from a program of continuous improvement.

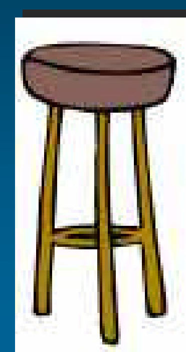
What is Capacity?

- Water system capacity is the ability to plan for, achieve, and maintain compliance with applicable drinking water standards
- For a water system to have "capacity" it must have adequate capability in three areas: technical, managerial, and financial

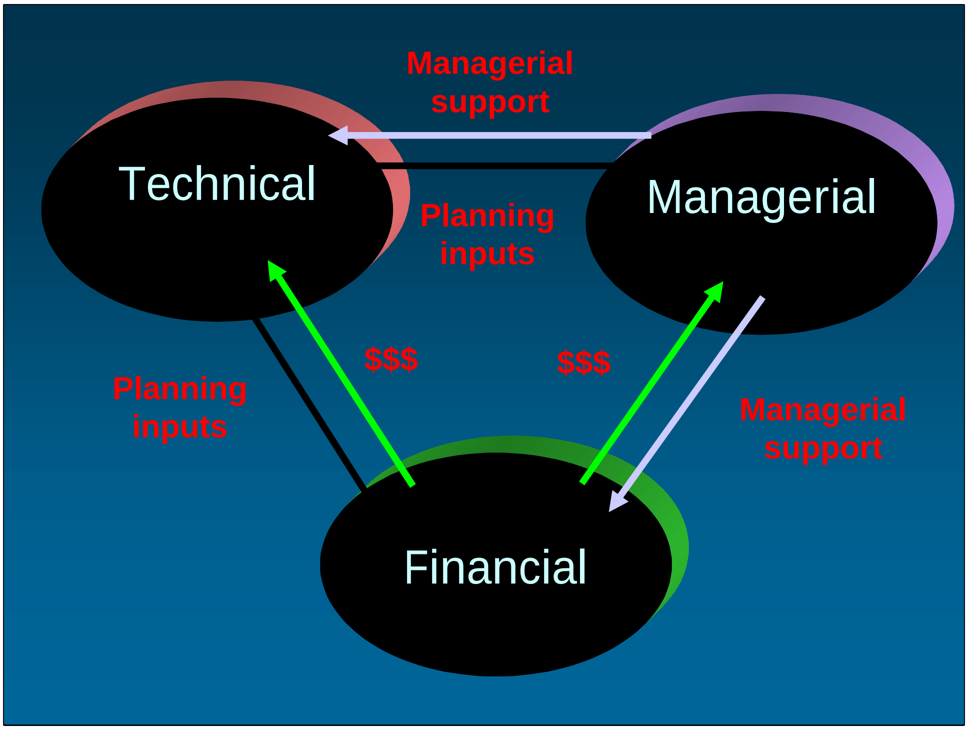
- Water system capacity (not to be confused with production capacity as measured in units of water) is:
  - The ability to plan for, achieve, and maintain compliance with applicable drinking water standards.
- For a system to have capacity, adequate capability is required in three distinct but interrelated areas:
  - Technical
  - Managerial
  - Financial
- The three basic elements of capacity have a statutory basis. Definitions and refinements were developed in EPA guidance documents with the broad-based input of stakeholders.

Capacity Elements

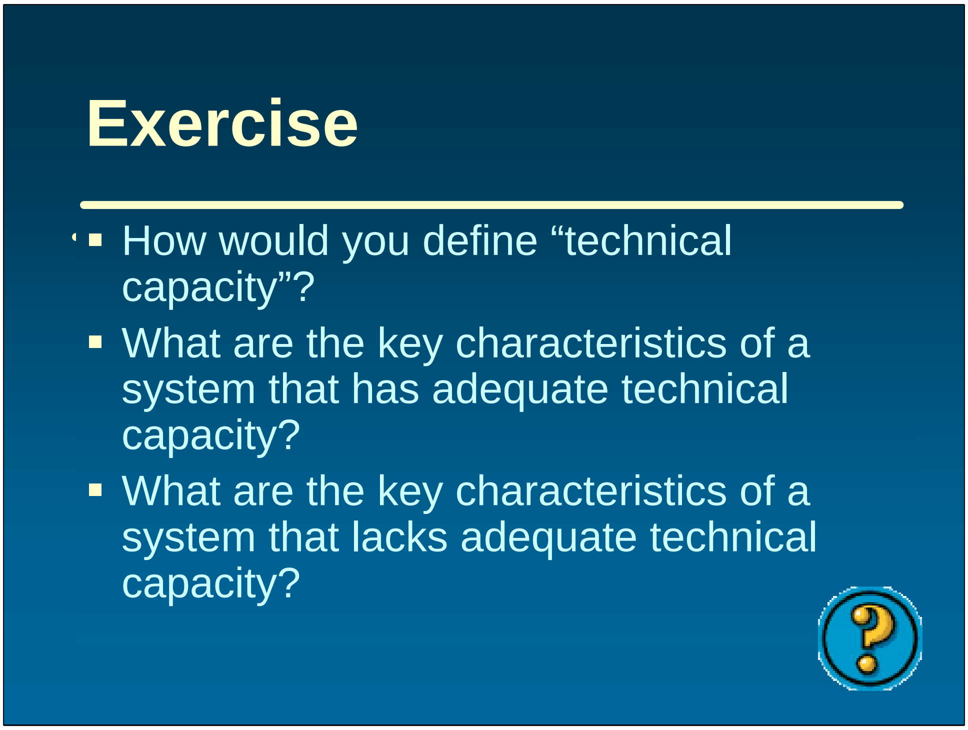
- Each capacity element – technical, managerial, and financial – is necessary but not sufficient
- Many aspects of system operation involve more than one capacity element
- Each element is important to ensure the protection of public health and meet the requirements of the Safe Drinking Water Act (SDWA)



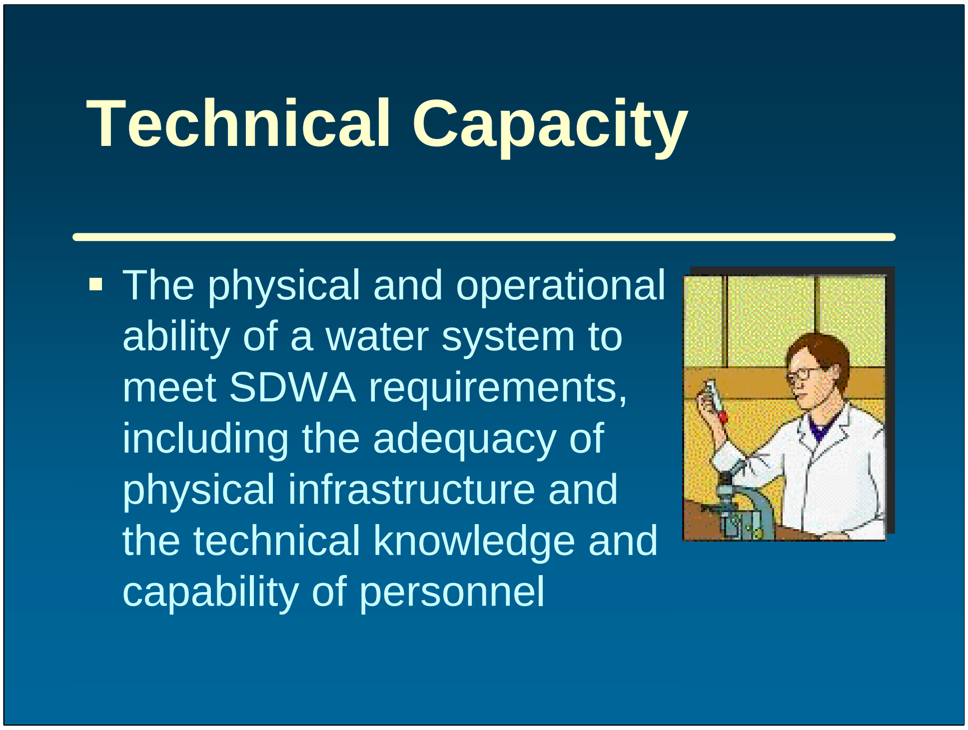
- Water system capacity has been depicted as a “three-legged stool” because each capacity element–technical, managerial, and financial–is essential.
- Each element of capacity is necessary but not sufficient by itself for sustaining the water system.
- Many aspects of water system operations involve more than one capacity element.
- Technical capacity is the focus of this presentation.



- Each of the elements of capacity is intrinsically related to the others:
  - Both technical and managerial capacity depend on financial resources.
  - Both technical and financial capacity depend on managerial support.
  - Both managerial and financial capacity depend on planning inputs.
  - Planning input is information provided by all water system staff on components or operations that need to be improved, replaced, or upgraded. Planning is needed to decide what and when to perform improvements, upgrades, and replacements. Planning involves management, financial decisions, and evaluation of the water systems technical aspects.
- Attention to these linkages is part of capacity development.



- Here is an exercise for defining capacity in practical terms.
- Participants in the workshop can provide their practical or working definition of technical capacity.
  - How do we know a seriously troubled system when we see one?
  - How do we identify systems that are “at risk” in terms of capacity?
- Describe a system that clearly has technical capacity or (conversely) lacks technical capacity.
  - List common characteristics and issues.
- Most characteristics related to capacity can be stated positively (e.g., keeps good records) and negatively (e.g., neglects record keeping).

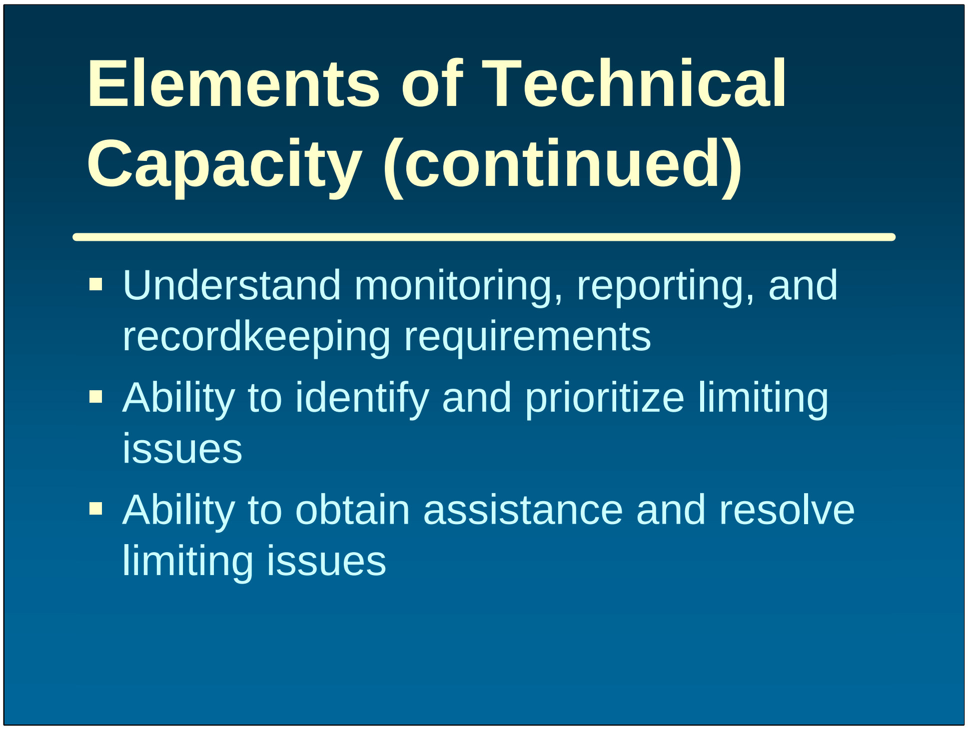


- Technical capacity is defined as:
  - The physical and operational ability of a water system to meet SDWA requirements, including the adequacy of physical infrastructure, technical knowledge and capability of personnel, and adequate source water.
  - Systems must provide water that meets customer satisfaction and promotes public health protection.

Elements of Technical Capacity

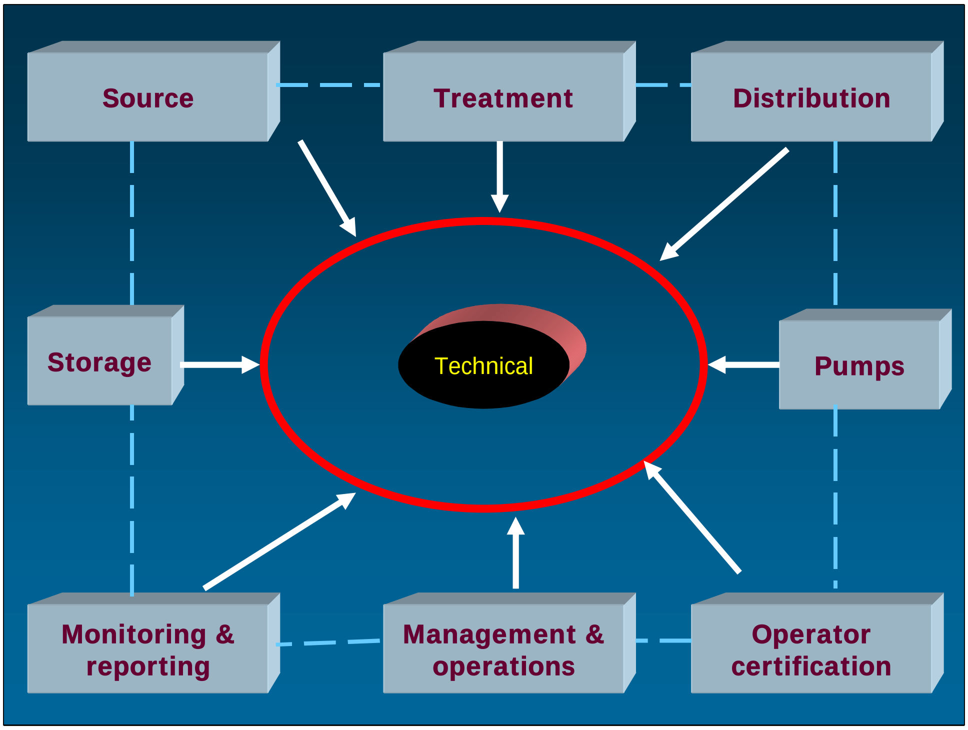
- Source water adequacy: quality and quantity
- Infrastructure adequacy
- System operations

- The essential elements of technical capacity are:
  - Source-water adequacy and protection.
  - Infrastructure adequacy and improvement.
  - System operations.

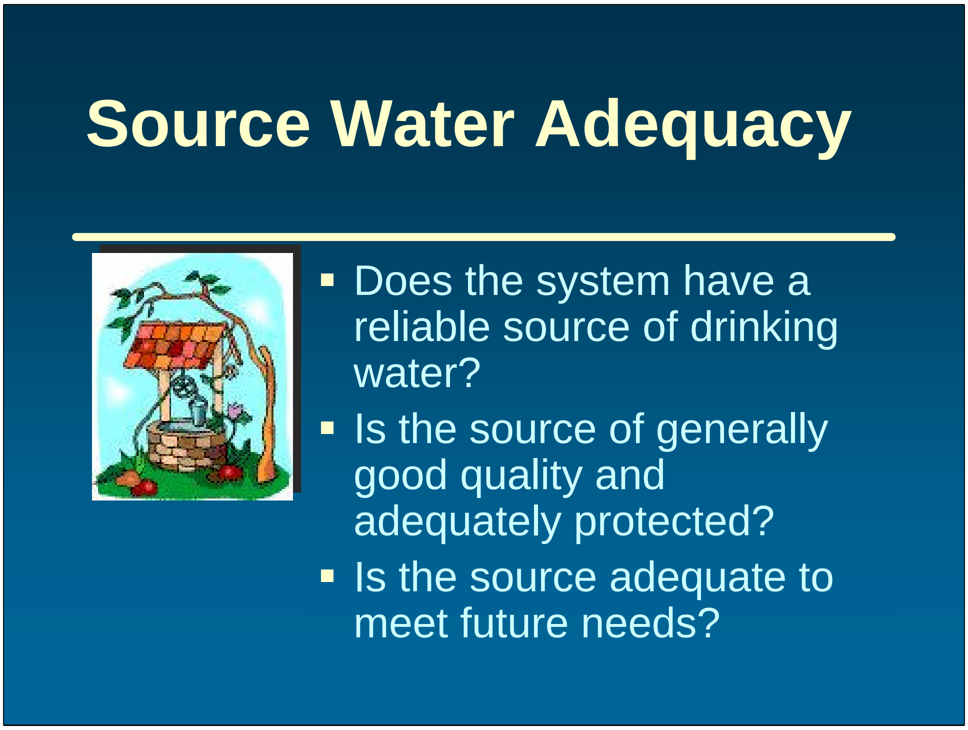


- Additional essential elements of technical capacity are:
  - Having a clear understanding of monitoring, reporting, and recordkeeping requirements (by operator, owner, and others associated with system management).
  - After identifying limiting issues or factors, prioritizing these issues based on urgency or associated health risks. Limiting issues are those components or system operations that prevent the system from providing adequate water, both in quantity and quality, on a consistent basis.
  - Developing a capital improvement plan.
  - Obtaining assistance and addressing all issues.

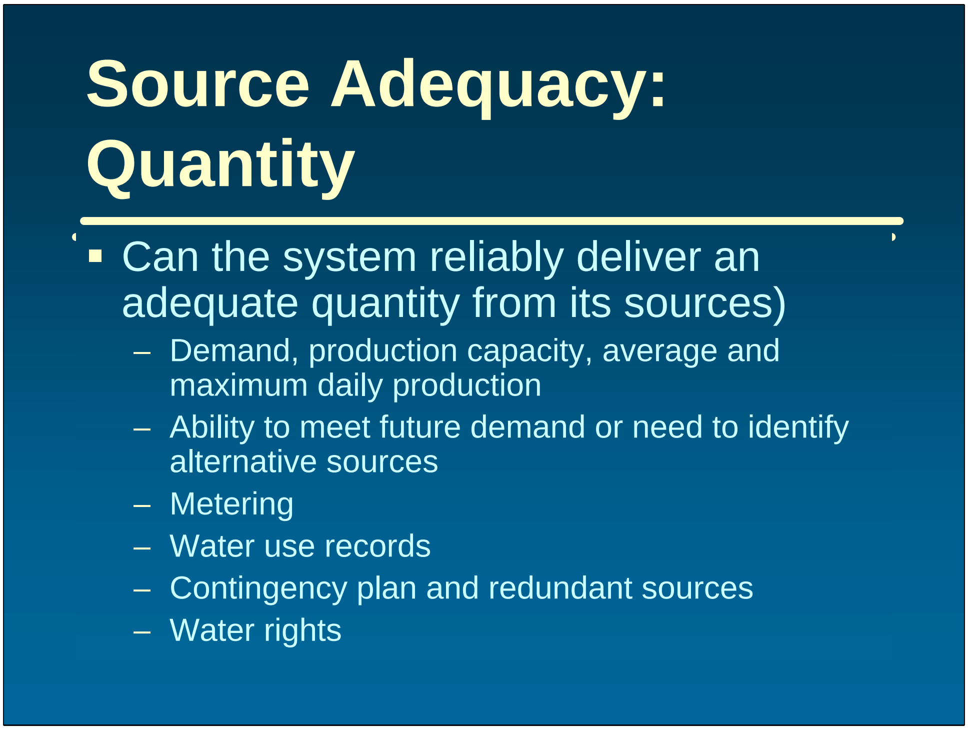
- Systems need to assess all system components: wells, pumps, surface water intakes, storage, treatment, distribution system; system operations such as water usage; and monitoring, reporting, and recordkeeping procedures.
- After assessment, identify which issues are limiting the ability to provide adequate water, either in quantity or quality, and begin to develop a plan to resolve the limiting issues.
    - An example of a limiting issue would be low water pressure and a lack of adequate water on one end of town. A new pump would solve the problem. The system would need to decide how the new pump would be financed, how big the pump should be, and how soon the pump needs to be purchased and installed. If a safety issue exists as a result of low pressures in the distribution system (e.g., back-siphonage), it should be made a priority.
    - Work with management and customers to prioritize limiting issues. May involve public meetings.
- Some systems have more detailed and long-range plans (up to 20 years) that identify what the system will need to replace within the planning period and how the replacement will be financed. These plans are called capital improvement plans. Other systems may have a capital improvement plan that only covers a 5-year period.



- Just as the different aspects of capacity development relate to each other, so do the components of technical capacity. For example:
  - Assume a small ground water system has no treatment. The system suddenly has coliform-positive hits in the distribution system. Repeat samples indicate the problem still exists and that the samples are fecal-positive. The system is placed on a boil-order by the State and in the meantime tries to identify the source of contamination. The operator and board meet to discuss the issue at an emergency meeting. They decide to test the source for contamination. Tests indicate that there are no coliforms present in the source. The system then goes to the tank and finds that birds have been able to get in the tank through a broken access hatch. The system cleans the storage tank, disinfects, and fixes the hatch. Additional testing shows the problem has been solved. As a result, the system decides to install full-time disinfection.
- The next series of slides provides information on the individual components of technical capacity:
  - Source-water adequacy and protection.
  - Infrastructure adequacy and improvement.
  - System operations.



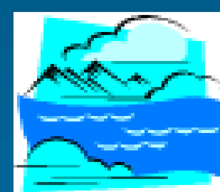
- Source-water protection and adequacy can be explored by asking:
  - Does the system have a reliable source of drinking water?
  - Is the source of generally good quality and adequately protected?
  - Is their an adequate quantity of water to meet future needs?



- To determine source water adequacy, systems can:
  - Assess current and future demands in terms of quantity. Consider all demands, domestic, commercial, and fire flows.
  - Identify the need for additional sources as the system expands or existing sources become limited due to drought or competing water rights.
    - Water records are very useful when examining water quantity issues.
    - Metering is useful to track water use and water losses between the plant and customers. Metering may help to identify significant leaks and these savings may eliminate the need to develop alternative sources.
- If only one source available, the system may want to develop another source as back-up. Single-source systems are typical of older ground water systems developed prior to rules requiring at least two ground water sources.
- Consider water rights issues which are crucial in western states, especially in drought years.

Source Adequacy: Quality

- Is the source of generally good quality?
  - Proximity to contamination sources
  - Monitoring and evaluating raw water quality
  - Treatment needed
  - Alternative sources

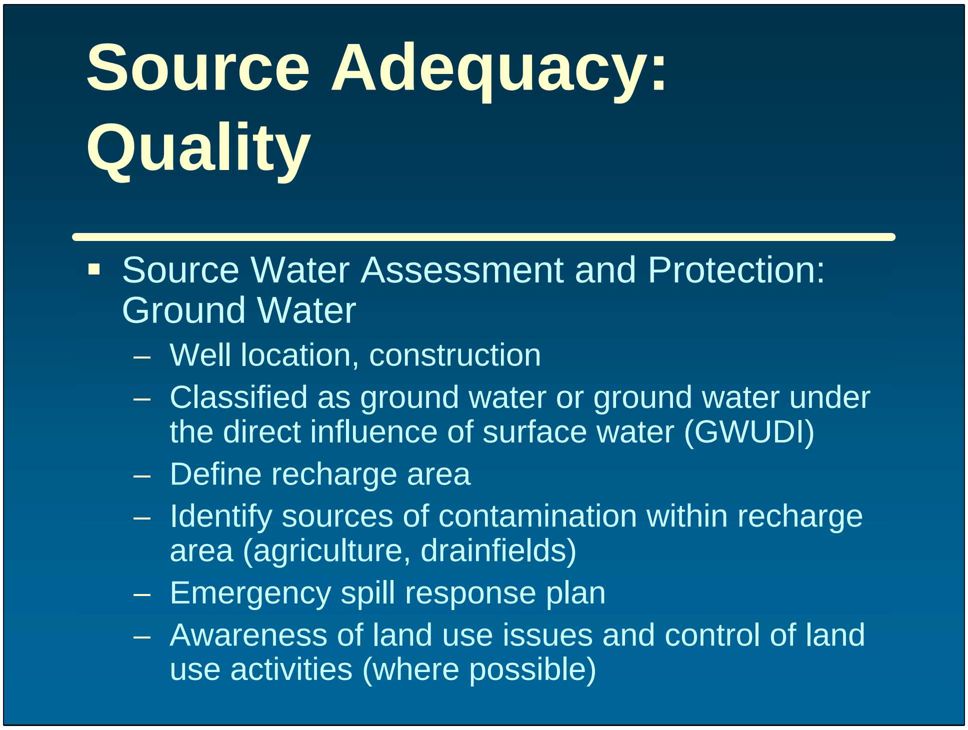


- Evaluating the source for adequate quality involves a number of considerations.
- It is a good idea to conduct periodic source water monitoring. If the system relies on surface water or unconfined ground water, source quality can vary on seasonal basis or over time. Drought has been shown to impact unconfined ground water system quality. Also, land use activities could change throughout time, and this can then impact surface water systems.
- Source water monitoring will allow operators to make better decisions on treatment.
- Developing an alternative source of higher quality may be more cost effective than treatment. For instance, a system may be able to blend two sources prior to the entry point to the distribution system to avoid treatment and this may be cheaper than installing treatment on the existing source. Alternatively, a system could abandon the existing source and use the new source exclusively for less cost than installing treatment on the existing source.
- Don't rule out connecting to a nearby system.
  - This option may be cost-effective.
  - This option is difficult in rural areas where the distance between systems is significant (5 miles or more).
  - May be difficult to do if nearby system cannot accommodate additional connections.

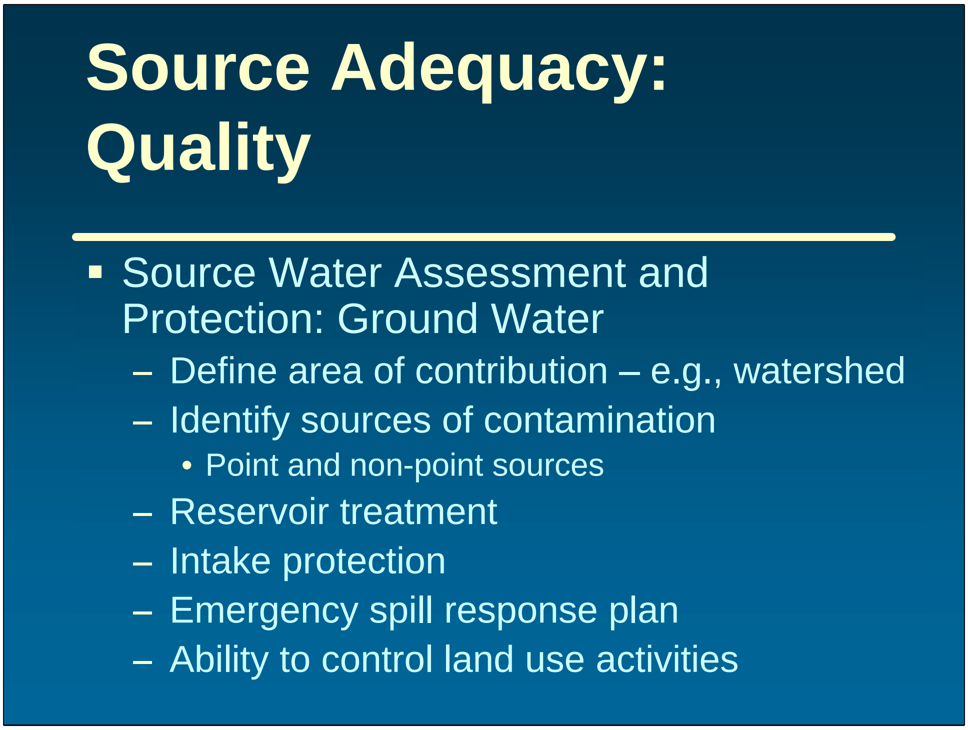
Source Adequacy: Quality

- Does the system have a wellhead protection or source water protection plan?
  - Protect your source to minimize contamination and treatment
  - Proactive approach
  - Key is the ability to control land use in vicinity of the source where possible and to remain aware of potential land use issues

- A wellhead protection or source water protection plan is very useful to protect existing sources and helps to identify areas for future source development, if necessary.
- The concept is to protect the source or sources from contamination or minimize vulnerability.
- This approach is very proactive.
- The key is to have some form of control of the land in the vicinity of the source. This may include zoning, easements, or actual purchase of the land. It may be cheaper to purchase land or purchase easements than install treatment. It is necessary to examine costs and benefits of alternative actions.
- Control of land use practices may not always be possible, but above all, remain aware of current and potential land use issues.



- For ground water systems, make sure the well is properly constructed with adequate grouting, adequate depth of grout, a sanitary seal, proper casing, and is deep enough to avoid vulnerable or contaminated aquifers.
- Need to know if the well is tapping ground water or ground water under the direct influence of surface water – based on State evaluation.
- Define the recharge area, the zone of influence, and/or the wellhead protection area (i.e., the land area that contributes water to your underground source of drinking water). State may allow area to be defined as a set radius around the supply well, depending on if the source aquifer is confined or unconfined. More concerned with water quality and potential contaminant sources in upgradient areas.
- Identify sources of contamination in recharge area or other defined areas or zones as required by the State. Contaminant sources to consider are wastewater systems (both municipal and on-site); sludge application areas; agricultural operations (fertilizers, herbicides, fecals from animals); industry (volatile organic contaminants (VOCs)); transportation routes (possible spills); and residential areas and other users of solvents, fertilizers, and herbicides.
- May want to have an emergency spill response plan in the event of a chemical spill on a transportation route or other contamination issues. Consider whether shutting down the contaminated source and using another source (including nearby systems) are feasible.



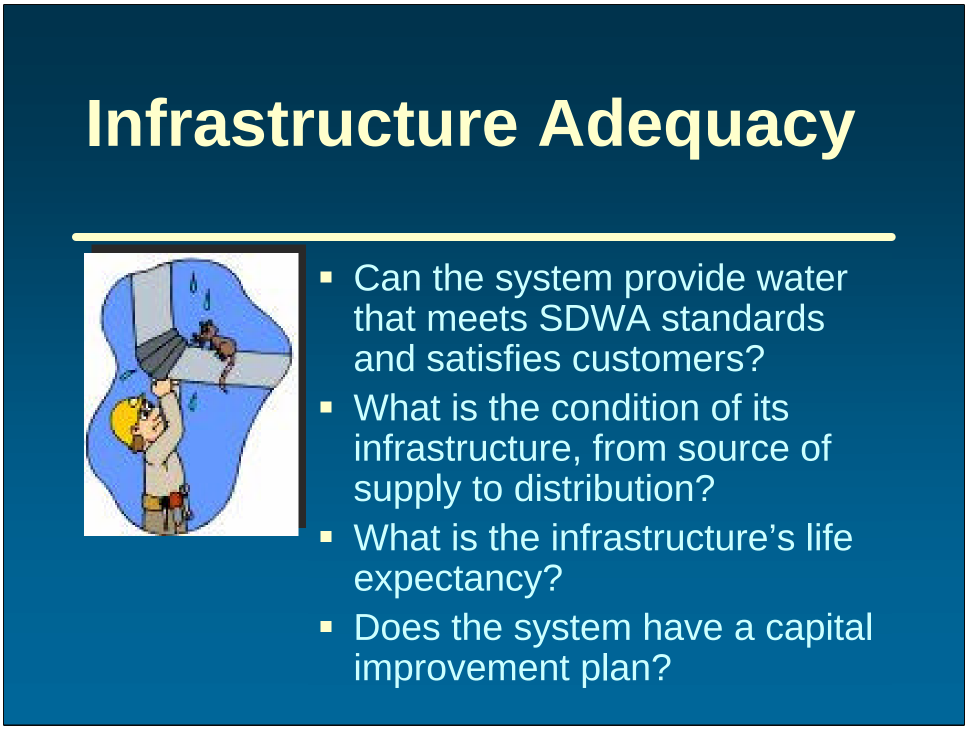
- A similar approach for determining source water adequacy (as presented for ground water sources) is used for surface water sources. Define the land area that contributes water to your surface drinking water source, and assess potential sources of contamination in that area.
  - Will want to evaluate land use activities in the watershed.
  - May want better protection of reservoir-limit recreational activities.
  - Want to evaluate depth of intake and determine whether it is adequately protected in the event of droughts or low water levels and spills.
- Again, some ability to control land use activities through zoning, easements, or ownership (Bull Run in Portland is an example of ownership on an unfiltered system) is an important aspect of source water protection.

Source Adequacy: Quality

- Other sources
  - Springs
  - Roof catchments
- Transmission from source to treatment facility
  - Distance between source and treatment may be extensive (miles of pipe or canal)

- Other sources of supply such as springs and roof catchments, may be vulnerable to contamination. The spring box and intake must be properly constructed and maintained to prevent contamination.
- Want to evaluate the transmission main from the source to the point of treatment or entry point. This distance may be significant in some circumstances and contamination can occur. For instance, a buried transmission main may pass through a wet or marshy area, and fittings may not be installed properly. Contaminated water is able to infiltrate the pipe at the location of a bad fitting. Canals are also vulnerable.
- Above-ground transmission lines (common in Alaska) also need adequate protection.

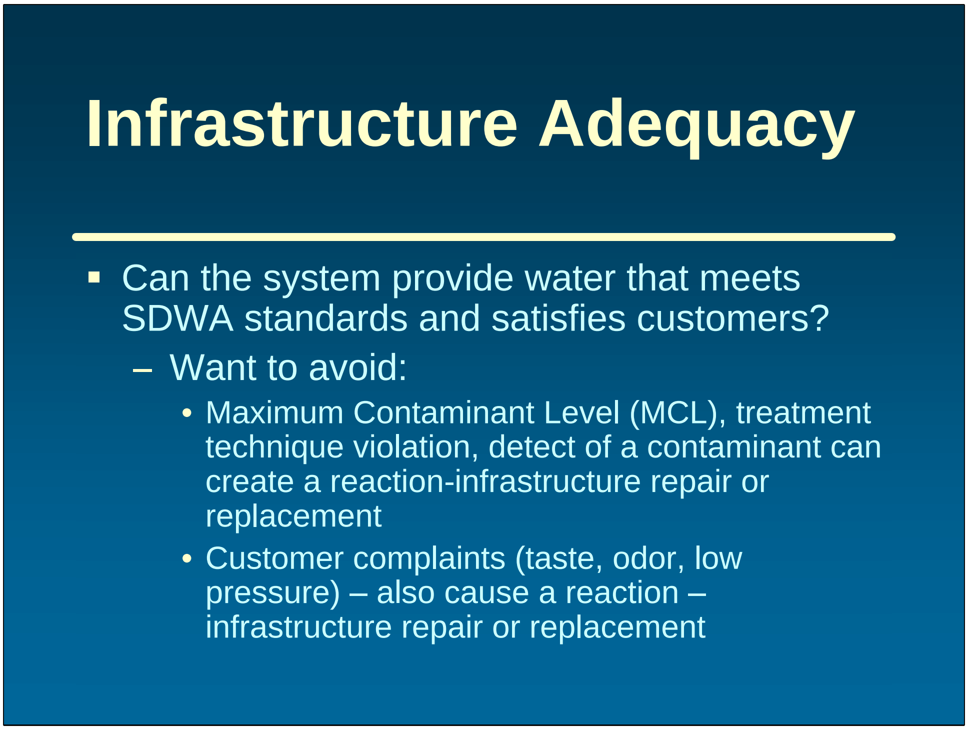
- Want to **avoid** storing chemicals near the source. This picture is an example of **what not to do**.



- Infrastructure adequacy and improvement can be explored by asking:
    - Can the system provide water that meets SDWA standards?
    - Are customers satisfied?
    - What is the condition of its infrastructure, from source of supply to distribution?
    - What is the infrastructure's life expectancy? Identify what components must be repaired, replaced, and upgraded.
    - Does the system have a Capital Improvement Plan? Plan financially to fund components identified for repairs, replacement, or upgrades.

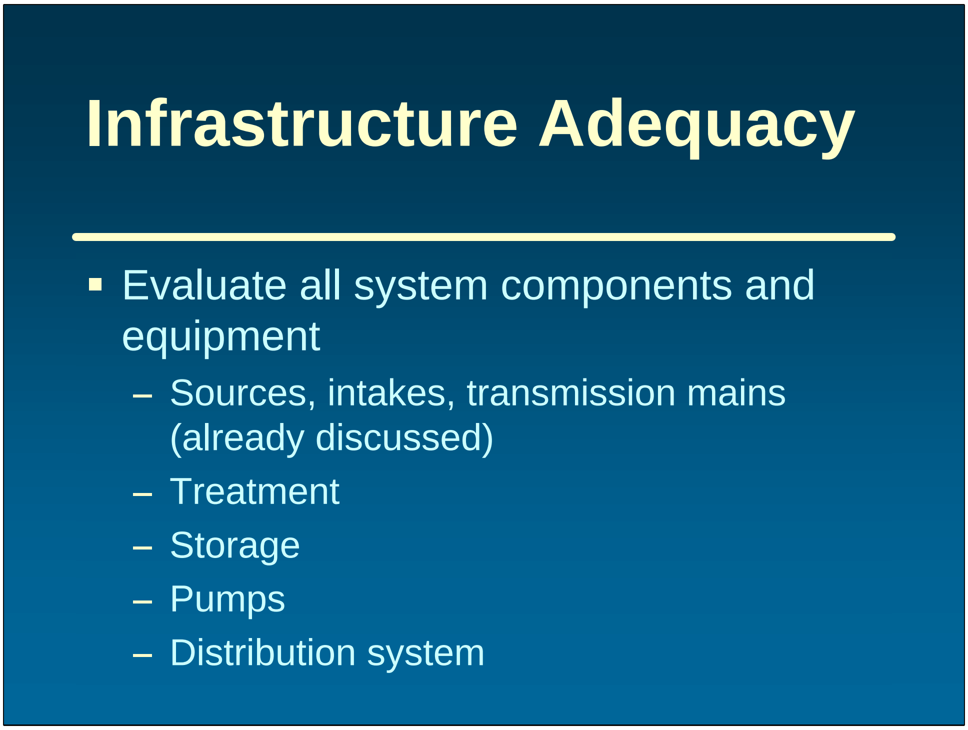
Infrastructure Adequacy

- Can the system provide water that meets SDWA standards and satisfies customers?
  - Evaluate all system components for proper operation to maintain adequate water quality and quantity
  - Identify what components must be repaired, replaced or upgraded based on life expectancy and future needs
  - Develop a capital improvement plan



- Want to avoid, if possible, a maximum contaminant level (MCL) or treatment technique violation. By this time, the problem has occurred and must be addressed. Depending on the issue, may require immediate response on the system’s part [e.g., an acute (fecal) detect]. The key is to be proactive and make sure all system components are operating properly to avoid MCLs, treatment technique violations, or contaminant detects.
- Example: A surface water plant has turbidity levels in excess of 5.0 NTU. Therefore, system must provide public notice and the State could place the system on a boil order. Turbidity levels of 5.0 NTU are a result of a filter failure which could have been avoided if the system had maintained the filters better. The system should have checked the media more often to determine that the media required replacement.
- Also want to minimize customer complaints. Don’t want to find out there is a leak or broken pump because customers on one end of town are suddenly out of water. Huge cross connection potential with a broken main.
- These two scenarios also result in loss of consumer confidence, heavier reliance on bottled water, and ultimately less support for the system (including paying fees, understanding need for new construction, road closure for system repair).

- The goal of assessing infrastructure through asset inventory and strategic planning is to identify which components are in need of repair, replacement, or upgrades prior to failure. Want to minimize the "broken main or pump" situation if possible.
- Developing programs or plans to allow routine inspection of components will help to avoid emergencies.
- Strategic planning requires the prioritization of components and deciding when to replace each piece of equipment.
- This can help with the development of a Capital Improvement Plan or a preliminary plan to finance repair, replacement, upgrades, and expansion of the system.



- **Sources** include well construction, sanitary conditions, source water, and water quality.
- **Treatment** includes design capacity, chemical storage and feed, and finished water quality.
- **Storage** includes capacity, age, materials, elevation, sanitary condition, and emergency storage.
- **Pumps** include pumping stations, pressure, pumping rate, auxiliary power, and pipe age.
- **Distribution system** includes pipes, looping, valves, and hydrants.

Infrastructure Adequacy: Treatment

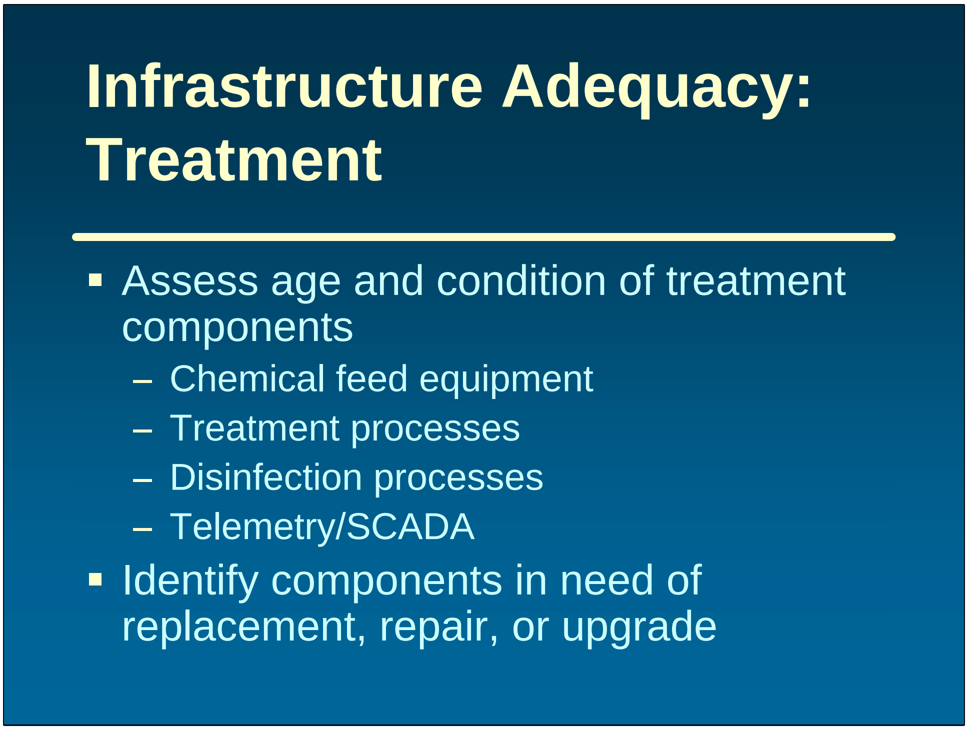
- Treatment systems
  - Disinfection/hypochlorination
  - Filtration
  - Corrosion control
  - Iron and manganese removal
  - Organics removal
  - Water softening
  - Other

- There are many different treatment options and combinations of treatment processes. Examples include:
  - Disinfection at more than one location, both in the treatment plant and distribution system. Systems may need to re-evaluate disinfection practices as disinfection byproducts monitoring occurs. Chlorine may also be used to precipitate out iron.
  - Filtration for physical removal of microbials and other particles. May also have green sand filter for manganese and radionuclide removal.
  - Corrosion control.
  - Iron and manganese removal through sequestering, precipitation, filtration.
  - Organics removal by aeration or granular activated carbon (GAC).
  - Water softening.

Infrastructure Adequacy: Treatment

- Must be aware of future rules with regard to treatment
- Treatment proposed to address today's problem may not be adequate for future regulations
- Provide flexibility in treatment plant

- As treatment is considered to address an existing problem, systems should also consider requirements of future regulations.
  - For example, a surface water plant decides to increase chlorine feed at the plant to maintain a better residual in the distribution system due to recent coliform positive hits in the distribution system. The system begins to monitor for total trihalomethanes (TTHMs) and haloacetic acids (HAA5s) in accordance with the Disinfection Byproduct Rule (DBPR). Because of the high organics in the raw water and chlorine concentrations, the system violates the TTHM MCL. One solution could be to add ozone or ammonia for chloramines and change disinfection application location rather than invest in more chlorine.



- Need to assess all treatment system components.
- Optimization is key as the future rules become effective – want to minimize chemical use, specifically disinfectants due to DBPR, and still maintain safe water.
- May want a professional, such as the equipment supplier, to assist with telemetry or Supervisory Control and Data Acquisition (SCADA) evaluation. A calibration issue could lead you to believe your chemical feed system or other system is broken when in reality the issue is electronic.

- This is an example of a package plant for use at small systems to remove hydrogen sulfide gas. Water is pumped from the well to a tray aerator on top of the plant. The aeration of the water effectively removes the gas. The water is stored in the back part of the unit, then disinfected and pumped to the distribution system.
- This plant can be moved on site as a complete unit.
- Package plants can provide adequate treatment and may be cheaper than constructing a new plant. However, package plants tend to be more operator intensive than conventional plants. Package plants typically require fine tuning to meet site-specific needs and systems should plan on having the operator check the package plant daily. O&M typically costs more for package plants than conventional plants as a result.

- Chlorine is the most commonly used disinfectant, but other oxidants are sometimes used and often have advantages over chlorine. The above photo shows ozone generators at a plant in the midwest. These particular ozonators have been in use since 1948, and are in especially good condition for their age. They are effective in removing tastes and odors as well as inactivating mircoorganisms.

- This photo is an example of an older iron removal plant at a small rural system. Here the water is allowed to cascade through the trays on the left where the metals are oxidized. Some of the oxidized metals settle in the settling basin below the aeration trays and the rest are removed in the two pressure filters located beside the well house.
- This plant, like many others across the nation, has probably **exceeded its useful life** and is in need of replacement.

Infrastructure Adequacy: Storage

- Storage
  - Adequate volume and pressure
  - Adequate capacity for peak flow
  - Covers and screens
  - Tanks professionally inspected every three to five years or more frequently

- Want to evaluate if storage equipment is adequate to meet current needs, both in volume and pressure. Evaluation includes:
  - Making sure telemetry is operating properly (i.e., the pumps, pressure switches, altitude valves, and storage tank are able to communicate properly to maintain pressure). Problem may be as simple as a new valve or pressure switch instead of a new storage tank.
  - Checking covers, hatches, screens on overflows, vents, or drains.
  - Professionally inspecting tanks typically every three to five years, or more frequently as directed by the State. Send in divers or remote cameras to inspect the tank. Divers and cameras allow the tank to be inspected without the tank being taken off-line.
  - Making sure adequate space is available for storage elements. Provide fences and locks on hatches as necessary to prevent vandalism or other security breaches. These types of security measures are especially important in light of current terrorism concerns.

Infrastructure Adequacy: Storage

- Storage tanks are not maintenance-free
- Need to routinely (monthly) check hatch; look inside with mirror and flashlight; and check screens on vents, overflows, drains
- Tanks can be a source of microbial contaminants (birds, rodents)

- Tanks should be superficially or visually inspected routinely – monthly if possible.
- Check the hatch, cover, screens on vents, drains, and overflows.
- Make sure you have all the necessary equipment before climbing to the top of the tank (e.g., keys, wrench, flashlight).
- Follow all safety precautions if on an elevated tank (safety ropes and harness, adequate personnel).
- Tanks are prone to contamination. It is better to routinely check the tank than to find out rodents or birds are in the tank by receiving fecal positive hits in the distribution system during monitoring.

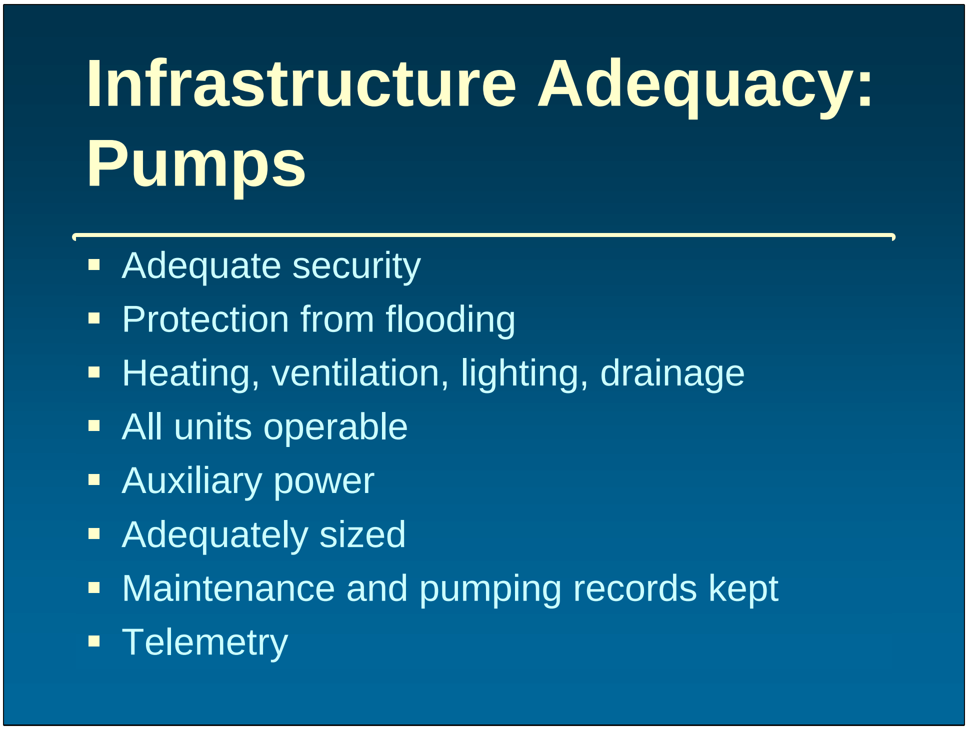
Infrastructure Adequacy: Storage

- Assess age and condition of storage facilities
- Identify necessary repairs based on inspections (new liner)
- Assess need for additional storage for future growth; storage tanks may allow system expansion without developing new sources (cost/benefit)

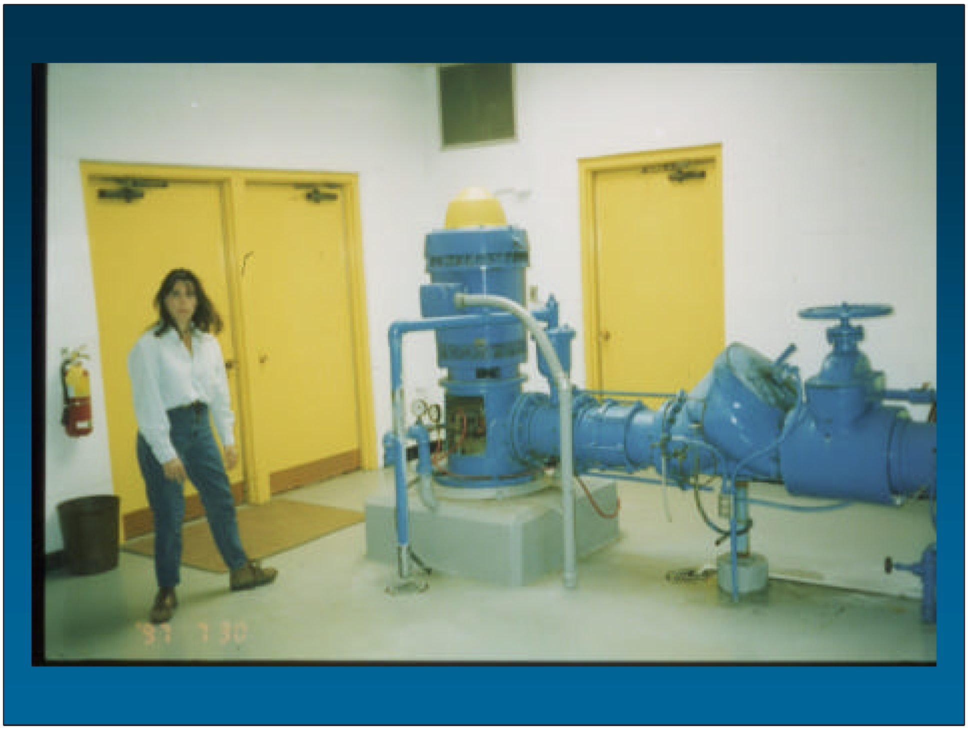
- Based on routine and professional tank inspections, identify need for repairs, replacement, or upgrades.
- The need for a new liner will require the tank to be taken off-line.
  - Make sure liner is approved for potable water use.
  - Also make sure liner is installed per manufacturer's specifications.
  - In an instance where the liner was applied in temperatures below those recommended by the manufacturer, the epoxy-based coating created aesthetic issues (diesel odors) and VOC was detected in the distribution system.
- The system needs to consider the need for two storage facilities which will allow one to be taken off-line for maintenance without service disruption.
- When considering additional storage, it may be possible to expand service through additional storage, without the need to develop a new source. Again, cost/benefit analysis is necessary to compare alternatives.
- Systems want to avoid adding too much storage. Can reduce disinfectant residual if too much storage time lapses prior to entry into the distribution system. Also, in Northern climes, water in the tank can freeze if there is not enough use and turnover in the winter.
- Also consider location of storage; it is better to be near the source or near users.

- This is a photo of a group of pressure tanks. These are commonly used in small ground water systems because of their low cost. The tanks are charged with air at a pre-determined level. Water is pumped into the tanks, compressing the air and increasing the pressure in the system. At another pre-determined pressure, the pumps turn off and the system is provided water from the pressurized tanks. When enough water has been used resulting in pressure falling to a lower level, the pumps are turned back on.
- The small box located in the center of the photo is the pressure switch. It senses the system pressure and automatically turns the pumps on and off.
- Small system tank set-ups like the one pictured, are typically sized to provide instantaneous peak demands with the pumps since very little storage is provided with the pressure tanks. These kinds of storage systems only provide enough storage to keep the pumps from cycling on and off too frequently.

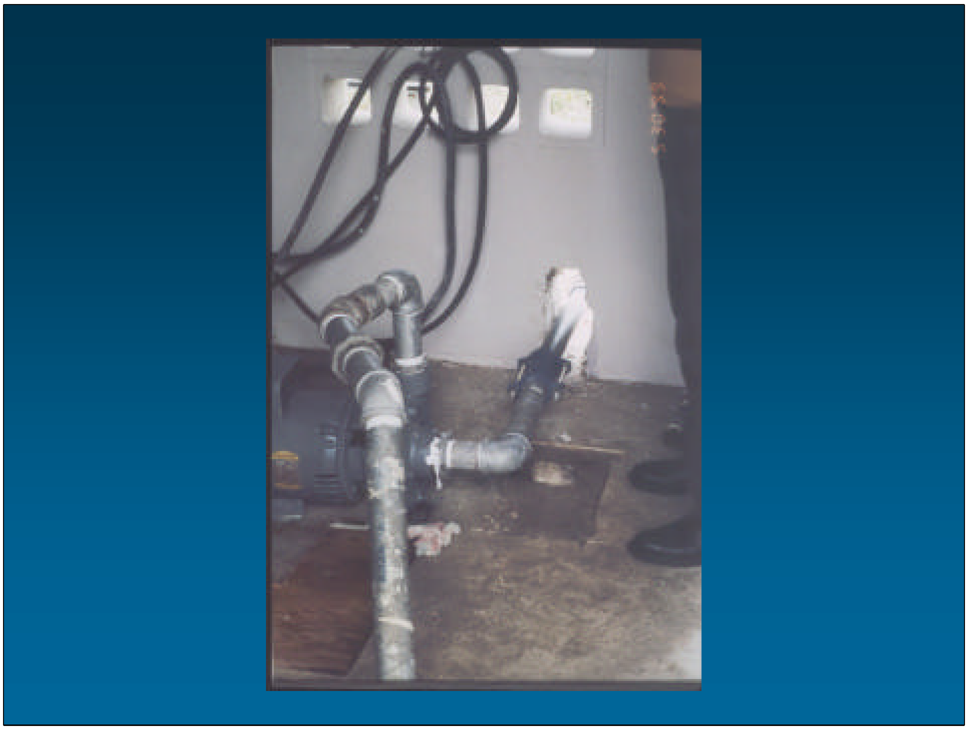
- Three common locations for storage tanks: buried below ground, on the ground surface, and elevated. This is a ground level tank that is constructed of a glass-coated steel. The glass coating makes it very resistant to corrosion which can greatly reduce the life of steel tanks. This particular tank is located on the island of Hawaii where salt air increases the potential for corrosion.
- Note that there is an entry hatch located on the roof of the tank just above the ladder. This is to allow entry for cleaning and inspection. It is important that all aspects of storage facilities be properly designed to prohibit the entrance of contaminants (e.g., dust, insects, rodents). The entry hatches are usually built with a 4 - 6 inch raised lip around the opening and with a locking, gasketed shoe-box type lid. Other potential entry points for contamination must also be designed properly as it has been shown that many contamination events can be tracked back to storage tanks.
- Note the fence, enhancing the security of the storage tank.



- Make sure pumps are adequately protected from the weather and vandalism.
- Provide proper heating, ventilation, lighting, and drainage.
- If pumps are designed to alternate, check pump records to make this is occurring. Also a good idea to check pump records to make sure all pumps are working as designed.
- Make sure auxiliary power is functional. Don't want to find out during a power outage that the generator isn't working or doesn't have adequate fuel. Also review with staff how to turn on the generator, especially if the generator must be manually started. If pumps have been recently replaced or upgraded, make sure generator is adequately sized for the pumps.
- Check pumps and ask the supplier if the current pumps are the most efficient. System conditions change with time, and a more efficient pump may be available that can save money on power bills.
- Keep good maintenance records. Records may be helpful if a warranty needs to be honored. Also good to check pumping records for water use.
- Make sure the telemetry is working. Pumps may not be operating properly due to a regulating valve in the distribution system or telemetry from the storage tanks.



- This is a photo of a vertical turbine well pump (a centrifugal pump) for a medium-sized water system. The large valve on the right hand side of the photo is an automatic valve that opens slowly when the pump turns on, and closes slowly when the pump shuts off. This is designed to prevent “water hammer” that can cause mains to break.
- Note that the pump is mounted on a base that is at least 1 foot above the well house floor and 18 inches above the 100-year flood elevation. This protects the well and aquifer from contamination from floods and spills.
- Note the fire extinguisher – need for safety equipment and easy access and exit.



- This is a small centrifugal pump that is used to boost pressures in the distribution system. The amount of water this pump will produce is inversely proportional to the pressure it is pumping against.
- There are a number of improvements that need to be made including:
  - Increasing the clearance between pipe and floor to **protect the piping**.
  - Improving the security of the building to **prevent insects and rodents from entering**.
  - Mounting the pump on pedestal for **protection from flooding**.

Infrastructure Adequacy: Distribution

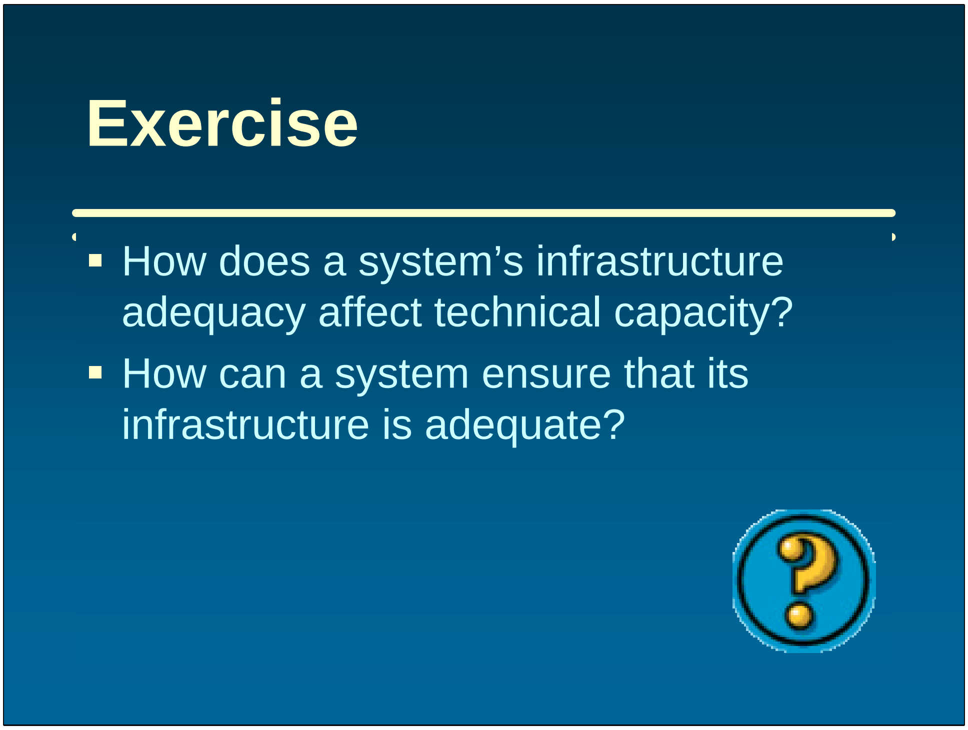
- Material standards
- Maps, as-built drawings, master plan
- Distribution system monitoring
- Flushing and hydrant testing
- Leak detection program
- Cross-connection control program
- Meters
- Valves
- Complaints from customers about low pressure, inadequate water, aesthetics

- Check distribution pipe material and make sure it is approved for potable water use. May want to consider replacing asbestos pipe or lead pipe if asbestos or lead is an issue.
- Systems should have maps, as-builts, and a facility or master plan. This information is important when verifying location and size of pipe for repairs or upgrades, and should be kept in a secure place.
- Systems should understand distribution system monitoring requirements (lead/copper, coliform, DBPs, etc.) and understand repeat monitoring. Monitoring locations should be clearly identified.
- Systems should have a flushing program and not just flush when a customer complains about aesthetics. Should also check hydrant flows and pressures regularly as another way to make sure system is operating properly and as a cheap alternative to a leak detection program. Important to flush dead-end mains.
- A leak detection program is an aggressive program where you "listen" for leaks using fairly sophisticated equipment, typically contracting with a firm specializing in leak detection. This type of program can be expensive but could pay off over time if the number of leaks is reduced and emergencies avoided.
- American Water Works Association (AWWA) Water Audits and Leak Detection (AWWA M36) is a helpful reference document.
- Cross Connection Control Programs are proactive programs that system can use to identify and installs backflow prevention devices on industry, irrigation systems, and others. Certified backflow prevention testers need to regularly tests backflow prevention devices.

- This is a photo of a 6-inch distribution main that has just been removed in a replacement project. Note the three stainless steel leak repair bands. Replacement of the mains in this system probably should have been done decades earlier. Breaks and leaks put water systems at risk for contamination from back-siphonage and at risk for expensive emergency repairs.
- Make sure equipment and new pipe fittings and repair sleeves are all disinfected before using. A five percent sodium hypochlorite is usually sufficient and can be daubed or sprayed onto materials and tools.
- Should have a truck available with all equipment necessary for main repairs. This will save time and can help to reduce the amount of water lost, number of customer complaints, and potential for contamination.
- Breaks present a huge potential for contamination.

Infrastructure Adequacy

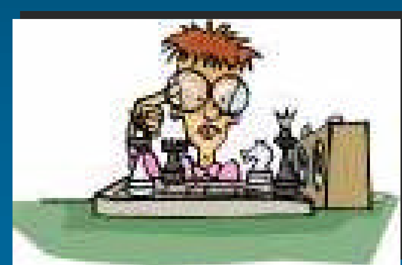
- Develop an asset inventory
  - After assessing all system components, identify those in need of repair and replacement in an asset inventory
  - Consider what components must be upgraded to meet demands
- Ensure strategic planning
  - Consider what future regulations will affect the system and how (flexibility is key)
  - Develop capital improvement plan



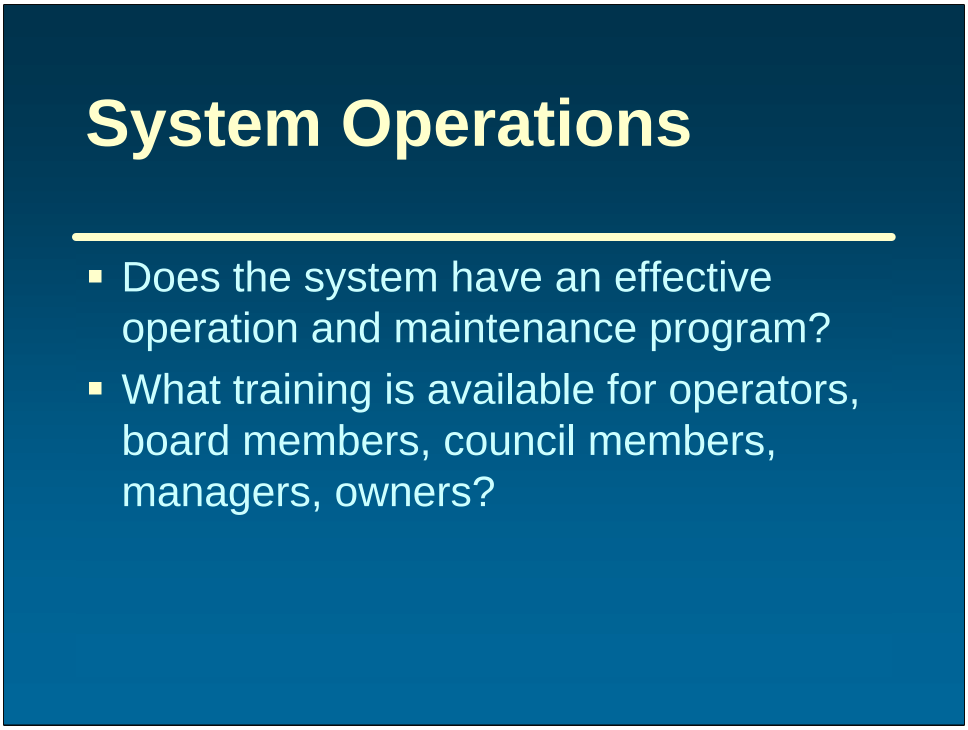
- In this exercise, participants think about the interrelationship among the components of infrastructure adequacy and overall technical capacity.
- Also, participants are asked to determine steps a system can take to improve or maintain infrastructure adequacy (e.g., implement a preventative maintenance program, develop a capital improvement plan, assess current conditions).

System Operations

- Is the system's operator certified?
- Do adequate resources exist to maintain safe and consistent operation of the system?



- System operations:
  - o Include routine aspects of system operation and the ability to handle emergency situations.
  - o Is the system's operator certified?
  - o Procedures should be in place to allow consistent and safe operation of the system.



- Adequate documents should be available to allow the operator to properly operate the system.
- Ties in with previous issue of consistent and safe operation.
- Training for the operator and others (e.g., board members, managers, owners) is important. If everyone is informed, better decisions are made.

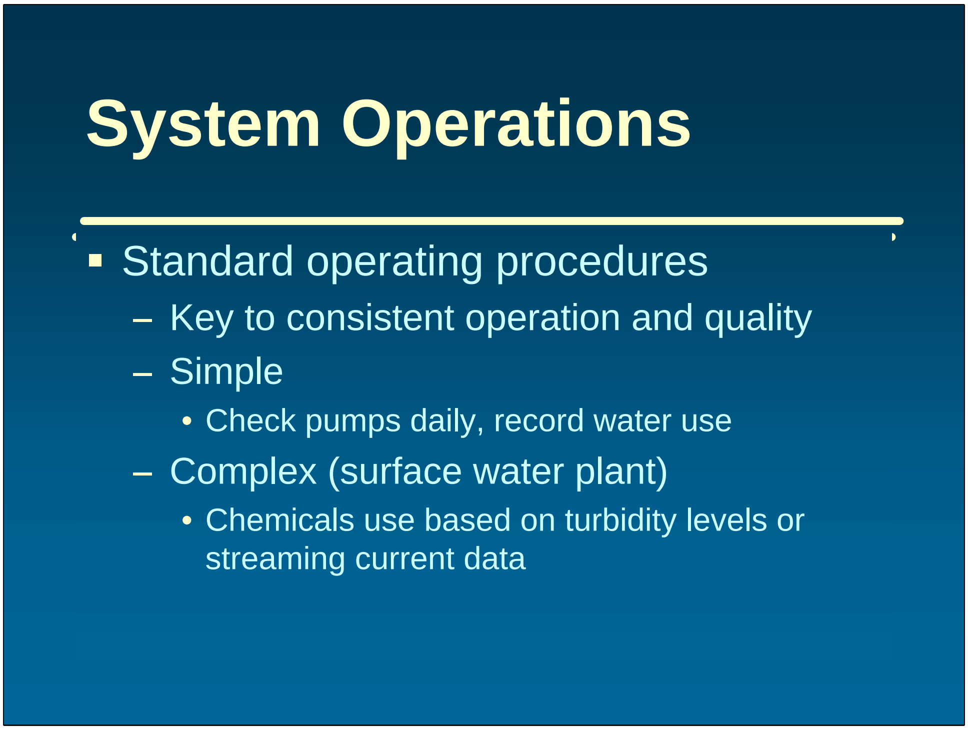
System Operations

- Is the operator certified and current?
  - All CWSs and NTNCWSs are required to have a certified operator; some States also require TNCWSs to have a certified operator
  - Operator should be current with certification
  - Operator should be properly trained
  - Training can be obtained through the State or other agencies approved by the State

- Operators should have proper certification. For instance, a Class I surface water system should be operated by a Class I certificate holder or by an operator making efforts to obtain a Class I certificate.
- Training and certification requirements differ by State. Check with your State on operator certification requirements.

System Operations

- Adequate resources to maintain safe and consistent operation of system
  - Standard Operating Procedures (SOPs)
  - As-builts
  - Operation & Maintenance (O&M) manuals-available and current
  - Adequate records on maintenance, repairs, water use, power use, chemical use
  - Other programs to consider – Vulnerability Assessment, Safety Program, Emergency Response Plan, Cross Connection Control Program



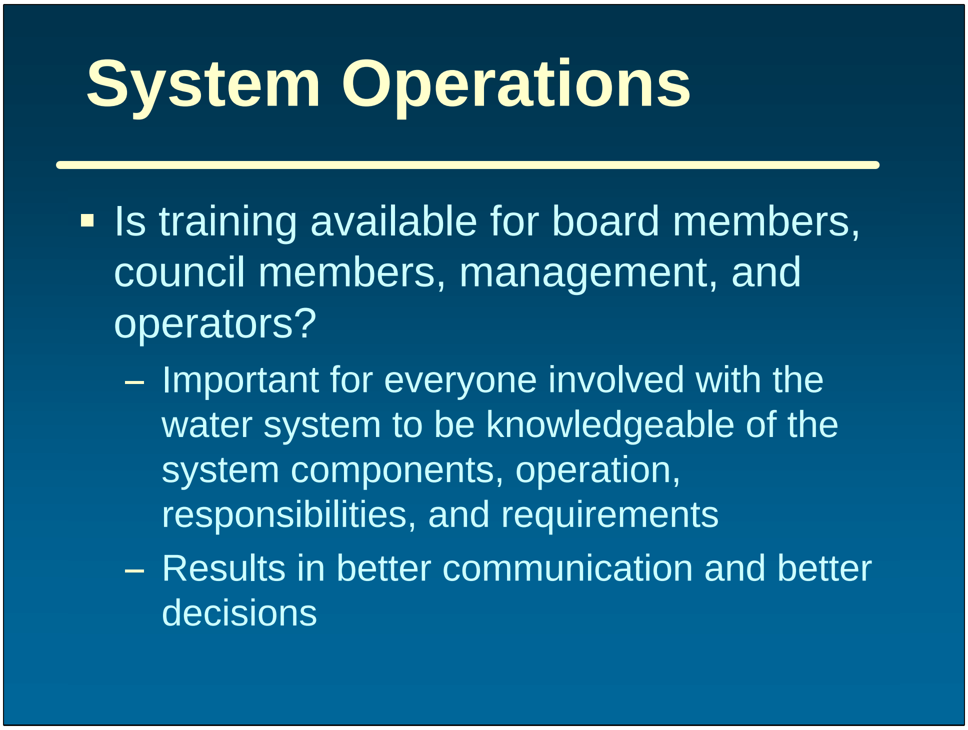
- Standard operating procedures (SOPs) are important and will allow consistent operation of system.
- Becomes important when the main operator takes a vacation or otherwise is unable to perform his duties, or when a new operator takes over the system. Also useful for part-time operators that work a few hours each week.
- SOPs can be simple – check pumps, flows, chemical pumps on daily basis, daily chlorine residuals.
- SOPs can be more complicated. A surface water treatment plant may need to develop SOPs for:
  - Responding to varying turbidity levels.
  - Turbidity calibrations – monthly, primary vs. secondary.
  - A filter backwash process.

System Operations

- Other programs to consider
  - Vulnerability assessments
  - Safety program
  - Emergency response plan
  - Cross connection control program
  - Leak detection program
  - Flushing schedule
  - Security
- How often are programs or plans reviewed and updated?

- It is important to review and update programs and plans on a regular basis. Technologies and system conditions change – systems need to keep important information current.

- Vulnerability Assessments
  - Assessment of system vulnerabilities, linked to Emergency Response Plans.
- Safety Program
  - Chemical storage and handling – proper containers, gloves, respirator.
  - Confined space entry – must be trained and have adequate apparatus – gas monitors, respirators, hoists, ventilators.
- Emergency Response Plans
  - Power outage – what equipment must be manually run, generators, chemical feed pumps. Want to make sure that all necessary pieces of equipment remain functional. Equipment start-up procedures after equipment is off for a period of time are essential.
  - Drought – water rationing criteria, eliminate lawn watering and car washing, conservation, low flow fixtures.
  - Fire – how to shut-down equipment properly (can't just throw a switch- could damage pumps or create water hammer), evacuation procedures. Equipment start-up procedures and necessary testing to insure water is still safe to consume after equipment is off for a period of time.
  - Chemical spills – first aid kit, who should be contacted, how to properly shut down equipment, how to isolate the spill, and evacuation procedures, if necessary.
  - Flood – shut down of equipment and evacuation procedures. More importantly will be equipment start-up and testing of water after a flood.
  - Sabotage and terrorist attack – which emergency personnel should be contacted, how to notify consumers, how to properly shut down equipment and isolate any contamination, how to obtain and distribute emergency water supply.



- Training should be available for all of those involved with the water system.
- Knowledge is key to better communication and better decisions. Easier for the operator to advise board members if the board members understand the concept.
- Can be difficult to train board members – they are often volunteers and may not have time to attend training.
- Example – small system in Montana requires all board members to become certified operators. As a result, many back-up operators exist and the system is financially independent. Financial independence is important since the system is a water users’ association and does not qualify for State and Federal money, except State Revolving Fund (SRF).

Monitoring, Reporting, and Recordkeeping

- Has an approved sampling plan been established?
- Is a certified laboratory used?
- Is a monitoring schedule available?
- When and how is information reported to the State?
- What records must be kept by the system?

- Systems need to be aware of regulated contaminants, and which contaminants they must monitor for; how often to take samples and where to have them analyzed; what information to provide to the State and when to provide this information; and what records to keep.

Monitoring, Reporting, Recordkeeping

- Monitoring requirements
  - Monitoring schedule available?
  - Sampling plan available?
- Are samples being analyzed by a certified laboratory?
  - Not all labs certified for all contaminants
- How is information submitted to the State?
  - Do labs send monitoring results to the State or is this the system's responsibility?

- Monitoring schedules and sampling plans are an outstanding tool for operators. Can help avoid missed sampling events and improper sampling procedures.
- Need to know what each lab is certified to perform. Not all labs are certified for all contaminants. State personnel can provide contact information for certified labs.
- Need to understand how information is submitted to the State. Some labs may copy the State directly and other labs will send the results back to the system for privacy reasons, and the system must send in the results to the State.
- Some States are practicing electronic reporting – could be the way of the future.

- Systems need to have a method for keeping records and should identify the person responsible for keeping them.
  - Avoid the situation where one person keeps them in his or her home and records are lost when that individual moves or quits as the operator.
- Electronic records may be best option, especially for turbidity readings (every 15 minutes) at surface water systems. Will want to backup all electronic information. Keep a backup copy in a safe place.
- Systems must know which records to keep. Long Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR) and Filter Backwash Recycling Rule (FBRR) require systems to keep records, and although the records must be available for review during a site visit, the system does not have to submit them to the State. Other rules may have different record keeping requirements.

- Other records should be kept by the system.
  - For instance, water use records may help the system identify a leak or illegal connection if water use changes drastically but number of users has not.
- Records are important.
  - Will allow system to prepare a Consumer Confidence Report (CCR) with accurate information.
  - Useful for public notification, if required.
  - Will allow management to review past water system operations and better plan for the future.
  - Consultants will appreciate good records when preparing facility plans and identifying future needs.

Exercise

- What elements of a system's operations contribute to its technical capacity?
- How are monitoring, reporting, and record keeping related to technical capacity?

Identify and Prioritize Limiting Issues

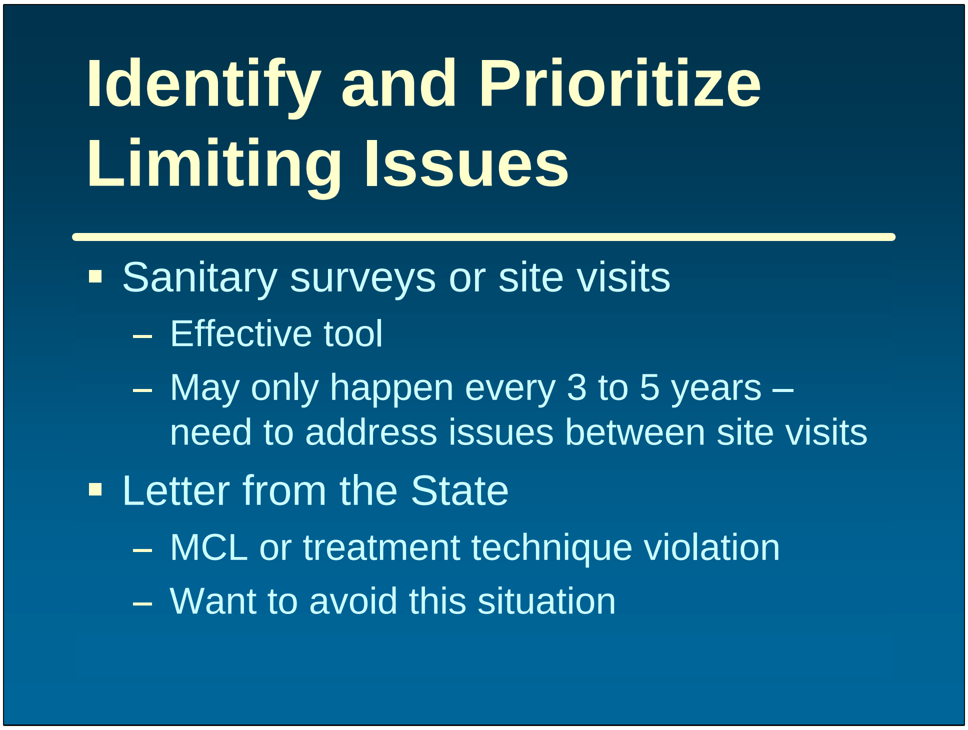
- How can limiting issues be identified?
- What issues require immediate attention?
- Ability to plan for the future
  - Future growth
  - Future rules

- System should have adequate tools and resources to evaluate system components and operations to identify limiting issues before a problem occurs.
- Must be able to prioritize limiting issues.
- Need to look to the future; new regulations may impact small systems (e.g., radon rule, ground water rule).

Identify and Prioritize Limiting Issues

- Methods to identify issues
  - Sanitary surveys or other State site visits
  - Letter from the State – MCL or treatment technique violation
  - Detect of contaminant (VOC, SOC)
  - Source water assessment
  - Self-assessment

- The next series of slides present information on methods systems can use to identify limiting issues.

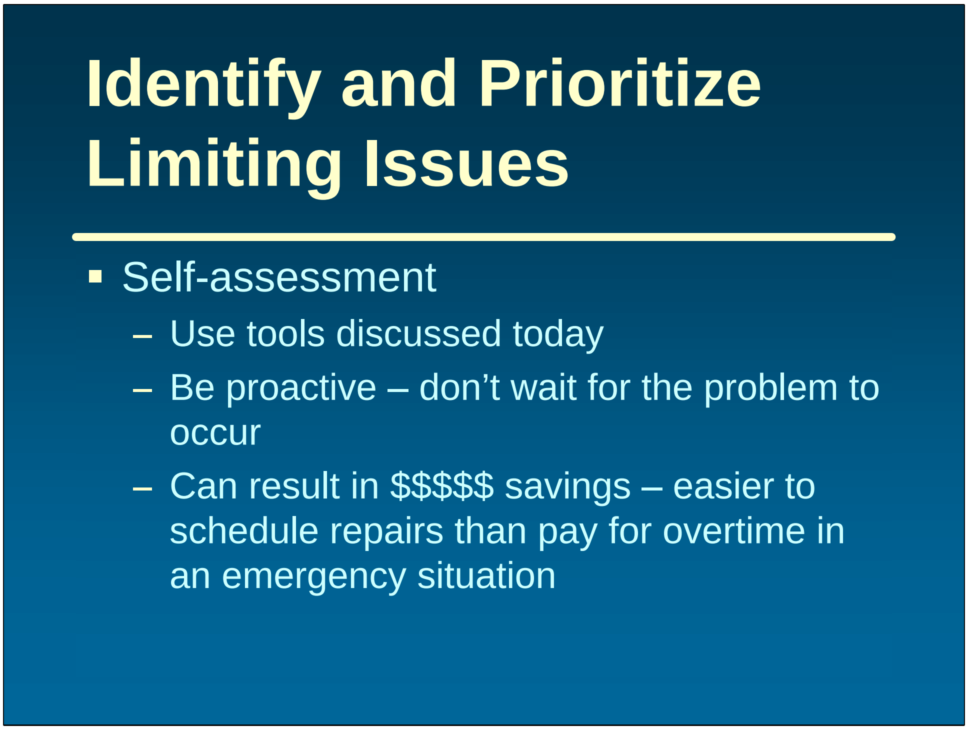


- Sanitary surveys typically happen every 3 to 5 years. Some States are behind schedule and may not get to systems that often. Don't wait for a sanitary survey to identify problems – may be too late. Systems need to address deficiencies identified in sanitary surveys.
- A violation letter from the State means the problem already exists. The only benefit of a letter from the State is that it may give system a higher priority for funding.

Identify and Prioritize Limiting Issues

- Contaminant detection
  - Monitoring detects a contaminant, but still below MCL
  - Time to address issue
- Source water assessment
  - Effective tool to identify sources of contamination
  - Can address the issue – reduce vulnerability

- Pay attention to monitoring records. May detect contaminants at levels that are below the MCL but may want to consider treatment or better source protection before the MCL is violated.
  - For example, a system may notice a steady increase in SOC herbicide, glyphosate, in the summer. Glyphosate is found in Roundup – available at most hardware stores and used for weed-control. The system's well is located near a county right-of-way in a county that sprays for weeds every spring. The system may want to work with county officials to eliminate spraying near the well and identify where the county can spray or other alternatives to spraying near the source of supply.
- Source water assessments are another good tool. The example just presented illustrates a simple source water assessment plan that is much cheaper than the system having to install treatment or respond to contamination.



- Today’s presentation has focused on a self-assessment approach which requires systems to routinely check system components and operation and actively seek out areas to improve before a problem occurs.
- Being proactive:
  - Helps you address and prepare for both anticipated and unexpected problems.
  - Reduces system “down-time” and the number and cost of emergency repairs.
  - May provide you with extra time to research cost-effective alternatives.

Identify and Prioritize Limiting Issues

- Methods to prioritize issues
  - Immediate health risk
  - Inability to provide adequate quantity of water
  - Equipment must be replaced immediately
  - Detection of contaminant a concern but not a health risk

- Once limiting issues have been identified, prioritize those issues.
- Sometimes easy to prioritize when a pump is broken or if an MCL violation has occurred.
- Will require board members, managers, owners, and operator to evaluate limiting issues.
- The evaluation process is much easier if all participants are knowledgeable about the system and if system has adequate records to assess the situation.

Obtain Technical Assistance and Resolve Limiting Issues

- State
- Local American Water Works Association (AWWA), National Rural Water Association (NRWA)
- Midwest Assistance Program (MAP)/Rural Community Assistance Corporation (RCAC)
- Training
- Nearby utility

- Technical assistance is available from many sources.
- Check with State personnel to obtain list of technical assistance providers and to explore technical assistance opportunities provided by the State.
- Check with State on training opportunities. For example, Montana publishes a calendar with training schedule for the entire year. Many States include this type of information (training topic, location, fee, and who to contact) on a Web site.
- Don’t rule out a nearby utility for assistance (i.e., a “Buddy” program).

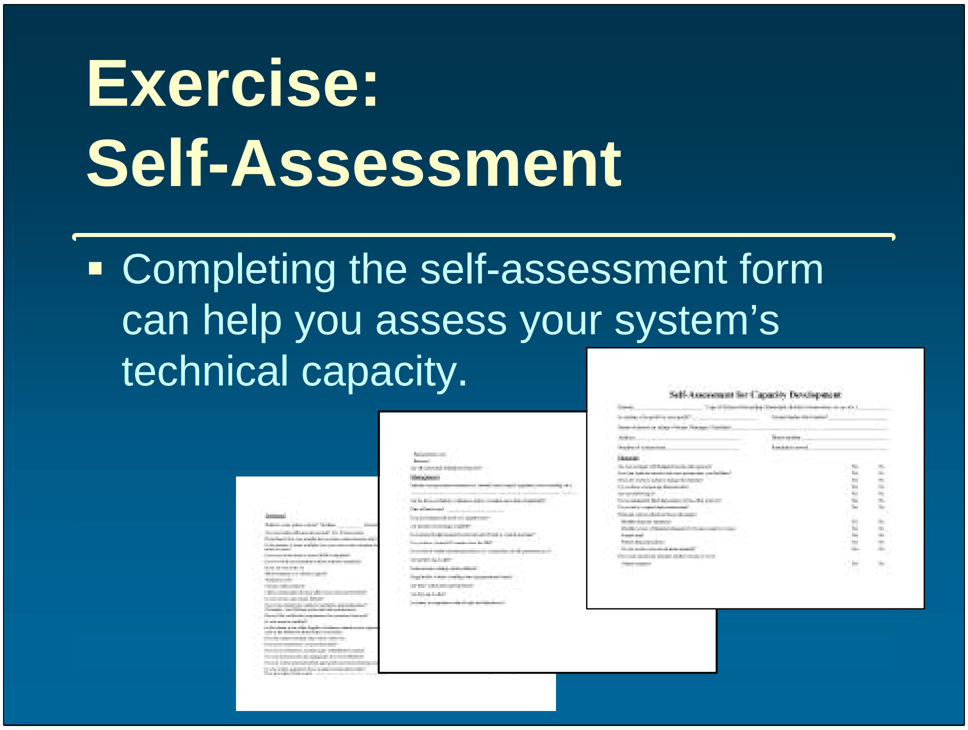
Obtain Assistance and Resolve Limiting Issues

- Must resolve limiting issues – may be required to act quickly depending on the issue
- May need to have $$$ in reserve or pursue grants and loans
- Plan ahead – grant and loan money typically a 2-year process (grant application, election, public notice)

- Be prepared to resolve the limiting issues that have been identified.
- Finances must be in order.
- Plan ahead if seeking grant or loan money.
    - Typically a 2-year process.
    - May require a bond election if obtaining SRF or rural development (RD) loans.
    - Typically must have an engineering report to identify issues and alternatives.
    - Public notice required with public funding. Could take up to 60 days.
    - When preparing a request for proposals (RFP) for consultant services, include clauses to retain the same firm for design and construction to save a lot of down time. Also include a severability clause in the contract if this approach is done.
    - Most State and Federal fund programs require systems to issue an RFP for engineering services.

Technical Capacity: Summary

- To achieve and maintain technical capacity a system should:
  - Identify the system components or operating issues that are limiting the ability to provide adequate water
  - Prioritize issues and develop a long-term strategic plan
  - Obtain assistance (technical and financial)



- Involve class participants by going through a self-assessment form. The National Rural Water Association (NRWA) has developed a form that is fairly simple and user-friendly. There are others available (e.g., California's).
- For additional information or for further assistance with technical capacity, contact:
  - EPA's Safe Drinking Water Hotline
    - hotline-sdwa@epamail.epa.gov
    - (800) 426-4791
  - EPA's Drinking Water Web Site
    - www.epa.gov/safewater
  - EPA's Small Systems Web Site
    - www.epa.gov/safewater/smallsys.html
  - Your State or Tribal Drinking Water Agency or EPA Regional Office
  - National Rural Water Association
    - www.nrwa.org
    - (800) 332-8715
  - Rural Community Assistance Program
    - www.rcap.org
    - (703) 771-8636
  - Rural Utilities Service
    - www.rurdev.usda.gov/rus/index.html
    - (202) 720-0962

Self-Assessment for Capacity Development

System: ______________________ Type of System Ownership (Municipal, districts, homeowner, co-op, etc.) __________

Is system a for-profit or non-profit? ______________________ Formed under what statute? ____________________

Name of person in charge (Owner, Manager, President) ____

Address ________________________________ Phone number ____________________________

Number of connections ________________________ Population served __________________________

Financial

Are you on target with budgeted income and expenses?	Yes	No
From last audit are current total assets greater than your liabilities?	Yes	No
If not, do you have a plan to change the situation?	Yes	No
Do you have a long-range financial plan?	Yes	No
Are you following it?	Yes	No
Do you adequately fund depreciation or have other reserves?	Yes	No
Do you have a capital improvement plan?	Yes	No
Financial controls (check all boxes that apply)		
Monthly financial statements	Yes	No
Monthly review of financial statements by board, council or owner	Yes	No
Annual audit	Yes	No
Written financial policies	Yes	No
Do you review your rate structure annually?	Yes	No
Does your current rate structure produce income to cover:		
Current expenses	Yes	No