BRIAN CUMBO
ATTORNEY AT LAW

86 W. Main St., Suite 100
P.O. Box 1844
Inez, KY 41224
(606) 298-0428
FAX: (606) 298-0316
cumbolaw@cumbolaw.com

ADMITTED IN KY AND WV

February 13, 2017

Public Service Commission
ATTN: David Spenard
P.O. Box 615
Frankfort, KY 40602

RE: Martin County Water District
PSC Case No. 2016-00142

Dear Mr. Spenard:

Enclosed please find an original and six (6) copies of Martin County Water District's Supplemental filing regarding the above captioned matter.

Thank you for your attention to this matter.

Very truly yours,

BRIAN CUMBO

BC/ld
Enclosure
cc: Martin County Water District

COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

INVESTIGATION OF THE OPERATING CAPACITY OF MARTIN COUNTY WATER DISTRICT PURSUANT TO KRS 278.280	)))	CASE NO. 2016-00142

SUPPLEMENTAL FILING

****

Comes the Martin County Water District (District), by counsel, and for their Supplemental Filing, state as follows:

1. Preventative Maintenance Plan is in draft form, and included in the District's Operation and Maintenance Manual attached hereto.
2. Capital Improvements Plan has been previously submitted (Exhibit 7 to District's Response to Information Requested in Appendix H of Public Service Commission's Order). All improvements are awaiting funding.
3. Honey Branch contract has been renegotiated. A contract prepared by Prestonsburg is attached. The signed copy from Prestonsburg has not yet been received.
4. System mapping is ongoing. Geo Sync has installed the software and training will soon begin.

BRIAN CUMBO
COUNSEL FOR MARTIN COUNTY
WATER DISTRICT
P.O. BOX 1844
INEZ, KY 41224
TELEPHONE: (606) 298-0428
TELECOPIER: (606) 298-0316
EMAIL: cumbolaw@cumbolaw.com

CERTIFICATE OF SERVICE

This will certify that a true and correct copy of the foregoing was mailed, overnight mail, postage paid, on this the 13 day of February, 2017, to the following:

Public Service Commission
ATTN: David Spenard
P.O. Box 615
Frankfort, KY 40602

BRIAN CUMBO

Martin County Water District

Water Treatment Plant
and
Distribution System

Operation & Maintenance
Manual

387 East Main St., Suite 140
Inez, KY 41224
Telephone: 606-298-3885
Fax: 606-298-4913

PWSID#: KY0800273
A.I.#: 2987

TABLE OF CONTENTS

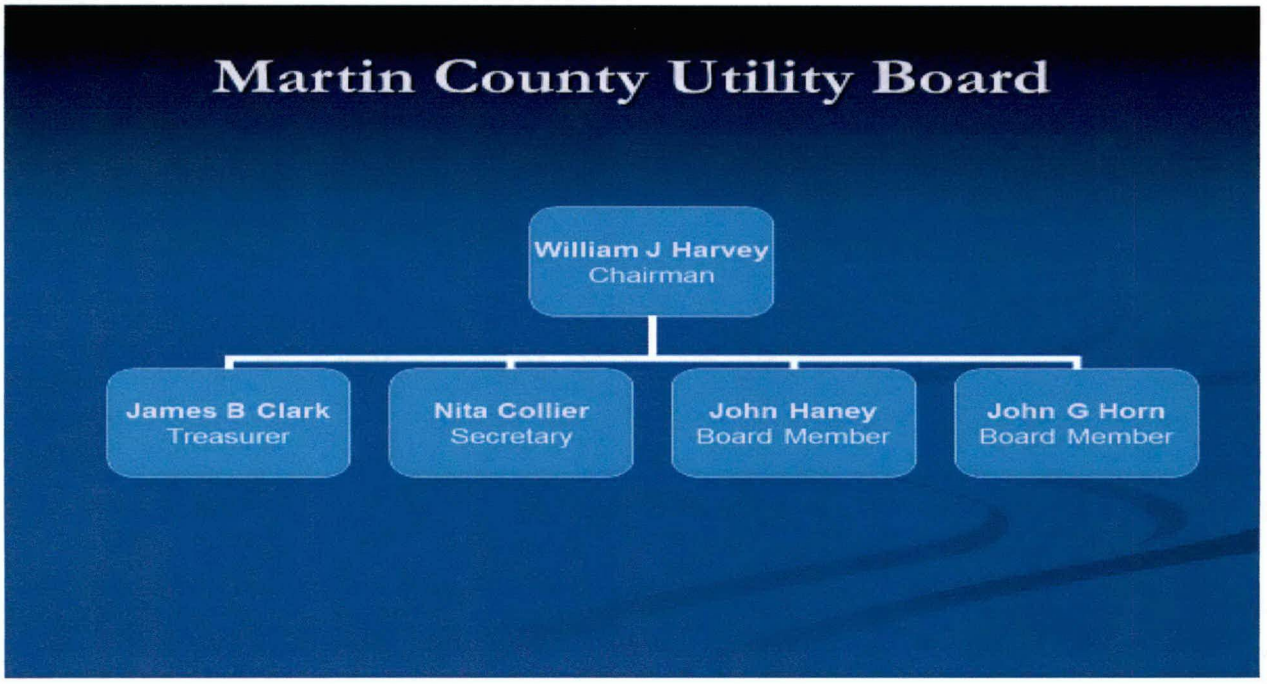
INTRODUCTION

In compliance with Kentucky Administration Regulation 401 KAR 8:020, Section 2 (13), this Operation and Maintenance Manual has been compiled to facilitate efficient operation and maintenance procedures for water treatment and distribution at the Martin County Water District. District. Management will ensure the accessibility of this manual to all employees and it will be made available for review by all regulatory agencies. All personnel of the Martin County Water District will be encouraged to familiarize themselves with and utilize the practices and procedures set forth within this manual.

ORGANIZATIONAL STRUCTURE

The Martin County Water District was created and organized in 1960s by the Martin County Fiscal Court subject to the provisions of Kentucky Revised Statutes (KRS) Chapters 74 and 65. As a water district, Martin County Water District is also considered a Special District. "A Special District means any agency, authority or political subdivision of the state which exercises less than statewide jurisdiction and which is organized for the purpose of performing governmental or other prescribed functions within limited boundaries. It includes all political subdivisions of the state except a city, a county, or a school district." For most purposes, a water district is considered a political subdivision of the county. A water district is regulated by the Kentucky Division of Water (DOW) and the Kentucky Public Service Commission (PSC).

The Martin County Water District serves all of Martin County and portions of Lawrence, and Pike counties. The Board of Commissioners of the water district consists of five (5) members appointed by the County Judge/Executive and approved by the Martin County Fiscal Court. The term of each commissioner is four (4) years. A resolution from the Martin County Judge/Executive for appointment should be on file at the water district office.



BOARD RESPONSIBILITIES

The Board of Commissioners (board) is granted all powers as provided under the KRS Chapters 74 and 278, and specifically KRS 74.076, which includes but is not limited to: acquiring, installing and operating a water system for a district and may make contracts with persons, municipalities or other agencies for water supply. The board may also prosecute and defend suits, hire necessary employees and other activities as provided under the Kentucky statutes.

In its role as overseer, it is critical that board members have an overall understanding of the operations of the water district, thoroughly review the background materials provided in advance of the meetings, participate in discussions, and request additional information as needed. Board members must use the expertise of each other and of their General Manager in determining the appropriate actions for the water district. Commissioners should be knowledgeable of laws and regulations pertinent to the water district. Commissioners should be loyal to the water district. Commissioners should, to the best of their ability, aid the water district in accomplishing its mission; operate morally, ethically, and within applicable laws and regulations. Commissioners should never knowingly participate in any illegal act or deception, should cooperate fully with proper investigations, and report any wrongdoing to the board.

GENERAL MANAGER AND BUSINESS MANAGER RESPONSIBILITIES

It is the responsibility of the managers to utilize the available resources in a timely manner to accommodate growth of the water utility while operating and managing the system efficiently. Management is the bridge between finance and operations whose duties include directing, administering and coordinating all operational, engineering, maintenance, construction, of financial activities of the water utility's operation within the scope delegated by the governing board. These positions has responsibility to bridge administration and field operations to achieve short and long-term system objectives in accordance with local policy and direction, sound engineering principles, safety consciousness, and federal, state, and local regulatory requirements. Prepares and administers annual budget. Reviews and approves expenditures and revenues. Develops, facilitates and evaluates annual capital improvement process. Directs development of capital improvement plans. Recommends capital improvement projects and is responsible for keeping project on time and costs within the budgeted amounts.

STAFFING AND JOB DESCRIPTIONS

General Manager

The purpose of this position is to plan, organize, direct and supervise water treatment, storage, distribution and maintenance. Also includes for interdepartmental coordination for short and long-range planning of new construction, as well as infrastructure management and replacement efforts. The work is performed under the direction of the Board.

Qualifications

1. Ability to exercise the judgment, decisiveness and creativity required in situations involving the direction, control and planning of utility operations.
2. Ability to communicate orally and in writing with public officials, contractors, personnel, county and state/federal agency personnel, attorneys, consulting engineers and the general public.
3. Ability to utilize a variety of advisory and design data and information such as billing invoices, monthly financial reports, budgets, equipment specifications, bids, contracts, construction/maintenance schedules, blueprints, site plans, equipment maintenance, records, accident reports, personnel policies, employee records, worker safety regulations, Uniform Traffic Control Manual, technical operating manuals, statutes, ordinances, procedures, guidelines and non-routine correspondence.
4. Ability to utilize a variety of advisory data and information such as meter reading records, billing statements, lab reports, job applications, production reports and graphs, personnel records, performance appraisals, annual reports, technical operating manuals, blueprints, professional books and manuals, research reports, procedures, and guidelines.
5. Ability to read, interpret, apply and explain codes, rules, regulations, policies and procedures.

Job Description

1. Plans, organizes, directs, coordinates, evaluates the operations, and other projects as directed. Coordinates to ensure that all construction activities address the needs, plans, and design standards of various affected departments. Drafts RFP's and functions as the manager for public works projects.
2. Analyzes and evaluates operating and maintenance procedures and develops new or improved practices.
3. Participates in maintenance or operating records, compilation of data, and report preparation.
4. Inspects water system facilities, assists in planning special maintenance work as well as minor alterations.
5. Responding to customer troubleshooting calls.
6. Represents the utility at various county and state/federal agency functions regarding public works matters.
7. Advises district commissioners regarding department activities and on technical matters. Prepares and gives reports and presentations.

Basic Qualifications

1. Bachelor degree in Applied Science with five years operations experience, two to three years progressively responsible supervisory, administrative, budgeting and

construction experience; or any combination of education and experience that provides equivalent knowledge, skills, and abilities.

2. Must possess an intermediate knowledge and use of Word, Excel and PowerPoint. have experience in distribution system operations and/or maintenance.
3. Holds valid driver's license.
4. Of sound mind to deal with irate individuals, intimidation and deadline pressures.

Business Manager:

DUTIES AND OBLIGATIONS OF THE EMPLOYEE - The employee is hired as the Business Manager of the Martin County Water District and the Martin County Sanitation District to perform the following services described but not limited to:

1. Evaluate operations and activities of assigned responsibilities.

2. Administer the coordination and training of staff to ensure safe and efficient performance; work with employees to correct deficiencies; implement discipline procedures.

3. Review and evaluate water and sanitation reports, records, logs, and graphs.

4. Prepare budget estimate based on anticipated material and personnel needs. • May prepare reports concerned with chemical and bacteriological analyses of water for administrative purposes and governmental agencies.

5. Respond timely and effectively to public inquiries.

6. Report all operation activities to the Martin County Utility Board on a monthly basis: respond to board promptly in emergency situations.

7. Recommend and assist in the implementation of the district's goals and objectives; establish schedules and methods for facilities operations; implement operational policies and procedures.

8. Serve as liaison between the sanitation and water districts and various Federal and State agencies, including the Kentucky Public Service Commission and Kentucky Division of Water.

These duties are to be performed in a professional manner, within the acceptable time frames in use industry wide, up to the standards set by the Board and as called for in the written task description. The employee is devoting his full time to his duties. The employee is not to "moonlight" for any other utility board in the area.

WATER TREATMENT OPERATOR

The water treatment operator is vital to the health of the community by ensuring that potable water is delivered to the distribution system. As a certified professional, this individual is responsible for the operation and maintenance of all treatment plant infrastructure and processes the knowledge needed to treat drinking water in compliance with state and federal laws.

Operator Qualifications

1. Must possess valid KY Drinking Water Treatment Operator license at or above the plant designation.
2. Must possess a valid driver's license
3. Must be thoroughly knowledgeable of operation and maintenance requirements
4. Must be thoroughly knowledgeable of applicable state and federal regulations.
5. Must be willing to participate in a weekend shift work and emergency "on call" issues.
6. Must be physically able to perform maintenance and plant operations.

Job Description

1. Operate water treatment plant in an efficient manner while meeting compliance with all state and federal regulations
2. Perform water quality process control and compliance monitoring.
3. Maintain all required records and conduct routine reporting
4. Maintain chemical and materials inventory.
5. Routine inspection of chemical feed systems, valves and other appurtances relative to safe and proper production of potable water
6. Perform preventative maintenance program tasks and house-keeping.
7. Attend training to maintain license that are required.
8. Perform duties according to company safety policy and attend all safety meetings
9. Maintain a professional attitude when communicating or interacting with other employees, individuals from other organizations and customers.
10. Maintain personal hygiene
11. Performs other related functions as assigned.

DISTRIBUTION OPERATOR

The water distribution operator is vital to the health of the community by ensuring the delivery of safe drinking water at every tap. As a certified professional, this individual is responsible for the operation and maintenance of all distribution infrastructure and processes the knowledge needed to distribute drinking water in compliance with state and federal laws.

Operator Qualifications

1. Must possess valid KY Drinking Water Distribution Operator license at or above the system designation.

2. Must possess a valid driver's license

3. Must be thoroughly knowledgeable of operation and maintenance requirements

4. Must be thoroughly knowledgeable of applicable state and federal regulations.

5. Must be willing to participate in a weekend shift work and emergency "on call" issues.

6. Must be physically able to perform maintenance and distribution operations.

Job Description

1. Operate distribution system in an efficient manner while meeting compliance with all state and federal regulations
2. Perform water quality assessment and compliance monitoring.
3. Maintain all required records and conduct routine reporting
4. Maintain material and parts inventory.
5. Perform leak detection, flushing, valve exercise and other programs needed to maintain a safe water supply.
6. Perform service installations, water line repairs and construction.
7. Perform preventative maintenance program tasks and house-keeping.
8. Attend training to maintain operator certification.
9. Perform duties according to company safety policy and attend all safety meetings
10. Maintain a professional attitude when communicating or interacting with other employees, individuals from other organizations and customers.
11. Maintain personal hygiene
12. Perform other related functions as assigned.

SAFETY PROCEDURES

This Health and Safety Rulebook is presented for the use of all employees of this utility to assist in the administration of our safety program and to provide means and methods that will aid in the performance of our various assignments in a safe and efficient manner.

It is the intent of the utility to conduct its operations in a safe and efficient manner with the utmost regard for the health and safety of the employees and the public. Safety is an integral part of everyone's duties and responsibilities.

This Health and Safety Rulebook expresses the basic safety policies of this utility. Each employee is expected to ensure proper application of its contents.

RESPONSIBILITY

Management

The employer shall have the same responsibility for safety as for any other part of the operation.

The employer shall appoint only competent personnel as supervisors, who shall be responsible for the safety of those under his or her supervision.

The employer shall require a supervisor to observe and enforce all safety rules.

The employer shall provide adequate automotive equipment, tools, and protective devices, and insist upon their proper use and maintenance.

The employer, or designated representative, shall fully investigate all serious accidents and take remedial steps to prevent repetition of similar accidents wherever possible.

The employer shall be responsible for safety records and shall be responsible for completing safety inspections and maintaining records to reflect findings and corrective actions taken.

The employer shall require employees to use suitable tools and equipment in order that they may perform their work in a safe manner.

The employer shall require employees to be instructed in safe methods of performing their work.

The employer shall require employees who, in the course of their work, are subject to the hazards of electrical shock, asphyxiation, or drowning, to be instructed in accepted methods of artificial respiration.

Supervisor

Supervisors shall have the same responsibility for safety as any other part of their utility operations.

Supervisors are at all times responsible for the execution of the work in a safe manner and for the job performance of all personnel under their direction.

Supervisors will be held accountable for all accidents and employee actions unless investigation indicates the actions were due to conditions beyond the supervisor's control.

Supervisors shall instruct all new employees on the reporting of all accidents and the prompt receipt of first aid.

Supervisors shall be responsible for the training and instruction of new employees and of employees transferred to their supervision.

Supervisors shall fully understand and comply with the safety rules of this manual. They shall also ensure that safety rules are understood by the wastewater operators under their supervision.

Supervisors shall insist on employees observing these safety rules and shall use disciplinary measures, if necessary, to obtain compliance.

Supervisors shall be responsible for the proper use of safety devices and equipment by the employees under their supervision.

Supervisors shall be responsible for the regular inspection of all tools and equipment, including employees personal tools used while working under their supervision.

Supervisors shall ensure no duties are assigned to an individual who is unqualified or incapable of completing those duties safely.

Before leaving a job, the supervisor shall see that the site is left in as safe a condition as possible. The supervisor shall arrange adequate warning of any condition that might endanger other employees, the general public, or inspectors.

Employee

It is the definite responsibility of each employee to so perform assigned duties while at work to assure:

- Safety for self;
- Safety for fellow employees;

- Protection for the public;
- Protection for company property, and for public and private property.

It is the responsibility of each employee to report to the person in charge all unsafe conditions or acts witnessed on the job.

When an employee is requested to perform duties under unsafe conditions, the employee should not perform those duties without first notifying the person in charge of the unsafe conditions.

It is the responsibility of management to verify that each employee is acquainted with the principles of first aid and resuscitation as soon as possible.

It is the responsibility of each employee to attend all safety meetings possible and to take an active part in safety work.

It is the responsibility of each employee to know and understand the safety rules of this manual, which will apply to the work being performed.

GENERAL SAFETY MEASURES

This document provides all staff with background information in the safety procedures that pertain to their type of work. A complete discussion of safety can be found in Safety Practices For Water Utilities, AWWA Manual M3. Safety is a priority for all staff of the utility. Obviously, no listing can cover all situations that may arise on a job. The following is a list of general safety rules which should be followed by all staff members:

1. Obey all safety rules and signs.
2. Follow instructions. If you are not sure of the safety procedure, don't guess get qualified assistance.
3. Correct unsafe conditions immediately.
4. Dress in clothing appropriate for the job.
5. Consult a physician for all injuries.
6. Never start or operate a machine, equipment or vehicle unless you know the safe method of operation and how to stop its operation.

7. Be certain equipment is completely stopped or locked out before making adjustments and repairs.

8. Order and cleanliness are important factors in preventing injuries. Keep work areas clean and orderly.

9. When lifting or pulling, do not subject yourself to strain.

10. After work and before eating, hands should be washed thoroughly with soap and water.

11. Wear appropriate eye protection when using impact tools, when cutting, welding, or soldering, when working with chemicals or when working in environments where there are flying or floating particles.

12. Use tools made of non-sparking material where there is a potential fire hazard.

13. When using electrically powered tools, insulating platforms, rubber mats and rubber gloves should be used to avoid possible shocks.

Location of Safety Manual

This safety manual has been prepared for use by the operating personnel of the company. Each employee shall be given a copy of this manual.

This manual is consistently updated to cover areas relating to the safe operation of water and wastewater infrastructure. A current copy may be obtained by contacting a supervisor or the Human Resources Dept.

Any comments or suggestions on improving this manual or updating information pertaining to the safe operation of equipment is welcome and may be incorporated into future editions.

Safety Meetings

Safety meetings shall be held on a weekly basis on the first Monday of the week. The company shall provide a program suitable for the season and discuss any current regulations or changes that may have occurred since the last meeting.

All personnel shall be required to take an active part in the safety program. Personnel should offer input and dissipate information regarding the safe operation of municipal sewage systems.

Personal Conduct While On Company Business

The use of intoxicating liquor during working hours, including lunch hour, is strictly prohibited. Any violation shall be considered sufficient cause for disciplinary action.

Any employee reporting for duty under the influence of liquor, illegal drugs, or illegal smoking materials shall be dismissed. Any supervisor or other person in charge who permits such employee to work shall also be subject to disciplinary action.

Risk Taking

Before commencing any work that may be hazardous, care should be taken to establish a safe procedure. Where more than one employee is engaged in the same job, all employees shall be concerned and understand the procedures to be followed to prevent endangerment to self or other personnel on the job. Under no circumstances shall safety be sacrificed for speed.

Employees shall always place themselves in a safe and secure position. The care exercised by others shall not be relied upon for one's own protection.

Safety Guards

No guard shall be removed from any machine or piece of equipment except to perform required maintenance. The machine or equipment shall be locked-out so that it cannot be energized during maintenance.

Protecting the Public

When an employee needs additional light while working on the premises of a customer, he shall use a battery powered flashlight, or an approved properly guarded electrical extension light. An open flame light such as a match, torch, or cigarette lighter shall not be used.

When operating temporary pumping equipment in a public location, barricades shall be used to keep all traffic and personnel a safe distance away from the site.

Housekeeping

Materials and supplies used at treatment plant, tank and pumping station sites should be stored in a neat and orderly manner at the site to prevent them from falling off of shelves onto moving equipment.

Junk parts removed from a piece of equipment should be disposed of in a proper manner. Spare parts used in the operation of the system should be kept in a neat and orderly manner with the item labeled to indicate on what piece of equipment the spare part is used.

Reporting Hazardous Conditions

When an employee observes a hazardous condition that may cause injury or property damage, the employee shall report it promptly to a proper authority and when necessary, guard it.

An employee who receives a report of a hazardous condition, either from the general public or another employee shall immediately refer this information to the person or utility responsible for such matters.

Fire Prevention and Control

Paper and other combustible materials shall not be allowed to accumulate in blower buildings or other structures in order to prevent them from getting into the machinery or causing a fire.

Flammable liquids such as gasoline and diesel fuel shall not be stored in blower buildings, chlorine rooms, or other structures where they may cause a fire or leak onto the floor causing hazardous working conditions.

Strict adherence shall be paid to "No Smoking" and "Stop Your Motor" signs at fuel dispensing stations.

Oily rags and papers used for cleaning shall not be allowed to accumulate in service trucks and car trunks, as these can spontaneously combust under the proper conditions.

SAFE WORKING PRACTICES

Clothing

Wearing of loose fitting clothing around machinery with moving parts or belt drives is discouraged, as clothing may become entangled in equipment resulting in serious injury or death.

Wearing of sandals or open toe shoes in a field environment is discouraged, especially when handling tools or entering areas where weeds and debris can hide glass or sharp objects. In all cases rubber boots or leather shoes shall be worn in areas where contact is possible with biological organisms found in wastewater treatment plants.

Personal Eye Protection

Eyeglasses, even hardened lenses, are not a substitute for goggles. Full cover goggles or face shields shall be worn when an employee is engaged in or is close to work involving:

1. Power grinding, buffing, or wire brushing, even if there is a built in eye shield.

2. Using compressed air to remove dust or debris from a piece of equipment.

3. Flame welding, cutting, or burning. (Approved colored lenses shall be used.).

4. Handling of acids, caustics, dry chlorine, ammonia, or other similar liquids, except when approved complete head covering is worn.

Lifting

Consider the size and weight of any object before attempting to lift or move the object. Do not lift any materials that cannot be handled comfortably. Always utilize the proper material handling equipment. If necessary, obtain assistance or wait until assistance is available.

1. Exercise extreme care in lifting oily or greasy parts. Use proper containers or straps to remove these objects.

2. Never carry a load that prevents you from seeing in front of you.

3. Never carry an object over a slick or iced surface.

4. When carrying objects near aeration or settling tanks extra care should be taken to avoid falling in the tanks or dropping objects into the tanks.

Mechanical Equipment Hazards

1. Prior to starting any machine, be sure to know how to stop it.

2. Prior to starting any machine, make a visual inspection to be certain all personnel are clear of the equipment.

3. Be certain the equipment is completely stopped and locked out prior to making adjustments or repairs. Test the lock-out by trying to start the equipment.

4. Do not wear long sleeves, neck ties, or jewelry while operating mechanical equipment.

Electrical and Fire Hazards

Open flames, lighted matches and burning tobacco products in or around underground structures rule dangerous and should be avoided. Maintain access to ABC fire extinguishers which can be used for oil, gas, petroleum product and electrical fires.

1. Fire extinguishers should be inspected on a semi-annual basis and recharged promptly after their use.

2. Firefighting equipment should be easily accessible.

3. Only approved gas cans with a pressurized safety cap should be used for transporting or storing fuel. Gas cans should be red and have the word "GASOLINE" printed on them.

4. Oily rags should be placed in metal safety containers with lids. Do not store rags in the open.

5. Change clothes immediately if oil, kerosene or any other flammable liquid has soaked into the fabric.

6. Oxygen deficiency and toxic gas detectors should be used to check for the lack of oxygen or the presence of harmful gases.

7. Underground structures and other confined spaces should be adequately ventilated before entry. The "buddy system" should always be used when entering confined spaces.

8. Respiratory equipment and safety belts should be used when working in potentially explosive or fire hazard situations.

Bacterial Infections

All operations staff should have routine tetanus and typhoid inoculations. Anyone working with wastewater treatment, collection or repair should be vaccinated against Hepatitis. A schedule for inoculations should be coordinated with a doctor for all staff members.

Make it a habit to thoroughly wash your hands before eating.

No cut or scratch should be considered minor. A 2 percent tincture of iodine or tincture of methiolate should be applied immediately to cuts or scratches.

Safety Equipment

If safe working habits are to be encouraged, utility staff must have access to and use of the proper types of safety equipment. The following list provides the basic safety equipment needed for the staff. The following list should not be construed as a complete list since each site may require unique equipment.

1. Hard hats reduce serious injuries or deaths due to head injuries. Hard hats should be worn whenever working in a trench or when the possibility of falling objects is present.

2. Ear protection is necessary when individuals are subjected to certain noise levels over various durations. Safety glasses/goggles are necessary when there is a possibility of eye injury.

3. Boots that are steel-toed safety boots should be worn to prevent injury to feet.

4. Rubber gloves should be worn when handling acids, alkalines, oils, solvents and other chemicals.

5. Safety harness, with at least 50 feet of nylon rope, is necessary for safely entering underground structures or other confined spaces.

6. Respiratory equipment is necessary for protection against noxious gases and oxygen deficient environments. Oxygen and toxic gas detection equipment is necessary to forewarn work crews of the danger of confined spaces.

7. Portable air blower is necessary to ventilate underground structures.

8. Fire extinguishers are necessary for fire control. ABC type recommended.

9. First Aid kit, the industrial purpose type, should be readily available at all work sites.

Proper Use and Care of Equipment

1. Employees shall use tools suitable for the job in progress and only those in good repair.

2. Employees shall avoid awkward positions when using tools to avoid possible injuries should the tools slip.

3. When using wrenches always pull the wrench toward you, protecting hands and knuckles in case the wrench slips.

4. Keep volt and amp meters in good working condition. You are dependent upon these instruments to tell you if a circuit is energized.

PROPER PROCEDURES

Entering Confined Spaces

Confined spaces including tanks, vaults, wet wells, trenches, manholes, dry wells, or any space that is below ground level or has inadequate ventilation, has the potential for containing deadly gasses or contain material with the potential to engulf someone. The most common gasses encountered in the water – wastewater industry include: carbon monoxide, hydrogen sulfide, chlorine, sulfur dioxide and methane. Consult OSHA circular 3138-01R for additional confined space information.

1. Prior to entering any confined space, an instrument check of the space should be completed to determine the presence of toxic gases.

2. All confined spaces must have an operating ventilation fan. If a fan is not present and operating, personnel should not enter the confined space without an air pack or proper retrieval equipment.

3. Portable ventilation equipment should be readily available for use in case of failure of the normal ventilation equipment.

4. Under no circumstances should personnel enter a confined space without proper equipment or rescue personnel standing by.

Operation of Water & Wastewater Plants

1. Extreme caution should always be used near basins, clarifiers, filters, lagoons, pump stations, aeration tanks and sludge collection tanks. Aerated water is turbulent and is very difficult to remain on the surface until reaching a hand hold.

2. Hoses, extension cords, and ropes not in use should not be left where operating personnel might trip over them and possibly fall into a tank.

3. Operating personnel should never assume that a piece of equipment is turned off and will remain turned off. Most equipment at treatment plants operate on timers or sensors may automatically start at any moment, unless locked out of service.

4. Steep stairways, uncovered aeration tanks, and narrow walkways are all potential

accident areas. Guard rails should be in proper repair and secured to their foundations any time operating personnel are performing their duties at a plant.

5. Gratings shall be kept in proper place and in adequate repair.

6. Rusted gratings should be replaced with adequate materials of construction to allow personnel to safely perform their duties.

7. Indoor areas, such as blower rooms, pump rooms, and electrical control rooms, shall have adequate lighting for operating personnel to perform duties in a safe manner.

Handling of Materials and Chemicals

Utility staff is responsible for handling fluoride, alum, lime, phosphates, oxidizers, acids and bases in addition to chlorine. Those chemicals in and of itself are not liable to create major safety hazards, however they should still be treated with care and stored in cool dry areas with MSDS sheets readily available. Read the MSDS sheet if you are unsure about handling a chemical safely.

The most commonly used chemicals in water and wastewater operations are chlorine, ammonia, chlorine dioxide and sulfur dioxide.

Dry or Liquid Chlorine

1. Dry chlorine is available in several forms: granular chlorine (HTH or PACE), tablet chlorine (Sanuril).

2. Liquid is available as sodium hypochlorite (12.5%) or household bleach (5.25%).

3. Chlorine, no matter what type – tablet, powder or liquid-- can be very volatile when mixed with other substances.

4. Dry chlorine should always be handled with a clean container that is used only for handling chlorine powder. It should always be kept in a dry container with the cover sealed to prevent moisture from coming into contact with the chlorine.

5. Dry chlorine should not be stored in an environment with electrical controls. If left open it can cause corrosion on electrical wiring and controls.

Gaseous Chemicals

Operators may be required to handle chlorine, ammonia, chlorine-dioxide and/or sulfur-dioxide gas in 150 lb. cylinders and, therefore, should receive thorough training on handling methods. These chemical gases are relatively stable when properly handled; however, cautions should be taken due to the large volume of gas that can be released in a short period of time. The following are some general safety techniques that should be considered when handling cylinders:

1. A self-contained air supply system is necessary to enter an atmosphere where these gases are present, because they displace oxygen in the atmosphere

1. Keep cylinders stored in a proper enclosure to prevent unauthorized tampering with cylinders.

2. Chain all cylinders to wall to prevent tipping.

3. Open cylinder valve only ¼ turn, or as much as needed, to obtain sufficient gas flow to the feed system.

4. If a valve on a container cannot be opened with the appropriate wrench, the container should be set aside and returned to the supplier.

5. Always plan your escape from the room prior to attempting any service on a chemical feed system.

6. Keep serviceable self-contained breathing apparatus available, outside of the chemical room, in case of emergency.

Herbicides

Herbicides are normally used in water and wastewater operations to control weeds around fences, tank sites, hydrants and to control algae in lagoons.

1. Always mix herbicides in a clean disposable container.

2. Use of gloves and appropriate eye protection is recommended.

3. Apply herbicides in proper dosages using the recommended application procedures - algaecides for lagoons and weed killers for ground application.

4. Wash hands and clothing thoroughly after each application.

5. Clean and dispose of unused portions and packaging materials properly.

6. Empty containers shall be disposed of in a safe manner. They shall never be thrown into lagoons or storage tanks.

Excavations

Common hazards to which utility staff is exposed in the construction or repair of water & sewer lines include head injuries and trench cave-ins. Head injuries may occur when pipe or other materials are being lifted for installation, removal or storage. Hard hats should be worn by all personnel when working in the vicinity of a backhoe or when materials are being lifted.

When excavations are necessary for the repair of water lines, the following general guidelines should be observed:

1. Excavations in unstable soils require shoring and bracing.

2. Excavations in stable soil conditions should be limited to 4 feet in depth.

3. Where excavations require depths of greater than 4 feet, the trench should be shored, sheeted, braced, sloped, or otherwise supported to provide protection of the staff.

Traffic Control

Utility activities within the roadway right-of-way require attention to traffic control. The purpose for traffic control is to insure worker safety and to insure the safety of the public. This is accomplished by providing for the orderly and predictable movement of traffic, both motorized and pedestrian, through the work zone.

Traffic control devices (e.g., cones, signs, temporary signals and flagmen) are used to direct and assist vehicle operators and pedestrians in safely navigating through the work zone. The Manual on Uniform Traffic Control Devices provides basic principles for traffic control in construction or work zone areas and can be used as a guide by employees. The Kentucky Transportation Center of the University of Kentucky, Guidelines for Traffic Control in Work Zone, prepared by the Kentucky Transportation Center of the University of Kentucky, is a pocket-size, traffic control reference and is available to utility personnel.

ACCIDENT REPORTING

In Case of Traffic Accident

1. Stop at once to determine if anyone was injured, the nature and extent of the injury, contact local dispatch and administer first aid and all reasonable assistance.

2. Obtain the names and addresses of all witnesses before they leave the scene of the accident.

3. Obtain the name and address of each driver involved, and the names and addresses of all passengers riding with such driver.

4. Secure all available data on each vehicle involved, including make, model, type, year, state, and license number.

5. Secure all available data from the operator, or driver's license of the driver of each vehicle involved.

6. Note the time and place of the accident.

7. Carefully list damage to each vehicle involved.

8. Secure the name and badge number of any police officials who appear.

9. If a parked vehicle is involved in an accident and the owner cannot be located, a notice should be left on or in the vehicle providing the name and address of the parties involved. Within 24 hours, the police, sheriff, or highway patrol should be notified of the accident.

10. Comply with other reports as required by state and local ordinance.

11. Avoid discussing the accident and make no admissions of responsibility to anyone except authorized representatives. Necessary data given to a law enforcement officer should be given in private. Never obligate your employer for damages or medical expenses for non-employees.

12. Report the accident to the main office location along with the above information.

In Case of Public Accident

1. All accidents resulting in injury or death of a member of the public and in which the company may be involved shall be reported to the main office immediately.

2. In the event of damage to the property of a member of the public, such damage shall be reported to the main office immediately.

3. No employee shall make statements concerning liability or indicating that settlement will be made in any accident resulting in injury or property damage to a member of the public.

4. It is important that the names and addresses of all witnesses be obtained in all accidents involving the public.

SAMPLING PROCEDURES

In general, the water system is responsible for the following tasks in terms of monitoring:

- Performing field tests (if applicable),
- Properly collecting all necessary samples in compliance with state and federal regulations,
- Completing Chain of Custody paperwork,
- Submitting samples to certified or accredited laboratories within allowed holding times,
- Collecting samples for confirmation (if necessary) and
- Providing payment for analyses,
- Keeping records of sampling results.

Although the water system may designate another party such as the contract laboratory technician to collect and submit samples, it is ultimately the responsibility of the system owner to make sure the samples are taken properly and the results are submitted to the Division of Water.

If samples are incorrectly taken or preserved, analyzed by uncertified or unaccredited laboratories, submitted beyond appropriate holding times, submitted with incomplete or inappropriate paperwork, or taken from inappropriate sampling sites, then the samples will be deemed unacceptable and rejected. Failure to submit valid test results to the state program within the required compliance period (because samples have been rejected by the laboratory and not analyzed) may result in a monitoring violation.

General Sampling Requirements

Before collecting any samples, all samplers should receive thorough training in proper sampling protocol. This training should include segments on proper procedures for storage and filling of sample containers, handling of preservatives, safety protocols, cleaning of sampling and field equipment, disposal of excess preservatives, and packaging and shipping requirements.

Measuring devices, such as pH, conductivity and chlorine meters, used for field monitoring must be maintained and calibrated daily following the EPA-approved analytical methods and the manufacturers' instructions. The calibration standards used must be within their expiration dates and free of suspended matter. Probes must be washed with deionized water after each use and stored according to instructions. Other equipment items used to collect samples also must be rinsed with deionized water and kept clean between sampling events to prevent contamination of the samples.

Appropriate sample containers must be used. Generally, your laboratory will provide sample containers that have been specially prepared, depending on the end use (e.g., bacteria bottles are sterilized, metals containers are acid washed, glass vials used for VOCs are washed and oven-dried, and bottles used for SOCs are washed and triple-rinsed with organic solvents). These containers should not be opened until the actual sampling event. Sampling containers that have

been compromised in any way, e.g., by being touched on the threads or the interior surfaces, must not be used.

Laboratory Requirements

Only laboratories certified (accredited) by their resident state's laboratory certification (accreditation) program or state/federal laboratories certified (accredited) by EPA are allowed to perform compliance testing for microbiology, inorganic, organic, and radiochemistry parameters. Prospective clients should make sure that the laboratory, which will analyze their samples, is certified (accredited) for the specific parameters involved. Turbidity, chlorine residual, and pH monitoring are some of the exceptions to the laboratory certification (accreditation) requirements for performing analyses. These tests can be performed by any person acceptable to the state.

State principal laboratories or laboratories certified (accredited) by the state should supply containers, preservatives, and any trip blanks (field reagent blanks) for sampling. The containers, blanks, and preservatives used must be free of contaminants at the detection levels of each parameter of interest.

Number and Frequency of Drinking Water Samples

The number of drinking water samples to be collected is determined by the federal agencies and state drinking water programs. Other considerations when establishing a sampling schedule include: contract laboratory location, staffing, routing, and workload. Regulations require a minimum number of samples for each parameter but additional samples may be considered to help meet compliance values.

Sampling Locations

The location for sample collection depends on:

- The water source,
- The analyses to be performed,
- The purpose for the testing and
- Regulatory requirements.

Samples may be collected from the source prior to treatment, at the point of entry (before or after treatment), at the point of use (at the tap), or within the distribution system. For example, volatile organic compound (VOC) samples are usually taken at the entry point of the distribution system. (Total trihalomethane samples are taken at points within the system as determined by the Stage 2 Disinfectants and Disinfectant Byproducts Rule.) Lead and copper samples are taken at the point of use.

Paperwork Submitted with Samples

Appropriate paperwork must accompany all samples to the laboratory. Each state requires specific information to identify the sample, the sampling time, and the sampling location. Forms for providing this information can be obtained from your state program. As a reminder, the submittal of any paperwork that is incomplete or inaccurate will result in the rejection of the sample by either the laboratory or the state program.

Analytical Methods

When samples are submitted to certified laboratories for analysis, the water system must notify the lab that the samples are for drinking water compliance purposes to ensure that appropriate methods are used and that the data are transmitted to the state drinking water program. (Only EPA-approved methods of analysis can be used.)

Quality Control Measures

Field duplicates. It is important for samplers to demonstrate proper sampling techniques by taking field duplicate samples on a regular basis. Field duplicates are two samples taken immediately one after the other from the same source in separate sample containers. Both will be analyzed by the laboratory, which will calculate the Relative Percent Difference between the results. This is a measure of the overall precision of analysis. Field duplicates should be collected for least 10% of all samples and more often when only small batches of samples are taken per sampling event.

Extra volumes for lab QC measures. Laboratories routinely perform quality control procedures, such as the analysis of spiked samples and the analysis of laboratory duplicates, which require extra volumes of samples. For this reason samplers are encouraged to take extra sample volumes for at least 10% of their sampling activities so that the laboratories can perform these vital QC procedures. (These extra volumes should be provided in addition to the field duplicates mentioned in the previous paragraph.)

Sampling and Safety Tips to Help Meet Requirements

Faucet aerators and screens should be removed before taking samples (except when taking lead and copper samples). Anything attached to the end of the faucet, e.g., hoses or filters, should be removed before taking samples.

Ice is not a packing material. Glass sample bottles should be wrapped in bubble wrap or other protective material to prevent breakage during shipping.

Chemical fumes from any source can potentially contaminate samples. Whenever sampling, the sampler should be conscious of his/her surroundings. For example, samples should not be taken

near motor exhaust from any pump or vehicle because it will contaminate them. In addition, if sampling for volatile organic compounds (VOCs), it is not advisable to refuel vehicles either on the way to the site or while the samples are being transported to the lab. Smoking and smoking areas should be avoided because tobacco smoke contains VOCs that can be absorbed by water. Other things to avoid include hairspray/mousse, cologne/perfume, or breath spray/mouthwash for the same reason as tobacco smoke.

Sample containers will be contaminated if the inside of the cap is touched or if the septum of a radon or VOC vial is reversed. If this should occur, the container must not be used. All containers must be kept closed until ready for use.
It is highly recommended that safety eye protection and gloves be worn while collecting samples. Such protective devices are readily available. Many of the chemicals used to preserve samples are highly acidic or caustic. They can cause severe burns to eyes, skin, and clothing if they are splashed or spilled. Sometimes these chemicals are added to the samples in the field. However, they may already be in the empty containers when they are obtained from the container provider.

The gloves of choice should be phthalate-free made of nitrile. Nitrile gloves provide the best overall protection from most chemicals while still allowing dexterity. Many other types of gloves, including some latex gloves, contain phthalates, which can contaminate samples for synthetic organic compounds (SOCs). Only phthalate-free gloves should be worn when collecting samples for SOCs. If such gloves are not available, the sampler must remove all gloves and wash his/her hands before collecting the samples (without gloves).

The sampling point(s) of each water system should be evaluated to determine the actual flushing time needed to remove the stagnant water before samples are taken. This is determined by measuring the temperature with a thermometer. Samples should not be taken until the temperature has stabilized.

A ballpoint pen or waterproof marker should be used when writing on sample tags to reduce bleeding of ink. If icing is required, samples should be placed on ice immediately after collection. When the weather is very warm, it may be advisable to pre-chill the samples in a refrigerator prior to packing on ice, this avoids depleting the ice to drop the temperature so it lasts longer. Placing filled sample containers in zip lock plastic bags prior to icing helps with sample organization, avoids wet sample tags, and results in less confusion when the samples reach the laboratory.

Well pits, ditches, and below-ground pumping stations, pipe raceways and vault systems are extremely dangerous sources from which to collect samples. Before entering confined spaces of any type, samplers must comply with the requirements of 29 CFR 1910.146, Permit Required Confined Space. Specially trained samplers and backup teams are required.

In general, preserved water samples are known environmental samples and are typically exempt from DOT and IATA (aircraft) shipping requirements. However, these regulations must be observed when shipping the preservatives or pre-preserved bottles via ground or air.

Sample containers that have preservatives in them should be labeled accordingly. The specific chemicals should be identified. This applies to empty containers to which preservatives are added before use as well as containers filled with sample. Additional containers are required when sample aliquots are collected for Matrix Spike and Duplicates.

MICROBIOLOGY (Bac-T) - SOP

READ INSTRUCTIONS CAREFULLY. LAB MAY REJECT SAMPLES IF ALL INSTRUCTIONS ARE NOT FOLLOWED. CONFIRM SCHEDULING AND INSTRUCTIONS WITH LAB BEFORE SAMPLING. WASH HANDS, WEAR SAFETY GLASSES, AND CLEAN NITRILE GLOVES.

1. **Applicable Parameters:** Total Coliforms, Fecal Coliforms, Escherichia coli, Enterococci, Heterotrophic Bacteria (HPC), Male-Specific and Somatic Coliphage (See 40 CFR Part 141 for the most up to date list of approved methods.)

2. **Sample Location:** A state-approved location. If one has not been designated, select an appropriate location that is representative of the distribution system. Avoid threaded faucets.

3. **Sampling materials:**
   (a) Containers: Sterile glass or plastic bottles with a minimum capacity of 125mL.
   (b) Preservative: Sodium thiosulfate in powder or tablet; ice
   (c) Other: Labels, marker, safety glasses, and clean disposable nitrile gloves.

4. **Safety Concerns:**
   (a) Before collecting samples, all samplers must receive thorough training in proper handling of chemical preservatives and safety protocols so they are aware of the associated dangers and to determine appropriate safety precautions and first aid, should it be necessary.
   (b) Sample bottles that have preservatives in them should be labeled accordingly. The specific chemicals should be identified.

5. **General Sample Collection Procedure:**
   All microbiological parameters:
   (a) Complete sample tag and sample collection form, using waterproof ink. Proper identification, including the date and time of collection must be submitted.
   (b) Avoid undesirable faucets such as swivel-type, or with leaky packing, on janitorial sinks, or near ground level. Remove aerator, screen, and all attachments from the faucet.
   (c) If necessary, a lint free cloth dampened with bleach and water may be used to clean the faucet rim.
   (d) Turn on cold water tap and run for 4 to 5 minutes or until the water temperature has stabilized, whichever is longer. Then reduce flow so that stream of water is no greater than 1/8 inch in diameter.
   (e) Remove container cap. Do not put cap face down or in pocket. Do not allow inside of cap, inside of container or bottle threads to be touched by any object.

(f) **DO NOT** rinse the bottle or remove any liquid or tablets in the bottom of the container. This may be the preservative.
(g) Fill container, ensuring that at least 100mL of sample are collected. Many bottles have a fill line. Leave an airspace above the fill line. Do not let water drip from hand into the bottle.
(h) Carefully replace cap on container and tighten securely. Replace dust cover if applicable.

6. Shipping and handling:

(a) Complete chain-of-custody form if requested by lab or water supply program.
(b) Keep sample in closed chest.
(c) Samples should be kept between 0º C and 10º C (**do not freeze**).
(d) If using wet ice to maintain temperature, it is best to contain the ice in plastic zipper locking bags so as not to contaminate the sample with the melting ice.
(e) Deliver samples to lab the same day if possible.

Microbiological holding times.

Parameters	Holding Time
Total Coliforms, Fecal Coliforms, Escherichia coli, Enterococci	30 hours
Male-Specific and Somatic Coliphage	48 hours
SWTR Total Coliforms, Fecal Coliforms, HPC	8 hours
Heterotrophic Bacteria (HPC)	8 hours

Water systems must strive to keep their drinking water free of disease causing organisms known as pathogens. Diseases caused by waterborne pathogens that can be found in all water supplies include: typhoid, paratyphoid (types A and B), cholera, dysentery, and hepatitis. The two protozoa that are found only in surface water supplies (*Giardia* and *Cryptosporidium*) form cysts and spores that protect them from cold temperatures. Because of this protection, they are much more difficult to kill with disinfectant chemicals.

Most of these diseases are caused by pathogenic bacteria. The exceptions are Hepatitis, Giardia and Cryptosporidium. Hepatitis is a virus. Giardia and Cryptosporidium are both protozoa. It is very difficult to identify any one particular pathogen by laboratory testing. To make testing more reliable and economical, the lab tests are designed to identify a large family of bacteria that are related to the disease causing bacteria, rather than identifying each type of pathogen.

Coliform bacteria are enteric bacteria. This means that they are found in the intestinal tract of warm-blooded animals, including humans. These bacteria do not cause disease but are necessary for the digestion of food. The waterborne pathogens are also enteric organisms. Some of the bacterial pathogens are part of the coliform family.

If coliform bacteria are present in the water supply, pathogens may also be present. The coliform bacteria live longer in water and are easier to detect by laboratory testing. This is the reason the

coliform group has been chosen as the indicator organism for waterborne pathogens. If coliform bacteria are not present it is assumed there are no pathogens present either.

The coliform family has been divided into two groups. Results may come back as either total coliform positive (TC positive) or fecal coliform positive, or (FC positive or *E. coli* positive.) Total coliform positive means that no human coliform are present. Fecal coliform positive indicates the presence of *E. coli*, which means there is a greater chance of pathogens being present. The laboratory tests for coliform include the MPN method, the Membrane Filter test, the Colilert test, and the presence-absence test.

There are times when water systems need to collect microbiological samples for reasons other than monitoring compliance. New water lines and lines that have been repaired should be tested. Wells that have been disinfected should be tested. These samples must be identified as something other than a routine or compliance sample so they will not count as a violation against the system if they are found to be positive. This is done by checking "Special Sample" on the form.

TRIHALOMETHANES (THMs) and VOLATILE ORGANIC COMPOUNDS (VOCs) - SOP

READ INSTRUCTIONS CAREFULLY. LAB MAY REJECT SAMPLES IF ALL INSTRUCTIONS ARE NOT FOLLOWED. CONFIRM SCHEDULING AND INSTRUCTIONS WITH LAB BEFORE SAMPLING. WASH HANDS, WEAR SAFETY GLASSES, AND CLEAN NITRILE GLOVES.

1. **Applicable Parameters:** Volatile organic compounds, including Trihalomethanes (See 40 CFR Part 141 for the most up to date list of approved methods.)

2. **Sample Location:** A state-approved location. If one has not been designated, select an appropriate location that is representative of the distribution system. Avoid threaded faucets.

3. **Sampling Materials:**
   (a) Containers: Three pre-cleaned 40-mL glass vials with Teflon septa per sampling location.
   (b) Preservatives: 1:1 hydrochloric acid, ascorbic acid, ice or refrigeration. 3 mg sodium thiosulfate for THMs.
   (c) Field reagent blanks: The laboratory must provide a pair of field reagent blanks, to accompany collectors, on each compliance monitoring sampling event. **Do not open trip blanks**.
   (d) Other: Labels, marker, pH test strip paper, and DPD chlorine field test kit (if water has been chlorinated).

4. **Safety Concerns:** Caution! Hydrochloric acid is a strong acid, and will cause burns. Caution! "Empty" sample vials may contain acid. Open them slowly and carefully.

5. **Sample Collection Procedure:** All samples – **Fill three vials** as follows:
   (a) Complete sample tag and sample collection form, using waterproof ink Proper identification, including the date and time of collection must be submitted.
   (b) Remove aerator, screen, and all attachments from the faucet.
   (c) Turn on the cold water tap and run it for 4 to 5 minutes or until water temperature has stabilized, whichever is longer. Then reduce flow so that stream of water is no greater than 1/8 inch in diameter.
   (d) Remove container cap. Do not put cap face down or in pocket. Do not allow inside of cap, inside of bottle or bottle threads to be touched by any object.
   (e) Follow specific instructions provided in sections 6 or 7 to collect the parameters of interest.

6. **Chlorinated Water Supplies**
   (a) Use vials that have 25 mg of powdered ascorbic acid added to vial by the bottle supplier.

(b) Hold vial at an angle. Fill vial carefully until water is above the vial rim. (This will prevent the formation of an air pocket in the vial). Gently tap the vial to dislodge any air bubbles.
(c) Carefully add 2 drops of 1:1 hydrochloric acid to center of the water surface (i.e., to the meniscus). The acid will sink to bottom of vial, displacing 2 drops of sample.
(d) Carefully hook cap over the top of the vial. The **Teflon side of the septum must be down** (facing the sample). (Teflon surface is shiny.)
(e) Screw cap on securely. Check for air bubbles by inverting the vial and gently tapping the vial. If bubbles are present, remove the cap and repeat step (b). If any sample in the vial is spilled, resample with a fresh vial. (Note: **Samples with bubbles cannot be analyzed.**)
(f) Shake sample for one minute.

7. Unchlorinated Water Supplies

(a) Use vials that have 1:1 hydrochloric acid added to the vial by the bottle supplier.
(b) Hold vial at an angle. Fill vial carefully until water is above the vial rim. (This will prevent the formation of an air pocket in the vial). Gently tap the vial to dislodge any air bubbles.
(c) Carefully hook cap over the top of the vial. The **Teflon side of the septum must be down** (facing the sample). (Teflon surface is shiny.)
(d) Screw cap on securely. Check for air bubbles by inverting the vial and gently tapping the vial. If bubbles are present, remove the cap and repeat step (b). If any sample in the vial is spilled, resample with a fresh vial. (Note: **Samples with bubbles cannot be analyzed.**)
(e) Shake sample for one minute.

8. Shipping and Handling:

(a) Complete chain-of-custody form if requested by lab or water supply program.
(b) Keep samples in closed chest at temperatures above 0°C and less than 6°C and away from direct light and solvent vapors.
(c) Deliver the samples to lab the same day, if possible.

The following table lists the maximum holding time for the applicable parameters.

Parameters	Holding Time
Volatile organic compounds, including trihalomethanes	14 days

HALOACETIC ACIDS (HAA5) - SOP

READ INSTRUCTIONS CAREFULLY. LAB MAY REJECT SAMPLES IF ALL INSTRUCTIONS ARE NOT FOLLOWED. CONFIRM SCHEDULING AND INSTRUCTIONS WITH LAB BEFORE SAMPLING. WASH HANDS, WEAR SAFETY GLASSES, AND CLEAN NITRILE GLOVES.

1. **Applicable Parameters:** Haloacetic acids (See 40 CFR Part 141 for the most up to date list of approved methods.)

2. **Sample Location:** A state-approved location. If one has not been designated, select an appropriate location that is representative of the distribution system. Avoid threaded faucets.

3. **Sampling Materials:**
   (a) Containers: For 552.1, one pre-cleaned 250-mL amber glass bottle with Teflon-lined cap. For 552.2, two pre-cleaned 60-mL amber glass septum vials with Teflon septa.
   (b) Preservatives: Granular ammonium chloride added to bottles before shipment to field, ice.
   (c) Other: Labels, marker, safety glasses, and phthalate-free gloves.

4. **Safety Concerns**:
   (a) Caution! "Empty" sample bottles will contain special preservatives. (They should be labeled accordingly.) Open them slowly and carefully.
   (b) Before collecting samples, all samplers must receive thorough training in proper handling of chemical preservatives and safety protocols so they are aware of the associated dangers and to determine appropriate safety precautions and first aid, should it be necessary.

5. **Sample Collection Procedure:**
   (a) Complete sample tag and sample collection form, using waterproof ink. Proper identification, including the date and time of collection must be submitted.
   (b) Remove aerator, screen, and all attachments from the faucet.
   (c) Turn on cold water tap and run for 4 to 5 minutes or until water temperature has stabilized, whichever is longer. Then reduce flow so that stream of water is no greater than 1/8 inch in diameter.
   (d) Remove container cap. Do not put cap face down or in pocket. Do not allow inside of cap, inside of bottle or bottle threads to be touched by any object.
   (e) Hold container at an angle. Fill each bottle or vial carefully until water is actually above the rim. (This will prevent the formation of an air pocket inside the container.) Gently tap the container to dislodge any air bubbles.
   (f) For vials, carefully hook cap over the top of the vial. The Teflon side of the septum must be facing the sample. (Teflon side is smooth and shiny).

(g) Screw cap on securely. Check for air bubbles by inverting the container and gently tapping the cap. If bubbles are present, add more water. (Note: Samples with bubbles cannot be analyzed.)
(h) Shake sample for one minute.

6. Shipping and Handling:

(a) Complete chain-of-custody form if requested by lab or water supply program.
(b) Keep samples in closed chest at above 0°C and less than 6°C. Keep them away from direct light and solvent vapors.
(c) Deliver samples to lab the same day if possible.

The following table lists the maximum holding time for the applicable parameters.

Parameters	**Holding Times**
Haloacetic Acids Monochloroacetic acid, dichloroacetic acid, trichloroacetic acid, monobromoacetic acid, dibromoacetic acid	28 days for 552.1 14 days for 552.2

Lead and Copper (in Residential Housing) - SOP

READ INSTRUCTIONS CAREFULLY. LAB MAY REJECT SAMPLES IF ALL INSTRUCTIONS ARE NOT FOLLOWED. CONFIRM SCHEDULING AND INSTRUCTIONS WITH LAB BEFORE SAMPLING. WASH HANDS, WEAR SAFETY GLASSES, AND CLEAN NITRILE GLOVES.

1. **Applicable Parameters:** Lead and Copper

2. **Sample Location: All lead and copper tap samples should be first draw samples.** The water in the plumbing system should have remained motionless for at least six hours before collecting the first-draw sample. Sample should be taken from a kitchen or bathroom sink cold water tap.

3. **Sampling materials:**
   (a) Containers: Acid-washed plastic or glass **1 liter bottles** with plastic or teflon cap liners.
   (b) Preservative: 1 mL 1:1 nitric acid per liter.
   (c) Other: Labels, marker.

4. **Safety Concerns:** None.

5. **General Sample Collection Procedure**:
   (a) Prior arrangements will be made with the customer to coordinate the sample collection event. Dates will be set for sample kit delivery and pick-up by water department staff.
   (b) There must be a minimum of six hours during which there is no water used from the tap the sample is taken from and any taps adjacent or close to that tap. The water department recommends that either early mornings or evenings upon returning home are the best sampling times to ensure that the necessary stagnant water conditions exist.
   (c) A **kitchen or bathroom cold water faucet** is to be used for sampling. If water softeners or other treatment devices are used on kitchen taps, the sample should be collected from a bathroom tap that is not attached to a water softener or other treatment device if possible. **Aerators should not be removed prior to sampling.** The opened sampling container should be placed below the faucet and the cold water tap gently opened. The container should be filled to the line marked "1000 mL" or "one liter", and the water turned off.
   (d) The sampling container should be tightly capped and placed in the sampling kit provided. The sample kit label should be reviewed at this time to ensure that all information on the label is correct.
   (e) If any plumbing repairs or replacements have been done in this home since the previous sampling event, this information should be noted on the label in the space provided. In addition, if the sample was collected from a tap with a water softener or other treatment device, this should be noted as well.

6. Shipping and Handling:

(a) If sample is to be picked up by the local water department personnel, pre-arrange same-day pick up. The sample kit should be placed outside the residence in the location agreed upon so that the water department staff may pick it up.

(b) If homeowner is delivering the sample to the lab, deliver sample to the lab the same day.

(c) All samples should be delivered to the lab as soon as possible after they are collected.

Parameters	Holding Time
Lead & Copper	6 months (14 days is the maximum time allowed before adding the preservative. Must be acidified a minimum of 16 hours before analysis.)

ASBESTOS - SOP

READ INSTRUCTIONS CAREFULLY. LAB MAY REJECT SAMPLES IF ALL INSTRUCTIONS ARE NOT FOLLOWED. CONFIRM SCHEDULING AND INSTRUCTIONS WITH LAB BEFORE SAMPLING. WASH HANDS, WEAR SAFETY GLASSES, AND CLEAN NITRILE GLOVES.

1. **Applicable Parameters**: Asbestos in water (See 40 CFR Part 141 for the most up to date list of approved methods.)

2. **Sample Location:** A state-approved location. If one has not been designated, select an appropriate location, which is representative of the distribution system. Avoid threaded faucets.

3. **Sampling Materials:**
   (a) Container:
   (b) Two Pre-cleaned 1-liter polyethylene or glass bottles.
   (c) Preservatives**:** Keep samples stored at temperatures above 0º C and less than 6º C
   (d) Other: Labels, marker, pH test strip paper, safety glasses, and gloves.

4. **Safety Concerns**:
   (a) Before collecting samples, all samplers must receive thorough training in proper handling of chemical preservatives and safety protocols so they are aware of the associated dangers and to determine appropriate safety precautions and first aid, should it be necessary.
   (b) "Empty" containers for chemistry parameters may contain corrosive or caustic preservatives that cause burns.
   (c) Sample bottles that have preservatives in them should be labeled accordingly. The specific chemicals should be identified.

5. **Sample Collection Procedure:**
   (a) Complete sample tag and sample collection form, using waterproof ink. Proper identification, including the project number and location, and date and time of collection must be submitted.
   (b) Remove the aerator and screen from faucet.
   (c) Turn on the cold water tap and run the water for 4 to 5 minutes or until the water temperature has stabilized, whichever is longer. Then reduce flow so that stream of water is no greater than 1/8 inch in diameter.
   (d) Remove first bottle cap. Do not put cap face down or in pocket. Do not allow inside of cap, inside of container or bottle threads to be touched by any object.
   (e) Hold bottle at an angle. Fill both bottles approximately to the shoulder.
   (f) Replace container cap securely.

6. Shipping and Handling:

(a) Complete chain-of-custody form if requested by lab or water supply program.

(b) Keep samples stored at temperatures above 0º C and less than 6º C to avoid excessive bacterial or algal growth.

(c) Deliver samples to lab the same day if possible.

The following table lists the maximum holding time for the applicable parameters.

Parameter	Holding Time
Asbestos	48 hours

PREVENTATIVE MAINTENANCE PROCEDURES

The purpose of a preventative maintenance program is twofold: 1) to ensure that equipment is properly functioning so that it meets or exceeds its expected service life and 2) identify maintenance trends that consume a great deal of the operator's time in order to reduce long term operational costs and improve system reliability. Without a sound preventive maintenance program, costs for labor, materials, and lost water due to emergency repairs will be incurred. Under emergency conditions damages to equipment can be much more severe and potential health effects and/or regulatory ramifications can be unacceptable to the customer and costly to the system. Therefore, three levels of maintenance activities that will be performed. These are predictive, preventative and breakdown maintenance.

Predictive Maintenance

The goal of predictive maintenance to identify potential equipment and distribution system failure before a breakdown occurs. This level of maintenance relies upon testing performance and analyzing operational trends. Equipment testing may include such items as oil analysis, to determine optimal oil replacement frequency, infrared analysis, to ensure that electrical connections are sound and that there are no imminent electric failures about to occur and vibration analysis, to ensure that equipment is properly aligned and that bearing wear is identified well before failure occurs. System testing may include pressure analysis to optimize hydraulic zones, chlorine analysis to determine proper dosing and identify areas of high demand to maximize flushing and resonance time analysis to understand hydraulic flow paths and determine water age throughout the system.

Preventive Maintenance

The primary goal of preventive maintenance is to prevent the failure of pumps and equipment before it actually occurs. It is designed to preserve and enhance equipment reliability by replacing worn components before they actually fail. Preventive maintenance activities include exercising valves and fire hydrants; equipment and tank inspections; partial or complete overhauls at manufacturer specified periods; oil changes; lubrication; and so on. In addition, operators can record equipment deterioration so they know to replace or repair worn parts before they cause system failure.

Breakdown Maintenance

This is maintenance that must be performed because of unexpected equipment failure and is the most disruptive and costly type of maintenance especially when it leads to emergency conditions and compromises customer service or public health. Even under the best preventative maintenance program, some breakdown maintenance will occur. Each of these events provides a learning opportunity to improve upon existing preventative maintenance programs. The operator should evaluate every equipment breakdown situation, to determine the cause, and

what measures could have been taken to prevent the occurrence. The lessons learned should then be added to the preventative maintenance program. Building these written feedback loops into the preventative maintenance program will yield significant returns.

Implementation

The Water Superintendent in conjunction with certified operators and designated staff are responsible for implementing the preventative maintenance program. The superintendent is responsible for compiling the schedule and budget to maintain the system while certified operators are responsible for performing the maintenance and recordkeeping. Inspection forms and maintenance schedules are located in the Appendices; however specific maintenance measures are detailed in their appropriate section of this manual.

RECORD RETENTION

Accurate records are an integral part of an efficient water system operation. These records serve as a historical reference source and are maintained at the water district office. Adequate records improve the efficiency of distribution operations and ensure compliance with regulatory agencies. Records maintained by the District may include:

RECORDKEEPING REQUIREMENTS Part A (for all water systems)	
REPORTING ITEM	**RETENTION TIME**
Bacteriological	5 years
Chlorine/Chloramines – Free chlorine monthly with BACT's, daily for MOR's, residual chlorine monthly	10 Years
C-T Profiling Data	min 1 year
Individual Filter Turbidity Data (other than MOR)	3 Years
MOR's – Monthly (turbidity analysis)	1 Year
Lead & Copper	12 Years
Nitrate	10 Years
Nitrite	10 Years
Secondary/Corrosivity	10 Years
Sodium	10 Years
IOC's (inorganic Chemicals)	10 Years
SOC's (Synthetic Organic Compounds)	10 Years
VOC"s (Volatile Organic Chemicals)	10 Years
TOC's (Total Organic Chemicals)	10 Years
TTHM's & HAA's	10 Years
Asbestos – 1 sample in the 1st 3 years of a 9 year cycle (begin 2011)	10 Years
RADS (Radionuclides)	10 Years
LT2 Cryptosporidium and E.coli Results	3 Years
LT2 Source Water Monitoring Avoidance	3 Years
LT2 Toolbox Treatment Monitoring Results	3 Years
Stage 2 IDSE Sampling Plan or 40/30 Certification	10 Years
Stage 2 IDSE Report	10 Years
Bromate	10 Years
Chlorine Dioxide	10 Years
Chlorite	10 Years
Dioxin	10 Years
Data Summaries (if actual data not retained)	12 Years
NOV's (Notice of Violation)	10 Years
Sanitary Surveys	10 Years
CCR (Consumer Confidence Report)	3 Years
Sampling Plan for BACT's	5 Years
Sampling Plan for Lead and Copper	12 Years
Sampling Plan for DBP's	10 Years
Sampling Plan for Chemicals	10 Years

Maps – (Showing all pipe location, material, and sizes, valves, hydrants, tanks, booster pumps, chlorination stations, emergency connections, alternative sources, and wholesale customer master meters.	Permanent
RECORD ITEM (Kentucky Local Government Records Retention Schedule)	**RETENTION TIME**
Geological Reports on Subsurface Ground Conditions	Permanent
Index to Maps and Plats	Permanent
Engineering Maps, Plats, Plans and Drawings File	Permanent
Capital Construction Engineering Project File	Permanent
Operation and Maintenance Manuals	Permanent
Discharge Monitoring Reports (DMR)	3 Years
Monthly Operating Reports (MOR)	3 Years (portions - 10 Years)
Sales and Use Tax Return	5 Years
Encroachment Permit File	3 Years
Permit File (Kentucky Pollutant Discharge Elimination System (KPDES)	3 Years after expiration
Service Work Orders	3 Years
Pretreatment Files	5 Years
Grease Trap Program File	5 Years
Sewer User Exemptions File	5 Years
Discharge Permit – Unusual Requests	10 Years
Construction Project File	7 Years
Rain Gauge Data File	5 Years
Pump Station – Daily Reports	3 Years
Pump Station – Flow Charts	5 Years
Tier II Hazardous Chemical Annual Report	5 Years
Calibration/Inspection Report (meters, fire extinguishers, etc.)	3 Years
Compliance Monitoring Records	10 Years
Notification and Complaint Records (pollutant release)	10 Years
Enforcement Records	Permanent
Compliance Deficiency Notification Records	10 Years after closure
Compliance Evaluation Records	10 Years
Environmental Impact Study Records	Permanent
Facility Planning Records	20 Years
Authorization Records	10 Years
Technical Assistance Records	10 Years
Certification Records	2 Years after expiration
Environmental Audits	10 Years
40 CFR 141.33	
Microbiological	5 Years
Turbidity	5 Years
Chemical Analyses	10 Years
Actions to Correct Violations	3 Years
Sanitary Survey - written reports, summaries or communications	10 Years

Variances and Exemptions	5 Years
Public Notices (including certifications)	3 Years
Monitoring Plans	Same as analyses
This is not a complete list of recordkeeping by utilities. **PSC regulations can be found in 807 KAR Chapter 5.** **Other agencies such as OSHA and IRS have specific requirements.**	

WATER TREATMENT PLANT OPERATION

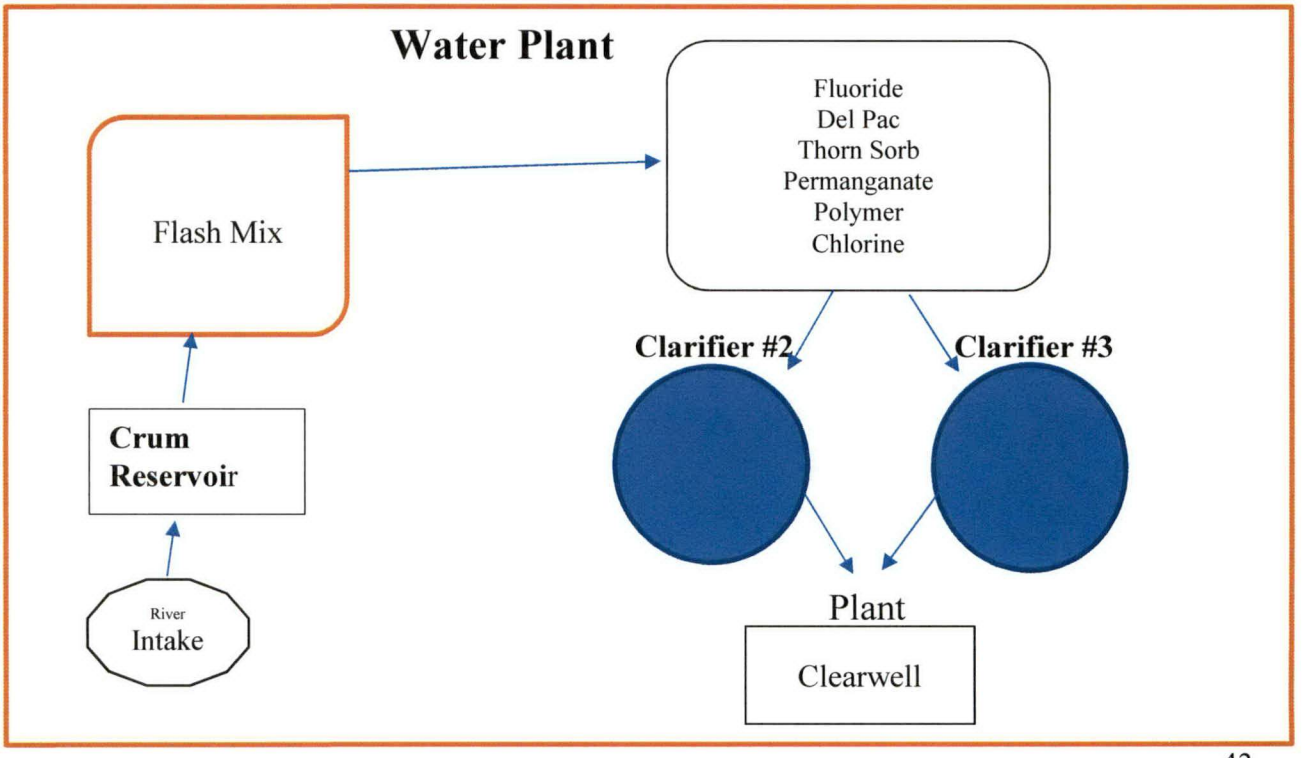
Water Plant Design

Martin County Water District operates a class IIIA conventional surface water treatment plant designed to produce 2.03 MGD. Raw water is withdrawn from the Tug River and Crum Reservoir as authorized by the Kentucky Division of Water under permit numbers 1060 and 0683. Construction plans of the facility are on file at water treatment plant.

Treatment Unit Processes

Raw Water gravity feeds from Crum Reservoir into the Water Plant. Flowing into the Flash Mix. Del Pac, Thorn Sorb, sodium Permanganate and Polymer is injected. Raw water leaving the Flash Mix and splits and goes to two treatment units, called Contra Flo or Upflow clarifiers, each producing one million gallons per day. Pre-chlorine is injected into each unit after going thru the process of mixing. Flocculation and Separation Zones, clear water falls over into the Filters, which is located along the walls of each Unit. Then flows into the Water Plant Clearwell. Post Chlorine, Fluoride and Caustic, is injected before the water enter the Plant Clearwell. High Service Pumps then pumps the water from the Plant into two Clearwell Tanks located behind the Water Plant and then the water is gravity into the Distribution System.

Plant Flow Schematic



Plant Operations

The procedures outlined in this manual are twofold: 1) to guide an experienced certified operator in the general processes required to operate and maintain the Martin County Water Treatment Plant in compliance; and 2) used as a training guide to educate personnel pursuing an operator license. Specific details regarding the operation, calibration and maintenance of laboratory equipment, pumps, chemical feeders and monitoring equipment can be found in the O & M manual addendum titled Plans and Specifications. This addendum, located in the water plant office is a compilation of manufacturer operating manuals.

Daily Operating Procedures:

1. At the beginning of each shift, the operator in charge will perform a visual and auditory inspection of all operational aspects of the plant. This will include raw water pumps, high service pumps, (vibration and leaking), chemical feeder pumps (tubing and connections).

2. All water testing equipment i.e.; Cl2, fluoride, and pH meters, will be calibrated each day before testing begins and recorded in the calibration log book.

3. Water quality parameters to be tested daily at WTP i.e.; pH, Cl2, turbidity, fluoride, hardness, and alkalinity, as required by state guidelines set by DOW. See Appendix A for Daily Bench Sheet form.

4. C-T Values will be calculated daily to ensure proper Cl2 dosing.

5. Cl2 residuals will be tested daily in the distribution system and recorded on daily sheets and MOR's.

Plant start-up procedure

1. Refer to daily log and check for changes or special instructions from previous shift.

2. Check tank levels, clearwell level, system pressures, master meter reading, plant usage meter reading, and record all readings.

3. Change all recording charts as needed.

4. Check chemical tanks and fill if necessary. Record any chemicals added to tanks.

5. Chemical feeders:
    a. Confirm that feed pumps start automatically.
    b. Check chemical feeders for proper functioning.

6. Turn on high service pump #1 and run for five minutes before turning on pump #2 to ensure they are operating. High service pumps shall be alternated daily.

Plant shut-down procedure

The water plant is designed to run on automatic when the storage tank level drops to xxx feet. However, the plant can be shut-down by turning the high service and raw water pumps to the off position on their respective control panels.

Chemical and Supply Inventory

Water treatment chemicals and supplies are routinely monitored to ensure that inventory does not fall below minimum operating levels needed to maintain service. The table below sets re-order limits and minimum levels to be kept on-hand.

Item	Normal	Qty	Minimum	Re-Order	Supplier	Phone
Chlorine	200	Gal	60	100	C. I. Thornburg	304-523-3484
Fluoride	300	Gal	50	50	C. I. Thornburg	304-523-3484
pH reagent	12	ea	6	4	HACH	514 354-2511
pH sensor	1	Ea	1	0	HACH	514 354-2511
Cl2 reagent	20	Ea	10	10	HACH	514 354-2511
Del Pac	600	Gal	300	200	C. I. Thornburg	304-523-3484

Water Quality Monitoring

Water quality analysis is performed to ensure optimum process control and to monitor for potential Maximum Contaminant Level (MCL) violations. The manufacturer specifications and instruction manuals for each process control test is located in the laboratory. All samples are to be analyzed by the certified operator on shift for the purpose of process control and compliance monitoring. Samples shall be analyzed by the following standard operating procedures.

pH/Temperature:
Source and treated samples shall be collected from the raw and finish water taps.

1) Calibrate meter daily in accordance to page 12 of the manufacturer's manual;
2) Ensure that the calibration buffers have not expired. If so, replace and re-order;
3)

Chlorine:
The sample shall be collected from the finish water tap.

1)
2)
3)
4)

Turbidity:
This is recorded on a Aqua Trend instrument and sent to the computer and printed and kept in a binder.

1)
2)
3)
4)

Fluoride:
The sample shall be collected from the finish water tap.

1)
2)
3)
4)

After performing the laboratory analyses discussed above, the necessary adjustments relative to each test shall be made. Record all laboratory results on the Daily Bench Sheet.

SDWA Compliance Analysis

Appalachian States Laboratory an independent certified laboratory, is collecting and providing analyses on additional samples at the frequency designated by the Division of Water. These laboratory analyses shall be reviewed by the operator to determine if any corrective actions should be implemented. The sample schedule for the water treatment plant is as follows:

Non-TCR Group Schedules

Water System Facility State Asgn ID	Water System Facility Name	Analyte Group Code	Analyte Group Name	Sample Count	Sample Type	Sample Frequency	Effective Begin Date	Effective End Date	Seasonal Start MM/DD	Seasonal End MM/DD
	INTAKE - Tug RIVER	TOCA	PRECUSOR RAW SCH	1	RT	MN	01-01-2004		0/0	0/0
KY0800273	Martin County WTP	RADA	RADA	1	RT	YR	01-01-2022	12-31-2022	0/0	0/0
KY0800273	Martin County WTP	RADA	RADA	1	RT	YR	01-01-2016	12-31-2016	0/0	0/0
KY0800273	Martin County WTP	IOCS	REG IOC	1	RT	YR	01-01-2002		0/0	0/0
KY0800273	Martin County WTP	SOCS	REG SOC W/O DIOXIN	2	RT	3Y	01-01-2002		0/0	0/0
KY0800273	Martin County WTP	VOCS	REG VOC	1	RT	YR	01-01-2002		0/0	0/0
KY0800273	Martin County WTP	SCND	SECONDARY	1	RT	YR	01-01-2010		0/0	0/0

Non-TCR Individual Schedules

Water System Facility State Asgn ID	Water System Facility Name	Analyte Code	Analyte Name	Sample Count	Sample Type	Sample Frequency	Effective Begin Date	Effective End Date	Seasonal Start MM/DD	Seasonal End MM/DD
KY0800273	Martin County WTP	2920	CARBON, TOTAL	1	RT	MN	01-01-2004		0/0	0/0
KY0800273	Martin County WTP	1040	NITRATE	1	RT	YR	01-01-2002		0/0	0/0
KY0800273	Martin County WTP	1041	NITRITE	1	RT	3Y	01-01-2020	12-31-2022	0/0	0/0
KY0800273	Martin County WTP	1052	SODIUM	1	RT	YR	01-01-2009		0/0	0/0

In-Plant Laboratory Standard Operating Procedures:

SOP

Preventative Maintenance Schedule

DISTRIBUTION SYSTEM OPERATION

Distribution System Overview

The distribution system consists of 275 miles of pipeline, thirteen water storage tanks, 262 hydrants and 3529 meters. The system utilizes thirteen tanks for storage and maintains adequate pressure (30 - 100 psi) throughout the distribution system. Current maps of the distribution system, depicting line location, line size, and the location of all tanks and pump stations, are maintained at the water district office.

Routine Workflow Chart		
Daily	Monthly	Annual
1. Read master meter 2. Check chlorine residual 3. Monitor tank level 4. Complete work orders	1. Begin Reading meters on the 10th day of the month 2. Collect 1 Bac-t in first week 3. Collect 1 Bac-t in third week 4. Monthly Operating Report 5. Water Loss Report	1. Flush system bi-annually 2. Monthly Operating Report Statistics page 3. Water loss report 4. Consumer Confidence Report

Distribution Maintenance

The procedures outlined in this manual are twofold: 1) to guide an experienced certified operator in the general processes required to operate and maintain the Martin County Water distribution system; and 2) used as a training guide to educate new personnel pursuing an operator license and as a guide for qualified substitute operators. This manual contains the necessary O&M procedures, worksheets and record keeping forms, safety policy and testing & monitoring procedures to need to operate and maintain the District's distribution system. Specific details regarding the operation, calibration and maintenance of hydrants, valves and meters can be found in the O&M manual addendum which contains a compilation of manufacturer operating manuals. Although, this manual will not contain the answers to every issue, it does however provide an informative description of the system components so that a qualified operator can take a logical approach to solving the most common problems that may arise that are associated

with the systems operation and maintenance. Recordkeeping forms for distribution maintenance are included in Appendix A.

Researching
SYSTEM SPECIFICATIONS

SIZE (in)	DISTRIBUTION LINE AND VALVES				
	FEET / PIPELINE MATERIAL				Count
	PVC	Cast Iron	Ductile	AC	Number of Valves
2					
3					
4					
6					
8					
10					
12					
Totals		0	0		

STORAGE TANKS						
Name	Type	Material / Coating	Volume	Overflow Elev (ft)	Year Const.	Last Cleaned
Clearwell (1)		Glass Lined	500,000	894	2009	
Clearwell (2)		Glass Lined	500,000	894	2009	
Middlefork		Glass Lined	260,000	942		
Big Sandy		Glass Lined	1,040,000	1360		
KY 40 West		Glass Lined	200,000	1171		
Calloway		Welded	100,000	1164		
Buffalo Horn		Glass Lined	50,000	950		
Turkey Creek		Welded	50,000	983		
Buck Creek		Glass Lined	500,000	1200	2009	
Elk Creek		Glass Lined	100,000	1080		
Rockcastle		Glass Lined	150,000	1080		
292 South		Glass Lined	100,000	1113		
645 Tank		Glass Lined	67,000	1026		
Total Storage			3,417,000			

Researching Specs

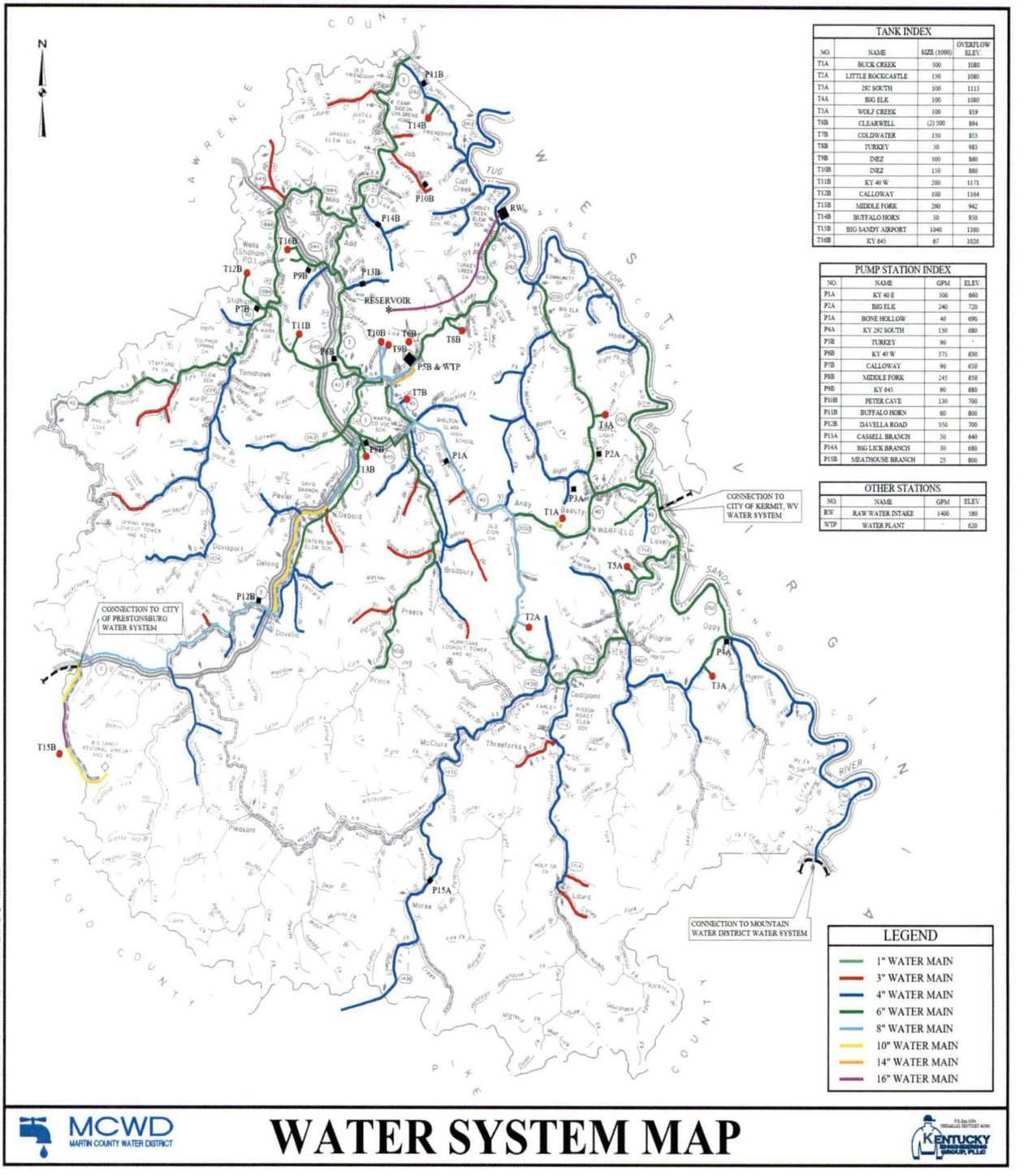
PRESSURE/LEVEL CONTROL						
Mfg	Model	Size (in)	Type	Installed	Low Set	High Set

Researching for Accuracy

HYDRANT			
Mfg	**Size**	**Hydrant Count**	**Isolation Valve Count**
Mueller & Kennedy		208	
	Total		

METERS						
Mfg	**Model**	**Size (in)**	**Count**	**Type**	**Read Type**	**Test Freq.**
Researching						

INSERT GENERALIZED SYSTEM MAP ON THIS PAGE



SYSTEM FLUSHING PLAN

The goal of the flushing program is to maintain infrastructure integrity and water quality. Martin County Water District operates over 275 miles of distribution line; 13 storage tanks and 15 pump stations in order to provide safe drinking water to over 3550 customers. Proactive flushing is a form of preventative maintenance necessary to preserve system stability with minimal service interruption.

Over time debris will enter the water distribution system and accumulate in pipes, tanks, control valves and meters. Debris also encourages the formation of scale, biofilm and tuberculation on the pipe wall. If left unchecked this buildup will adversely affect system hydraulics and water quality leading to service interruptions and boil water advisories. Disinfectant residuals can deplete due to low usage and disinfectants may combine with materials in the system to form disinfection by-products. Each of these situations may be corrected by the appropriate flushing strategy.

1) Process

A systematic flushing of the entire distribution system will be conducted biannually in the spring and fall under the guidance of a certified distribution operator; however drought conditions may preclude the fall flushing. This will be accomplished by flushing from the treatment plant to the storage tanks, then downstream to the ends of lines by utilizing hydrants / blow-offs and valves. Flushing crews will take steps to protect pavement and property to reduce potential damage during flushing. Customers will be notified prior to system wide flushing. The notification will include expected date and time of the areas to be flushed. The method of notification may include any of the following: local media, door hangers, bill card messages, phone calls and signs. The flushing program will ensure that:

1) Drinking water standards are met;
2) Dead end and low demand areas are flushed periodically;
3) Sediment and air are removed;
4) The optimal free chlorine residual is maintained;
5) Reduce water age and disinfection by-product formation;
6) Maintain fire protection; and
7) Maintain mechanical devices

Maintenance Flushing: The goal of maintenance flushing is to improve water quality and hydraulic stability by removing silt, sediment, biofilm and other deposits from the distribution system. This is an intensive system-wide flushing performed biannually (spring & fall) that should be conducted at off-peak times and must be coordinated with the water treatment plant.

Routine Flushing: The goal of routine flushing is to maintain water quality by decreasing water age which reduces chlorine demand and disinfection by-product formation. This type of flushing occurs on an as needed basis based upon customer complaints of taste, odor, discolored water, or when indicated by water quality monitoring. Routine flushing will commence in response to disinfection by-product results and daily disinfectant residual monitoring shows free chlorine

<0.5 mg/l or when the ratio of free chlorine to total chlorine is less than 85%. Flushing can be performed manually or automated with the use of flushing devices to maintain disinfectant residual and reduce water age in portions of the distribution system that have known stagnation or circulation issues.

Repair Flushing: Water lines will be flushed following repairs to remove air and sediment from the repaired section of line. Flushing will cease when the optimal chlorine residual can be maintained. If "shock" disinfection is necessary due to possible contamination, the line will be flushed to remove the high chlorine content after sufficient contact time has passed. During flushing, water containing high chlorine concentrations will be directed to the sanitary sewer system or flushed on relatively flat ground so as not to contaminate a receiving stream or body of water. Sodium Thiosulfate will be used at the discretion of the certified distribution operator to de-chlorinate flushed water when deemed necessary to protect the environment.

2) Record Keeping

Records of each flushing will be maintained by the Chief Distribution Operator. These records will include the following for each flush point:

1) Date/time
2) Location
3) Persons responsible
4) Length of flushing
5) Static and dynamic pressure
6) Gallons flushed
7) Free / total chlorine
8) Other information deemed useful

3) Flushing Methodology

Unidirectional Flushing (UDF) is the most efficient method of cleaning water distribution pipes to improve water quality, restore capacity and maintain infrastructure. Beginning at the storage tank; water is flushed from the source through a pipe segment and discharged through single or multiple hydrants depending upon the flow required to achieve the target velocity. By isolating each pipeline to create flow in a single direction reduces flushing time and minimizes impact on utility customers. Concentrating flow in this manner creates higher velocities that are better able to clean the pipe. Scouring velocities of > 5 ft/s can be achieved as compared to 1 to 3 ft/s with conventional flushing. At these velocities, UDF scours out sediment, biofilm, corrosion products, and tuberculation.

Not only is UDF a more effective way of cleaning than conventional flushing, but it uses on average about 40 percent less water. Equally important, the sediment and other debris are flushed out and not just moved to another pipe segment which often occurs with conventional flushing. Removing debris and other organic sources from the system greatly reduces the potential to form trihalomethanes.

- General guidelines for UDF
  - Always flush from larger to smaller mains to avoid flow and velocity restrictions;
  - Use line valves to isolate flushing zones and to keep flushing lengths as short as possible in order to maximize velocity;
  - Close isolation valves before opening hydrant(s);
  - Open isolation valves before or simultaneous to closing the hydrant(s) to reduce water hammer and remove slugs of poor quality water trapped behind the valve;
  - Monitor system pressure and maintain >20 psi during flushing.

4) Flushing Procedure

System flushing begins at the source of water and proceeds throughout the distribution system to the end of each line.

1. Notify customers at least one week in advance of scheduled flushing.

2. Stand to the side and carefully remove one of the nozzle caps. Always assume that the hydrant barrel is pressurized. Use a hydrant operating wrench.

3. If flow control is necessary, attach a valve to the nozzle. Attach a hose, deflector, or diffuser to prevent damage to the surrounding area.

4. Open the hydrant slowly to prevent an excessive surge in the distribution system. Using the operating nut or nozzle valve open the hydrant to a full open position.

5. Continue flushing until the water becomes clear and the desired disinfectant residual is obtained.

6. Close the hydrant slowly. Avoid damage to the main valve or stem coupler by over-tightening or use of excessive force.

7. Replace the nozzle cap hand tight plus ¼ turn.

8. Complete appropriate records.

5) Distribution System Specifications

Waterline Specifications / Capacity		
Size (in)	**Length (ft)**	**Gallons**
2	41,924	6,842
3	270,759	99,415
4	273,968	178,833
6	462,703	679,569
8	555,255	1,449,779
12	144,612	589,976
Totals	**1,857,477**	**3,715,544**

Pump Station Specifications				
Name	**Flow (gpm)**	**TDH (ft)**	**Suction (psi)**	**Discharge (psi)**

Tank Location And Storage									
Name	**Height**	**Gallons**	**Pics #**	**On/Off**	**Capacity**	**Dia**	**SN#**	**Height**	**ACT**
Buck Creek Tank	75'	300,000	6	30/60	521,000	33.57	8101528	78.83	
Rockcastle Tank	30'	150,000	8	20/27	158,000	30.77	8930522	28.43	
Elk Creek Tank	90'	100,000	9	40/87	101,000	13.9	6930520	88.65	
292 South Tank	30'	100,000		10/28	105,000	25.1	89303521	28.43	
Turkey Creek Tank	37'	50,000		20/32	50,000				
Marcus Wells Tank	125'	200,000	1	86/115	199,000	16.78	8960477	120.73	
CallowayTank	75'	100,000	0		100,000				
Otto Brown	48'	260,000	0	8/20	260,000				
645 Tank	50'	69,000	5	25/36	69,000	13.9	800707	60.50	
Buffalo Horn Tank	35'	50,000	4	15/35	54,000	16.78	8000070	33.01	
Airport Tank	47'	1,040,000	7		1,040,000	61.54	8000066	46.76	1
Clearwell Tanks (2)	38'	500,000	2	20/36	1,000,000				
Totals					3,657,000				

8) Velocity, Line Capacity and Hydrant Charts

1. **Work in Progress**

9) Sample Recordkeeping Form

Valve Exercise

The location and operational status of line valves is necessary to maintaining and repairing the distribution system. Functioning line valves allow operators to perform leak detection, directional flushing and repairs with minimal disruption of service. All valves in the distribution system are to be exercised at least once per year and records maintained on any maintenance performed. A valve record form is included in Appendix B.

Valve Exercise Procedure

1. Locate valve using maps
2. Clean valve box of all debris
3. Do not close valves on main feed lines while pumps are running
4. Operate valve (close valve, open three turns, close again, open completely)
5. Take note of turns to determine valve size
6. If valve box is low use valve box risers to raise to desired height
7. Paint valve box lid (blue)
8. Install concrete collar (if in yard)
9. Install valve marker (if in yard)
10. If valve is in the road mark the size and direction of flow (if not in road mark offset from edge of pavement)
11. Take G.P.S. coordinates
12. Fill out valve exercise and service form
13. Mark area that has been located on small map
14. Mark valves located on big map with green marker
15. If valves are closed call Distribution Office and Water Plant before opening
16. If valves will not move; do not force. Fill out Work Order and replace with new valve. (don't forget to call 811 to get located, and if it is a state highway make sure to obtain a state encroachment permit)
17. Only repair valves if they are newer style; replace all old style valves if they no longer work

REPLACE LIDS AND VALVE BOXES AS NEEDED

Valve Status Codes
L.O. – leave off
S.O. – stub out
F.V. – foot valve
H.W. – hand wheel
N.R. – needs replaced

Gate Valve Cycle Chart
4" - 13-14 TURNS
6" - 19-20 TURNS
8" - 24-25 TURNS
10" - 32-33 TURNS
12" - 38-39 TURNS

HYDRANT MAINTENANCE

Hydrants spend most of their time unused and ignored, yet they are called upon in a moment's notice to provide fire flow for the protection of a business or home. In addition to fire protection, hydrants are an integral component to maintaining public drinking water quality.

Preventative Measures

When performing any sort of flow test or flushing of hydrants, there is the potential to damage infrastructure and affect water quality. The two main dynamics of improperly operating a hydrant that must be understood are; water hammer and discolored water.

Water hammer is caused by an abrupt change in the velocity of flowing water and is most often the result of closing a valve too quickly. Since water does not compress it will not absorb any of the energy it gives off by being forced to suddenly decelerate. Therefore, the water mains, hydrants, control valves and the ground have to absorb all of the energy. If a valve is closed too quickly, the weakest link in the system will fail first. **This is the reason for slowly opening and very slowly closing hydrants.**

Discolored water may be caused by several factors, however improperly operating a fire hydrant a sure-fire way to trigger customer complaints. During normal conditions, water velocity is slightly higher through the center portion of a water main because of friction loss between water and the wall of the pipe. As the average velocity increases, so too will the velocity of the water close to the wall of the pipe. As the water velocity increases, it begins to pick up sediment that usually stays at the bottom of the pipe. This sediment becomes suspended and does not settle out until the velocity decreases. **This is the reason for slowly opening and very slowly closing hydrants.**

Hydrant Use

Hydrants are installed for two main purposes; fire protection and water quality. Depending upon system hydraulics a hydrant may not be approved for fire protection, therefore its primary use is for water quality.

FIRE PROTECTION

Although fire hydrants are often used for other purposes, their primary function is to supply water for fire protection. Any other use is considered of secondary importance and any other use is rigorously controlled for the protection of the water distribution system.

LINE FLUSHING

The hydrants ease of operation and high flow capability make it a natural for use in flushing distribution system main lines. Bi-annual line flushing is the ideal time to perform hydrant inspections.

SYSTEM TESTING

Fire hydrants are used to test the hydraulic capabilities of the distribution system to establish ISO ratings and provide data for hydraulic models. These tests, when possible should be conducted in conjunction with normal hydrant maintenance or flushing to reduce unnecessary water loss.
OTHER USES
Fire hydrants are also commonly used as a water source for street cleaning, sewer cleaning, construction, and as a watering point for other commercial applications.

Dry Barrel Hydrants
All hydrants in the system are "dry barrel hydrants." Dry barrel hydrants are manufactured in accordance with AWWA Standard C-502. Dry barrel hydrants have the main valve located below ground and the section that extends above ground is void of water except during operation. These hydrants are equipped with drain valves or weep holes to allow the portion of the hydrant above the main valve to automatically drain.

Painting and Color Coding Fire Hydrants
The appearance of fire hydrants has a direct impact on the public's confidence in the quality of the drinking water and Fire Departments ability to protect their homes and businesses. Therefore, it is necessary to maintain the appearance of the hydrants by painting. Fire hydrants are also color coded as set forth in NFPA Standards, to indicate the expected fire flows from the hydrant during normal operation.

Fire Hydrant Color Coding		
Flow (gpm)	Color	Color Match*
1,500	Light Blue	Enamel Laser Blue SW4079
1,000 – 1,500	Green	Enamel Safety Green SW4085
500 – 1,000	Orange	Enamel Safety Orange SW4083
< 500	Red	Enamel Safety Red SW4081
*Sherwin Williams Industrial Paint Code		

Routine Inspection
All hydrants should be inspected annually. Performing hydrant inspection and maintenance in conjunction with biennial line flushing will conserve water loss and maximize staff time. Routine inspection of common fire hydrants by experienced operators should take approximately 30 minutes per hydrant unless maintenance and/or painting are required. If a hydrant is found to be inoperable during inspection or operation or is in need of major repairs it should be reported to the utility manager and fire department. **Note: any lubricant used for hydrant maintenance must be certified food grade.**

1. Communication.

    a. Notify the utility office. This allows the office staff to better field customer complaints.
    b. Customer complaints regarding low pressure should be recorded.

c. Notify water treatment plant.

2. Visually Inspect the Area Around the Hydrant.

    a. Hydrants are required to have a minimum clearance of 3 feet in all directions.
    b. Remove any weeds or brush.
    c. In order to protect landscape, vehicles, etc. in the surrounding area, it may be necessary to use a diffuser or hose to direct water away from the area.

3. Visually Check the Hydrant for any Defects.

    a. Remove all caps and check the threads. Remove the first cap slowly to ensure there is no pressure on the hydrant. Clean threads with a wire brush and lubricate the threads if necessary.
    b. Check for water or ice in barrel. The presence of water indicates:
        i. Leakage of the main valve.
        ii. Drains are below the water table.
        iii. Drains are obstructed.
        iv. Nozzle replaced prior to allowing the barrel to drain.
    c. Replace caps.
    d. If hydrant is equipped with safety chains, ensure the chains are loose and do not bind on the cap. Lubricate the chain race on the cap.
    e. Check the breakaway flange for damage or loose bolts.
    f. Lubricate the operating nut if required. Kennedy hydrants have grease fitting on the operating nut that requires grease. Detailed manufacturer specific instructions for most hydrants are available in the utility office or online.

4. Hydrant Barrel Test:

    a. Tighten all caps except one for air venting.
    b. Slowly turn valve to fully open.
    c. Tighten cap after all air has escaped and water appears.
    d. Check nozzles, flange connections and seals for leakage.
    e. Slowly close the main valve then remove the 2 ½" nozzle cap.
    f. Place hand over opening. A strong suction will indicate that the hydrant is draining properly.

5. Operating Test:

    a. Take note of main valve operation during the barrel test. The operating nut should turn smoothly, if not, check and add fresh oil thru the oil port till full.
    b. If operating nut is still stiff remove the operating lock down nut and remove all old grease on, around, and inside the operating nut (use Emory cloth if necessary).
    c. If accessible clean the threads on the operating stem with a wire brush.

d. Using, fresh hydrant oil, lubricate the operating nut, stem, & lockdown nut.
e. Reinstall the hydrant operating parts and fill the hydrant with fresh oil thru the oil port until full.
f. If the main valve is still difficult to open, mark for repair on the inspection record.

6. Pressure Test

   a. Remove the 2 ½" cap and slowly open hydrant 3 – 5 turns to fill the barrel then slowly close hydrant.
   b. Install pressure gauge on the 2 ½" nozzle and open petcock.
   c. Open the hydrant slowly then close petcock when flowing a steady stream.
   d. Continue to slowly open the hydrant until the pressure has stabilized.
   e. Check for leaks at the flanges, operating nut, nozzles and nozzle caps and record the pressure.
   f. Slowly close the hydrant and open the petcock to relieve pressure.
   g. Remove the pumper nozzle cap and close pressure gauge petcock.
   h. Attach hose or diffuser if necessary to protect surrounding area.
   i. Attach meter, pitot tube, orifice plate, or other device to measure the hydrant flow and total gallons flushed.

7. Flow test and hydrant operation:

   a. Open the hydrant SLOWLY approximately 3 to 5 turns to allow time for the air to escape from the hydrant barrel. Then continue to SLOWLY open hydrant to the full open position to check operation.
   b. When the hydrant is flowing full, a flow test can be conducted.
   c. Record dynamic pressure and flow.
   d. Check nozzles, flange connections and seals for leakage.
   e. Allow the water to flow for a minimum of 3 to 5 minutes to flush the hydrant and water lines.

8. Complete flow test:

   a. Look for discoloration and debris. A sample collected in a solid white cup is useful for checking water clarity.
   b. Continue to flush hydrant until water is clear.
   c. Once the water is clear, close down hydrant VERY SLOWLY.
      i. Be aware that some hydrants may not seem to slow down when you turn them. This usually means the hydrant may slam (it will have some slop in the stem and may make a thump sound when closing). This causes water

hammer and could cause major damage to the water distribution system. This is why it is imperative that hydrants are closed VERY SLOWLY.

9. Closing the hydrant:

    a. Wait to make sure the hydrant stops dripping. It should not be necessary to close the hydrant with great force.
    b. If the hydrant does not shutoff completely, there may be debris stuck between the disc and seat. Over tightening of the hydrant can do permanent damage to the disc. Open the hydrant to flush the debris and then close the hydrant again.
    c. After the hydrant is closed, back off on the operating nut about 1/4 turn. This removes the pressure from the operating nut and stem. The main valve will remain closed.
    d. Ensure that water drains from the hydrant barrel. If not, clean weep holes or pump out hydrant to remove water from the barrel.
    e. Remove any fittings or hoses and replace the caps.
    f. Tighten the cap and then back off slightly. Caps should be tight enough to prevent removal by hand but loose enough to be removed with ease using a spanner wrench.

10. Paint hydrant according to NFPA standard as needed.

11. Repair any damages from running water.

12. Complete the hydrant maintenance form (Appendix C).

13. Notify the utility office and treatment plant when you are done for the day.

Guidance Manuals and Publications

The following publications should be used when installing, testing or inspecting fire hydrants.

- Installation, Field Testing, and Maintenance of Fire Hydrants (AWWA M17)
- Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems (NFPA 25)
- Standard for the Installation of Sprinkler Systems (NFPA 13)
- Recommended Practice for Fire Flow Testing and Marking of Hydrants (NFPA 291)
- AWWA Standard for Dry-Barrel Hydrants (C502-94)
- AWWA Standard for Disinfecting of Water Mains (C651-99)
- AWWA Standards for Installation of Pipe (C600 thru C606)

CROSS CONNECTION

Martin County Water District is aware of a potential threat to the health and safety of those served by the public water supply from cross-connections. The possibility of backflow due to a cross-connection within the customer's premises can be extremely dangerous because, when it occurs, the potable water supply may become contaminated with bacteria, toxic materials, and/or other hazardous substances.

The District shall take reasonable precautions to protect the public water system from cross-connections originating from the customer's system that may degrade the quality of the water in the distribution system. This program is designed for the detection and elimination of potentially hazardous cross-connections and the prevention of the creation of new cross-connection.

Customers with a meter size larger than 5/8 x 3/4 inches or whose use of water poses a higher degree of hazard than that normally associated with use at a typical single family residence will be evaluated regarding water use and potential cross-connections at the customer's premises. Also, existing customers will be re-evaluated where any modification, additions, or changes to their property are made requiring a plumbing permit issued by the local authority or where the plans must be approved by the Fire Marshall.

Martin County Water District staff shall make all evaluations of the cross-connection hazards which exist in supplying a customer's water system and may use surveys and on-site inspections of premises for that purpose. An approved backflow prevention device shall be required at any point of connection between the public water supply and the customer's water system where the District determines that a present or potential contamination or pollution hazard to the public water system may exist. All service connections considered as low hazard applications shall have at a minimum a dual check valve backflow preventer installed between the water meter and the residence.

The District will maintain records for each location requiring a backflow prevention device. A separate file shall be created and maintained for each location. Records are to include, but are not limited to:

The customer contact information	Degree of hazard rating
Type of backflow preventer	Installation review by Plumbing Inspector
Backflow device information	Test reports

The charts on the following pages are used by the Operator to determine the degree of hazard and the appropriate backflow application needed to protect the public.

Cross Connections, Degree of Hazard and Acceptable Protection								
Connection Category	**Degree of Hazard**			**Acceptable Protection**				
Connections subject to back pressure from:	Severe	Moderate	Minor	Air Gap	Reduced Pressure Device	Double Check Valve Assembly	Pressure Type Vacuum Breaker	Atmospheric Type Vacuum Breaker
Pumps, tanks, and lines handling toxic substance	X			X				
Pumps, tanks, and lines handling non-toxic substance		X		X	X	X		
Boilers with chemical additives	X			X	X			
Boilers without chemical additives		X		X	X	X		
Gravity conditions subject to contamination by toxic substances	X			X	X			
Gravity conditions subject to contamination by non-toxic substances		X		X	X	X		
Connections not subject to back pressure from:								
Sewer or sewage pump	X			X				
Outlet to receptacles with toxic substances	X			X	X		X	X
Outlet to receptacles with non-toxic substances		X		X	X	X	X	X
Outlet into domestic water tanks			X	Each case treated separately				
Flush valve toilets	X			X	X		X	X
Flush valve urinals		X		X	X		X	X
Hose outlets subject to toxic substances	X			X	X		X	X
Hose outlets subject to non-toxic substances		X		X	X	X	X	X
Outlets to recirculating cooling tower with chemical additives	X			X	X			
Outlets to recirculating cooling tower without chemical additives		X		X	X	X		

Backflow Device Application Chart

Type & Pressure	Description	Installed At	Examples of Installations	Applicable Standards
Reduced Pressure Principle Backflow Preventer - high hazard cross connections	Two independent check valves with intermediate relief valve. Supplied with shut-off valves and ball type test cocks.	All cross connections subject to backpressure or back-siphonage where there is a high potential health hazard from contamination. Continuous pressure.	Supply Lines Commercial Boilers Cooling Towers Hospital Equipment Laboratory Equipment Car Wash Sewerage Treatment	A.S.S.E. No. 1013 A.W.W.A. C506 FCCCHR of USC CSA B. 64.4 Sizes 3/4" - 10"
Double Check Valve Assembly - low hazard cross connections	Two independent check valves. Supplied with shut-off valves and ball type test cocks	All cross connections subject to backpressure where there is a low potential health hazard or nuisance. Continuous pressure.	(Non-toxic) Supply Lines Food Cookers Tanks & Vats Lawn Sprinklers Fire Sprinkler Lines Commercial Pools	A.S.S.E. No. 1015 A.W.W.A. C506 FCCCHR of USC CSA B.64.5 Sizes 3/4" -10"
Dual Check Valve Backflow Preventer - low hazard applications.	Two independent check valves. Checks are removable for testing.	Cross connections where there is a low potential health hazard and moderate flow requirements.	(Non-toxic) Post ground hydrants	A.S.S.E. No. 1024 Sizes 3/4" and 1"
Backflow Preventer with Intermediate Atmospheric Vent - moderate cross connections in small diameter pipes.	Two independent check valves with intermediate vacuum breaker and relief valve.	Cross connection subject to backpressure or back-siphonage where there is a moderate health hazard. Continuous pressure.	Boilers (small) Cooling Towers(small) Dairy Equipment Residential	A.S.S.E. No. 1012 CSA B. 64.3 Sizes 1/2" and 3/4"
Backflow Preventer with Intermediate Atmospheric Vent - moderate cross connections in small diameter pipes.	Two independent check valves with intermediate vacuum breaker and relief valve.	Pump outlet to prevent backflow to carbon dioxide gas and carbonated water into the water supply system to beverage machines.	Post-mix Carbonated Beverage Machine	Special Approvals
Laboratory Faucet and Double Check Valve with Intermediate Vacuum Breaker - in small pipe sizes for moderate to low hazard.	Two independent check valves with intermediate vacuum breaker and relief vent.	Cross connection subject to backpressure or back-siphonage where there is a moderate to low health hazard.	Laboratory faucets and pipe lines Barber Shop and Beauty Parlor sinks	A.S.S.E. No. 1035 (N-LF9)
Atmospheric Vacuum Breakers - moderate to high hazard cross connections.	Single float and disc with large atmospheric port.	Cross connections not subject to backpressure or continuous pressure. Install at least 6" above fixture rim. Protection against back-siphonage only.	Process Tanks Dishwashers Soap Dispensers Washing Machines Lawn Sprinklers	A.S.S.E. No. 1001 ANSI. A112.1.1 CSA B. 64.1.1 FCCCHR of USC Sizes 1/4" - 3"
Anti-Siphon Pressure Breakers - for moderate to high hazard cross connections.	Spring loaded single float and disc with independent first check. Supplied with shut-off valves and ball type test cocks.	Designed for installation in a continuous pressure potable water supply system 12" above the overflow level of the system being supplied. Protection against back-siphonage only.	Laboratory Equipment Cooling Towers Commercial Laundry Swimming Pools Commercial Plating Urinal Facilities Degreasers, Photo Tanks Live Stock Systems	A.S.S.E. No. 1020 CSA B. 64.1.2 FCCCHR of USC Sizes 1/4" - 2"
Hose Connection Vacuum Breakers - for residential and industrial hose supply outlets.	Single check with atmospheric vacuum breaker vent.	Install directly on hose bibbs, service sinks and wall hydrants. Not for continuous pressure.	Hose Bibbs Service Sinks Hydrants	A.S.S.E. No.1011 CSA B. 64.2 Size 3/4" hose

WATER LOSS PREVENTION AND LEAK DETECTION

The goal of the water loss program is to reduce "unaccounted-for water" to zero. In doing so, real and apparent losses must be addressed. Real loss consists of physical water losses from leaks, line breaks, tank overflows, etc. and places a financial and operational burden on the utility. Apparent loss consists of unauthorized consumption, customer metering inaccuracies, and errors in the meter reading and billing processes. This can result in overtime and wasted hours testing for leaks that are not real.

Water Accountability

Water Purchased – Water Sold = Non-Revenued Water

Non-Revenued Water – Water Used (i.e. flushing, breaks, etc.) = Accounted-for Water

Non-Revenued Water - Accounted-For Water = Unaccounted-For Water

Distribution management is the key to reducing water loss. Standard methods such as creating hydraulically isolated zones, accurate metering, pressure monitoring, tank performance, demand factoring and preventative maintenance are needed to identify real water loss.

The first step is to understand the current system demand as it relates to the "theoretical" system demand. This is determined by calculating the demand factor. This can be calculated for the entire customer base or by discrete zones where water flow can be monitored.

Demand Factor

Average Customer Usage /30 days/1,440 minutes = Demand Factor

5,000 gal / 30 days / 1,440 minutes = 0.1157 gpm

Demand Factor * # of Customers = Expected daytime flow (gpm)
Demand Factor * # of Customers * 33% = Expected nighttime flow (gpm)

0.1157 * 200 = 23.14 gpm
0.1157 * 200 *0.333 = 7.7 gpm

By dividing the system into zones and comparing actual flow to the expected flow allows an operator to quickly assess the volume and significance of the loss. The quickest way to find leaks is to knowing where not to look.

Actual -vs- Demand

Actual Flow =< Expected Flow = Do Nothing

Actual Flow => Expected Flow = Continue to Monitor

Actual Flow >> Expected Flow = You Have Leakage

The following plan outlines processes and procedures that Martin County Water will conduct on a routine basis to identify and repair water line leaks, monitor water usage, eliminate tank overflows, to reduce its overall water loss.

1. **Records**

   A. Infrastructure: Knowledge of water system components and how they function under normal operating conditions is crucial to identifying where water loss occurs. Infrastructure inventory, maintenance and operational performance records are maintained where applicable.

      - Water meters
      - Water mains
      - Service lines
      - Valves
      - Hydrants
      - Storage tank

   B. Customer: Billing and water usage data needs to be maintained as a historic record so that apparent losses can be identified.

      - Meter readings
      - Billing adjustments
      - Count of active/in-active meters
      - Total water usage by zone

2. **Routine Procedures:**

   A. Daily
      - Record master / zone meter readings;
      - Record readings in field log and spreadsheet;
      - All distribution personnel (meter readers, maintenance, etc.), shall immediately report any identified water leaks, tank overflows, or other concerns that are presently or could result in water leaks or loss.
      - Water leaks, given the urgency of the problem reported are repaired immediately or at the earliest possible time;
      - All office personnel shall immediately report any customer reported leaks, tank overflows, pressure problems, or other issues (whether during regular operational hours or after hours) to the Operator.

   B. Monthly
      - Read customer meters approximately the same time;
      - Record fire department usage
      - Compile estimated loss from flushing, line brakes, overflows, etc.;

- Compile customer usage by hydraulic zone; and
- Analyze data with water audit and demand factor spreadsheets (see Appendix D).

C. Annually
   - Customer meters will be tested every ten years to ensure that they are registering water accurately;
   - Meters between 1" and 3" shall be tested every three years;
   - Meters larger than 4" shall be tested annually; and
   - All meters will be replaced as warranted.

3. Leak Detection Procedures

A. On a routine basis, as system operations permit, the Water Works Supervisor will assemble a leak detection team by enlisting assistance from to check zone during a time when customer usage is minimal. This allows field personnel to go valve to valve (and often meter to meter) with listening devices and detect abnormal flows without affecting customer service. Personnel will perform leak detection in those areas with the highest known water loss, based on routine data collection and analysis.

B. Outside consultants such as Kentucky Rural Water, contract engineer or industry specialists are utilized as circumstances dictate.

4. System Demand Calculation Examples

Meter Size		Customer Count	Annual Water Sales for 2016												Monthly Average	Estimated Systemwide Flow (GPM)	
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		Daytime	Nighttime
5/8" x 3/4"		2,600	10,125,000	10,400,000	9,600,000	9,450,000	10,920,000	12,500,000	12,975,000	13,150,000	12,500,000	11,120,000	10,800,000	10,350,000	4,291	258.28	77.48
Meters Larger than 5/8-3/4	1														-	0.00	0.00
	2														-	0.00	0.00
	3														-	0.00	0.00
	4														-	0.00	0.00
	6														-	0.00	0.00
															-	0.00	0.00
Totals		2,600	326,612.90	371,429	309,677	315,000	352,258	416,667	418,548	424,194	416,667	358,710	360,000	333,871	4,291	258.28	77.48

Meter Size		Account Number	Customer Name	Customer Count	Average Monthly Usage	Average Expected Flow (GPM)				
						Daytime	Nighttime			
5/8" x 3/4"				200	4,000	18.52	5.56			
Meters Larger than 5/8-3/4	3/4					0.00	0.00			
	1					0.00	0.00			
	2					0.00	0.00			
						0.00	0.00			
						0.00	0.00			
						0.00	0.00			
						0.00	0.00			
						0.00	0.00			
						0.00	0.00	Measured	Estimated	Estimated
						0.00	0.00	Night Flow	GPM Loss	Daily Cost
Water Cost / 1,000		$ 2.35	Calculated Avg. Daily Demand		26,667	18.52	5.56	22.5	16.94	$ 57.34

PREVENTATIVE MAINTENANCE CHECKLIST

- ✓ Altitude Control Valves are critical to controlling system hydraulics and maintaining consistent customer service. ACV's should undergo visual and functional inspections and undergo annual maintenance as recommended in the manufacturer manual.
    1. Monthly visual inspection to locate leaks and external damages;
    2. Quarterly functional inspection including: closing, opening and regulation of the ACV and by-pass; and
    3. Annual maintenance including internal component inspection.

- ✓ Records will be retained at the water district office. These records are to include the following:
    1. Trouble shooting charts or guides which references pages in manufactures service manual;
    2. Inventory for each type of equipment to include; numbering system, catalog, nameplate data cards, maintenance record cards;
    3. Manufacturers' maintenance schedule for routine service.

- ✓ Hydrants and valves will be inspected / exercised in concert with flushing program.

- ✓ Storage tank inspected annually by utility staff and professionally inspected every five years. The annual inspection form is in Appendix E.

- ✓ Line breaks can occur at any time; therefore parts, materials and sample bottles are on-hand or readily available to repair water line of all sizes. Regulatory compliance and recordkeeping requirements are in Appendix F.

Safe Drinking Water Act Compliance

Martin County contracts with Appalachian States LABs. for certified drinking water analysis. Water samples are collected by the certified operator and analyzed at the frequency designated by the Division of Water. These laboratory analyses shall be reviewed by the operator to determine whether additional samples should be collected and/or operational changes implemented. The following sections describe the sample collection responsibilities and requirements.

Sample Collection Schedule

TCR Schedules

Sample Count	Sample Type	Sample Frequency	Effective Begin Date	Effective End Date	Seasonal Start MM/DD	Seasonal End MM/DD	Analyte Code	Analyte Name
4	RT	MN	01-01-2016		1/1	12/31	3100	COLIFORM (TCR)

Frequent Field Sample Schedules

Water System Facility State Asgn ID	Water System Facility Name	Analyte Code	Analyte Name	Days to Monitor per month	Samples Required per day	Effective Begin Date	Effective End Date	Summary Type
0910675DS001	DISTRIBUTION – Martin County WATER DIS	0999	CHLORINE	31	1	01-01-2002		SDRD

Non-TCR Group Schedules

Water System Facility State Asgn ID	Water System Facility Name	Analyte Group Code	Analyte Group Name	Sample Count	Sample Type	Sample Frequency	Effective Begin Date	Effective End Date	Seasonal Start MM/DD	Seasonal End MM/DD
0910675DS001	DISTRIBUTION Martin County WATER DIS	PBCU	LEAD & COPPER TAP	20	RT	3Y	01-01-2015		6/1	9/30
IDSE9036	IDSE – Martin County WATER DIST	DBPS	TTHM THAA	2	RT	QT	10-01-2013		8/1	8/31

Non-TCR Individual Schedules

Water System Facility State Asgn ID	Water System Facility Name	Analyte Code	Analyte Name	Sample Count	Sample Type	Sample Frequency	Effective Begin Date	Effective End Date	Seasonal Start MM/DD	Seasonal End MM/DD
0910675DS001	DISTRIBUTION Martin County WATER DIS	1094	ASBESTOS	1	RT	3Y	01-01-2020	12-31-2022	0/0	0/0

The Stage 2 Disinfection Monitoring plan is found in Appendix G.

Appendix A
Hydrant Flushing Form

Martin County Water District
Hydrant Flushing Form

Date / Time	Hydrant I.D.	Location	Minutes Flushed	Pressure		Gallons Flush	Cl2 Residual		Operator Initial	Comments
				Static	Dynamic		Begin	End		

Appendix B
Valve Record Form

VALVE RECORD				
Location (street / address):				
Type:		**Make:**	**Size:**	
Opens: ☐ Left ☐ Right ☐ Other:			**# of Turns:**	
Date Installed:				
Date Exercised	**Close/Open? (Y / N)**	**# of Turns**	**Condition of Stem, Packing, Nut, Gearing, Etc.**	**Valve Status (Open or Closed)**

Appendix C
Hydrant Inspection/Maintenance Form

Hydrant Record

Hydrant No.:_____ Date Installed:_____

Location:_____

Brand:_____ Type:_____ Model:_____

Opens: Clockwise ☐ Counterclockwise ☐

Number of Outlets:_____ Size of Pumper Nozzle:_____ Size of Other Nozzles:_____

Type of Nozzle Threadings:_____

Size/Type of Base:_____ Depth of Bury:_____

Size of Main:_____Isolation Valve: Yes ☐ No ☐

Flushing Dates	Reason For Flushing

Servicing Date	Static Pressure (psi)	Residual Pressure (psi)	Flow Pressure (psi)	Flow Rate(gpm)

Remarks:

Appendix D
Water Loss Audit Form

Annual Water Use Report

Water Utility:		**Martin County Water District**						
Year:	2016	2016						
LINE #	ITEM						GALLONS (Omit 000's)	%
1	**WATER PRODUCED or PURCHASED**							
2	Water Produced						696.292	99%
3	Water Purchased						10.341	1%
4	**TOTAL PRODUCED AND PURCHASED**						706.633	
	WATER SOLD							
5	Residential						197.826	87%
6	Commercial						6.097	3%
7	Industrial						0.000	0%
8	Bulk Loading Stations						0.000	0%
9	Wholesale						0.000	0%
10	Other Sales (explain)		Honey Branch				23.084	10%
11	**TOTAL WATER SOLD**						227.007	32%
12	**TOTAL WATER NOT SOLD**						479.626	68%
	BREAKDOWN OF UNSOLD WATER USED							
13	Utility and/or Water Treatment Plant						5.631	1%
14	Wastewater Plant				Estimated		0.000	0%
15	System Flushing				Estimated		30.050	4%
16	Fire Department				Estimated		3.725	1%
17	Other (explain)		Leaks Not Repaired 474 GPM				135.050	19%
	TOTAL UNSOLD WATER USED						**174.456**	25%
	BREAKDOWN OF WATER LOST							
18	Tank Overflows				Estimated		0.000	0%
19	Line Breaks				Estimated		51.724	7%
20	Other Loss						258.616	37%
	TOTAL UNSOLD WATER LOST						310.340	44%

	"OTHER LOSS" FLOW RATE CALCULATION:							
21						"Other Loss"	258.616	
22						% "Other Loss"	37%	
23						Number of Days in Period	366	
24						"Other Loss" per Day (1,000's gallons per Day)	0.707	
25						"Other Loss" per Minute (GPM)	0.491	
This form approved by: EPPC/DEP/DOW, KY PSC, KRWA								

Water Storage Inspection Form

Type: ( ) Elevated ( ) Standpipe ( ) Ground Storage ( ) Clearwell

Size:_____ Location:_____ Date Constructed:_____

Type Tank: ( ) Welded Metal ( ) Steel-lined Glass ( ) Concrete

Site:

1. Does site slope away from bank? ( ) Yes ( ) No
2. Is ground soft or soggy? ( ) Yes ( ) No

Foundations:

1. Is the concrete foundation cracked? ( ) Yes ( ) No
2. Is the concrete foundation level? ( ) Yes ( ) No
3. Is there a gap between riser base and the concrete? ( ) Yes ( ) No
4. Condition of anchor bolts? ( ) Yes ( ) No

Tank or Shell

1. Any disfiguration in tank bottom, shell, roof or irregularities in the contour of the steel? ( ) Yes ( ) No
2. Are any weld seams concave? ( ) Yes ( ) No
a. Are there any rust streaks originating from the weld seams? ( ) Yes ( ) No
b. Any evidence of water leaking from tank? ( ) Yes ( ) No
3. Is there any metal loss by pitting? ( ) Yes ( ) No
4. Condition of finish coat? ( ) Good ( ) Fair ( ) Poor
5. Condition of intermediate coat? ( ) Good ( ) Fair ( ) Poor
6. Condition of primer coat? ( ) Good ( ) Fair ( ) Poor
7. Amount of surface area showing rust?_____
8. Any water ponding on roof? ( )Yes ( ) No

Accessories

1. Is there a safety climbing device or cage on the ladder? ( ) Yes ( ) No
2. Is there a target on tank? ( ) Yes ( ) No
a. Is it working properly? ( ) Yes ( ) No
3. Does the utility have a climbing harness? ( ) Yes ( ) No
4. How often does the utility climb tank? ( ) Day ( ) Week( ) Month
Other:_____
5. What is the condition of the overflow? ( ) Good ( ) Fair ( ) Poor
a. Does overflow have a screen or flapper? ( ) Screen ( ) Flapper ( ) Neither
b. Any evidence of cross connections? ( ) Yes ( ) No
c. Rip-rap to prevent erosion at end of overflow? ( ) Yes ( ) No

Appendix F
Water Line Break/Repair Log

Martin County Water District
Monthly Line Break Log
Date_____2016

Date	Location	Time Found	Population Affected	Time for Repair	Disinfectant Residuals			Bact Samples	
					Date	Time	Result	Date	Time

Appendix G
Stage 2 DBP Monitoring Plan

FIRST AMENDMENT
TO
JOINT OPERATION AGREEMENT

THIS FIRST AMENDMENT TO JOINT OPERATOIN AGREEMENT dated as of the 1st day of January, 2017, by and between the MARTIN COUNTY WATER DISTRICT (hereinafter "District") and PRESTONSBURG CITY'S UTILITIES COMMISSION (hereinafter "PCUC") (collectively, as "parties").

RECITALS

WHEREAS, the parties entered into a certain Joint Operation Agreement, dated July 3, 2000 (hereinafter "Joint Operation Agreement"), which was filed by PCUC with the Kentucky Public Service Commission (hereinafter the "Commission") on July 11, 2007.

WHEREAS, the parties desire to modify certain provisions of the Joint Operation Agreement to adjust the rate for water charged under Sections 13 and 14 thereof.

NOW, THEREFORE, in consideration of the covenants and agreements set forth in the First Amendment and for other good and valuable consideration, the receipt and adequacy of which are hereby acknowledged, the parties agree as follows:

1. The provisions in Sections 13 and 14 setting the water rates shall be deleted in its entirety and the following is substituted therefore:

First 112,000 gallons per month	$348.50
All over 112,000 gallons per month	$7.75 per 1,000 gallons

2. This First Amendment shall be filed by PCUC with the Commission, and shall be subject to the Commission's jurisdiction and review.

3. The rate adjustment set forth herein shall become effective thirty (30) days after the date the First Amendment is filed with the Commission.

4. In all other respects, the parties hereto approve, confirm and ratify the terms and conditions of the Joint Operation Agreement.

This First Amendment is made as of the year and date first above written, and shall be effective as of that date without regard to the fact that execution hereof by the parties shall have been effected at the same or different times.

MARTIN COUNTY WATER DISTRICT

BY: William J. Harvey

ITS: CHAIRMAN

ATTEST:

N. La Collier

SECRETARY WITH PERMISSION OF WSH

PRESTONSBURG CITY'S UTILITIES COMMISSION

BY: _____

TURNER E. CAMPBELL, SUPERINTENDENT/CEO

ATTEST:

_____

JIMMY A. CALHOUN, CHAIRMAN OF
THE PRESTONSBURG CITY'S
UTILITIES COMMISSION