

Appendix R

**AGRICULTURE, FOOD AND NATURAL RESOURCES (AFNR)
YOUTH APPRENTICESHIP**

**ENVIRONMENTAL SYSTEMS PATHWAY
BASIC WATER RESOURCES UNIT
UNIT 10**

Basic Water Resources Unit- REQUIRED FIRST

Competency (Work Tasks)	Performance Standards What employer checks for while doing task. Train YA Student on. YA student will ...	Learning Objectives What to know/learn to do this task. Content Suggested for Class/Reading/On-the-Job Training.
1. Apply water industry knowledge	<ul style="list-style-type: none"> • Use water terms correctly • Follow all safety and security rules • Manage all hazards correctly (mechanical, electrical, chemical, etc.) • Apply basic principles of water quality management, chemistry, and physics as indicated in job functions 	<ul style="list-style-type: none"> • Explain the natural water cycle • Define common water industry terms • Classify water sources- surface water, groundwater, watersheds, wastewater types, etc.- • Evaluate characteristics of source water- normal, abnormal, compliance, watershed protection • Compare different industries in water resources and management • Describe characteristics of wastewater (residential and industrial) • Outline basic processes for treating drinking water, industry use (food, medical) water, and wastewater treatment • Describe water use, processes, and conservation historically and today • Define effluent • Explain the purpose of ponds and lagoons in water treatment • Identify basic electrical, mechanical, and hydraulic principles • Discuss basic environmental water regulations such as the Clean Water Act, Wisconsin Department of Natural Resources Administrative codes for wastewater, storm water, drinking water, Wisconsin Pollutant Discharge Elimination System (WPDES) discharge permitting • Describe “green” urban and infrastructure planning and how it relates to wastewater management of run-off
TREATMENT & OPERATIONS		
2. Read technical drawings & work orders	<ul style="list-style-type: none"> • Review technical drawing as needed for operational tasks • Identify symbols and meaning on technical drawings • Plan work from work orders 	<ul style="list-style-type: none"> • Explain the need for technical drawings, also known as blueprints, schematics, or engineering drawings in water treatment facilities or job functions • Identify terminology related to technical drawings

	<ul style="list-style-type: none"> • Identify procedures to be completed from work orders • Refer to Operations and Maintenance Manuals during course of job tasks 	<ul style="list-style-type: none"> • Describe how to interpret views, projections and elements from a technical drawing • Discuss how to interpret work orders in your facility • Explain the role of Standard Operating Procedures (SOPs)
3. Monitor operating conditions, meters & gauges	<ul style="list-style-type: none"> • Identify and monitor the system control instruments • Operate flow measuring device to monitor the flow of water • Collect operational data • Monitor and respond to alarm systems according to protocol • Document conditions, readings, and any actions taken 	<ul style="list-style-type: none"> • Discuss common preliminary treatment processes • Compare pre-, primary-, secondary, tertiary, and post treatment for water quality • Describe the flow of water and its monitoring from point of entrance to exit in your facility • Compare flow measurement devices • Explain the use of pumps, cross connections, backflow methods, and devices/valves in water flow through a treatment facility
4. Collect operational data	<ul style="list-style-type: none"> • View and obtain operational data at prescribed intervals • Collect and store samples for testing • Download data from meters and data-loggers into computer system databases • Perform physical measurements and process control calculations • Report any abnormal conditions to worksite professional as required 	<ul style="list-style-type: none"> • Identify the basic components of a treatment strategy • Explain the water quality requirements for both your water supply and treatment • Differentiate between normal and abnormal operating conditions
5. Use operations software (SCADA, PLC, GIS/GPS, DBs)	<ul style="list-style-type: none"> • Obtain and use appropriate reference materials • Access and use appropriate file management to search for appropriate file • Add, Edit, Verify and Query data • Use appropriate computer codes, formatting, macros, charts, spreadsheets, etc. • Verify data prior to entry/storage • Generate reports as required 	<ul style="list-style-type: none"> • Describe instrumentation and controls used on your facility • Define Supervisory Control and Data Acquisition (SCADA), Programmable Logic Controller (PLC), Geographic Information/Positioning System (GIS/GPS) and their purpose in a water treatment facility • Compare GIS and GPS • Explain the need for probes, controllers, meters and alarms in water resource monitoring • Explain how data and files are stored and “backed up” • Describe the purpose of security and identification information within electronic and computer systems
6. Adjust basic operating conditions based on readings	<ul style="list-style-type: none"> • Collect operational data • Adjust chemical feed rates as allowed • Adjust flow patterns and rates as allowed • Collect and store samples for testing as required • Monitor adjustments to ensure conditions corrected 	<ul style="list-style-type: none"> • List common troubleshooting processes taken in water treatment facilities • Describe indications and purposes for common adjustments

	<ul style="list-style-type: none"> • Document conditions and actions taken 	
7. Clean & maintain facility, tanks, filter beds, etc.	<ul style="list-style-type: none"> • Review procedure for cleaning and basic maintenance • Verify safety considerations prior to task • Gather supplies and cleaning solutions required • Operate tools and equipment safely • Collect and store samples for testing if required • Document cleaning and maintenance as required 	<ul style="list-style-type: none"> • Relate housekeeping and facility maintenance to operational quality • Identify common by-products from water treatment • List common housekeeping and basic maintenance functions in water treatment • Explain safety considerations for cleaning • Explain how to properly use pressurized fire hoses safely
8. Treat &/or dispose of solids/sludge/scale	<ul style="list-style-type: none"> • Review procedure for treatment and/or disposal of waste • Verify safety considerations prior to task • Gather supplies and cleaning solutions required • Operate tools and equipment safely • Collect and store samples of solids/sludge/scale and effluent for testing if required • Report any abnormal conditions to worksite professional as required • Dispose of waste materials as required • Document treatment and/or disposal as required • Prepare draft manifest/disposal documents 	<ul style="list-style-type: none"> • Explain the purpose of treating/monitoring effluent • Describe how common substances are removed and treated during water treatment such as solids, bacteria, algae, fungi, viruses, minerals, pollutants, and fertilizers • Define sludge • Discuss the treatment of biosolids/sludges • Compare aerobic and anaerobic digesters • Discuss recycling methods for biosolids/sludge • Discuss the regulatory requirements for treatment and disposal of wastes- solids/sludge/scale, etc. • List common methods of sludge disposal • Discuss water reuse from a waste water treatment plant or other type of facility
LAB		
9. Clean & maintain lab equipment	<ul style="list-style-type: none"> • Rinse items thoroughly, as required, with the appropriate solvent • Soak glassware and other items in warm aqueous solution of detergent • Clean items to remove all residual matter • Rinse and dry items in required manner • Document cleaning procedure if required • Return clean glassware and instruments to their proper storage locations 	<ul style="list-style-type: none"> • Identify common glassware, instruments, and reusable testing supplies used in the lab • Describe the use of common lab glassware and instruments • Describe proper dish washing technique for chemical glassware
10. Collect & store samples	<ul style="list-style-type: none"> • Review Standard Methods for the Examination of Water and Wastewater manuals and protocols • Identify equipment and safety requirements to collect samples • Setup sampling equipment and materials • Setup field testing equipment, materials, etc. (test kits) • Identify proper method and container for sample • Pre-label sample containers or label immediately after 	<ul style="list-style-type: none"> • Compare manual to automatic sampling equipment • Describe how to collect typical water test samples (samplers, flow meters, water quality sondes, etc.) • Compare types of samples • Describe sampling methods such as composite-timed, flow proportional, grab, ultra-clean, etc. • Identify safety issues with sampling in the field • Describe field test methods

	<ul style="list-style-type: none"> collection • Collect sample according to protocol • Place required amount of sample in container • Store sample as required for test • Preserve chain of custody 	<ul style="list-style-type: none"> • Explain regulations for confined space work • Identify proper storage and preservation methods • Identify containers for different tests
11. Preserve chain of custody	<ul style="list-style-type: none"> • Plan for sampling and locations prior to task • Identify sample with information such as sample person ID, date, time, location, sample number, type of sample (grab vs. composite), type of test conducted/to be conducted, other observations • Label/ID each sample tested or collected • Complete chain of custody form(s)/records • Affix custody seals as required • Obtain proper signatures and information when relinquishing custody 	<ul style="list-style-type: none"> • Define chain of custody • Explain the purpose and requirements for chain of custody of samples in water treatment testing • Point out common sections on chain of custody forms • Define what situations constitute a sample is “under custody”
12. Weigh & measure accurately	<ul style="list-style-type: none"> • Review the protocol for accurately using the measuring equipment including safety precautions • Ensure equipment is usable and current for calibration • Weigh/measure mass (solids and liquids) • Weigh/measure volume • Measure temperature • Record measurements in appropriate units • Clean up equipment 	<ul style="list-style-type: none"> • Explain how to properly weigh and measure solids and liquids • List common units used in labs for mass, volume, and temperature • Explain how to zero and use scales • Identify the proper glassware to deliver and contain specific volumes • Demonstrate reading volume in glassware • Explain how to pipette and micropipette different volumes of liquid correctly • Convert measurements from U.S. Standard to metric and vice versa
13. Perform calculations & conversions	<ul style="list-style-type: none"> • Review the appropriate chart or reference materials to make calculations or conversions • Identify given values • Identify unknown values • Determine the calculations or conversions and formulas that need to be performed • Perform calculations or conversions as required <ul style="list-style-type: none"> ○ Calculate volumes ○ Calculate "pounds formula" ○ Calculate pump rates ○ Calculate detention times ○ Calculate percent removal ○ Convert flow rates • Verify calculations or conversions with worksite 	<ul style="list-style-type: none"> • Explain how to convert between U.S. standard measurements and metric measurements • Explain the link between significant figures in calculations and the measuring devices used • Describe the units involved in concentrations of mass, volume, molarity, molality, normality, ppm and ppb • Use the mole concept to convert between moles and grams • Explain how to calculate Percent by mass, Percent by volume, Molarity, Molality, Normality, parts per million (ppm) and parts per billion (ppb)

	professional • Record calculations or conversions as required	
14. Conduct basic lab testing	<ul style="list-style-type: none"> • Review the testing protocol including safety precautions • Select and set-up the correct equipment and supplies • Prepare reagents, solutions, and/or buffers • Prepare any quality control samples required • Locate and identify the sample(s) to be tested • Prepare samples for testing according to protocol • Test the sample(s) according to protocol • Include Quality Control (QC) samples, if applicable • Operate lab equipment properly • Records results • Clean glassware and instruments • Segregate, Recycle or Dispose of chemical, biohazardous, or infectious waste according to facility guidelines using Standard Precautions • Document testing results 	<ul style="list-style-type: none"> • Compare routine lab testing to special projects analysis • Describe the chemistry of common water tests • Describe how to conduct testing for Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Suspended Solids (TSS), solubility, pH, colloids, H⁺ concentration, Ammonia Nitrogen (NH₃-N), Total Phosphorus (TP), and Total Residue Chlorine (TRC), etc. • Define limit of detection (LOD) • Discuss common water quality standards • Explain common treatment requirements based on test results and permit requirements • Describe the proper storage and handling of various chemicals: Inorganic, Organic, acids, chlorinated chemicals, flammable, corrosive • Define the common uses of reagents, solutions, and buffers in testing labs • Explain how to avoid contaminating reagents during preparation • Discuss the requirement for quality control (QC) samples and/or equipment controls in testing • Define positive and negative control • Explain the procedures for safe handling and disposal of chemical and biological Materials • Define the purpose of Standard Precautions • Explain how to handle and dispose of laboratory wastes safely
EQUIPMENT & QUALITY		
15. Operate tools & equipment safely	<ul style="list-style-type: none"> • Operate only equipment trained on • Choose correct tool or equipment for the task • Follow and complete any tool check list • Verify tool/equipment is available for use and in working order • Verify tool/equipment is current for preventative maintenance and/or calibration • Verify safety equipment and any Personal Protective Equipment (PPE) needed for tool/equipment use • Inspect tool/equipment and work area for safety 	<ul style="list-style-type: none"> • Describe the types and uses of pumps used in water treatment in your facility • Describe common water treatment equipment used in aeration, filtering, disinfecting, coagulation, sedimentation, screening, sludge treatment, nutrient removal, etc. • Explain the proper use of fire hoses, hydrants, and hose bibs • List the various tools and equipment used at your facility

	<p>considerations</p> <ul style="list-style-type: none"> • Set up and prepare tool/equipment for safe operation: • Wear the required Personal Protective Equipment (PPE) at all times as required for the operation of the tool/equipment • Operates tool/equipment safely with guarding devices in the manner required for the job task • Monitor tool/equipment for safe operation while operating • Compare tool/equipment performance regularly to optimal equipment operations • Follow facility procedures for cleanup and shut down after use • Investigate and promptly report abnormal tool/equipment conditions • Properly shut down and label any tool/equipment that is not operating as expected • Follow Lock Out/Tag Out procedures as applicable • Document use as required 	<ul style="list-style-type: none"> • Outline applications of each tool and equipment • Describe and demonstrate the safety requirements for each tool and equipment • Describe emergency shutdown procedures for the tool/equipment you will operate • Explain how to recognize and address malfunctions for the tool/equipment you will operate • Describe how to recognize wear and tear on equipment components • List which tools and equipment require safety certification • Explain Lock Out/Tag Out indications and procedures in your facility
<p>16. Monitor pumps & equipment for correct operation</p>	<ul style="list-style-type: none"> • Identify the pump and equipment quality measures tracked • Compare current pump and equipment performance to optimal equipment operations on a regular basis • Report any noted deviations from expected performance • Assist worksite professional to investigate abnormal equipment conditions in a timely manner • Continuously monitor equipment that is corrected to ensure that the corrective action solved the problem • Document all monitoring activities 	<ul style="list-style-type: none"> • Discuss pump and water treatment equipment features and performance • Explain basic hydraulic and pneumatic principles, and lubricant and fluid characteristics • Describe how trends for malfunctioning equipment might appear in facility records • List common tools and equipment that must be monitored and maintained • Define Total Productive Maintenance (TPM) • Identify the purpose of a control chart • Identify conditions that require preventive or corrective actions