WATER/WASTEWATER TECHNOLOGY

California's 40 million residents and businesses rely upon our State's complex water and wastewater infrastructure to perform its functions more than one billion times per day. With the State's population projected to reach 60 million by 2050, it is essential that our water resources be more effectively managed and our wastewater be reclaimed and recycled for beneficial usages. Nothing is more vital to the State's economic development and quality of life than water and wastewater services. In order to reduce Southern California's reliance on imported water, it is imperative that we diversify our water resources portfolio through expanded water conservation efforts, wastewater reclamation and reuse, grey water utilization, improving watershed management practices, tapping groundwater reserves, and employing new technologies for seawater desalination. Having a pool of well-trained candidates ready to fill the large number of job vacancies that are being created by the exodus of Baby Boomers from this field is essential to the efficient operation of our State's critical water and wastewater infrastructure. This is especially true here in Southern California, where our natural occurring water resources are so scarce.

The Water and Wastewater Technology (WWTR) program at Cuyamaca College is the oldest continuously operating educational program for this critical industry sector in the entire California Community College system. With nearly 25 different courses leading to Certificates of Achievement and/or Associate of Science degrees in six majors, the WWTR program is easily the most comprehensive of its type in the State.

Careers in water/wastewater technology involve the administration, operation, and maintenance of drinking water and wastewater treatment facilities, drinking water distribution systems, and wastewater collection systems. The courses, certificates and degrees in this major are designed to prepare students for employment by municipal drinking water and wastewater agencies and private industrial treatment facilities. To supplement their regular classroom learning activities, students have opportunities to visit key water and wastewater facilities, hear guest speakers from the industry, and participate in internship and/or cooperative work experience programs.

Many water and wastewater industry jobs require specialized certifications. Many of our WWTR courses specifically prepare students for these certification examinations administered by the State of California as well as those administered by professional associations supporting the water and wastewater industry. In addition to providing the necessary training for entry-level water and wastewater industry workers, the program is also heavily utilized by incumbent employees already working in the field to gain the additional knowledge, skills and abilities necessary to earn higher levels of certification and prepare them for promotional opportunities to advance their careers.

CAREER OPPORTUNITIES

Backflow Program Manager
Biologist
*Chemist
Construction Inspector
Construction Laborer/Supervisor
Cross Connection Control Specialist
Electronic Technician
*Engineer, Civil
*Engineer, Electrical
Engineering Technician
Equipment Technician
Equipment Maintenance Operator
Field Operations Supervisor
GIS/Mapping Specialist
Groundwater Management Specialist
Inspector
Instrumentation and Control Technician
Instrumentation and Control Supervisor
Irrigation Consultant
Irrigation System Designer
Laboratory Analyst
Landscape Water Auditor
Leak Detection Technician
*Marine Biologist
Mechanical Systems Technician
Meter Maintenance Technician
Meter Reader
Water Treatment Plant Operator
Plant Process Control Technician
Plant Process Control Supervisor
Reclaimed Water Specialist
Reservoir Keeper
*Safety and Risk Manager
Survey Technician
Utility Worker
Wastewater Plant Operator
Wastewater Reclamation Plant Operator
Wastewater Treatment Supervisor
Water Distribution System Operator
Water Quality Lab Technician
*Water Quality and Treatment Manager
Water Systems Technician

*Bachelor Degree recommended

I. BACKFLOW AND CROSS CONNECTION CONTROL

Students will study the technical processes, procedures, and methods used in the production, use, and distribution of recycled and reclaimed wastewater, including backflow protection, legal, administrative and permitting issues, the treatment process, health and safety concerns, and the cross connection control (shut down) test as performed in San Diego County. The courses consist of both classroom and demonstration sessions which cover all aspects of cross connection control and recycled water shut down testing.

Program Learning Outcomes

Upon successful completion of this program, students will be able to:

- Differentiate between different backflow devices and methods.
- Compare and contrast the effective uses of backflow devices and explain their limitations.
- Describe the specifications, installation, and operation of typical devices used in backflow prevention and testing and explain their proper installation.
- Perform accurate backflow prevention tests using proper test equipment.
- Analyze backflow prevention test results using standardized test reporting forms.
- Evaluate backflow testing device malfunctions.
- Articulate the importance of proper backflow testing equipment selection and use.
- Cite specific laws pertaining to cross connection control programs.
- Complete basic backflow testing device repairs requiring breakdown and reassembly.
- Articulate the AWWA and ABPA testing standards.

Associate in Science Degree Requirements:

Course	*Title*	*Units*
WWTR 101	Fundamentals of Water/Wastewater Technology	3
WWTR 102	Calculations in Water/Wastewater Technology	3
WWTR 104	Applied Hydraulics	3
WWTR 130	Water Distribution Systems	3
WWTR 280	Backflow Tester Training	2
WWTR 282	Cross Connection Control Specialist	3
WWTR 284	Cross Connection Control Specialist–Recycled Water	3
		20

Select at least nine units from the following:

WWTR 103	Introduction to Water Resources Management	3
WWTR 105	Principles and Practices of Water Conservation	3
WWTR 106	Introduction to Electrical and Instrumentation Processes	3
WWTR 110	Laboratory Analysis for Water/Wastewater	3
WWTR 115	Wastewater Reclamation and Reuse	3
WWTR 132	Wastewater Collection Systems	3
WWTR 134	Mechanical Maintenance	3
WWTR 290	Cooperative Work Experience	2
		9
	Total Required	29
	Plus General Education Requirements	

Certificate of Achievement

Students who complete only the major requirements above qualify for a Certificate in Backflow and Cross Connection Control. An official request must be filed with the Admissions and Records Office prior to the deadline as stated in the Academic Calendar.

II. WATER RESOURCES MANAGEMENT

This major prepares students to design, implement and evaluate water conservation/water resources management programs and to assist in developing more diversified water resource portfolios in the water and wastewater sector or in the landscape and property management field. Emphasis is on emerging technologies and methods that lead to long-term sustainability of our water and wastewater resources. Attaining a certificate or degree in this major will prepare students to enter careers in water conservation, watershed management, water resources and groundwater, public information, and community education. Careers in landscape and facilities maintenance, irrigation system design, urban water management, and landscape design are also options. Students successfully completing the core requirements for this major will qualify to take the American Water Works Association's Water Use Efficiency Practitioner certification examination, the Landscape Water Management certification offered by the California Landscape Contractor's Association, and the Certified Landscape Water Manager certification offered by the Irrigation Association. In addition to preparing students for entry level jobs in the water and wastewater field, courses in this major prepare students to transfer to a number of four-year college or university degree programs, including Water Resources, Environmental Sciences, and Natural Resources Management.

Program Learning Outcomes
Upon successful completion of this program, students will be able to:
- Describe the essential uses of water, the infrastructure that has been developed to meet demand, and the problems the water industry faces.
- Identify a specified number of legal and financial constraints which complicate efficient and effective water resource management.
- Explain the concept and importance of water portfolio diversification.
- Describe the political/organizational structures and list the major agencies involved in providing water in the greater San Diego region.
- Compare and contrast the sources of wastewater, the major collection/transportation networks, and the major wastewater treatment/reclamation facilities operating in San Diego County.
- Identify the major regulatory agencies that monitor and regulate the water/wastewater industry.
- Explain how the current carbon footprint of the water and wastewater infrastructure significantly impacts California's energy and power demands.
- Compare and contrast a specified number of resource recovery/alternative treatment methods.

Associate in Science Degree Requirements:

Course	*Title*	*Units*
OH 120	Fundamentals of Ornamental Horticulture	3
OH 170	Plant Materials: Trees and Shrubs	3
OH 221	Landscape Construction: Irrigation and Carpentry	3
OH 250	Landscape Water Management	2
WWTR 101	Fundamentals of Water/Wastewater Technology	3
WWTR 103	Introduction to Water Resources Management	3
WWTR 105	Principles and Practices of Water Conservation	3
WWTR 115	Wastewater Reclamation and Reuse	3
WWTR 290	Cooperative Work Experience	2
or		
OH 290	Cooperative Work Experience Education	2
		25

Select two of the following:

WWTR 102	Calculations in Water/Wastewater Technology	3
WWTR 112	Basic Plant Operations: Water Treatment	3
WWTR 114	Basic Plant Operations: Wastewater Treatment	3
WWTR 130	Water Distribution Systems	3
WWTR 132	Wastewater Collection Systems	3
WWTR 280	Backflow Tester Training	2
WWTR 282	Cross Connection Control Specialist	3
WWTR 284	Cross Connection Control Specialist–Recycled Water	3
		5-6

Select two of the following:

OH 102	Xeriscape: Water Conservation in the Landscape	2
OH 140	Soils	3
OH 174	Turf and Ground Cover Management	3
OH 220	Landscape Construction: Concrete and Masonry	3
OH 235	Principles of Landscape Irrigation	4
OH 238	Irrigation System Design	3
OH 255	Sustainable Urban Landscape Principles and Practices	2
		4-7
	Total Required	34-38
	Plus General Education Requirements	

Certificate of Achievement
Students who complete only the major requirements above qualify for a Certificate in Water Resources Management. An official request must be filed with the Admissions and Records Office prior to the deadline as stated in the Academic Calendar.

III. WATER TREATMENT PLANT OPERATOR

Students enrolled in this major learn the key steps, processes, and current technology involved in operating modern water treatment plants. Students who satisfactorily complete the required courses in this certificate and/or degree program will qualify to take the California Department of Public Health (CDPH) Grade T-1 and T-2 Water Treatment Plant Operator examinations required for certification and employment at water treatment plants.

Program Learning Outcomes
Upon successful completion of this program, students will be able to:
- Identify in detail characteristics and sources of ground water and surface water supplies including the chemical, physical and bacterial characteristics, and explain the effects on quality of geological formations, stratifications, and watershed management.
- Compare the basic principles of each water treatment process and list them in order performed.
- Identify and classify water distribution system components.
- Explain pump cavitation, corrosion, cross-connection, air valves, head loss and main flushing in relation to water and wastewater collection, distribution, and treatment.
- Compare and contrast the basic principles of each water treatment process and list them in order performed.
- Explain and prepare a plan for the use of chlorine including the characteristics of and methods for storing, feeding and measuring chlorine including the effects of moisture, pH and temperature on feed rate, and the health and safety effects, procedures and personal protective requirements.
- Determine the methods used for coagulation, flocculation and sedimentation including common chemicals used, feed systems, effects of time temperature, turbidity and pH, and the measurement of turbidity and color.
- Compare and contrast the six basic water quality parameters and explain in detail microbiological and chemical components, including sampling requirements and properties.
- Demonstrate through testing basic knowledge of the regulations for monitoring water quality and performing water treatment.
- Perform basic mathematical calculations and conversions relating to water flow, pressure, volume, velocity, chemical dosage, and hydraulic and organic loading.
- Determine appropriate safety procedures applicable to service and operation of water treatment and distribution systems including potential problems.

Associate in Science Degree Requirements:

Course	*Title*	*Units*
WWTR 101	Fundamentals of Water/Wastewater Technology	3
WWTR 102	Calculations in Water/Wastewater Technology	3
WWTR 104	Applied Hydraulics	3
WWTR 106	Introduction to Electrical and Instrumentation Processes	3
WWTR 110	Laboratory Analysis for Water/Wastewater	3
WWTR 112	Basic Plant Operations: Water Treatment	3
WWTR 117	Advanced Plant Operations: Water Treatment	3
		21

Select at least nine units from the following:

WWTR 103	Introduction to Water Resources Management	3
WWTR 105	Principles and Practices of Water Conservation	3
WWTR 114	Basic Plant Operations: Wastewater Treatment	3
WWTR 115	Wastewater Reclamation and Reuse	3
WWTR 130	Water Distribution Systems	3
WWTR 132	Wastewater Collection Systems	3
WWTR 134	Mechanical Maintenance	3
WWTR 268	Introduction to Membrane Plant Operation	3
WWTR 270	Public Works Supervision	3
WWTR 280	Backflow Tester Training	2
WWTR 282	Cross Connection Control Specialist	3
WWTR 290	Cooperative Work Experience	2
		9
	Total Required	30
	Plus General Education Requirements	

Certificate of Achievement
Students who complete only the major requirements above qualify for a Certificate in Water Treatment Plant Operator. An official request must be filed with the Admissions and Records Office prior to the deadline as stated in the Academic Calendar.

IV. WATER DISTRIBUTION SYSTEMS OPERATIONS

Students in this major learn the methods, processes, technology, and current practices involved in operating and maintaining modern, complex water distribution systems. Students who satisfactorily complete the required courses for this certificate and/or degree program will qualify to take the CDPH Grade D-1 through D-5 Water Distribution Operator examinations required to obtain certification and employment with a water district.

Program Learning Outcomes
Upon successful completion of this program, students will be able to:
- Identify sources and characteristics of water common to water distribution systems.
- Compare and contrast the different types of water distribution systems currently used in the United States.
- Identify drinking water public health hazards and water quality standards common to the industry.
- Using calculations and conversions, determine water flow, pressure, volume, velocity and force, and chemical dosage used in water distribution systems.
- Identify and compare methods used to handle, install and repair water distribution pipe.
- Explain principles of pump operation for the types of pumps used in water distribution systems, including common problems, necessary adjustments, and typical packing gland problems.

- Explain the electrical principles involved in control circuits common to water distribution systems.
- Explain the required safe handling and storage of chlorine used in water distribution systems.
- Check and utilize water maps and drawings to determine location, type and characteristics of water distribution systems.
- Specify necessary procedures needed to safely complete field work in a water distribution system.
- Compare and contrast factors considered in the selection of pipe and different types of water meters.
- Demonstrate the ability to read meters and calculate the meter accuracy.

Associate in Science Degree Requirements:

Course	*Title*	*Units*
WWTR 101	Fundamentals of Water/Wastewater Technology	3
WWTR 102	Calculations in Water/Wastewater Technology	3
WWTR 104	Applied Hydraulics	3
WWTR 106	Introduction to Electrical and Instrumentation Processes	3
WWTR 130	Water Distribution Systems	3
WWTR 134	Mechanical Maintenance	3
WWTR 265	Water Distribution Systems II	3
		21

Select at least nine units from the following:

WWTR 103	Introduction to Water Resources Management	3
WWTR 105	Principles and Practices of Water Conservation	3
WWTR 110	Laboratory Analysis for Water/ Wastewater	3
WWTR 112	Basic Plant Operations: Water Treatment	3
WWTR 115	Wastewater Reclamation and Reuse	3
WWTR 270	Public Works Supervision	3
WWTR 280	Backflow Tester Training	2
WWTR 282	Cross Connection Control Specialist	3
WWTR 284	Cross Connection Control Specialist–Recycled Water	3
WWTR 290	Cooperative Work Experience	2
		9
	Total Required	30
	Plus General Education Requirements	

Certificate of Achievement

Students who complete only the major requirements above qualify for a Certificate in Water Distribution Systems Operations. An official request must be filed with the Admissions and Records Office prior to the deadline as stated in the Academic Calendar.

V. WASTEWATER COLLECTION SYSTEMS

Students completing the required courses for this major will qualify to take nearly a dozen wastewater related certification examinations offered by the California Water Environment Association (CWEA). Although current State regulations do not require certification of wastewater collection system personnel, many public sector employers either require or prefer job applicants who have obtained the CWEA Wastewater Collection and Maintenance certifications.

Program Learning Outcomes

Upon successful completion of this program, students will be able to:

- Define common terminology pertaining to collections system components, design, and management as well as inspection and quality control.
- Identify the types and functions of pipes and fittings used in wastewater collection system design and management.
- Given a wastewater collection map book, identify pipeline dimensions, pipe construction materials, direction of flow, and location of valves, services and lift stations.
- Describe in detail basic underground location and leak detection, trenching and shoring, and backfill and compaction methods of construction used in the field.
- Describe the nine basic cleaning methods and basic principles involved in hydraulic and mechanical cleaning methods.
- List and describe the operation of common valves used in a wastewater collection system.
- Perform basic mathematical computations and conversions relating to wastewater collection systems, pressure, volume, velocity, chemical dosage, and hydraulic and organic loading.

Associate in Science Degree Requirements:

Course	*Title*	*Units*
WWTR 101	Fundamentals of Water/Wastewater Technology	3
WWTR 102	Calculations in Water/Wastewater Technology	3
WWTR 104	Applied Hydraulics	3
WWTR 106	Introduction to Electrical and Instrumentation Processes	3
WWTR 132	Wastewater Collection Systems	3
WWTR 134	Mechanical Maintenance	3
WWTR 267	Wastewater Collection Systems II	3
		21

Select at least nine units from the following:

WWTR 103	Introduction to Water Resources Management	3
WWTR 105	Principles and Practices of Water Conservation	3
WWTR 114	Basic Plant Operations: Wastewater Treatment	3
WWTR 115	Wastewater Reclamation and Reuse	3
WWTR 270	Public Works Supervision	3
WWTR 280	Backflow Tester Training	2
WWTR 282	Cross Connection Control Specialist	3
WWTR 284	Cross Connection Control Specialist–Recycled Water	3
WWTR 290	Cooperative Work Experience	2
		9
	Total Required	30
	Plus General Education Requirements	

Certificate of Achievement

Students who complete only the major requirements above qualify for a Certificate in Wastewater Collection Systems. An official request must be filed with the Admissions and Records Office prior to the deadline as stated in the Academic Calendar.

VI. WASTEWATER TREATMENT OPERATOR

Students who complete the required courses for this certificate and/or degree program will qualify to take the SWRCB certification examination for the Grade I Wastewater Plant Operator as well as nearly a dozen wastewater related certification examinations offered by CWEA. There are over 80 wastewater treatment and reclamation facilities in San Diego County that are currently licensed and regulated by the SWRCB.

Program Learning Outcomes

Upon successful completion of this program, students will be able to:

- Describe wastewater collection system components.
- Identify the characteristics and sources of municipal sewage.
- Define wastewater collection system and wastewater treatment plant terminology.
- Describe the basic principles of conventional wastewater treatment.
- Compare and contrast wastewater treatment unit processes including preliminary, primary, secondary and tertiary treatment.
- Explain the basic principles of preliminary, primary, secondary and tertiary treatment.
- Perform basic mathematical calculations and conversions relating to water flow, pressure, volume, velocity, chemical dosage, and hydraulic and organic loading.
- Recognize and comment on safety procedures applicable to service and operation of wastewater collection and treatment systems, including potential problems.

Associate in Science Degree Requirements:

Course	*Title*	*Units*
WWTR 101	Fundamentals of Water/Wastewater Technology	3
WWTR 102	Calculations in Water/Wastewater Technology	3
WWTR 104	Applied Hydraulics	3
WWTR 106	Introduction to Electrical and Instrumentation Processes	3
WWTR 110	Laboratory Analysis for Water/ Wastewater	3
WWTR 114	Basic Plant Operations: Wastewater Treatment	3
WWTR 120	Advanced Plant Operations: Wastewater Treatment	3
		21

Select at least nine units from the following:

WWTR 103	Introduction to Water Resources Management	3
WWTR 105	Principles and Practices of Water Conservation	3
WWTR 112	Basic Plant Operations: Water Treatment	3
WWTR 115	Wastewater Reclamation and Reuse	3
WWTR 130	Water Distribution Systems	3
WWTR 132	Wastewater Collection Systems	3
WWTR 134	Mechanical Maintenance	3
WWTR 268	Introduction to Membrane Plant Operation	3
WWTR 270	Public Works Supervision	3
WWTR 280	Backflow Tester Training	2
WWTR 282	Cross Connection Control Specialist	3
WWTR 290	Cooperative Work Experience	2
		9
	Total Required	30
	Plus General Education Requirements	

Certificate of Achievement

Students who complete only the major requirements above qualify for a Certificate in Wastewater Treatment Operator. An official request must be filed with the Admissions and Records Office prior to the deadline as stated in the Academic Calendar.