



Unit Title	Water treatment processes (L/506/1614)	
Level	4	
Credit Value	12	
Learning Outcomes – the learner will be able to:	Assessment Criteria – the learner can:	
1. Understand the background to and reasons for water treatment	1.1	describe how water treatment processes have developed in response to the incidence of waterborne diseases and other key events and developments.
	1.2	explain different water treatment processes and the appropriateness of each for different water sources.
	1.3	explain how the key quality parameters influence the method, operation and choice of water treatment processes to make water potable.
2. Understand the processes used in the first stage screening of raw waters	2.1	describe advantages and disadvantages of natural and engineered storage and settlement of water.
	2.2	explain the features and operations of the main types of screens and strainers used in water treatment.
3. Understand the principles of chemical handling and storage	3.1	describe the general principles of chemical handling and storage.
	3.2	describe the different ways that chemicals are delivered to, and stored on, water treatment works.
	3.3	describe typical chemical dosing systems used in water treatment in terms of the type of pumps and control systems used.
4. Understand the principles and processes of raw water clarification	4.1	explain the general function of the coagulation and flocculation processes.
	4.2	explain the key parameters and values which must be optimised in the coagulation process, including any other agents that may be used to affect the process.
	4.3	explain the chemical reactions that take place when iron and aluminium coagulants are used to clarify raw waters, including the importance of pH.
	4.4	explain the physical processes of flocculation that take place when iron or aluminium coagulants are used to clarify raw waters, including charge neutralisation and the role of polyelectrolytes in influencing particle size.
	4.5	describe the different types of plant and processes used in water clarification and the factors that influence the choice of process used.
	4.6	explain how the clarification process is optimised and controlled.
	4.7	describe typical problems which can occur in the clarification process and the corrective actions to resolve them.
5. Understand the principles and processes of filtration	5.1	describe the general function of filtration in the water treatment process.
	5.2	explain the principles and mechanisms of filtration.
	5.3	describe the different types of plant and processes used in



	<p>water filtration and the factors that influence the choice of process used.</p> <p>5.4 explain how the different filtration processes are optimised and controlled.</p> <p>5.5 describe typical problems which can occur in filtration processes and the corrective actions to resolve them.</p>
6. Understand the principles and processes involved in water disinfection	<p>6.1 describe the general function of disinfection in the water treatment process.</p> <p>6.2 explain the principles and mechanisms of disinfection.</p> <p>6.3 explain the different factors that can influence disinfection.</p> <p>6.4 describe the different types of chemicals and processes used in water disinfection and the factors which could influence the choice of process.</p> <p>6.5 describe typical problems which can occur in disinfection processes and the corrective actions to resolve them.</p> <p>6.6 describe the chemicals and processes involved in the dechlorination of water.</p>
7. Understand the principles and processes of pH correction	<p>7.1 describe the process functions of pH.</p> <p>7.2 describe the different types of chemicals used in pH correction and the factors that influence the choice of chemical and process used.</p> <p>7.3 describe typical problems which can occur in pH correction processes and the corrective actions to resolve them.</p>
8. Understand the principles and processes involved in other aspects of water treatment	<p>8.1 explain the sources of manganese in raw water, reasons for its removal and the processes used to remove it.</p> <p>8.2 explain the sources of taste and odour forming compounds, pesticides and herbicides in water, and the processes involved in their removal.</p> <p>8.3 explain the sources of arsenic in drinking water, reasons for its removal, and the processes used to remove it.</p> <p>8.4 explain how and why nitrate is removed from drinking water and the removal processes used.</p> <p>8.5 explain the processes involved in preventing lead contamination of drinking water, including the effect of pH and the chemicals used to prevent lead contamination.</p> <p>8.6 explain how and why fluoride is added to drinking water, and the risks of using fluoride.</p>
9. Understand the principles and processes of sludge treatment at water treatment works	<p>9.1 describe the function and mechanisms of sludge treatment in water treatment works.</p> <p>9.2 explain the principles of sludge settlement and thickening.</p> <p>9.3 describe the different types of plant and processes used in sludge treatment and the factors that influence the choice of process used.</p> <p>9.4 describe the disposal routes for sludge from water treatment works.</p> <p>9.5 describe typical problems that occur in the sludge treatment processes and the corrective actions to resolve them.</p>
10. Understand new developments within water treatment	<p>10.1 describe at least one current development in water treatment processes, including:</p>



	(a) the stage of development (b) the processes involved (c) the potential advantages of the development.
--	----------------------------------------------------------------------------------------------------------------

Additional information about the unit	
Unit purpose and aims	<p>This unit is designed to enable the learner to develop their understanding of the principles and processes used to produce drinking water.</p> <p>On completion of the unit, the learner will be able to explain:</p> <ul style="list-style-type: none">• why water must be treated to make it potable.• the processes used in the first stage screening of raw waters.• the principles involved in chemical handling and storage.• the principles and processes involved in the clarification of raw waters.• the principles and processes involved in the use of filtration.• the principles and processes involved in water disinfection.• the principles and processes of pH correction.• the principles and processes involved in other aspects of water treatment.• the principles and processes involved in water treatment works sludge treatment.• recent developments within water treatment.
Unit expiry date	31/03/2019
Assessment requirements and guidance	<p>In the assessment of this unit, the learner must ensure that the evidence that they produce covers the following:</p> <ol style="list-style-type: none">1. The learner must explain the appropriateness of at least three different water treatment processes in terms of:<ol style="list-style-type: none">(a) cost(b) efficiency(c) efficacy.2. The learner must explain how at least three key quality parameters of raw waters influence the method, operation and choice of water treatment process, and how these may vary for different water resources.3. The advantages and disadvantages of natural and engineered storage and settlement of water must include:<ol style="list-style-type: none">(a) three advantages and three disadvantages of natural storage and settlement



	<p>(b) three advantages and three disadvantages of engineered storage and settlement.</p> <p>4. The learner's description of how chemicals are delivered to and stored on water treatment works must include:</p> <ul style="list-style-type: none">(a) for delivery – bulk powder, bulk liquid, IBC, pallets, drums, cylinders, carboys(b) for storage – bulk, IBC, pallets, drums, cylinders, carboys. <p>5. The description of chemical dosing systems in terms of the pumps and control systems used must include:</p> <ul style="list-style-type: none">(a) how control is affected(b) the type of pumps for at least three systems(c) the control systems used for at least three systems. <p>6. The types of plant and processes used in water clarification must include:</p> <ul style="list-style-type: none">(a) floc blanket clarification(b) dissolved air flotation(c) inclined plate sedimentation(d) actiflo. <p>7. The learner's explanation of how the clarification process is optimised and controlled must cover three different types of optimisation and control systems.</p> <p>8. The learner must describe at least three typical problems for each of the clarification processes and their corresponding corrective actions.</p> <p>9. The types of plant and processes used in water filtration must include:</p> <ul style="list-style-type: none">(a) rapid gravity filters(b) slow sand filters(c) granular activated carbon filters(d) pressure filters(e) direct filtration plants. <p>10. The learner's explanation of how the filtration processes are optimised and controlled must include:</p> <ul style="list-style-type: none">(a) backwash and air scour optimisation(b) the effect of head loss in a filter(c) slow sand filter skimming and re-sanding. <p>11. The learner must describe at least three typical problems for each of the filtration processes and their corresponding corrective actions.</p>
--	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------



12. The learner's explanation of **principles and mechanisms of disinfection** must include:
 - (a) super chlorination
 - (b) break point chlorination
 - (c) marginal chlorination.

13. The **factors that influence disinfection** must include:
 - (a) the effect of pH
 - (b) colour
 - (c) turbidity
 - (d) ammonia
 - (e) temperature
 - (f) flow.

14. The **chemicals and processes used in water disinfection** must include:
 - (a) gas chlorination
 - (b) chlorine dioxide
 - (c) ultra violet (UV)
 - (d) OSEC
 - (e) chloramination
 - (f) sodium hypochlorite
 - (g) ozonation.

The learner's description must also include at least two advantages and at least two disadvantages of each of the processes and chemicals listed.

15. The learner must describe at least three typical problems with the **disinfection process** and their corresponding corrective actions.

16. The **types of chemicals used in pH correction** must include:
 - (a) sulphuric acid
 - (b) lime
 - (c) sodium hydroxide.

17. The learner must describe at least two typical problems for each of the chemicals used in **pH correction** and their corresponding corrective actions.

18. The **types of plant processes used in sludge treatment** must include:
 - (a) sludge dewatering
 - (b) sludge pressing
 - (c) centrifuging
 - (d) drying beds.

19. The **disposal routes** for water treatment works sludge



	<p>must include:</p> <ul style="list-style-type: none">(a) disposal to sewer(b) landfill(c) soil bulking(d) recycling. <p>20. The learner must describe at least three typical problems that can occur in the sludge treatment processes and their corresponding corrective actions.</p> <p>The assessment of this unit will be via a combination of centre-devised assignments and tests, and will be conducted in supervised conditions. The assessment strategy for the unit has been agreed with industry stakeholders.</p>
Location of the unit within the subject/sector classification system	4.1 Engineering
Name of the organisation submitting the unit	CABWI Awarding Body
Availability for use	Shared
Unit guided learning hours	48