Wyoming Department of Education Required Virtual Education Course Syllabus			
Natrona County School District # 1			
Program Name	Natrona Virtual Learning	Content Area	SC
Course ID	NCV03003.2	Grade Level	9, 10, 11, 12
Course Name	Environmental Science 2	# of Credits	0.5
SCED Code	03003G0.5022	Curriculum Type	Odysseyware

COURSE DESCRIPTION

Sem. 2 Environmental Science continues covering a wide variety of topics including biology, physics, geology, ecology, chemistry, geography, astronomy, meteorology, oceanography, and engineering. The course also considers ways in which human populations affect our planet and its processes. Of special emphasis is the concept of sustainability as a means of using resources in a way that ensures they will always be around us.

WYOMING CONTENT AND PERFORMANCE STANDARDS	
STANDARD#	BENCHMARK_(Standard/Indicator) Use the Standards and Benchmarks as Spreadsheets")
HS-PS1-5	Apply scientific principles and use evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
HS-PS1-7	Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.
HS-PS1-8	Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.
HS-PS3-3	Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.
HS-LS2-2	Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
HS-LS2-7	Evaluate and assess impacts on the environment and biodiversity in order to refine or design a solution for detrimental impacts or enhancement for positive impacts.
HS-LS4-6	Create and/or use a simulation to evaluate the impacts of human activity on biodiversity.

HS-ESS1-3	Communicate scientific ideas about the way stars, over their life cycle, produce elements.
HS-ESS1-5	Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks.
HS-ESS2-4	Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.
HS-ESS2-5	Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
HS-ESS2-6	Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.
HS-ESS3-1	Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
HS-ESS3-2	Evaluate competing design solutions for developing, managing, and using energy and mineral resources based on cost - benefit ratios.
HS-ESS3-3	Use computational tools to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.
HS-ESS3-4	Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
HS-ESS3-5	Analyze data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impact s to Earth systems.
HS-ESS3-6	Use the results of a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

SCOPE AND SEQUENCE		
UNIT OUTLINE	STANDARD#	OUTCOMES OBJECTIVES/STUDENT CENTERED GOALS
Unit 1: Energy Part 1		
LESSON 1: INTRODUCTION TO ENERGY	-HS-PS3-3 -HS-PS3-3. -HS-PS1-7 -HS-ESS3-2	-Define energy. -Describe different forms of energy, and give examples of each. -Understand energy transformation, energy efficiency, and the law of conservation of energy. -Distinguish between renewable and nonrenewable energy sources.

LESSON 2: ENERGY CONSUMPTION HISTORY	-HS-ESS3-2 -HS-ESS2-4 -HS-ESS3-2	-Relate advances in technology to energy use. -Describe the impact of events such as the Industrial Revolution on energy use. -Describe the history and trends of energy use in the United States.
LESSON 3: FOSSIL FUELS	-HS-ESS2-6 -HS-ESS2-6 -HS-ESS2-6 -HS-ESS2-6 -HS-LS2-2	-Describe the processes that formed oil and natural gas. -Compare and contrast oil and natural gas in terms of supply and environmental impact. -Identify global areas of major oil production. -Define oil sands and know some of the advantages and disadvantages in their use. -Describe the controversy concerning oil exploration in the Arctic National Wildlife Refuge.
LESSON 4: PROJECT: FOSSIL FUELS	-HS-ESS2-6 -HS-ESS2-6 -HS-LS2-2 -HS-ESS2-6	-In two or more sentences describe the impact of fossil fuel combustion on the global carbon cycle. -In three sentences or less explain why predicting our future oil supply is controversial and involves some uncertainty. -State at least one reason for and one reason against both offshore drilling of oil and drilling for oil in the Arctic National Wildlife Refuge. Compose a complete paragraph. -Describe in one complete paragraph how oil and natural gas compare in terms of predicted supply and carbon dioxide emissions.
LESSON 5: COAL	-HS-ESS1-5 -HS-ESS3-2 -HS-ESS3-4 -HS-ESS3-2 -HS-ESS3-2	-Describe the processes that formed coal. -Describe the different types of coal. -Discuss coal in terms of supply and environmental impact. -Illustrate the basics of a coal-burning power plant. -Discuss some advantages and disadvantages to the use of coal. -Describe some technologies associated with "clean coal."
LESSON 6: PROJECT: COAL	-HS-ESS3-2 -HS-ESS3-2 -HS-ESS3-2	-Draw a bar graph to represent the average carbon value of the four types of coal to show the highest energy yield and most plentiful -Describe three clean coal technologies and how they can mitigate the environmental impacts of coal -Do you think we adequately account for its environmental impact in the cost that consumers pay for coal?

LESSON 7: SYNTHETIC FUELS	-HS-ESS3-1 -HS-ESS3-2 HS-ESS3-2 HS-ESS3-2	-Define synthetic fuels. -Know sources for the production of synthetic fuels. -Explain how synthetic fuels are produced from coal, natural gas, and biomass. -Discuss issues related to the use and development of synthetic fuels, including their advantages and disadvantages.
LESSON 8: INTRODUCTION TO NUCLEAR ENERGY	-HS-PS1-8 -HS-PS1-8 -HS-PS1-8 -HS-ESS1-3 -HS-ESS3-2	-Define isotope and radioisotope. -Describe processes of nuclear change. -Explain what happens in a nuclear chain reaction. -List common sources of nuclear fuel. -Explain how uranium is processed to prepare it for use as a nuclear fuel.
LESSON 9: NUCLEAR POWER PLANTS	-HS-ESS3-2 -HS-ESS3-2 -HS-ESS3-2 -HS-ESS3-2	-Describe the major components of a nuclear reactor and explain what they are used for. -Explain the difference between a boiling water reactor and a pressurized water reactor. -Explain how a fast breeder reactor works and why this technology is not used much anymore. -Describe the stages of the nuclear fuel cycle.
LESSON 10: PROJECT: NUCLEAR POWER PLANTS	-HS-ESS3-3 -HS-ESS3-2 -HS-ESS3-3	-Explain the importance of control rods, containment structures, and moderators in a nuclear reactor -In a few sentences, compare and contrast pressurized water reactors and boiling water reactors. -Where does the explosion potential from fast breeder reactions come from?
LESSON 11: NUCLEAR ENERGY AND THE ENVIRONMENT	-HS-ESS3-6 -HS-ESS3-6 -HS-ESS3-6	-Describe the three types of nuclear fuel waste. -Discuss the environmental risks and benefits associated with nuclear power. -Describe ways of treating radioactive wastes.
Unit 2: Energy Part 2		

LESSON 1: HYDROELECTRIC POWER	-HS-ESS3-2 -HS-ESS3-2 -HS-ESS3-2 -HS-ESS3-3	-Describe hydropower and hydroelectric power. -Explain how hydroelectric power is generated. -Describe some advantages and disadvantages of hydroelectric power. -Explain how fish ladders can be used to help migrating fish get around dams.
LESSON 2: PROJECT: HYDROELECTRIC POWER	-HS-ESS3-3 -HS-ESS3-2 -HS-ESS3-3	-How a hydroelectric power plant works, including why dams are built as parts of large hydropower plants; -The environmental and economic benefits of hydroelectricity, giving examples from the case studies; and -The environmental and cultural disadvantages of hydropower, giving examples from the case studies.
LESSON 3: TIDES AND WAVES	-HS-ESS3-3 -HS-ESS3-3 -HS-ESS3-3	-Describe how electricity can be generated from tides and ocean waves. -Explain the limitations of using tides and waves to generate electricity. -Describe the advantages of using waves and tides to generate electricity.
LESSON 4: SOLAR ENERGY	-HS-ESS3-3 -HS-ESS3-3 -HS-ESS3-3	-Describe the four types of solar energy technologies and give an example of each. -Explain how energy from the sun can be used to heat homes and to provide electricity. -Describe the advantages and disadvantages of solar energy.
LESSON 5: WIND POWER	-HS-ESS3-3 -HS-ESS3-3	-Explain how wind is used to generate electricity. -Describe the advantages and disadvantages of wind power.
LESSON 6: PROJECT: WIND POWER	-HS-ESS3-3 -HS-ESS3-2 -HS-ESS3-4 -HS-ESS3-3	-Discuss what makes a site suitable for wind power -How costs will compare during and after construction of wind turbines -How wind energy could impact the environment -How people in your community could benefit from wind power, both environmentally and economically -The difference between a wind farm and small wind

LESSON 7: GEOTHERMAL POWER	-HS-ESS3-3 -HS-ESS3-3 -HS-ESS3-3 -HS-ESS3-4	-Explain where geothermal energy comes from. -Describe how a geothermal power plant works. -Describe how geothermal heating works. -Explain the advantages and disadvantages of geothermal energy.
LESSON 8: PROJECT: GEOTHERMAL POWER	-HS-ESS3-3 -HS-ESS3-3 -HS-ESS3-3	-In three sentences or fewer, explain the difference between using geothermal energy to generate electricity and using the geothermal gradient to heat your home with an underground heat pump. -In two or three sentences, explain where geothermal energy comes from and why we have to drill so far down to access superheated fluids. -Describe the process of generating geothermal electricity by outlining the steps involved. Take your description from the drilling for hot water stage to the electricity production stage.
LESSON 9: HYDROGEN FUEL	-HS-ESS3-3 -HS-ESS3-4 -HS-ESS3-4	-Explain how hydrogen fuel can be produced and used as vehicle fuel. -Describe the advantages of hydrogen fuel. -Describe the hurdles we need to overcome to make hydrogen fuel more feasible.
LESSON 10: PROJECT: HYDROGEN FUEL	-HS-ESS3-4 -HS-ESS3-4 -HS-ESS3-3	-In at least three sentences, describe why transitioning to a hydrogen economy has advantages. -In at least three sentences, explain three disadvantages associated with hydrogen fuel use. -Why is a high use of renewable energy necessary to make hydrogen fuel an environmentally sound alternative?
LESSON 11: ENERGY EFFICIENCY	-HS-ESS3-4 -HS-ESS3-4 -HS-PS1-5	-Describe benefits of improving energy efficiency and conserving energy. -Explain ways that energy use can be reduced. -Relate energy efficiency to laws of thermodynamics.
LESSON 12: PROJECT: ENERGY EFFICIENCY	-HS-ESS3-3	Describe the role, either for good or for bad, in achieving energy sustainability
Unit 3: Pollution Part 1		

LESSON 1: INTRODUCTION TO AIR POLLUTION	-HS-LS4-6 -HS-LS4-6 -HS-LS4-6 -HS-LS4-6 -HS-LS4-6	-Define air pollution. -Differentiate between primary and secondary air pollutants. -Identify common air pollutants and their sources. -Describe common sources of indoor air pollution. -Explain the effects of outdoor and indoor air pollution on human health.
LESSON 2: ACID DEPOSITION	-HS-LS4-6 -HS-LS4-6 -HS-LS4-6 -HS-LS4-6	-Define acid deposition and acid rain. -Recognize the causes of acid deposition. -Explain the environmental effects of acid deposition. -Explain why some areas of the world are more prone to acid deposition than others.
LESSON 3: CLIMATE CHANGE	-HS-ESS2-4 -HS-ESS2-4 -HS-ESS2-4 -HS-ESS2-4	-Explain how Earth's temperature and climate have changed in the past. -Describe how we learn about past climate. -Explain the greenhouse effect. -Explain global warming, its causes, and its effects.
LESSON 4: PROJECT: CLIMATE CHANGE	-HS-ESS2-4 -HS-ESS2-4 -HS-ESS2-4 -HS-ESS2-6 -HS-ESS3-5	-Explain why the greenhouse effect is necessary but how an enhanced greenhouse effect can harm the planet. -Define global warming and explain what has caused the recent trend of warming that the earth is experiencing. -Explain why Earth's temperature is directly affected by the amount of greenhouse gases in the atmosphere. -Define carbon sequestration and explain how deep geologic burial of carbon works. -Describe the connection between fossil fuel burning, the melting of polar ice, and the rising of global sea levels.
LESSON 5: REDUCING AIR POLLUTION	-HS-ESS3-2 -HS-ESS3-2 -HS-ESS3-2 -HS-ESS3-2	-Explain the history of air-pollution regulation in the United States. -Describe the key components of the 1990 Clean Air Act. -Describe some ways to prevent and reduce air pollution. -Explain the role of the markets in controlling air pollution.

LESSON 6: PROJECT: REDUCING AIR POLLUTION	-HS-ESS3-2 -HS-ESS3-2 -HS-ESS3-2 -HS-ESS3-2 -HS-ESS3-2	-Under the Clean Air Act, how can the public participate in decisions concerning emissions regulations placed on the plant? -What could you do if the plant is placed in your community and later leads to pollution beyond the amounts allowed by the EPA? -What are the six criteria pollutants monitored under the 1990 Clean Air Act? -What part of the government oversees monitoring them in the environment, and what happens if a business or organization emits them at above allowable levels? -Explain how the emissions trading program works and identify one major advantage and one major disadvantage. -Explain how the program must work in order to be successful.
Unit 4: Pollution Part 2		
LESSON 1: NOISE POLLUTION	-HS-ESS3-3 -HS-ESS3-3 -HS-ESS3-4	-List causes of noise pollution. -Describe the effects of noise pollution on people and wildlife. -Describe some ways to prevent noise pollution.
LESSON 2: PROJECT: NOISE POLLUTION	-HS-ESS3-4	-Explain what noise pollution is and where it comes from, how noise pollution can harm people, how noise pollution can harm wildlife, and how you think national noise pollution laws could work.
LESSON 3: WATER POLLUTION	-HS-ESS3-1 -HS-ESS3-1 -HS-ESS3-4 -HS-ESS3-3	-List causes of water pollution. -Identify common water pollutants and their effects on the environment. -Describe how we can prevent and control water pollution. -Differentiate between point and non-point source water pollution.
LESSON 4: SEWAGE TREATMENT	-HS-ESS3-4 -HS-ESS3-4 -HS-ESS3-4 -HS-ESS3-4	-Describe methods for treating sewage and wastewater. -Differentiate primary, secondary, and tertiary treatment. -Explain the environmental advantages of secondary and tertiary treatment. -Explain the main steps of the wastewater treatment process.
LESSON 5: SOLID WASTE	-HS-ESS3-3 -HS-ESS3-3 -HS-ESS3-3	-Define municipal solid waste and know where it comes from. -Discuss environmental problems associated with solid waste generation. -Describe disposal methods for solid waste and give advantages and disadvantages of each.

LESSON 6: PROJECT: SOLID WASTE	-HS-ESS3-3 -HS-ESS3-3 -HS-ESS3-4	-Predict what would happen to the environment and the health of people if a community's solid waste was not tended to and disposed of in some way. -Explain why e-waste is a problem and present one possible way of mitigating the growing e-waste problem. -Explain three things you think local governments can do to encourage more primary and secondary waste prevention.
LESSON 7: HAZARDOUS WASTE	-HS-ESS3-3 -HS-ESS3-3 -HS-ESS3-4	-Define hazardous waste. -Discuss the characteristics of hazardous waste. -Describe treatment and disposal methods for hazardous waste.
LESSON 8: PROJECT: HAZARDOUS WASTE	-HS-ESS3-3 -HS-ESS3-3 -HS-ESS3-3	-Report on the responsibilities of hazardous waste technicians and how they keep themselves safe during their job duties -Explain the four main characteristics and treatment options for hazardous waste. -Describe the difference between chronic and acute exposure.
Unit 5: Environmental Impact & Efforts		
LESSON 1: ENVIRONMENTAL HEALTH	-HS-ESS3-1 -HS-ESS3-1	-Define environmental health and know several aspects of it. -Discuss the types and sources of hazards that humans face from their environment.
LESSON 2: PROJECT: ENVIRONMENTALHEALTH	-HS-ESS3-1 -HS-LS2-7	-Explain what could be done to reduce the number of deaths by infectious diseases worldwide. -Describe three methods for controlling malaria in developing countries. Explain why malaria is still a problem even when we know of ways to control it
LESSON 3: SUSTAINABLE CITIES	-HS-ESS3-3 -HS-ESS3-3 -HS-ESS3-3	-Define urbanization and urban sprawl. -Describe the major resource and environmental problems of urban areas. -Describe some methods for planning and controlling urban growth.
LESSON 4: PROJECT: SUSTAINABLE CITIES	-HS-ESS2-5 -HS-ESS3-5 -HS-ESS3-3	-Explain how urban sprawl affects wildlife, runoff, and water pollution in an urban area. -Explain the connection between transportation and the environmental impacts of urban areas. -Consider the global trend that most new urbanization is taking place in developing countries.

LESSON 5: ENVIRONMENTAL ECONOMICS	-HS-ESS3-2 -HS-ESS3-2 -HS-ESS3-2	-Discuss the relationship between the economy and the environment. -Contrast environmentally sustainable and unsustainable economic growth. -Describe how economic tools can be used to improve environmental quality.
LESSON 6: PROJECT: ENVIRONMENTAL ECONOMICS	-HS-ESS3-2	-List and describe five things that we can do to encourage more environmentally sustainable economic growth and which holds the most promise?
SEMESTER REVIEW	Comprehensive review over standards presented above	Evaluation of Semester 2 Environmental Science
FINAL EXAM	Comprehensive review over standards presented above	Evaluation of Semester 2 Environmental Science