**STEAM Program One-Page Outline**

**Topic:**
Human Impact on the Springs of Hot Springs National Park

**Summary:**
Students will work through Hot Springs National Park history in protecting the 143-degree thermal water for public use. Students will collaborate in teams in solving different problems the park faced throughout its progression. Students will also learn the unintended consequences of actions taken to protect a resource that is provided to the public.

**Standards:**
*Arkansas State Standards*

***Arkansas Science Curriculum Framework -***

[*https://dese.ade.arkansas.gov/Files/20201211134615\_revised\_Arkansas\_5-8\_Science\_Standards\_Topic\_Arrangement.pdf*](https://dese.ade.arkansas.gov/Files/20201211134615_revised_Arkansas_5-8_Science_Standards_Topic_Arrangement.pdf)

*5th Grade*

Earth’s Systems

* 5-ESS2-1: Develop a model using an example to describe the ways the geosphere, biosphere, hydrosphere and/or atmosphere interact.

Human Impact

* 5-ESS3-1: Obtain and combine information about ways individual communities use science ideas to protect the Earth’s resources and environment.

*6th Grade*

Human Impact

* 6-ESS3-3: Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
* 6-ESS3-4: Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth’s systems

Earth’s Systems

* 6-ESS2-4: Develop a model to describe the cycling of water through Earth’s systems driven by energy from the sun and the force of gravity.

*7th Grade*

History of Earth

* 7-ESS2-2 Construct an explanation based on evidence for how geoscience processes have changed Earth’s surface at varying time and spatial scales.

*NGSS Standards*

* MS-ETS1-1.: Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
* MS-ETS1-2.: Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem,

**Essential Questions:**

*How does the national park manage to protect the natural systems while allowing for human use?*

**Enduring Understandings:**

* Hot Springs is a combination of natural forces and human engineering that require deep understanding before actions can be taken for preservation.

**Objectives:**

* *Students will understand the history of human use of the thermal water and the human impacts to the thermal water*
* *Students will collaborate in teams to design a collection distribution system for the thermal water of Hot Springs National Park*
* *Students will identify the effects of fire in maintaining a healthy hot springs ecosystem*
* *Students will collect data and information to determine the health of thermal water*
* *Students will identify current impacts on thermal water system and discuss management considerations*

**Key Vocabulary:**
**(Definitions from** [Geology Terms - Hot Springs National Park (U.S. National Park Service) (nps.gov)](https://www.nps.gov/hosp/learn/nature/geology-terms.htm#geothermal%20gradient) **and USGS Water Science School** [Water Science School | U.S. Geological Survey (usgs.gov)](https://www.usgs.gov/special-topics/water-science-school)**)**

* Geothermal Gradient: The rate of increase of temperature in the earth with depth. The gradient differs from place to place depending on the heat flow in the region and the thermal conductivity of the rocks (*how well heat travels through the rocks*). The average geothermal gradient approximates 25o C/km (*77o F/km*) of depth.
* Faults:  A break in rock characterized by displacement (*movement*) of one side relative to the other.
* Cracks/Fractures: are a mechanism of brittle deformation in response to stress A fracture is any separation in a geologic formation, such as a joint or a fault that divides the rock into two or more pieces. A fracture will sometimes form a deep fissure or crevice in the rock.
* Folds: A bend in *rock layers*. A fold is usually a product of directional pressure caused by mountain building events
* Aquifer/confined/unconfined: a body of permeable rock which can contain or transmit groundwater/ permeable rock units that are usually deeper under the ground than unconfined aquifers/ is one in which a water table exists
* *Ground water: water held underground in the soil or in pores and crevices in rock.*
* *Recharge Zone: surface area where the water enters the aquifer Infiltration (movement of water into soil or porous rock) process that replenishes groundwater.*
* Condensation: the process by which water vapor in the air is changed into liquid water.
* Precipitation: water released from clouds in the form of rain, freezing rain, sleet, snow, or hail.
* Evaporation: the process that changes liquid water to gaseous water (water vapor).
* Evapotranspiration: the sum of all processes by which water moves from the land surface to the atmosphere via evaporation and transpiration.
* Surface Runoff: water “running off” the land surface
* Spring: a place where water moving underground finds an opening to the land surface and emerges, sometimes as just a trickle, maybe only after a rain, and sometimes in a continuous flow.
* Rain/Snow/Hail: the main way that the water in the skies comes down to Earth. Can also be frozen to be hail or snow
* Conductivity: a measure of the ability of water to pass an electrical current.
* pH: is an expression of hydrogen ion concentration in water.
* Temperature: is the concentration of thermal energy in a substance such as water
* Dissolved oxygen (DO): is the amount of oxygen that is present in water.