

River energy essay



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Describe and explain the factors that influence how much work a river can do (25) The work that a river does is erosion, transportation and deposition. The amount of work a river can do is dependent on the energy it has and this energy is determined by many factors. The study of water flow in a river channel is known as hydraulics. Hydraulic geometry is the study of the relationships that exist within river channels that ultimately determine how much work the river will be able to carry out. Width, depth, velocity, discharge, channel width, water depth, channel bed roughness and slope angle all change as the river travels from source to mouth and it is these factors either in isolation or in combination with one another that influence how much work the river can do. A river flows downhill due to gravity and this gives it 2 types of energy - potential and the higher above sea level the river is the more potential energy it will have and kinetic energy, which is generated by the actual movement of water as it travels down slope. Many factors influence how much energy a river has and therefore how much work it can do. A river uses most of its energy (95% in fact!) overcoming friction with its bed and banks in particular large rocks and boulders. The river has to use energy to flow over these obstacles and therefore does not use it to do work. Type of flow is also important. In a river channel that is rough and irregular the water very rarely flows in a smooth straight line (known as laminar flow). Instead it is turbulent and flows in many different directions. This water movement is known as eddies. Turbulence creates an upward movement of water that allows a river to pick up material and move it i. e. to do work. However, how turbulent a river is depends on how fast it is flowing. A river with high velocity can overcome friction and still have the energy to erode and transport material whereas a river with slow velocity will need to

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use its energy to overcome friction, will not therefore be so turbulent so the sediment remains undisturbed. Friction and turbulence are therefore inter-related. Both friction, turbulence plus the river's ability to carry out work are also directly affected by the roughness and the shape of the river channel. Channel shape and hydraulic radius are also connecting factors that influence how much work a river can do. A river's hydraulic radius is the ratio between its cross-sectional area (multiplying the width and depth measurements of the river channel — see red line below) and the length of its wetted perimeter (the total length of river bed and banks in actual contact with the water - see yellow line below. [pic] The hydraulic radius is a measure of the effectiveness of the river channel's shape for carrying out water. A stream with a larger hydraulic radius and a shorter wetted perimeter will have to lose less energy overcoming friction and will therefore have a greater velocity and ability to work. However, a river with a longer wetted perimeter will have to overcome more friction so will have less energy available to do work. As a river travels from source to mouth and its characteristics change there are many other factors that influence how much work the river can do. Quantity of water is important. As a river travels from source to mouth its velocity and discharge and depth all increase. The more water in a river from tributaries, surface runoff, throughflow, and groundwater flow increase the discharge cross-section and the hydraulic radius increase too. All of this plus the fact that the river uses less energy overcoming friction means more work can be done. In conclusion, there are many different factors that determine how much energy a river has to do work many of which interact with one another. The upper stages of a river have the most potential energy but also the most turbulence, the channel is

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at its roughest so there is more friction and less velocity and discharge. This means that in its upper stage although it looks like it is working hard the river actually has little energy left to do work. A river in its mid to lower stage is flowing over a gentler gradient and has less potential energy but it has more kinetic energy. It has far more energy to do work as it has greater discharge, velocity a more efficient hydraulic radius, smooth banks so less friction and a greater cross-sectional area. ----- Channel roughness is a measure of how many large obstacles a river channel contains. A river or stream channel that contains many large and or angular rocks and boulders will create a great deal of turbulence but also cause a lot of friction that the river needs to use its energy to overcome. If a river has a smooth channel then it has no friction to overcome so can do plenty of work. In some cases for example in an upland stream potential energy is so great due to the river's height above sea level and this means that even though the river is incredibly turbulent due to boulders etc it can still pick them up and move them. Sometimes it appears that a river in its youthful stage is moving faster than a lowland river. It is however, moving slower but over steeper land. It is an example of more haste less speed - it looks like it is moving really fast and working hard it is not.