



**CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY**

Name(s) Matthew Perri; Hayden Pisano	Project Number J0807
Project Title Undeground Fluid Flow and Darcy's Law	
Objectives/Goals The objective of this project is to build actual reservoir models using earth materials, then use Darcy's Law to calculate permeability and study the other factors affecting oil and water flow. The following questions are the objectives of our science project: 1. Which reservoir material (pea gravel, aquarium gravel or sand) will result in the highest water flow rate? Why? 2. How important is pressure or the height of water on the amount of produced water? 3. How does oil flow compare with water flow? Does it flow more freely or less? Why?	
Abstract Methods/Materials We used 2-liter soda bottles to build reservoir models out of pea gravel, aquarium gravel and sand. We then flowed water through the three models and measured the amount of fluid collected. We used Darcy's Law to calculate permeability. We repeated the experiment with vegetable oil to understand the role of viscosity. Water was also flowed through the models at different heights to understand the effect of pressure (water column) on fluid flow.	
Results The pea gravel resulted in the highest water flow rate and highest calculated permeability, followed by aquarium gravel and then sand. Oil flow was considerably less when compared to water for the aquarium model (170 ml with oil vs. 580 ml with water). However, the calculated permeability was about the same (478 darcies with oil to 480 darcies with water). Water flow rate was highest when we had the highest height of water column.	
Conclusions/Discussion 1. The pea gravel reservoir has the highest permeability of the three reservoirs tested. This is because it has the highest porosity which is the pore space around the rock particles. 2. The sand reservoir has the lowest permeability of the three reservoirs tested. This is because it has the lowest porosity which is the pore space around the rock particles. 3. The lowest hole #4 had the highest flow rate. This is because the higher the height of water, the higher the pressure and the higher the flow rate according to Darcy's Law. 4. Water flows easier than oil because oil is thicker. The thicker the fluid the higher the viscosity. According to Darcy's Law, the higher the viscosity the lower the flow rate.	
Summary Statement Darcy's Law explains the important variables that control fluid flow in reservoir rocks.	
Help Received My Dad helped us with Excel plots and my Mom helped us with the board.	