



**CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY**

Name(s) Joseph P. Monaghan	Project Number J0808
Project Title Sinkholes: Grout Method vs. Graded Filter Technique for Repairing Typical Cover Collapse Sinkholes in Karst Areas	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals This project was to determine which sinkhole repair technique would result in fewer sinkholes in neighboring areas where potential sinkholes can occur. The hypothesis was that if the graded filter technique allows more drainage of water than the grout method, then neighboring potential sinkholes would less likely form. If the grout method completely blocks out drainage, then neighboring potential sinkholes would more likely occur and at a faster rate.</p> <p>Methods/Materials A tank was built with simulated limestone karst, with five cavities in cross-section that were potential sinkholes. A tablespoon of damp salt was placed at each of the cavity openings to prevent sand from falling into the cavities. Ten trials were conducted for each situation: no repair methods (control), simulated graded filter in two out of five cavities, and simulated grout in two out of five cavities. Sand was placed on top and packed down. Water was evenly dripped on sand, creating sinkholes, voids, or no disturbances. The tank was rinsed out after each of the thirty trials. Observance of sinkholes, voids and no disturbances were recorded, as well as the time it took for the sinkholes to form.</p> <p>Results Data supported my hypothesis in that there were fewer sinkholes in neighboring areas for the trials using the graded filter technique than the grout method. Graded filter trials had a total of 17 sinkholes, 4 voids and 8 no disturbances. Grout method trials had a total of 23 sinkholes, 3 voids and 4 no disturbances. Control trials had a total of 32 sinkholes, 8 voids and 8 no disturbances. There was no significant difference in the amount of time for sinkholes to form for any of the thirty trials conducted.</p> <p>Conclusions/Discussion The graded filter technique is an important form of sinkhole repair because drainage is necessary in karst areas. Fixing a sinkhole under a house using this technique would be very difficult, if even possible. The grout method would then be used but consideration of drainage nearby is important. If preparing land for future development, excavating and using graded filter technique would be ideal. Areas overburdened by excess water drainage, will dissolve the carbonate rock and sinkholes will eventually occur. Each sinkhole is unique and must be looked at carefully before any repair technique is done.</p>	
Summary Statement This project was to determine which sinkhole repair technique either grout method or graded filter, would result in fewer sinkholes in neighboring areas where potential sinkholes can occur.	
Help Received Mother helped rinse out tank between trials, and with layout of display board.	