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STATE MINING AND GEOLOGY BOARD

Roles of the Engineering Geologist under the Surface Mining and Reclamation Act (SMARA)

Natural Resources Agency
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This report does not set forth policy, but rather presents information that the SMGB relies on in considering policy.

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Roles of the Engineering Geologist under California's Surface Mining and Reclamation Act (SMARA)

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ABSTRACT

Sections of California's Surface Mining and Reclamation Act (SMARA) addressing annual mine inspections, evaluations of geological and/or engineering conditions, and preparation of financial assurance cost estimates specifically mention licensed geologists or professional engineers; however, SMARA contains no explicit requirements for the services of certified engineering geologists. California has elevated its scrutiny of preparation, review and execution of individual surface mining and reclamation plans and financial assurances, and has increased SMARA lead agency performance reviews. Increased state and local government attention has heightened awareness regarding situations where engineering geologists play key roles. Engineering geologists are favorably qualified to serve both mining operators and SMARA lead agencies. Operators developing projects may reduce financial liability by retaining engineering geologists during early planning to evaluate sites for potential adverse geological conditions, and to propose feasible mitigations per SMARA's requirements. Often operators postpone involvement of engineering geologists until after regulators review proposed activities and subsequently require submittal of supporting documentation—resulting in delays and potential enforcement actions. Qualified engineering geologists can also serve as valuable reviewers for SMARA lead agencies, providing recurring oversight of key program requirements, which if omitted, may trigger State review of lead agency performance. Furthermore, engineering geologists are particularly useful in conducting required annual mine inspections, as violations commonly surface due to inadequate slope design and construction. Although engineering geologists are not specifically designated to conduct activities under SMARA, current standards of practice dictate that certified engineering geologists, or similarly qualified geo-professionals, should be involved in certain surface mining and reclamation tasks.

INTRODUCTION

California's Surface Mining and Reclamation Act (SMARA) is a grouping of statutes (Public Resources Code (PRC), Division 2, Chapter 9, Section 2710 et seq.) and regulations (California Code of Regulations (CCR) Title 14, Division 2, Chapter 8, Subchapter 1) that were originally signed into law in 1975, and became effective on January 1, 1976. SMARA dictates how local lead agencies and the State must interact in order to implement surface mining and reclamation requirements.

A lead agency is defined as the city, county or State agency (e.g. State Mining and Geology Board (SMGB)) which has the principal responsibility for approving a reclamation plan under SMARA. Currently there are 109 lead agencies: 57 counties, 50 cities, the California Department of Water Resources and the SMGB (Beeby, 2007).

Although SMARA contains no explicit requirements for the services of a California Certified Engineering Geologist (CEG), certain sections of SMARA do specifically mention that the services of professional geologists (PGs) or professional engineers (PEs) licensed to practice in California must be utilized. In this report we argue that when considering current standards of practice there are many instances when activities relating to surface mining and reclamation should rely upon input from CEGs or similarly qualified geo-professionals. We recognize that practitioners holding additional licenses and/or certifications (e.g. Professional Geophysicist and/or Certified Hydrogeologist) may be better qualified to complete certain mining and reclamation tasks, however, the primary focus of this report is the role of CEGs.

DISCUSSION

As noted above, PGs and PEs are specifically mentioned within SMARA. For example, with regards to required annual inspections of surface mines within California, PRC Section 2774(b) states, in part, that *"The lead agency may cause an inspection to be conducted by a state licensed geologist, state licensed civil engineer, state licensed landscape architect, or state licensed forester, who is experienced in land reclamation…"* Similarly, CCR Section 3504.5(b) stipulates *"Evaluation of geological and engineering conditions, when required, shall be performed by or under the supervision of a Geologist Registered to practice in the state…or a Professional Engineer registered to practice in the state…"* Finally, a *"licensed civil engineer"* and a *"licensed geologist"* are both offered as examples of individuals who may be qualified to prepare a detailed cost estimate under CCR Section 3814(d).

Additional sections of SMARA imply that the services of a PG and/or PE should be sought. As examples, PRC Section 2772(c)(5) requires reclamation plans to include a description of the general geology of the area, and a detailed description of the geology of the area in which surface mining is to be conducted, and CCR Section 3504.5(d) states *"Annual surface mine inspections may be conducted by a specialist or a team of specialists with expertise that includes but is not limited to, geology, engineering, surveying, ecology, water chemistry and quality, and permitting."*

Without considering portions of SMARA known as the Reclamation Standards (CCR Section 3700 et seq., implemented in the early 1990s), the strongest language that implies that use of a CEG or Geotechnical Engineer (GE) is required is found in CCR Section 3502(b)(3), which states the following: *"The designed steepness and proposed treatment of the mined lands' final slopes shall take into consideration the physical properties of the slope material, its probable maximum water content, landscaping requirements, and other factors. In all cases, reclamation plans shall specify slope angles flatter than the critical gradient for the type of material involved. Whenever final slopes approach the critical gradient for the type of material involved, regulatory agencies shall require an engineering analysis of slope stability."* In other words, final slopes that will remain at a site after mining and reclamation activities are completed should be designed based on the results of a slope stability analysis. This is where the current standards of practice in California enter into the arena, as any slope stability analysis conducted within the state must be completed and signed by a qualified professional (e.g. CEG or GE).

INCREASED STATE OVERSIGHT

The surface mining regulatory program in California is relatively unique in that local governments issue all surface mining permits and act as primary enforcers of surface mining regulation (Beeby, 2007; Testa and Beeby, 2007). Two State government entities, the Department of Conservation's Office of Mine Reclamation (OMR) and the SMGB, oversee local government implementation of state and federal surface mining requirements. In the 1990s California elevated scrutiny relating to preparation, review and execution of individual surface mining and reclamation plans and financial assurances, and monitoring of SMARA lead agency performance. Most pertinent to this report was the 1993 implementation of the Article 9 Reclamation Standards as mentioned above, which provided additional requirements for the design of proposed final slopes at mine sites.

Specifically with regards to final fill slopes, CCR Section 3704(d) states: *"Final reclaimed fill slopes, including permanent piles or dumps of mine waste rock and overburden, shall not exceed 2:1 (horizontal:vertical), except when site-specific geologic and engineering analysis demonstrate that the proposed final slope will have a minimum slope stability factor of safety that is suitable for the proposed end use, and when the proposed final slope can be successfully revegetated."*

With regards to final cut slopes, CCR Section 3704(f) requires that *"Cut slopes, including final highwalls and quarry faces, shall have a minimum slope stability factor of safety that is suitable for the proposed end use and conform with the surrounding topography and/or approved*

end use." Use of phrases such as "site-specific geologic and engineering analysis" and "minimum slope stability factor of safety" within the Performance Standards for slope stability leaves no doubt that SMARA lead agencies are expected to accept nothing less than work products prepared by qualified CEGs and GEs.

Additional portions of the Article 9 Reclamation Standards illustrate the fact that current standards of practice require utilization of qualified geo-engineering professionals. For example, CCR Section 3704(a) requires that when backfilling is a component of reclamation at mine sites where urban end uses are proposed, such backfilling shall be completed in accordance with the Uniform Building Code and local ordinances. The intent of this requirement is to ensure that backfilled material is properly placed and compacted to acceptable standards (Figure 1).

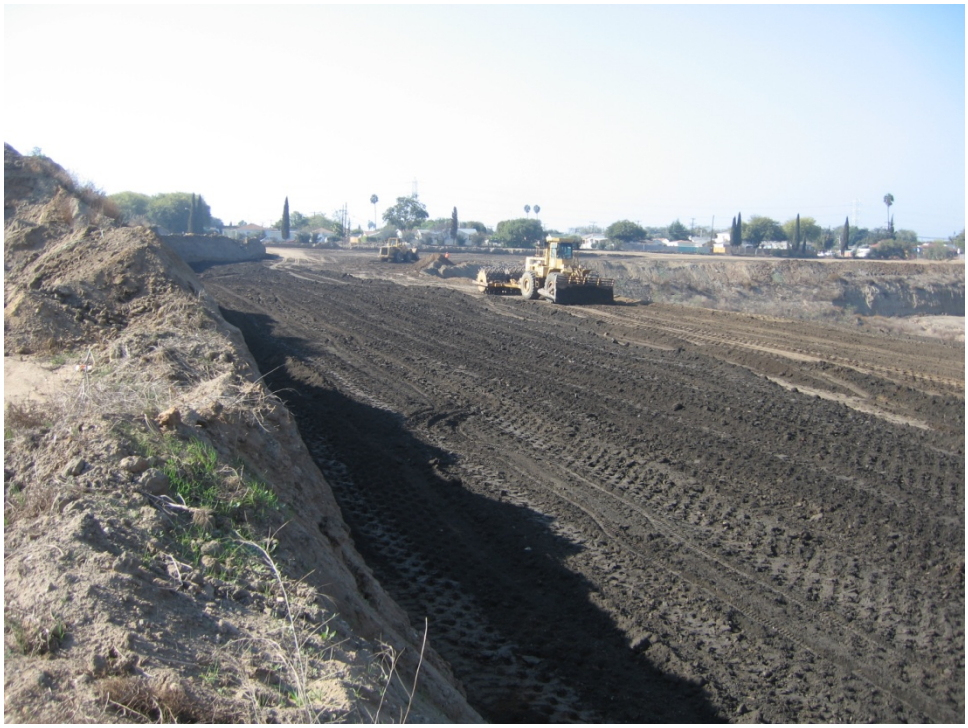

Figure 1. Ongoing fill material placement and compaction in a former Clay Pit that is being backfilled up to original grade in an industrial/residential neighborhood in the City of Compton (Photo by Will Arcand; November 17, 2010).

CCR Section 3706(d) requires installation of erosion control measures in order to control surface runoff and drainage from mine sites (Figure 2). Such measures may include structures such as berms, silt fences, sediment ponds or catchment basins, and all erosion control methods shall be designed to handle runoff from not less than the 20 year/1 hour intensity storm event. Current standards of practice dictate that design of

effective erosion control structures must be completed by qualified professionals.

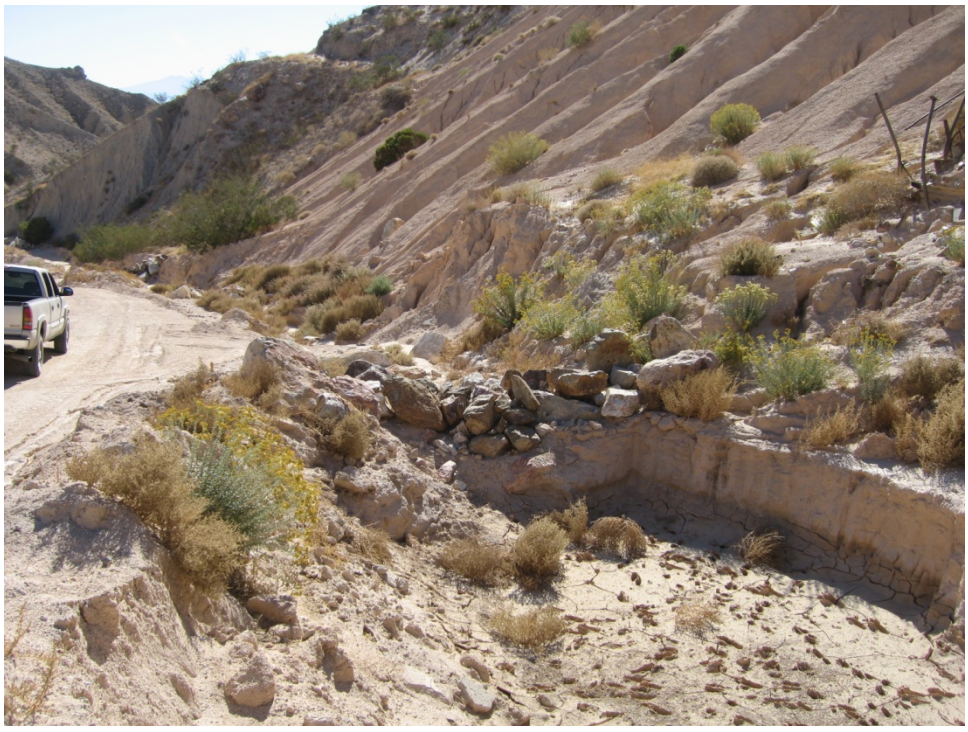

Figure 2. Rock check dam and sediment catchment basin placed at toe of gullied mine tailings slope. This structure was required to be redesigned in order to effectively control sediment eroding from the slope (Photo by Will Arcand; November 18, 2010).

ENGINEERING GEOLOGISTS VALUE TO MINE OPERATORS

Increased State and local government attention to surface mine planning, development, and ultimate reclamation has heightened awareness regarding situations where Engineering Geologists (EGs) play key roles. During the past decade it has become apparent that EGs are favorably qualified to serve both mining operators and SMARA lead agencies. Although EGs are considered specialists, an educational background based firmly in the geological sciences and supplemented by specific coursework in engineering principles creates a multi-faceted geoscientist with a broad base in two widely varying fields. Project work experience and networking coupled with rigorous requirements for professional licensure and certification further grooms an EG for success when dealing with challenging surface mining issues. For instance, surface mine operators and/or landowners that are considering development of a mine project may reduce financial liability by retaining an EG during early planning to evaluate the site for an array of potential adverse geological conditions. If potential geologic hazards are identified that may present significant risks to the mining operation and/or its proposed end use,

adjacent properties or the environment, the EG will likely be able to propose feasible mitigations that meet SMARA's requirements. Too often operators postpone involvement of EGs until after SMARA regulators require submittal of supporting documentation following review of proposed mining and reclamation activities, which subsequently results in project delays and potentially opens the door to enforcement actions by the lead agency or State.

SITE EXAMPLES

We present examples of two sites where involvement of an EG prior to review by SMARA regulators at the local or State government level would have saved the surface mine operators significant amounts of time and money. In the first example the mine operator had constructed three waste rock dumps by sidecasting rock and soil materials off the edge of narrow haul roads established across steep slopes (Figure 3). Space constraints led the operator to file a request with the local SMARA lead agency to expand the mine operations footprint so that an additional waste rock dump could be developed. Upon inspection by State SMARA review staff, which included an EG, potential fill slope instability features were identified. Incidentally, approximately one month after the site inspection, the waste rock fill slope failed as a slump/debris slide following heavy rains (Figure 4). Consequently, the mine operator was directed to resubmit a revised reclamation plan that included engineered design plans for both the proposed new waste rock dump and the existing waste rock dumps that were obviously unstable. Such design plans were required to be supported by slope stability analyses that demonstrated adequate factors of safety.

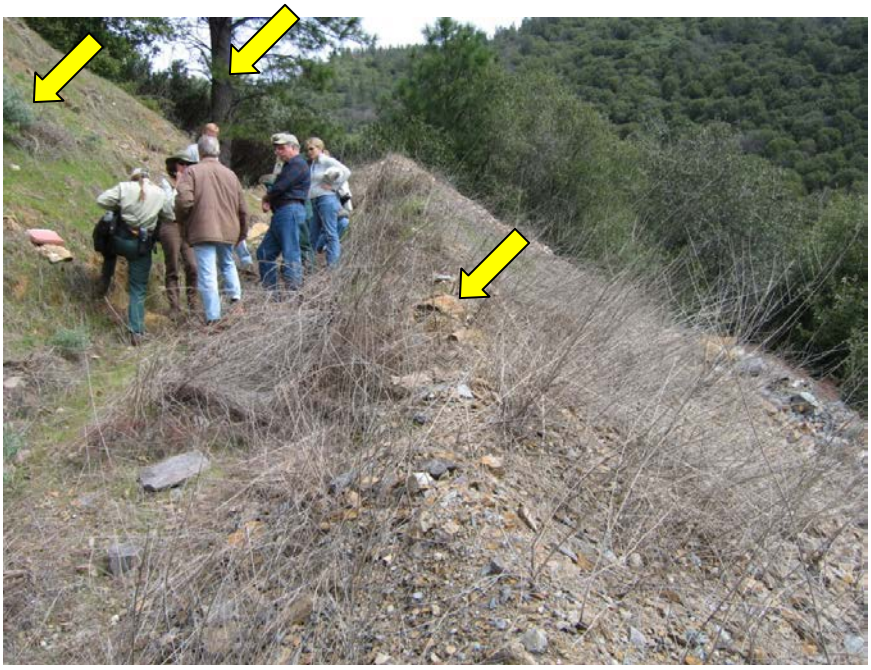

Figure 3. Mine operator, State and County SMARA regulators, and USFS staff standing on haul road traversing the top of a waste rock dump constructed by sidecasting on a steep slope. Arrows point to (from left to right) a lavender bush, pine tree and large rock that are also referenced in Figure 2 (Photo by Will Arcand; March 26, 2006).

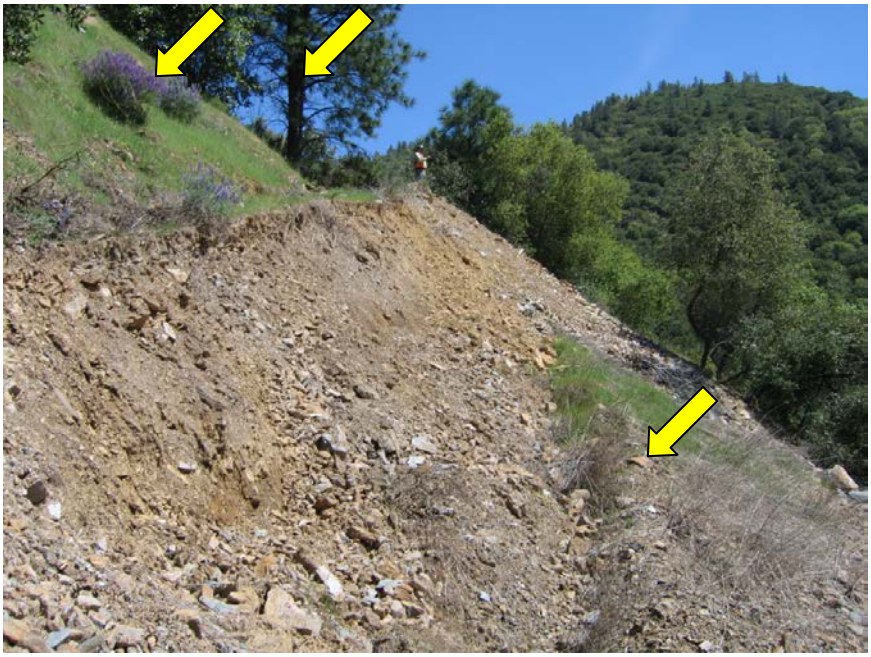

Figure 4. 4/27/06 – Failure of upper portion of waste rock dump approximately one month after photograph used in Fig. 1. USFS staff member visible at upper center. Arrows correspond to reference points described in Figure 1. (Photo by Will Arcand; April 27, 2006)

Another example consists of a hillside quarry in Quaternary volcanic flow rocks (basalts). The mine operator planned to expand the quarry further into the hillside and submitted a proposed reclamation plan amendment to the local SMARA lead agency that illustrated a typical uniform benched final cut slope with overall angle of 1:1 (horizontal:vertical). Upon review and inspection State SMARA staff observed that potential cut slope stability issues may arise due to variations in rock structure (columns adjacent to pillows—see Figure 5) and the highly weathered and discontinuous condition of the outcrop (Figure 6). Again, the operator was directed to resubmit a revised reclamation plan amendment that included specific quarry cut slope design parameters supported by a slope stability analysis demonstrating adequate factors of safety.

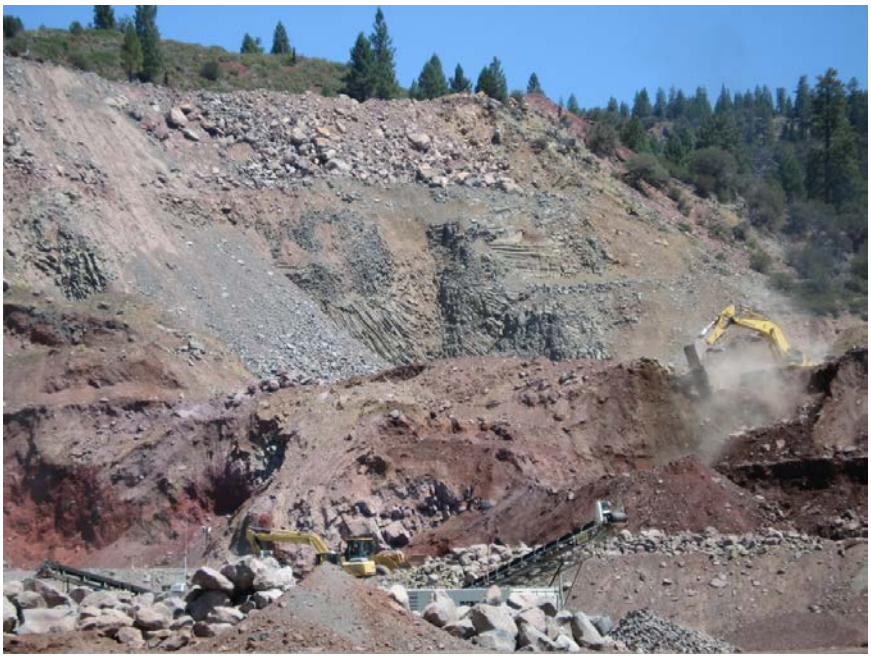

Figure 5. View of quarry cut slope proposed for expansion into volcanic flow rocks of Quaternary age with locally variable structures (columns adjacent to pillows) (Photo by Will Arcand; dated August 2, 2006)

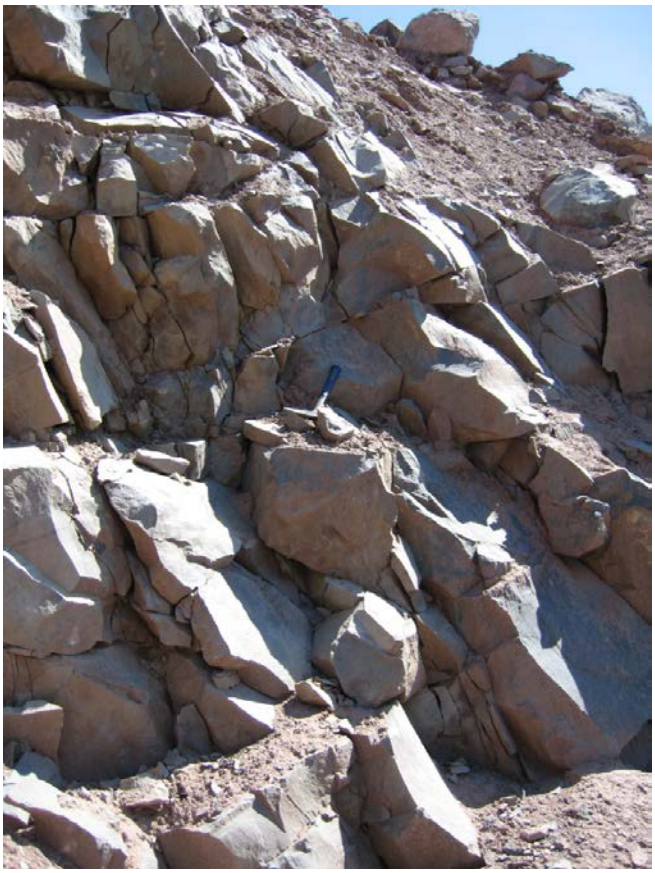

Figure 6. Highly jointed and fractured volcanic rocks of Quaternary age located on face of quarry cut slope proposed for expansion. Rock hammer visible at center for scale. (Photo by Will Arcand; dated August 2, 2006).

In both of the above examples it was State SMARA reviewers that requested slope stability analyses be completed to support proposed final mine slope designs. In both cases local and State government reviews of the proposed reclamation plans were put on hold, and additional costs were incurred by the mine operator in order to revise and resubmit the reclamation plans with the requested documentation. Finally, in neither case did the local reviewing SMARA lead agency have an EG or similarly qualified technical reviewer on staff whom may have identified the potential slope stability issues at earlier stages and saved time and money for the operator.

ENGINEERING GEOLOGISTS SERVING LOCAL SMARA LEAD AGENCIES

The two site examples provided are individual cases that illustrate the worth of qualified EGs serving as reviewers for SMARA local lead agencies. However, there are key additional benefits to local agencies utilizing the services of EGs, in a cumulative sense. Recurring inattention

to key SMARA lead agency requirements may trigger State review of such lead agency performance. Since 2001, the SMGB has assumed responsibility for certain SMARA lead agency duties from three counties due to poor SMARA program implementation.

One key aspect of an effective SMARA program is regular conduct of annual inspections at each surface mining operation. EGs are particularly useful, and indeed are strongly encouraged by language within SMARA, in conducting required annual mine inspections, as violations commonly surface due to inadequate slope design and construction.

CONCLUSIONS

Although EGs are not specifically designated to conduct activities under SMARA, current standards of practice within California dictate that CEGs, or similarly qualified geo-professionals, should be involved in certain surface mining and reclamation tasks.

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