

## CONTENT SPECIFICATIONS FOR ENGINEERING GEOLOGIST EXAMINATION

I. PROJECT PLANNING (17%) – Determine scope and objectives of project, applicable regulatory or jurisdictional statutes, and evaluate research and background information.
Tasks
T1. Define type and level of engineering geologic investigation for intended application. T2. Plan monitoring system to quantify ground movement and fluctuations in groundwater. T3. Identify types and quantity of subsurface explorations to adequately characterize the geologic conditions at the site for the intended application. T4. Identify regulatory permits and requirements for field exploration and project application. T5. Review grading and development plans to evaluate potential impacts from adverse geologic conditions and impacts to exploration program. T6. Plan areal reconnaissance to evaluate potential geologic impacts and constraints on site exploration and development. T7. Review published and unpublished geologic information to identify geologic conditions that could impact site development. T8. Review site conditions, and historical and anecdotal information to support observed geological conditions, past site usage and site modification. T9. Review aerial photographs and other remote sensing data to plan explorations, and identify past site usage, ground surface changes and landforms. T10. Plan laboratory programs to characterize earth materials for intended application.

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II. GEOLOGIC INVESTIGATION (16%) – Determine earth processes, develop investigation programs, conduct surface and subsurface investigations, and, use investigative tools.
Tasks
T11. Conduct areal reconnaissance to evaluate potential geologic impacts and constraints on site exploration and development.
T12. Use aerial photography and remote sensing data to identify geomorphic features.
T13. Identify potential safety hazards and governing regulations related to subsurface explorations.
T14. Log geology and engineering properties of earth materials in subsurface explorations.
T15. Log soil and rock stratigraphy in trenches to identify geologic conditions and hazards.
T16. Select exploration techniques to describe and evaluate site conditions for the intended application.
T17. Perform engineering geologic mapping of site-specific geomorphic, lithologic, and geologic features from surface exposures.
T18. Collect representative samples of soil and rock to identify subsurface conditions and for laboratory testing.
T19. Conduct hydrogeologic testing for engineering applications.
T20. Measure soil properties and soil strength parameters of earth materials with in-situ tests.
T21. Measure properties of earth materials with geophysical tests.
T22. Install geotechnical instrumentation to monitor changes in surface and subsurface conditions.

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III. GEOLOGIC CHARACTERIZATION AND INTERPRETATION (17%) – Characterize and interpret geologic materials, recognize geologic hazards, and develop models of geologic conditions.
Tasks
T23. Prepare cross-sections and maps to depict surface and subsurface characteristics. T24. Evaluate laboratory test results to estimate geotechnical properties of earth materials. T25. Identify areas of collapsible, compressible, and expansive soils. T26. Identify areas of existing and potential subsidence. T27. Identify secondary seismic hazards. T28. Identify landslide hazards and slope instability. T29. Identify volcanic hazards. T30. Identify areas of existing and potential erosion and sedimentation impacts. T31. Synthesize geologic structure, geomorphology, geologic hazards, geologic history and hydrogeology from published, unpublished and field geologic data to model geologic conditions. T32. Describe distribution of primary and secondary faulting and fault-related deformations and potential presence of blind or disseminated faults. T33. Use geophysical data to interpret subsurface structure, stratigraphy and groundwater conditions. T34. Evaluate in-situ field test data to estimate engineering geologic properties of earth materials. T35. Review data from geotechnical instrumentation monitoring to interpret surface and subsurface conditions and processes. T36. Utilize time history and attenuation to develop model for site ground motion.

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IV. GEOLOGIC AND GEOMECHANICAL ANALYSIS (22%) – Analyze geologic hazards, hydrologic conditions, model geologic conditions, and determine site and material suitability.
Tasks
T37. Assign material strength values to soil and rock units. T38. Analyze effect of site conditions on seismic ground motion and site response. T39. Analyze fault surface rupture hazard based on paleoseismic and historic evidence. T40. Analyze liquefaction susceptibility, settlement and lateral spread of project site. T41. Estimate relative potential for surface rupture due to faulting. T42. Identify geologic constraints and conditions that impact mining reclamation plans. T43. Identify geologic constraints and conditions that impact timber harvest plans. T44. Analyze geologic factors affecting slope stability of natural and graded slopes. T45. Analyze impact of water recharge on slope stability. T46. Analyze seismic stability of natural and graded slopes. T47. Analyze impact of development on stability of adjacent properties. T48. Analyze effects of riverine processes. T49. Analyze effects of coastal shoreline processes. T50. Evaluate effects of erosional and depositional processes on natural and graded areas. T51. Analyze potential impact of subsidence on project site. T52. Analyze settlement due to site development. T53. Analyze settlement due to groundwater extraction. T54. Evaluate potential impact of volcanic hazards on project site. T55. Estimate degree of risk associated with surface and underground openings, e.g., mining, tunnels, pipelines. T56. Evaluate soil, rock and water conditions related to tunneling or other trenchless technologies. T57. Evaluate soil, rock and water conditions related to dam construction and removal. T58. Analyze groundwater piezometric data to estimate gradient and flow direction for engineering geologic applications. T59. Analyze hydrogeologic data to estimate aquifer characteristics for engineering geologic applications. T60. Construct flow nets for engineering geologic analysis. T61. Evaluate characteristics of rock materials pertinent to design of excavation methods. T62. Evaluate suitability of earth materials for use as construction materials.

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V. DESIGN (15%) – Develop specifications for earth structures, drainage, grading, surface processes, and mitigate various geologic conditions.
Tasks
T63. Provide recommendations for foundation bearing capacity. T64. Provide recommendations for foundation type. T65. Provide recommendations for surface and subsurface drainage. T66. Provide recommendations for engineered fill. T67. Provide recommendations for expansive soils. T68. Provide recommendations for erosion control. T69. Provide recommendations for soil reinforcement/improvement. T70. Provide recommendations for temporary and permanent slope angle. T71. Design soil improvement programs for seepage control. T72. Design measures for drainage for slope stability improvements. T73. Establish setback distances from geologically hazardous conditions. T74. Design groundwater monitoring systems to evaluate seepage, permeability, seasonal fluctuation, construction dewatering, and groundwater quality. T75. Design slope monitoring systems to evaluate depth, direction and rate of slope movement.

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VI. PREPARATION AND REVIEW OF REPORTS, DESIGN PLANS, AND SPECIFICATIONS (4%) – Evaluate grading and development plans for adverse conditions and conformance to geologic recommendations.
Tasks
T76. Review reports, plans and specifications to evaluate conformance with engineering geologic recommendations. T77. Prepare engineering geologic reports, plans and specifications.

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VII. CONSTRUCTION AND POST-CONSTRUCTION MONITORING (5%) – Evaluate conformance to design specifications and report as-built/as-graded conditions.
Tasks
T78. Document geotechnical conditions during grading and construction to assess conformance to expected conditions, project plans and specifications.
T79. Prepare as-built engineering geologic report and map to document actual geologic conditions encountered during construction.
T80. Supervise grouting program for soil and rock strength improvement and permeability reduction.
T81. Provide recommendations for post construction monitoring.
T82. Provide recommendations for mitigating unanticipated geologic conditions.
T83. Provide recommendations for construction dewatering.

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VIII. PROFESSIONAL RESPONSIBILITIES (4%) – Recognize professional responsibilities specified in state statutes and regulations.
Tasks
T84. Recognize types of professional work that require the engineering geologist stamp. T85. Recognize professional responsibilities regarding engineering geologic practice.

## ASSOCIATED KNOWLEDGE FOR ENGINEERING GEOLOGIST EXAMINATION

### Construction – General

- K017. Knowledge of techniques to read design information in grading plans.
- K026. Knowledge of effects of geologic hazards on site development.
- K079. Knowledge of safety hazards associated with underground construction.
- K093. Knowledge of different methods and procedures for grouting programs.
- K117. Knowledge of soil mechanics in stability, settlement, consolidation and bearing capacity.
- K119. Knowledge of blasting methods for rock excavation.
- K129. Knowledge of methods for construction and slope dewatering.
- K133. Knowledge of techniques to address unforeseen geologic conditions during construction.
- K138. Knowledge of vibration, air blast and noise monitoring for construction activities.
- K139. Knowledge of preconstruction surveys.

### Construction – Earthwork

- K008. Knowledge of effects of physical changes on ground surface depicted on grading plans.
- K083. Knowledge of methods to evaluate settlement potential.
- K126. Knowledge of grading and excavation techniques.
- K127. Knowledge of engineering factors that affect fill compaction and performance.
- K137. Knowledge of effect of soil and rock properties on excavation methods.
- K147. Knowledge of temporary and permanent erosion control methods.
- K153. Knowledge of soil compaction methods and tests.
- K154. Knowledge of suitability of different soil types and classifications for use as structural fill materials.

### Construction – Structures

- K016. Knowledge of state guidelines for siting of critical facilities/structures.
- K019. Knowledge of geotechnical requirements for types of structures.
- K091. Knowledge of techniques to mitigate impacts of geologic hazards and conditions on planned structures.
- K104. Knowledge of techniques for retaining wall construction.
- K125. Knowledge of geologic factors that affect various foundation types.
- K155. Knowledge of soil parameters used to determine bearing capacity.

## ASSOCIATED KNOWLEDGE FOR ENGINEERING GEOLOGIST EXAMINATION

### Fieldwork

- K011. Knowledge of field evidence of land modifications and past use.
- K023. Knowledge of field measurement techniques and tools to collect geologic data.
- K027. Knowledge of capabilities of different drilling and trenching equipment.
- K045. Knowledge of techniques to log exploratory trenches and large-diameter borings.
- K046. Knowledge of techniques to sample earth materials for relative and absolute age dating.

### Materials – General

- K022. Knowledge of characteristics of joints, fractures, shears, and rock fabric.
- K035. Knowledge of methods to describe lithologic and pedologic properties of earth materials.
- K043. Knowledge of standardized soil and rock classification systems.
- K054. Knowledge of engineering properties of earth materials used in construction.
- K067. Knowledge of effects of corrosive water and soil on engineered structures.
- K076. Knowledge of potential for mineral alteration to affect engineered projects.
- K089. Knowledge of statistical analysis to define mass properties of materials.
- K092. Knowledge of applications for different geotextiles and geofabrics.
- K116. Knowledge of effects of rock properties on excavation methods.

### Materials – Mitigation

- K041. Knowledge of soil pedogenesis for interpretation of subsurface conditions.
- K085. Knowledge of techniques to mitigate impacts of active soils.
- K095. Knowledge of methods and materials for soil reinforcement.
- K097. Knowledge of methods for in-place ground improvement.
- K101. Knowledge of methods to mitigate impact of compressible soils.
- K102. Knowledge of methods to mitigate impact of corrosive soils.
- K103. Knowledge of methods to mitigate impact of organic soils.
- K112. Knowledge of techniques to mitigate impacts of collapsible soils.
- K113. Knowledge of techniques to mitigate impacts of dispersive soils.
- K114. Knowledge of techniques to mitigate impacts of expansive soils.

## ASSOCIATED KNOWLEDGE FOR ENGINEERING GEOLOGIST EXAMINATION

### Materials – Testing

- K024. Knowledge of laboratory tests to evaluate hydrogeologic properties of earth materials.
- K028. Knowledge of methods of in-situ testing of physical characteristics of earth materials.
- K040. Knowledge of sampling and testing methods to evaluate engineering and chemical properties of soil and rock.
- K048. Knowledge of tests to assess performance and durability of rock and aggregate materials.
- K051. Knowledge of laboratory tests to evaluate geotechnical properties of earth materials.
- K063. Knowledge of field and laboratory tests to evaluate geotechnical properties of earth materials.

### Regulatory

- K002. Knowledge of building codes pertaining to grading and seismicity requirements that affect local jurisdictions.
- K004. Knowledge of guidelines for setbacks.
- K005. Knowledge of methods to construct site access.
- K006. Knowledge of effects of historical land uses on current site condition.
- K007. Knowledge of effects of local requirements on engineering geologic studies and reports.
- K009. Knowledge of environmental and safety regulations pertaining to exploration and sampling of contaminated soil and groundwater.
- K010. Knowledge of regulations for safeguarding personnel engaged in excavations, trenches and earthwork.
- K038. Knowledge of regulatory requirements for permitting, construction, and abandonment of exploratory borings and wells.
- K084. Knowledge of volcanic activity and associated hazards.
- K098. Knowledge of effect of local guidelines on setbacks for structures near active faults.
- K140. Knowledge of state guidelines regarding use of the engineering geologist stamp.
- K141. Knowledge of state regulations regarding the engineering geologist specialty.
- K142. Knowledge of state regulations regarding the consequences of unprofessional conduct.
- K143. Knowledge of state regulations regarding consumer recourse for unprofessional conduct.
- K144. Knowledge of professional responsibilities and liabilities of engineering geologists.

### Remote Sensing

- K039. Knowledge of techniques to interpret aerial photographs.
- K047. Knowledge of methods to interpret remote sensing data.
- K145. Knowledge of techniques to interpret LIDAR

## ASSOCIATED KNOWLEDGE FOR ENGINEERING GEOLOGIST EXAMINATION

### Reports/Data Presentation

- K060. Knowledge of methods to depict engineering geologic conditions in cross-sections.
- K065. Knowledge of methods to depict or present field and laboratory data for interpretation.
- K121. Knowledge of methods to depict engineering geologic conditions on maps.
- K122. Knowledge of methods to describe geologic structures.
- K123. Knowledge of state guidelines for preparing engineering geologic studies and reports.
- K124. Knowledge of standard professional guidelines for graphical and written presentation of engineering geologic information.

### Seismic

- K001. Knowledge of building codes pertaining to earthquake design.
- K003. Knowledge of different regional fault systems and tectonic frameworks.
- K013. Knowledge of safety hazards associated with subsurface exploration.
- K018. Knowledge of state guidelines for evaluating seismic hazards.
- K020. Knowledge of advantages and disadvantages of sampling and testing methods to evaluate engineering properties of earth materials.
- K031. Knowledge of field evidence of seismic shaking.
- K037. Knowledge of geomorphic and field evidence of fault rupture.
- K042. Knowledge of methods to assess regional seismicity, volcanics, and tectonics.
- K053. Knowledge of geophysical exploration methods.
- K077. Knowledge of methods for deterministic and probabilistic seismic hazard analysis.
- K078. Knowledge of relationship between strong ground shaking and slope stability.
- K086. Knowledge of procedures to evaluate earthquake ground motion parameters.
- K106. Knowledge of techniques to mitigate impacts of liquefaction.
- K109. Knowledge of techniques to mitigate impacts of land subsidence due to development.
- K111. Knowledge of techniques to protect developments from impacts of seiche.
- K115. Knowledge of techniques to mitigate impacts of secondary seismic hazards.

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### Slope Stability

- K025. Knowledge of measurement techniques to assess ground movement.
- K029. Knowledge of field evidence of erosional and depositional processes.
- K030. Knowledge of field evidence of mass wasting processes.
- K036. Knowledge of geologic characteristics and processes of erosional environments.
- K059. Knowledge of methods to construct stereonet for slope stability and discontinuity analysis.
- K064. Knowledge of effects of vegetation removal on steep slopes.
- K066. Knowledge of use and effects of different timber harvest methods on slope processes.
- K071. Knowledge of methods to rock slope stabilization.
- K080. Knowledge of methods to analyze landslide mechanics and soil and rock slope stability.
- K081. Knowledge of techniques to mitigate impacts of gross and surficial slope instability.
- K090. Knowledge of methods for calculating factors of safety.
- K105. Knowledge of techniques to mitigate impacts of static and dynamic slope instability.
- K110. Knowledge of techniques to mitigate impacts of coastal erosion, bluff instability, sedimentation along rivers and coastlines.
- K118. Knowledge of rock mechanics in rock slope instability mitigation design and foundation design.
- K120. Knowledge of techniques to mitigate sediment delivery from vegetation removal on steep slopes.
- K130. Knowledge of techniques for interpreting ground movement monitoring data.
- K132. Knowledge of influence of groundwater on slope stability.
- K152. Knowledge of methods to dewater unstable slopes.
- K156. Knowledge of methods to monitor slope movement

### Water

- K032. Knowledge of field methods to determine permeability.
- K034. Knowledge of methods to develop groundwater monitoring wells.
- K049. Knowledge of advantages and disadvantages of different methods to sample and test groundwater.
- K052. Knowledge of field methods for hydrologic testing.
- K055. Knowledge of methods to construct isopach maps.
- K056. Knowledge of methods to construct structure and groundwater contour maps.
- K068. Knowledge of conditions that affect groundwater flow.
- K107. Knowledge of techniques to design effluent disposal and water infiltration systems.
- K108. Knowledge of methods to control groundwater levels, flow and seepage.
- K146. Knowledge of subsurface drainage methods.