LOS ANGELES COUNTY
PUBLIC WORKS

GEOTECHNICAL AND MATERIALS
ENGINEERING DIVISION

Manual for Preparation of
Geotechnical Reports

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1.0 INTRODUCTION

1.1 Purpose

This document presents the requirements for geotechnical work for development projects under the purview of Los Angeles County Public Works' Land Development and Building and Safety Divisions. Many civil engineering projects require geotechnical investigations with input from both a State of California licensed engineering geologist and civil engineer, experienced in the field of soil engineering, in accordance with the County of Los Angeles Subdivisions Code (Code of Ordinances Title 21) (LACSC) Section 21.48.050.8 and the 2023 County of Los Angeles Building Code (Code of Ordinances Title 26) (CLABC).

1.2 Definition of Roles

1.2.1 Building Official

The Building Official, as defined in the CLABC, is the officer or other designated authority charged with the administration and enforcement of this code, or a duly authorized representative. They are responsible for issuing building and grading permits for development projects throughout and within their jurisdictional areas. Geotechnical and Materials Engineering Division (GMED) is one of several agency referrals made by the Building Official. GMED's engineering geologists and civil engineers serve as the geotechnical experts for the Los Angeles County Building Official. GMED's development review staff prepares the Geologic and Geotechnical Engineering Review Sheet (GMED review sheet) and may recommend grading and/or building plans for approval from a geotechnical standpoint and convey necessary mitigation recommendations of the project geotechnical consultant when required.

A key aspect of our GMED's Development Review is that GMED does not recommend specific geologic or geotechnical reports for approval. GMED recommends the grading and/or building plans that are associated with the reports for approval. This means the development plans will need to accurately reflect the recommendations from the geologic and geotechnical reports. It will be crucial for the development that the consultant geologist and geotechnical engineer have good coordination with the civil engineer and/or architect so that they can get their recommendations on the plans. Verification of the plans by the geologist or geotechnical engineer will be required prior to recommendations of approval for the Building Official. The Building Official will review GMED recommendations and other agency approvals prior to issuance of permits.

1.2.2 Project Applicant

Applicants may include landowners, homeowners, architects, civil engineers, permit specialists/expeditors, contractors, or others directly involved with the proposed development or improvement project. Applicants are responsible for providing a complete submittal of documents required for geotechnical review, including a Building and Safety Agency Referral Sheet, a set of plans, and a geotechnical report. The applicant is responsible for payment of required fees based on the type of submittal.

1.2.3 Engineering Geology and Geotechnical Engineering Reviewers

Registered and licensed professional engineers and geologists (or under direct supervision) from GMED serve as the engineering geology and geotechnical engineering reviewers for the Los Angeles County Building Official. On referral by the Building Official, GMED reviews building and grading plans, along with engineering geology, soils, and/or geotechnical reports, for proposed improvement and development projects. GMED reviews submitted documents to determine whether geologic conditions and/or hazards have been adequately evaluated by the geotechnical consultant-of-record. When a geotechnical report is not submitted with plans, GMED will make a determination based on various reference materials, on whether an engineering geology, soils engineering, or geotechnical report is warranted based on the proposed project improvements. Emphasis is placed on determining geologic/geotechnical impacts to a proposed development or improvement project and the effect of a proposed project on adjacent properties. In the form of a GMED review sheet, GMED inform the Building Official and applicant(s) of any additional information or data, testing, research, analyses, policy requirements and/or required geotechnical mitigation measures associated with a specific development project.

1.2.4 Project Geotechnical Consultants

Project geotechnical consultants are consulting professionals who are registered and licensed in the State of California and who provide engineering geology and geotechnical engineering services for the project applicant. The project geotechnical consultants consist of:

- A California registered Certified Engineering Geologist ("project engineering geologist"), and

- A California registered Geotechnical Engineer or a California registered Civil Engineer with experience in geotechnical engineering ("project geotechnical engineer").

Project geotechnical consultants typically provide two types of services for an applicant. The first type is to provide data and analyses to determine the feasibility of the site for development with regard to geologic and geotechnical hazards during the Department of Regional Planning review stage. The second type is to provide design recommendations, to review and approve project plans and specifications, and to provide construction observation services.

1.2.4.1 Level of Professional Responsibility

All documents that include engineering geology data, interpretations, or recommendations must be signed, dated, and stamped by a California Certified Engineering Geologist or by a California registered Professional Geologist with experience in engineering geology and must include the geologist's license number and license expiration date. Certain projects, including essential facilities and schools, will require a California Certified Engineering Geologist.

All documents that include geotechnical engineering data, interpretations, or recommendations must be signed, dated, and stamped by a California registered Geotechnical Engineer or a California registered Civil Engineer with experience in geotechnical engineering, and must include the engineer's license number and license expiration date. Certain projects, including essential facilities and schools, will require a California registered Geotechnical Engineer.

GMED may require project geotechnical consultants to review and verify that their recommendations, notes, or details are adequately represented and shown on the development plans. When geotechnical recommendations are placed on the development plans, project geotechnical consultants must sign, date, and stamp in verification of their recommendations, notes, or details on the plans. A note may be placed on the development plans to clarify scope of their recommendations and services.

1.3 Submittal Requirements

GMED only accepts documents for review through referrals from Building and Safety (BSD) or Land Development (LDD) Divisions. Submittals will not be accepted without a referral. Generally, a complete submittal consists of a set of plans which clearly shows the proposed work, an agency referral sheet (applicable only for projects referred by BSD), and a recent or an updated geotechnical report (dated one year from the date of submittal) which addresses the proposed work depicted on the plans. A bar scale must be included on each plan sheet where scaling is applicable.

1.3.1 Referrals from Building and Safety Division

Applications for building and single lot grading permits are initiated at BSD district offices or through the online permitting system, EPIC-LA. BSD plan checkers will determine if GMED clearances are required prior to the issuance of permits and provide applicants with an agency referral sheet which shows the various agencies that are required to clear the proposed work. If GMED referral is required, an additional GMED specific referral sheet may be provided to applicants. The GMED referral sheets will specify items that GMED reviewers should focus on when performing the reviews.

Documents for projects located within the unincorporated County area and City of Westlake Village must be submitted through EPIC-LA website (https://epicla.lacounty.gov/energov_prod/SelfService/#/home).

Documents for projects located in other contract cities must be submitted through the GMED web portal (https://dpw.lacounty.gov/apps/esubmissions/gme/default.aspx).

1.3.2 Referrals from Land Development Division

LDD plan checkers may refer subdivision grading plans, Low Impact Development (LID), storm drain plans, and Flood Control District Permit (FCDP) applications for GMED clearance. For submittals to LDD, a specific GMED plan case number will be assigned through EPIC-LA. Applicants may request the geotechnical study plan case numbers from the LDD plan checker and upload documents to the plan cases for GMED review through EPIC-LA. For FCDP applications, responses to initial review comments should be uploaded to the FCDP plan cases through EPIC-LA.

LDD may also refer tentative subdivision maps and other plan cases from Department of Regional Planning for GMED review. Documents responding to initial GMED review comments for a project should be submitted to a new geotechnical study plan case on EPIC-LA. Any subsequent responses to GMED review comments for that same project should be uploaded to the same geotechnical study plan case.

1.4 Applicable Codes and Policies

All submitted geotechnical reports and recommendations must demonstrate that the final geologic and geotechnical conditions of the proposed development will meet and will be in compliance with the current CLABC and are consistent with geotechnical standards determined by the California licensure for geologic and geotechnical work. The following CLABC sections, but not limited to, relate to geologic and geotechnical hazards and should be considered when developing reports for GMED review.

- CLABS Section 110.2 – Geotechnical Hazards – requires that the building site will be free of geotechnical hazards, such as landslide, settlement, or slippage, and that the proposed work will not adversely affect offsite property.

- CLABC Section 111 – Engineering Geology and Soils Engineering Reports – requires the report contain a finding to show compliance with CLABC Section 110.2.

- CLABC Section 112 – Earthquake Fault Maps – states that the California Public Resources Code is considered a part of the CLABC and should be referenced for fault maps. Additional fault maps will be required for review for site specific locations and will be discussed later in this manual.

- CLABC Section 113 – Earthquake Faults – states that no building or structure shall be constructed over or upon the trace of a known active earthquake fault which is shown on maps maintained by the Building Official.

The CLABC that is applicable to developments are the CLABC that are in effect at the time of submittal of the engineering geology or geotechnical engineering reports to EPIC-LA.

This Manual does not supersede applicable Federal, State, and local codes or ordinances. In particular, engineering geology and geotechnical engineering reports should comply with:

- Alquist-Priolo Earthquake Fault Zoning Act of 1972.

- Seismic Hazards Mapping Act of 1990.

In addition to applicable codes and guidelines, applicants and consultants are encouraged to review the selected geologic and geotechnical memos (GS Memos) referenced and listed in Appendix A.

If any differences exist between this Manual and other references, guidelines, and codes, the more restrictive requirement governs.

1.5 Aging/Update Reports

For a geotechnical report to be considered current for a proposed development, the report must have been prepared within one year of the submittal date to GMED. An update report/letter will be required for any project in which the report is older than one year from the submittal date to, at a minimum, verify the validity and applicability of the original report.

The update report/letter must address the latest proposed development/plans, current site conditions, and utilize the latest building or grading plans and/or tentative map as a basis for the geotechnical map(s) contained in the report. The update report/letter must address any changes to the proposed scope of work, existing conditions, or geologic hazards. Additional subsurface data, updated analyses, and/or updated geotechnical maps and cross-sections may be required to provide adequate updated recommendations and conclusions for development of the project.

1.6 Change of Consultant Letters

GMED requires that a letter/report from the new geotechnical consultant-of-record be submitted when a change in consultant occurs during the process of review or during construction. If a change of consultant occurs during project construction, the construction must stop until the change has been approved by the Building Official. Clarification and resolution of pertinent discrepancies in professional opinions and data of in-progress construction and/or grading will be required before the recommendation for approval can be provided by GMED.

1.7 Communication with GMED Review Staff

The public may contact the GMED review staff via phone or e-mail to verify completeness of their submittal, check the status of their review, review public records, and obtain copies of available documents.

Applicants and professional consultants are encouraged to contact GMED prior to and/or during the plan check process to obtain information and clarification on applicable codes and policies to avoid an extended plan check process.

GMED review sheets are addressed to the professionals that are hired to provide the geologic and geotechnical expertise for the proposed development. Therefore, it is often helpful when applicants, owners, and their professionals are communicating and agreeing on the proposed design. We will discuss comments on the GMED review sheets with those contacts related to the plan check; however, for some of the technical comments, we will need to discuss them with the consultant professionals. In addition, some GMED comments will require coordination from various design professionals for the same project if discrepancies are identified. GMED will periodically reach out to discuss review comments to ensure that all parties are aware of these issues. This is to help streamline the GMED review process and shorten the overall time of plan check.

For review of geologic and geotechnical records on a specific parcel or subdivision, please submit a completed Geotechnical Documents Request Form to gmedrequests@pw.lacounty.gov and GMED will notify the requestor the availability of the requested documents. Applicants can also request a Geotechnical Documents Request Form by e-mailing to gmedrequests@pw.lacounty.gov.

1.8 Definitions

1.8.1 Building Site

The building site includes that portion of the lot or parcel of land upon which the structures are located as well as the surrounding area that includes hardscape, clearances (required setbacks), proper site drainage improvements, and easements.

1.8.2 Restricted Use Area

The Restricted Use Area (RUA) is part of the geotechnical subdivision recordation process and are easements dedicating Los Angeles County the right to restrict building within those areas. Refer to GS Memos GS051.0 and GS063.0 (Appendix A) for specific details regarding the requirements of the process. All geologic hazards, such as landslides, debris/mudflow/rockfalls, and active fault traces that may affect a proposed subdivision must be mitigated. In some cases, if it can be demonstrated that the hazard will not affect buildable areas, the geotechnical consultants may recommend that the area affected by the hazard be designated as a RUA. Prior to recordation of a subdivision, a letter or report is required to be submitted by the engineering geologist and soils engineer stating whether RUAs are recommended. If recommended, the RUA letter must provide a discussion of the basis for its delineation and include a geotechnical map that depicts the boundaries of the RUA. Once established by the consultant and approved by GMED, the RUA must be labeled as "Restricted Use Area" on the recorded Final Map. Only unmitigated geologic hazards and the areas underlain by geotextiles or other structural anchoring elements used in the support of slopes or retaining walls may be designated as a RUA and the application of this process is subject to the approval of GMED. The Los Angeles County Building Official may require a covenant-agreement to be recorded prior to the issuance of the development permit.

1.8.3 Building Restriction Area

Geotechnical consultants may be required to designate Building Restriction Areas on geotechnical maps and development plans for areas susceptible to instabilities that are not mitigated by the proposed work. These Building Restriction Areas are utilized for single lot developments in which there will be unmitigated geotechnical areas that will not affect the proposed development. Some examples of Building Restriction Areas maybe setbacks from a slope due to debris flow or erosion, underlying landslide deposits or compressible materials, or areas of uncertified fills or stockpile, etc. A description, data, and analyses of the geologic or geotechnical hazard must be provided within the report and the building restriction area must be delineated and labeled on the geotechnical map. This information must also be shown on the development plans and as-builts maps. This designation on the project development

plans must be delineated, labeled as a Building Restriction Area, and indicate the geologic/geotechnical issue and/or provide direct reference to the geotechnical report.

1.8.4 Geotechnical Setback

All proposed developments must meet all applicable slope setback requirements as required by the building code. However, some projects will also be subject to geotechnical setback due to site specific conditions as determined by the project geotechnical consultants.

Geotechnical setbacks may be required to be shown on cross-sections and geologic and geotechnical maps, as well as the project development plans. The setback on the project development plans must be delineated, labeled as a geotechnical setback, and provide direct reference to the geotechnical report. When there are multiple setback requirements that can apply to the development, the more conservative setback will apply. Please refer to Appendix A, GS Memo S002.0, for additional details.

2.0 GUIDELINES

The guidelines contained in the following sections have been prepared for the purpose of providing a general format and minimum standards for analysis and report preparation by geotechnical consultants for compliance with County codes and policies. These guidelines define the minimum standards however site-specific conditions may require these standards be exceeded.

2.1 General Guidelines

The intent of these guidelines is to assist geotechnical consultants so that the reports contain the necessary information for the proposed development.

2.2 Types of Studies/Reports

2.2.1 Entitlements

2.2.1.1 Tentative Maps

The purpose of a tentative subdivision map and the accompanying report(s) is to demonstrate that the site is suitable for the proposed future development. Therefore, the geotechnical consultants must present sufficient information to establish that the site will be safe for the intended use and that all existing and potential geotechnical hazards will be mitigated. The recommended mitigation measures must demonstrate feasibility for all aspects of the proposed future development, including all building pads, utility corridors, stormwater and sewer infrastructure, and all access routes. It also must be demonstrated

that the proposed future development will not cause geologic or geotechnical instability on the subject site or to offsite properties.

2.2.1.2 Conditional Use Permits/Coastal Development Permits

A geotechnical report prepared in support of a conditional use permit must identify and address all geologic/geotechnical hazards potentially affecting the feasibility of the proposed project. The report must discuss and evaluate the geologic/geotechnical hazards to determine whether mitigation measures are necessary to comply with County Codes and policies. Recommended mitigation measures shall be shown on the geotechnical map and cross sections, as appropriate. The same requirements are applicable to reports prepared in support of a coastal development permit. Similar to reports prepared for tentative subdivision maps, the geotechnical consultants must demonstrate the proposed development will not cause geologic or geotechnical instability on the subject site or adversely impact offsite properties.

2.2.2 Fault Rupture Hazard Reports

2.2.2.1 Active Fault

The Alquist-Priolo Earthquake Fault Zoning Act (A-P Act) or, more specifically, California Public Resources Code (CPRC) Section 2621.6 requires fault studies for "structures for human occupancy…" when they are located within zones of active faulting as mapped by the State. The A-P Act also states that "the area within 50 feet of such active faults shall be presumed to be underlain by active fault branches of that fault unless proven otherwise…" (A-P Act Policies Section 3603[a]).

Additionally, CLABC Section 113.5 states that "no building or structure shall be constructed over or upon the trace of a known active earthquake fault which is shown on maps maintained by the Building Official." The same section states that a geology investigation is required "when the proposed building is within 50 feet of that line designated by the Building Official as the assumed location of a known earthquake fault…" or "when the proposed building is within 50 feet of the most probably ground location of the trace of a known active earthquake fault shown on the aforementioned maps."

An active earthquake fault is defined as a fault "which has had surface displacement within Holocene time (about the last 11,000 years)." This definition is followed in California Geological Survey (CGS) Special Publication 42 (SP42), revision dated 2018, Page No. 27 by: "This definition does not, of course, mean that faults having no evidence for surface displacement within Holocene time are necessarily inactive. A fault may be presumed to be inactive based on satisfactory geologic evidence; however, the evidence necessary to prove inactivity sometimes is difficult to obtain and locally may not exist."

Surface rupture of an active fault in a depositional environment could subsequently be covered by additional material, and would, therefore, not necessarily have ruptured the currently existing ground surface, yet may still have had activity in Holocene time. Therefore, Los Angeles County considers a fault active if it has displaced Holocene materials and requires a fault investigation to penetrate the Holocene-Pleistocene boundary. All fault investigation excavations must extend through the Holocene and into Pleistocene deposits in order to demonstrate the lack of Holocene fault activity. If appropriate data cannot be provided, then the presence of an active fault trace within the area of investigation must be assumed.

All available fault maps, such as the State A-P Act, CGS and United States Geological Survey Open File Reports, various published and unpublished fault maps, and geology and geotechnical reports for nearby properties, are used to make this determination.

CGS Note 49 presents Guidelines for Evaluating the Hazard of Surface Fault Rupture (Appendix B).

2.2.2.2 County of Los Angeles Building Code

Refer to Section 113.0 "Earthquake Faults" of the current CLABC for specific requirements, exceptions, and exemptions.

2.2.2.3 Single-Family Residential Development

Fault investigations for single-family residential developments are governed by the CLABC and are required whenever the proposed building location is within 50 feet of the surface trace of an active fault.

All available fault maps, such as the State A-P Act, CGS and United States Geological Survey Open File Reports, various published and unpublished fault maps, and geology and geotechnical reports for nearby properties, are used to make this determination.

2.2.2.4 Commercial Development

Fault investigations for commercial developments are governed by the CLABS and the A-P Act (commercial development is defined as a "project" by the A-P Act). Therefore, a fault investigation for a commercial development is required whenever the proposed building location may be underlain by the surface trace of an active fault, and/or if the property, or a portion of the property lies within the boundaries of an Alquist-Priolo Earthquake Fault Zone.

2.2.2.5 Subdivision Development

A fault investigation for a subdivision of land is required whenever the property or a portion of the property to be subdivided lies within the boundaries of an A-P Act Earthquake Fault zone, or if the property or a portion of the property may be underlain by a fault that, based on available information, is considered active by the County.

The A-P Act requires fault studies for subdivisions of land within zones of active faulting, as mapped by the State (Section 2621.6). The A-P Act also states that "the area within 50 feet of such active faults shall be presumed to be underlain by active fault branches of that fault unless proven otherwise…" A-P Act Polices Section 3603(a). Additionally, CGS SP42 states on Page No. 6 that "Zone boundaries on early maps were positioned about 660 feet (200 meters) away from the fault traces to accommodate imprecise locations of the faults and possible existence of active branches. The policy since 1977 is to position the Earthquake Fault Zone boundary about 500 feet (150 meters) away from major active faults and about 200 to 300 feet (60 to 90 meters) away from well-defined, minor faults." Los Angeles County interprets these statements to imply that an active fault trace maybe present anywhere within the boundary of an A-P Earthquake Fault Zone; therefore, all areas within the project site must be investigated per the requirements of the A-P Act. In some cases, the County may allow areas of potential faulting to be designated as "Restricted Use Areas" in lieu of investigation.

2.2.2.6 Sierra Madre Fault Zone

The Los Angeles County Building Official recognizes the Sierra Madre Fault Zone as an active fault zone and development within the County designated fault zone must adhere to all provisions of Section 113.0 the CLABC.

2.2.2.7 Fault Rupture Evaluation Report

A geology report must contain, at a minimum, description of the proposed development, the geologic and tectonic setting, a site location map showing the location of all major fault traces and known faults near the site based on a review of applicable Fault Evaluation Reports prepared by the CGS, regional published geologic maps, surrounding geology and geotechnical reports, stereo pairs of aerial photographs, and surface observations, include mapping of artificial fills, soil and geologic units, geologic structures, geomorphic features, springs, vegetation, existing structures, and factors that may affect investigative methods and interpretation of site data, subsurface investigation (described below), geophysical investigations can be utilized but cannot be relied upon for determining the absence of a fault or identifying the recency of activity, a variety of age-dating techniques are essential for determining the ages of soils, surfaces, and geologic units that bracket the time(s) of faulting; conclusions, and recommendations.

When the excavation of a trench is required to evaluate the existence of an active earthquake fault, the geologist(s) should excavate a trench (Refer to Section 113.5 CLABC), the trench should be approximately perpendicular to the most probably direction of the fault trace, be at least 1½ feet wide, extend at least 5 feet beyond the proposed structure, and penetrate the Holocene-Pleistocene boundary. The trench must be accessible for mapping and inspection by the Building Official, when requested, and meet the requirements of California Code of Regulations, Construction Safety Orders (Title 8, Division 1, Chapter 4, Subchapter 4). Detailed, illustrated logs of the trenches (at a scale of 1 inch equals 5 feet) need to be provided, along with descriptions of all soils, geologic units, geologic structure, and geologic conditions encountered. A discussion of the findings should be provided, including conclusions regarding activity of all faults exposed in the excavations. Other forms of site-specific fault rupture hazard investigations may be acceptable provided they are conclusive (based on concurrence between the project geologist and the County Geologist). Per CGS Note 49, acceptable methods may include boring, test pit, and Cone Penetration Test (CPT) investigations with sufficient spacing that allows for valid correlations and interpretations.

Refer to CGS Note 49 for Guidelines for Evaluating the Hazard of Surface Fault Rupture (Appendix B).

2.2.2.8 Fault Setback Requirements

Los Angeles County has not established a minimum setback from the tract of an active fault. CLABC Section 113.5 states that, "no building or structure shall be constructed over or upon the trace of a know active earthquake fault…." The same section states that a geology investigation is required "when the proposed building is within 50 feet of the assumed location of a known active earthquake fault…" or "when the proposed building is within 50 feet of the most probable ground location of a trace of a known active earthquake fault…."

The A-P Act does not establish a minimum fault setback. A-P Act Policies Section 3606(a) of the A-P Act states that "the area within 50 feet of such active faults shall be presumed to be underlain by active fault branches of that fault unless proven otherwise…" CPRC Section 2621.6 requires fault studies for "Projects" (defined as subdivisions of land, any commercial development, and a development of four or more single-family residences), but does not require a fault study for a single-family wood frame dwelling.

The building setback from an active fault trace is recommended by the consulting geologist investigating the property. Many geologists recommend a 50-foot fault setback; however, smaller setbacks may be recommended by some geologists based on the data obtained during the fault investigation.

2.2.3 Grading Plan Report

The report must present all the geotechnical information for the area pertinent to the proposed grading as well as areas outside grading where the grading may affect or be affected by geologic or geotechnical hazards. Cross sections of existing and proposed significant slopes that may be unstable must be included. The geologic map must utilize a copy of the latest grading plan as a base. The scale of the map should be appropriate to permit sufficiently accurate measurements for analysis of remedial design and construction. Generally, for geologic purposes, the scale of the map and cross sections should be prepared at a minimum scale of 1 inch equal to 40 feet. If the grading plan is revised, the geologic map and cross sections should also be revised using the new plan as a base.

Geotechnical consultants must review and sign and date the grading plan to verify that their recommendations have been incorporated in the grading design and are shown correctly on the plans. At the grading plan review stage, engineering geology reports prepared to address a tentative map are commonly requested to be expanded to provide additional exploration, detailed analysis, and testing. Reports addressing grading plans must demonstrate that the proposed grading (and by implication the proposed future structures and access roads) will be stable and safe from geologic and geotechnical hazards. Where onsite sewage disposal systems are necessary, the reports must include data, analysis, and recommendations to assure that effluent will not "daylight" on the surface, create instability or adversely affect adjacent property.

2.2.3.1 In-Grading Progress Report

During grading operations, sufficient geologic inspections must be made by the geotechnical consultant to assure that all geologic conditions are as anticipated, and that any geotechnical remediation is completed per their recommendations. Periodic in-grading inspection reports are generally required during project construction. If unanticipated adverse conditions are encountered, the Building Official may require that the construction cease until the impact of the conditions can be properly assessed. The primary purposes of in-grading geotechnical reports are to inform the GMED development review units of the following:

- Grading status.
- Any unanticipated geologic conditions encountered.
- Compliance with the geotechnical consultants' recommendations.
- Any revised recommendations and/or corrective measures.

Adequate inspections must be performed by the geotechnical consultants of record. Canyon clean-outs and buttress and shear keys must be inspected and approved by the engineering geologist prior to the placement of any fill. The geotechnical consultants must work together in determining adequate subdrains and the extent of removals of loose surficial materials and/or landslide debris. If a design change is made during grading, the geotechnical consultants should immediately notify GMED to determine if review of the revised design will be required prior to its construction.

2.2.3.2 Final Rough Grading Geotechnical Report

A final rough grading geotechnical report should contain references to all existing reports applicable to the grading. It should provide a summary of all geologic and geotechnical data, recommendations, conclusions, and inspections. References and geologic/geotechnical information and analyses not previously submitted should accompany the final geotechnical report. To expedite the GMED approval of rough grading, the geotechnical consultants should organize all previous work and should be communicating with the GMED review staff that conducted the review prior to submittal of the rough grade report.

The final geotechnical map must be based on a map showing original topographic contours and final grading (as-built) contours. This data becomes a permanent record and may be used to assess future grading or construction projects. It may also be used to evaluate any problems should they arise. The final geotechnical map should, at a minimum, include the following:

- Geology as exposed by grading of natural slope areas in sufficient detail to justify the engineering geologist's conclusions that the site will be safe for the intended use.
- Areas containing fill.
- All geologic data collected prior to and during grading.
- Geologic data collected in back cuts, shear keys, buttresses, and excavations.
- Locations of all compaction tests plotted on an as-graded geotechnical map.
- Location of subdrains and other drainage structures incorporated into the fill.

- A table of all compaction test data that includes types of compaction tests conducted, dates, test numbers, locations (extra details as necessary), maximum dry densities, required relative compactions, and field compaction results.

- Location of all final geotechnical cross-sections, subdrains with positive slope directions and outlets, drainage devices, shear keyway locations and dimensions, buttress fills, approved sewage disposal area(s), detailed geotechnical mitigation structures and reinforcements (i.e. soldier piles, geo-grids, soil-cement, etc.), recommended "Restricted Use Areas", geotechnical setback lines, landslides removed and/or not removed by grading, areas of over-excavation and replacement, and sufficient geologic symbols to clearly depict site geology.

- Tract, parcel, lot numbers, and their boundaries corresponding to the subdivision map.

The geotechnical consultant must include a finding regarding the safety of the completed grading and any proposed structures against hazard from landslide, settlement, or slippage (see CLABC Section J105.12.2) and a statement that, to the best of their knowledge, the work within their area of responsibility is in accordance with their approved reports and applicable provisions of the CLABC Section 111.

If the GMED determines that the final geotechnical report and/or map is not sufficiently detailed to substantiate the safety and stability of the site for the intended use, the recommendation for rough grading approval will be withheld until the safety and stability of the site can be demonstrated. When the geologic/geotechnical map and/or final geotechnical report information conflicts with field observations, the recommendation for the rough grading approval will be withheld until the conflicts are resolved.

2.2.3.3 Remedial Grading or Repair

The need for remedial grading or structural repair may result from natural disasters such as storm related erosion, mudslides, or slope failures. Other natural disasters may include landslide movement, ground movement resulting from changes in soil volume (including hydrocollapse, settlement, and expansive soil), or from an earthquake (including ground rupture, liquefaction, seismic settlement, or lateral spread). The geotechnical reports related to such remedial grading projects should clarify and address the geologic or geotechnical causes and extent of damage from these hazards. In addition, the report should provide repair recommendations that are in full compliance with CLABC, GMED GS policy memos, and industry standards. It is the responsibility of the project geotechnical consultants of record to ensure that the geotechnical report clearly makes the property owner aware of the extent of the potential damage that may occur to the property if hazards are not fully mitigated.

Unless otherwise exempted by the CLABC and Public Works policies, geotechnical reports and remediation for reconstruction must meet the current County Codes and policy requirements for new construction. The applicant is encouraged to contact the Building Official's representatives at the BSD District Office for guidance regarding required permits for proposed repair of damages from natural geologic and/or geotechnical hazards. The Building Official may require proposed plans and repair reports to be reviewed by GMED.

2.2.4 Building Plan Report

The geotechnical report for a building plan must include all geologic and geotechnical items required for grading plan reports described above. Appropriate data and analyses must be provided to substantiate that the development complies with Section 111 of the CLABC.

A geotechnical report prepared for a building plan must provide the following, at a minimum:

- Geotechnical map utilizing building plot plan as a base.
- Geotechnical design recommendations for foundations related to, but not limited to, mat foundations, piles/caissons, micro-piles, ground modifications, special foundations, etc.
- Foundation embedment depths and embedment material recommendations must be provided.
- Retaining wall design recommendations, includes but not limited to, seismic loading, at-rest conditions, braced conditions, etc. All connections associated with the retaining walls must be addressed (e.g., tie-backs, lagging, etc.).
- A determination as to the anticipated total and differential settlement and mitigating measures required to protect the structures.
- Analyses of the corrosive properties of on-site soils.
- Justification for deviation of foundation setbacks from top and bottom of slopes, if less than minimum requirements defined in the CLABC.
- All geotechnical/geologic setbacks, as necessary.

- On-Site Wastewater Treatment Systems (OWTS), when applicable.

If the building plan is part of a subdivision development, the conditions set forth in the approved geotechnical report(s) for the subdivision must also be met. If the building plan is for a single-lot development, the geotechnical report(s) must demonstrate that the proposed development (including all structures, utility rights of way, access roads, and driveways) will be located on stable material and that the development will be safe for the intended use and will not adversely affect offsite property.

2.2.4.1 Additions to Existing Structures

The geotechnical consultant must provide recommendations on the proposed foundations of the addition and address, including but limited to, the following items:

- Amount of differential settlement between existing structure and addition.
- Surcharge loads on to and from foundations of existing structures.
- Active loads due to difference in grades.
- Stability of temporary excavations.
- Use of shoring/slot cutting.
- Slope Stability for structures adjacent to slopes.

Structures such as, but not limited to, additions, new stories, basements, decks, patios, and pools that are attached or structurally tied to an existing structure must have adequate information described above to verify the geotechnical stability of the proposed structure and the effects on existing structures.

The geotechnical consultant must also provide adequate information on slope stability if proposed structures are located adjacent to slopes. Analyses must clarify the impact of the proposed construction will have on the existing structures and recommend adequate mitigation. This will be especially important for decks and pools that are proposed near slopes.

2.2.4.2 Accessory Dwelling Units

When a referral from BSD is made for a geotechnical review of an Accessory Dwelling Unit (ADU), geotechnical consultants should provide data, analyses, conclusions, and recommendations similar to the sections above. If the proposed ADU is attached or structurally connected to an existing structure, geotechnical considerations and information should be provided according to the section above. If the proposed ADU is a stand-alone structure the geologic and geotechnical considerations should be similar to a building plan report.

If there is any uncertainty regarding the referral from BSD or how to address the proposed construction, please contact the BSD plan checker that made the referral to discuss. GMED plan checkers will also be available to clarify any geologic/geotechnical standards that may apply based on the location and proposed development plans.

2.2.4.3 Swimming Pools/Spas

All swimming pools and spas must be designed as free-standing structures. The walls of pools must be designed so that it can withstand the lateral earth pressure when the pool is empty. Additional surcharge loads may be required for the design if warranted.

Pool and spas located adjacent to slopes must comply with all CLABC foundation setback requirements. In addition, if the project geotechnical consultants determine existing geologic and geotechnical conditions require a site-specific geotechnical setback the more conservative setback will be determined and used.

2.2.4.4 Repairs to Existing Structures

The geotechnical consultants must clearly determine, describe, and characterize the cause of distress with substantiating soil data and analyses prior to recommending mitigation measures for foundation repairs. The geotechnical consultants must determine and document the depths and limits of unsuitable soils/conditions. The depths and limits of unsuitable soils/conditions must be shown on the geotechnical map. It must be clearly shown that the recommended foundation repairs or mitigation measures must provide adequate support for the existing structure and will not be negatively affect offsite property.

Repair of existing foundations typically involve modifying subsurface conditions or use of a foundation system that gains strength from deeper soils or rock. Such foundation repair methods may include, but not limited to, mud-jacking, geo-foam, helical pile foundations, micro-piles, and deep soil mixing. The geotechnical consultant should evaluate the change in the foundation support and the potential seismic shaking effects on the structure as a whole.

Plans and reports for mud-jacking, or geo-foam injection operations must evaluate and address potential impacts to utility conduits/lines and adjacent property.

The use of mud-jacking, geo-foam, helical piles, or similar foundation repair techniques will not be permitted to be used for the purpose of geologic hazard mitigation, supporting new foundations, or resisting lateral loading.

All calculations and design parameters used to determine the mud-jacking, geo-foam placement, helical piles, or similar foundation repair techniques must be provided to the GMED for review and must be in conformance with appropriate manufacturer specifications. Final design requirements for foundation repairs, including manufacturer specifications, must be made part of the development plans.

2.2.4.5 Repairs or Replacement of Existing Structures due to Natural Disasters

Unless otherwise exempted by the CLABC and Public Works policies, geotechnical reports and remediation for reconstruction must meet the same current County Codes and policy requirements for new construction. The applicant is encouraged to contact the Building Official's representatives at the BSD District Office for guidance regarding required permits for proposed repair of damages from natural geologic and geotechnical hazards. BSD may require the proposed plans and repair reports to be reviewed by GMED.

2.2.4.6 On-Site Wastewater Treatment Systems (OWTS)

There are many areas in Los Angeles County where an OWTS will be required for the development of a site. Los Angeles County Department of Public Health-Environmental Health (DPH-EH) is the County's regulatory agency which oversees the applicable health and environmental standards for the safe use of various on-site wastewater treatment systems. Three primary designs of effluent dispersal used within the County are: seepage pits, leach lines or fields, and drip irrigation dispersal zones. The location, depth, and capacity of these systems will vary with the proposed development.

Geotechnical project consultants should consider the short-term and long-term effects of these systems on the geologic and geotechnical site conditions. They will need to evaluate how the dispersal of effluent into the subsurface may affect groundwater levels, slope stability, adjacent developments, and whether daylighting of effluent may occur on the property or adjacent sites over time. GMED may request additional data, analyses, and recommendations if the effects of effluent on geologic or geotechnical conditions are not adequately addressed.

The requirements from all regulatory agencies, including but not limited to, DPH-EH, GMED, and State Water Boards, must be met prior to the issuance of the development permits.

3.0 GUIDELINES FOR REPORTS

3.1 Report Organization

3.1.1 Site Location Map

A Site Location Map must be provided for all projects and must utilize a prominent north arrow, an approximate scale, identify the subject site and surrounding area, and must encompass a large enough area to easily and accurately locate the site on regional maps.

3.1.2 Regional Geologic and Hazard Maps

Regional geologic and hazard maps must depict conditions that include and extend beyond the site. It is expected that the location of the subject property be shown on all regional maps along with a prominent north arrow and scale. Regional geologic maps may be used to locate and generate geologic cross-sections that extend offsite, especially where sites encroach into hillside areas.

For all sites, it is the responsibility of the project geotechnical consultants to provide copies of Seismic Hazard and/or Earthquake Fault Zone maps that show the site. The scale of the hazard map must clearly show the property location and the proposed improvements proximity to the hazard.

Note: GMED reviewers will refer to published geologic maps and reports on file for the subject property and adjacent properties where available for their review of a project. This information may aid in limiting or guiding subsurface work; therefore, it is strongly recommended that geotechnical consultants review the same information prior to initiating their subsurface investigation. If published information indicates the property is within or may be affected by a mapped landslide, the geotechnical consultants must review, reference, and acknowledge that information, depict the mapped landslide boundaries on their geologic map, and provide subsurface data that confirms or denies the existence of the landslide. If reports submitted for a project indicate conditions that differ from those presented in reports on file, the geotechnical consultants will be required to review, reference, and acknowledge that work and provide subsurface data to substantiate their conclusions.

3.1.3 Seismic Hazard Evaluation

For project sites located within a Seismic Hazard Zone, in accordance with the Seismic Hazards Mapping Act of 1990 (SHMA), project geotechnical consultants are responsible for ensuring that the geotechnical report incorporates a section evaluating seismic hazards (or that a separate report is provided) that meets all requirements of the SHMA and these guidelines.

3.1.4 Site Geologic/Geotechnical Maps

The California State-licensed Engineering Geologist should include published geologic data along with mapped geologic units across the site (e.g., geologic contacts), geologic structures, surficial features in detail, and geologic data/structure from all subsurface excavations, in accordance with the standard of professional practice. The map should present all geologic features relevant to the proposed improvements and provide a complete and accurate evaluation of proposed improvements.

A site-specific geotechnical map must be provided for all projects and must depict the project site and surrounding areas. The most recent grading and/or building plan should be used as a base map and must have a prominent north arrow and scale. The scale for grading plans should be at least 1 inch = 40 feet (only a tentative subdivision map may be presented at a scale of 1 inch = 100 feet). A bar scale must be included on the geotechnical map. A detailed geotechnical/geologic map is necessary for hillside development and should include geology of adjacent properties.

All exploratory borings, trenches, test pits, etc., known to exist on the site and illustrate geologic information on the geotechnical/geologic map.

A comprehensive explanation/legend must be included on the map.

Existing structures and/or offsite structures that have the potential to be impacted by the proposed development/improvements must be shown on the map.

Locations of all geologic/geotechnical cross-section lines must be shown on the map.

3.1.5 Subsurface Exploration

It is the responsibility of the geotechnical consultants to determine the extent of subsurface exploration and laboratory testing programs to adequately describe and characterize the existing geologic and geotechnical subsurface conditions. The collected information and data must be used to evaluate potential geologic and geotechnical hazards and conduct engineering analyses. The geotechnical recommendations and conclusions must be based on substantive, sufficient, and appropriate subsurface data, laboratory testing results, and engineering analyses.

The subsurface exploration and laboratory testing program should be informed by research of on- and off-site information collected prior to the current exploration. All information and data collected should be focused on the construction of the proposed development. Previous subsurface exploration and laboratory testing may be referenced if found to be applicable to the proposed development.

Subsurface exploration with detailed graphic and descriptive logs is one of the most important and necessary aspects of any geologic investigation. Subsurface exploration is needed to determine and substantiate professional opinions, conclusions, and mitigation measures. The nature of an engineering geologist's work is visual; that is also true of the engineering geologist reviewing the report. The preparation and presentation of clear and accurate graphic logs of the observed subsurface data significantly reduces the time required to review the report and often minimizes or eliminates review comments based on the written description.

Detailed logs and graphic depictions must illustrate and describe conditions in exploratory borings or excavations, including physical properties, discontinuities, and other relevant geologic information.

Subsurface exploration for the investigation of a proposed subdivision must be sufficient to preclude design changes after the tentative map has been approved. If adverse geologic conditions requiring a design modification are discovered during the investigation for the grading plan review, the approved tentative map may have to be modified and resubmitted through Regional Planning and possibly require another public hearing. Additional subsurface data will be required by the geotechnical reviewers in areas where potential geotechnical design is determined to be necessary.

Logs for all geotechnical explorations performed on site need to be provided with the report. The following information must be depicted on the exploration logs or otherwise incorporated into the report:

- Names of the responsible field personnel.
- Date and duration of exploration.
- Exploration method/drill rig type (e.g., hollow stem auger, bucket auger, or wet rotary, etc.).
- Detailed geologic descriptions of subsurface conditions encountered (e.g., artificial fill, native soil, colluvium, bedrock, bedding orientation, discontinuities, seepage, groundwater, etc.).
- Groundwater observations (indicating the nature of the water encountered, depth, and time of measurement).
- Sample depths.

- Hammer (e.g., safety hammer), sampler details (e.g., Standard Penetration Test [SPT] with or without liners, or modified California sampler), method of hammer drop (e.g., automatic or rope-cathead, with number of wraps), and method used to convert measured sampler blow counts to an equivalent blow count associated with SPT with a delivered energy of 60 percent (N60). SPT data derived from wire-line hammers cannot be used to perform quantitative analyses that use blow-count data, as such systems deliver inconsistent energy to the sampler.
- Detail of Kelly bar weight and drop height (if applicable).
- Field (unmodified) sampler blow counts.
- Description of excavation backfill.
- CPT data.
- Results of field tests (e.g., pocket penetrometer and vane shear).
- Results of soil density and moisture tests and percentage fines.

The following are some conditions or circumstances that warrant subsurface exploration:

- Proposed cut slopes exceeding 50 feet in height (required exploration at least 10 feet below the elevation of the toe of the cut, or equivalent data) to determine geologic conditions slope stability modeling. (If fills are proposed above the cut, the total height of the slope includes the fill portion).
- Proposed fill areas of slopes exceeding 20 feet in height.
- Areas that do not have sufficient natural exposures to characterize geologic conditions in a clear and reliable manner.
- To identify and investigate active and potentially active faults as required by the AP Act, CLABC, and the Department of Regional Planning General Plan- Chapter 12, Safety Element.
- Areas of suspected landsliding and/or anomalous topography to determine the origin of the landform and assess whether a hazard exists.
- Landslide areas:
  - Areal extent and depth of the landslide deposits and affected area.
  - Identify slide/slip planes or zones of landslide deformed/disrupted geologic units for geotechnical testing and analysis.
  - Define three-dimensional geometry and hydrogeology necessary for analysis and/or mitigation.
  - Determine geologic conditions adjacent to the landslide to evaluation the potential for enlargement and additional mitigation measures.
- To substantiate slope stability models.
- To substantiate mitigation measures.
- To investigate areas subject to seismically induced settlement, lateral spreading, expansive soils, and/or collapsible soils.

3.1.5.1 Landslides

The investigation of a landslide should:

- Consider proposed development and remediation.
- Determine geometry and mechanics of movement.
- Evaluate groundwater/hydrogeologic conditions past and present and estimate effects of change in land use.
- Provide slope stability analyses and earth material testing by a soils engineer.
- Include specifically observed slide plane data, geologic mapping, and study of stereo pairs of aerial photographs.

The interpretation of three-dimensional geometry, groundwater conditions, and material shear strengths parameters must be based on subsurface exploration data and testing. Although "worst case" scenarios may be useful where information is scarce, data are necessary for landslide shear strength parameters for approval of development and/or remediation plans. Generally, a minimum of three points/borings are necessary to define a planar failure, and more are needed for arcuate or other complex landslide geometries and large planar type landslides.

3.1.6 Cross Sections

The site geologic map and the associated cross sections should present all relevant geotechnical and geologic features needed for a complete and accurate evaluation of the feasibility and the design of the proposed development.

The California State-licensed Engineering Geologist is responsible for providing the necessary geologic profiles in the report. Cross sections are generally necessary to depict geologic conditions and must be at the same scale as the geotechnical map (at least 1 inch = 40 feet). Cross sections should present sufficient detail so that the stability of the site can be accurately modeled. Geologic structure must be plotted on the cross section, including true and apparent dip of bedding planes, geologic contacts, and other discontinuities, such as joints, faults, etc., are required on the geologic cross sections to substantiate interpretations.

The geotechnical engineer is responsible for accurately showing any proposed geotechnical mitigation measures and recommended structural elements (e.g., soldier piles, geo-grid, tiebacks, soil-cement, etc.) on cross sections and to clarify where they are to be implemented. They must clearly show their engineering design for the development property.

Cross sections used to illustrate subsurface conditions and/or proposed mitigation measures must be:

- Drawn to true to scale (horizontal=vertical). Minimum scale equals to 1 inch = 40 feet.
- Show any elements that define the property or location (e.g., boundary lines, property lines, utilities, etc.).
- Show the location of relevant geologic features including, but not limited to, true and apparent dips, groundwater, and geologic descriptions/material types.
- Show the critical potential failure planes.
- Indicate the various shear strength parameters in the appropriate failure plane segments.
- Show all recommended geotechnical mitigation measures, such as, but not limited to, soldier piles, tie backs, geo-grids, surficial mitigations, retaining walls, impact walls, catchment fences, areas of soil cement, etc.
- Show all recommended buttress, stability fill, areas of densified soils, or shear key dimensions.

3.1.7 Groundwater

The project geotechnical consultants are responsible for addressing how groundwater conditions may affect the proposed development. Groundwater, for the purpose of this document, refers to all subsurface water. The project geotechnical consultants should address how the proposed development may affect future groundwater and how these changes will affect the proposed development. When performing geotechnical analysis, the project geotechnical consultants should use the anticipated groundwater elevation that would result in the lowest strength of geologic materials. At a minimum, the geotechnical report associated with the proposed development should address and consider historic high groundwater, perched water, effects of effluent, heavy rainfall, and irrigation. Geotechnical hazards associated with water should also be addressed in the geotechnical report.

3.1.8 Previous Geologic/Geotechnical Data

Project geotechnical consultants should perform diligent research for previous reports and published maps and should discuss known geotechnical investigations for the project site and adjacent sites. If there are previous geologic or geotechnical reports for the subject property that have relevant data, professional interpretations or descriptions of the site, engineering analyses, and/or recommendations, the geologic and geotechnical

consultants of record must acknowledge all pertinent previous geologic/geotechnical reports and make a statement that he/she either agrees with their findings, conclusions, and recommendations or provide appropriate modifications. Modifications should be supported with discussions and may need to be substantiated with additional data as necessary. (Note: Re-interpretation of previous consultant's subsurface observations will not be accepted).

3.1.9 Identification and Mitigation of Risks

The project geotechnical consultants are responsible for describing, discussing, and evaluating all potential geologic and geotechnical hazards. They are also responsible for providing appropriate mitigation measures for the proposed development on the subject site. Discussions and evaluations of the potential geologic and geotechnical hazard and any proposed mitigation measures must be adequately and clearly supported with engineering geology and geotechnical engineering data and analyses. The project consultants must demonstrate that they have given adequate consideration to each potential geologic and geotechnical hazard. In addition, the consultant report should be written to clarify to the property owner(s) the associated risks, the work required to mitigate the risks, and clarification any maintenance required after construction. The geotechnical consultants should provide appropriate statements for each of the geotechnical hazards. Reports submitted without an evaluation of a potentially geologic or geotechnical hazard may be deemed incomplete and additional information may be requested by the GMED.

3.1.10 Technical Documentation

For the purposes of this Manual, technical documents are considered to be any documents, information, standards, and/or data utilized in support of the geologic and geotechnical report submitted for a proposed development. The project geotechnical consultants of record must review and utilized this information with their professional judgement and expertise to apply towards the development. For all submitted technical documentation, the project geotechnical consultants are responsible for:

- Substantiating all findings, conclusions, and recommendations utilizing data included within the report.

- Reviewing and referencing any applicable published geology reports, maps, aerial photographs, and geotechnical engineering reports on file with GMED for the immediate area or subject property.

- Researching all publicly available files for the adjacent properties and the greater surrounding areas. This may mean that the scope of the geotechnical work may be extending further than the property if it needed to ensure the major or critical geologic and geotechnical conditions are adequately considered. It is suggested that geotechnical consultants contact GMED when they list additional references that should be reviewed as a part of the description of the existing geologic and geotechnical conditions.

- For updated reports, previous areas of research should be revised and updated as necessary.

- Substantiating all recommendations and conclusions with site-specific field and/or laboratory data and appropriate analyses.

- Discussing the data, analyses, and technical rationale to support conclusion, judgment, and professional recommendations.

- Disclosing any potentially hazardous geologic and geotechnical site conditions.

3.1.11 References

Reports should include a statement referring to the standards and specifications used for all field and laboratory procedures. Referenced materials may include:

- Literature and records reviewed and cited.

- Aerial photographs or images interpreted, listing the type, date, scale, source, index numbers, etc.

- Compiled data, maps, or plates included or referenced.

- Other sources of information, including well records, testing procedures, or other subsurface data sources.

- Computer Software used in engineering analyses.

- Geologic and Geotechnical publications specific to descriptions or analyses.

- ASTM testing standards utilized.

3.1.12 Computer-Assisted Analyses

When a software program is used to assist engineering analyses all relevant input data, all reference information, and all relevant output data and results from the program must be provided for review. When spreadsheets are used to perform the analyses, sufficient cells demonstrating the results of calculations need to be shown such that the reviewer can confirm the results. All equations for the calculations should be documented in sufficient detail that the analyses can be verified.

In certain situations, or conditions, GMED will run their own independent analyses to verify the results from geotechnical consultant reports. When there are significant discrepancies in engineering analyses or software results, GMED may request additional information on a software program and/or data inputted to clarify the differences. When there is a dispute in the output the more conservative result must be utilized for the results.

3.1.13 Cone Penetrometer Data

CPT data should include profiles of cone tip resistance, either sleeve resistance or friction ratio, and porewater pressure. Interpreted results, such as soil type, estimated relative density, friction angle, or undrained shear strength of the soil, and equivalent sample blow counts also need to be included in the report. It is the responsibility of the project geotechnical consultants to cite the methodology for interpreting the CPT data and to document the type and size of the cone and its penetration rate.

When using CPTs, a confirmation boring that meets the minimum depth of exploration will be required. The CPT and confirmation boring must be conducted in close proximity to each other, but not be spaced so closely that stress relief would significantly affect the results. More than one confirmation boring may be required considering the size of the subject site, onsite soil data, and locations of liquefiable soil.

3.2 Geotechnical Engineering Guidelines

3.2.1 Slope Stability Analyses

Slope stability analyses (including establishing design criteria and performing calculations) will generally be required for all cut, fill, and natural slopes when the slope gradient is steeper than 2H:1V (Horizontal:Vertical) and/or any gradient when the slope height exceeds 30 feet. Slope stability analyses may be required for any slope height or gradient when adverse geologic conditions have been identified, either by published geologic resources and/or the geotechnical consultant. The minimum Factor of Safety for gross static and surficial stability is 1.50.

The data to be utilized in the slope stability analyses must be based on detailed site plans, geologic/geotechnical cross sections, detailed field descriptions, onsite exploration data, and laboratory test data. It is the responsibility of the geotechnical consultants to determine the weakest potential failure surface based on the aforementioned factors. In performing any analysis, the critical scenario must be evaluated, such that planned use of the site will address all potential adverse scenarios.

Long-term static loading must be based on residual shear strength values. Peak values may be used for seismic loading or pseudostatic slope stability analyses when appropriate for the rock or soil type being represented. Shear strength parameters assigned to landslide shear/bedding plane materials may have to be based on past or current back analyses or obtained through repeated shear testing. Shear strength parameters for clay slip surfaces should be compared against Stark and Hussain, 2013. The assignment of shear strength parameters in slope stability analyses must be justified with laboratory test data, geologic descriptions, and past performance of similar materials. The sample description, depth, and location must be included for each set of shear strength parameters.

When multiple sets of shear strength parameters represent the same soils (or very similar materials under similar geologic conditions), the shear strength parameters may be reported on the same graph. However, only the lower 10 percent boundary of data may be used in the slope stability analyses, without explicit explanations as to why certain strengths are appropriate for specific slope stability analyses. The intent of this requirement is not to mandate the most conservative values be applied to an entire subdivision development. Appropriate values must always be used to represent in-situ and engineered fill soils. This requirement is to assist geotechnical consultants in justifying the need to gather site specific data in support of geotechnical analyses.

3.2.2 Seismically Induced Slope Instability

Pseudostatic slope stability analyses must include the effect of static loads combined with a horizontal inertial force acting out of the slope and through the center of gravity.

The minimum seismic coefficient must be equal to 0.15. This minimum value should be increased where, in the opinion of the geotechnical consultants, subsurface conditions, or site conditions warrant the use of higher values. SP117A provides additional guidance and details regarding pseudostatic analyses and alternative methods that might be used to evaluate seismic shaking on site conditions.

3.2.3 Temporary Stability

Slope stability analysis for temporary excavation and short-term conditions during construction will be required where the potential of instability is probable. Temporary slope stability analysis under static conditions will require a minimum Factor of Safety of 1.25. At a minimum, but not limited to, the following conditions may be used to determine the necessity for temporary slope stability analysis:

- Any vertical excavation cuts.
- Any excavation cuts with a backslope gradient greater than 2:1 H:V. Although, analysis may be required if subsurface conditions indicate potential instability regardless of slope gradient.
- The use of temporary shoring.
- The use of slot cutting.
- Removal and replacement of infrastructure such as retaining walls, buildings, roadways, etc.
- Impact to existing infrastructure or buildings.
- Loose or unstable subsurface conditions.
- Locations identified via the state seismic hazard map.
- Locations identified with previous or active slope failures.
- Adverse bedding conditions.
- Groundwater conditions.
- Recent changes to surface conditions resulting from natural acts. For example, but not limited to, recent seismic activity, brush fires, failures due to weather conditions.

Stability analysis should be justified with stability analysis that represents the worst-case scenario during construction. Geotechnical consultants should consider the effects of structures, slopes, weather, and other existing site conditions on adjacent properties that may negatively affect the stability of a temporary condition. GMED may require adequate data, analyses, and recommendations to address these conditions.

3.2.4 Soil Creep

The project geotechnical consultants are responsible for addressing the potential effects of soil creep where any proposed structure is planned in close proximity to an existing fill slope or natural slope. The potential effects on the proposed development should be evaluated and mitigation measures proposed, as appropriate, including appropriate setback recommendations.

3.2.5 Surficial Stability

Surficial stability should be evaluated by the geotechnical consultant for slopes steeper than 2H:1V, slope heights greater than 12 feet, or as warranted by geologic conditions. Surficial stability analysis should be performed using an infinite slope failure model with seepage parallel to the slope surface. If there is insufficient data to establish the depth of surficial unstable material, the minimum acceptable depth of material saturation must be 4 feet.

All slopes with factors of safety of less than 1.50 for surficial slope stability must be considered to be subject to debris flow hazard. Appropriate mitigation measures must be recommended and shown on the plans. If containment of the debris flow is proposed, then volume calculations for both the anticipated debris and the available containment area will be required. Any debris impact or diversion walls proposed must be designed for a minimum 125 pounds per cubic feet equivalent fluid pressure. Alternative methods of mitigation will be considered on a case-by-case basis with appropriate data, information, and analyses. Mitigation measures will not be allowed to divert debris flow onto adjacent properties.

3.2.6 Seismically Induced Settlement – Liquefaction

The geotechnical report must consider liquefaction potential of the foundation soils and make recommendations if required.

SP117A and the Recommended Procedures for Implementation of DMG Special Publication 117 Guidelines for Analyzing and Mitigating Liquefaction in California (SCEC, 1999) provide guidelines for evaluating and mitigating seismic hazards in California. Provisions of those publications must be followed in preparation of geotechnical reports that address liquefaction, lateral spreading, seismic settlement, and related seismically induced hazards.

Liquefaction analysis is required for developments classified as a "Project" as defined in the Seismic Hazards Mapping Act and is located within a mapped potentially liquefiable area per the State of California Seismic Hazard Zone Maps. Liquefaction analysis may also be required for a development that is not classified as a "Project", but it is located in areas designated as "potentially liquefiable" and "liquefiable" on the State Seismic Element Map for Los Angeles County. Liquefaction exploration and analyses must conform to the provisions of SP117A and the Public Works Directive GS045.0 (see Appendix A).

3.2.7 Hydrocollapse

The geotechnical consultant must evaluate the possibility that hydrocollapse may occur within onsite soils and conduct appropriate field sampling and testing and laboratory tests to quantify the full collapse potential of all applicable soil layers. The collapse potential of soils under saturated conditions should be evaluated at project sites and the settlement potential evaluated. In areas where settlement is anticipated to exceed County minimum standards, the soils engineer shall obtain sufficient data to determine the depth and extent of the hazard and make findings and recommendations to mitigate the geotechnical hazard.

3.2.8 Expansive Soils

Expansion Index (EI) Test results should be performed in accordance with ASTM D4829 and conform to the requirements of the current edition of the CLABC. Adequate tests should be performed for proposed supporting material, including at basement level, and during final grading as necessary. The recommended classification of potential expansion based on EI is provided in ASTM D4829. Swell potential of cohesive soils should be performed in accordance with ASTM D4546. The report must provide recommendations to mitigate expansive soils conforming to the current edition of the CLABC. Typical recommendations may include, but are not limited to, minimum embedment depth of footings, soil moisture conditioning, additional active pressure on retaining walls, and/or removal and replacement with low expansion soils.

3.2.9 Settlement

The project geotechnical consultants are responsible for analyzing and estimating future total and differential movements of all structures such as foundations, slabs, and pipelines, as well as any engineered fills that will be supporting those structures. The subsurface profiles used for settlement analysis should be shown in cross-section and be substantiated by subsurface data. Settlement analysis calculations should be submitted with supporting subsurface data. If professional judgment is used in addition to the calculated settlement or to modify the calculated settlement, then the project geotechnical consultant(s) should provide the justification or rationale upon which the judgment is made.

When estimating vertical movement, project geotechnical consultant(s) should consider, at a minimum:

- Seismically induced settlement. (See Section 4.3.10)
- Compression of the fill materials due to their own weight.
- Compression/consolidation of subsurface materials underlying fill.

- Secondary consolidation.
- Hydrocollapse. (See Sections 3.2.7)
- Settlement of foundations due to dead and live loads.
- Potential movement due to swelling (i.e., expansive) soils (where EI > 20).

A settlement-monitoring program should be implemented during and after construction in situations where the fill depth exceeds 40 feet. Settlement monitoring should consist of surface monuments and subsurface settlement plates. Settlement monuments should be clearly shown on the grading/building plans. Rough grading will not be approved until data from settlement monuments indicates that future settlement will be within Los Angeles County minimum standards.

Additions to existing structures should consider differential movement between the existing structure and proposed addition.

3.2.10 Expansive Soil and Rock

In areas containing expansive soil and/or rock, the report must recommend specific design criteria or provide appropriate mitigation measures. Typical recommendations to address expansive soil and/or rock may include, but not limited to, minimum embedment depth of footings, soil moisture conditioning, additional active pressure on retaining walls, and/or removal and replacement with low expansion soils.

3.3 Geotechnical Engineering Recommendations

3.3.1 Shallow Foundations (e.g., wall and spread footings)

The allowable bearing capacity and lateral resistance should be based on laboratory or field data when deviating from the maximum design Building Code values. The geotechnical engineer should recommend the minimum footing dimensions and embedment material for which the recommended bearing capacity is applicable. The geotechnical consultant must inspect and approve the foundation excavations before reinforcing steel and concrete is placed.

3.3.2 Deep Foundations

Deep foundations must be designed considering the strength of the supporting materials based on laboratory test results or in-situ data. The geotechnical engineer must obtain onsite data a minimum of 10 feet below the bottom of the proposed foundations. For developments within areas that required liquefaction analysis, the geotechnical engineer must obtain onsite data a minimum of 20 feet below the bottom of the proposed foundations. The foundations must be designed for all applicable lateral and down-drag

loads. Soil creep must also be considered when determining the foundation design loads. Underpinning, such as helical piles (see Section 2.2.4.4 of this manual), are not permitted for the support of new foundations.

3.3.3 Pool Foundations

The project geotechnical consultant should provide recommendations for pool foundations and should include foundation type, supporting material, and bearing capacity of supporting material.

Pool and spas located adjacent to slopes must comply with all CLABC foundation setback requirements. In addition, if the project geotechnical consultants determine existing geologic and geotechnical conditions require a site-specific geotechnical setback the more conservative setback shall be determined and used.

3.3.4 Floor Slabs

The project geotechnical engineer should provide recommendations for floor slabs and consider potential geotechnical hazards which may cause distress to slabs. Mitigation should be recommended to reduce cracking and prevent differential settlement of the floor slab and surrounding footings.

3.3.5 Shoring and Slot Cutting

The project geotechnical consultant should provide analysis to justify recommendations for temporary shoring and slot cutting. At a minimum, temporary shoring recommendations should include the recommended embedment material, retained material, and lateral earth pressure associated with each material. When tie-backs, rakers, and/or soil nails are used, recommendations should include the grout-to-ground bond strength, lock off load, load and proof test schedule, inclination angle, and bonded length, as necessary.

When slot cutting is proposed, the geotechnical project consultants' recommendations should include minimum slot width, height, and back-cut inclination. Recommendations should be justified with analysis.

All recommendations, details, and location of the shoring design must be shown on the development plans.

3.3.6 Retaining Structures

Retaining walls must be designed to ensure stability against overturning, sliding, excessive foundation pressure and uplift. Retaining walls must be designed to resist the lateral action of soil to produce sliding and over-turning with a minimum safety factor of 1.5 in each case. Geotechnical consultants must also take into consideration additional geologic and geotechnical conditions that may add passive loads, live loads, and/or surcharge on the retaining structures and provide recommendations accordingly.

In accordance with Section 1803.5.12 of the CLABC, the project geotechnical consultants are responsible for providing recommendations for seismic lateral pressures on all foundation walls and retaining walls supporting more than 6 feet of backfill. Therefore, this requirement will apply to basement walls and pool walls. Seismic loading for walls retaining more than 6 feet in height should be evaluated using GS Memo S004.0 (See Appendix A).

3.3.6.1 Standard Retaining Walls

Recommendations for retaining walls (cantilever and basement walls) should include lateral earth pressures, surcharge, bearing capacity of foundation soils, drainage design, and seismic loading on walls retaining more than 6 feet of backfill. The project geotechnical consultants should consider both the CLABC, Chapter 18 and current up-to-date references and should provide an explanation for the basis of their recommendations based on soils data and onsite conditions. All retaining walls designed with sub-drains must show positive drainage to an outlet location. Note: leaving spaces between blocks on the first course of a wall will not be accepted as adequate drainage.

3.3.6.2 Reinforced Retaining Walls

In addition to the aforementioned recommendations required for retaining structures, the project geotechnical consultant should provide the following for reinforced walls:

- Stability analysis to show internal and external stability. In the internal stability analysis, a cohesion equal to 0 pound per square feet must be used for reinforced fill.

- Reinforcement details including, but not limited to, the type of reinforcement, the length into the wall, and spacing of reinforcement. This will be required to be placed on the project development plans.

- All pertinent manufacturer's specifications and recommendations are to be included in the report.

- A map showing the area behind the walls containing reinforcement is to be clearly shown on the development plans and as-built maps. All reinforced areas behind the proposed retaining wall plus 10 feet beyond this limit shall be designated as an RUA on subdivision maps and on the development grading and building plans.

3.3.6.3 Surcharge Behind Retaining Walls

The project geotechnical consultants are responsible for evaluating the potential for vertical and lateral surcharges on retaining walls due to adjacent structures, footings, traffic load, hydrostatic pressure, etc. Surcharges within a 1:1 projection from the base of the wall will require a method to calculate the lateral surcharge on the wall. When adverse bedding conditions or jointing and fractures exist in the retained mass, bedrock surcharge loading should be provided.

3.3.7 Grading Recommendations

When the proposed development project includes grading, the geotechnical report should contain sufficient and appropriate recommendations that are in accordance with the CLABC, Appendix J and Los Angeles County Public Works Grading Guidelines. Grading recommendations should specify the depth and extent of all proposed cut and fill underlying or affecting the proposed foundations. If removal and recompaction is recommended, minimum removal depths and lateral extent must be specified and must be consistent with recommendations related to settlement or expansive soil tests and analyses. Grading recommendations, limits of grading, land elevations, slopes, drainage patterns and other important features must be shown on the grading plans. The project geotechnical consultants will be required to verify their recommendations are adequately reflected on the development plans prior to issuance of permits.

3.3.7.1 Removal and Recompaction

When removal and recompaction is recommended by the project geotechnical engineer, all lateral limits and specified depth of the work must be shown on the development site plans. Recommendations must be consistent with soils tests and analyses conducted as a part of the project report. If foundations will be placed in the fill, the depth of embedment and the depth of underlying fill must be specified. It is the responsibility of the project geotechnical engineer to provide specific recommendations for compacted fill. They must provide, but not limited to, the following regarding compacted fill.

- Minimum relative compaction.
- Moisture conditioning.
- Maximum particle size limits.
- Lift thickness.

- The relative compaction for fills should be measured against the laboratory maximum dry density as determined by ASTM D1557. The minimum relative compaction for fill should meet or exceed County minimum standards.

3.3.7.2 Subdrains

When engineered fill is proposed as a part of the project development, project geotechnical consultants must also provide recommendations for the adequate drainage of subsurface water. Subdrains and adequate gravity drainage is required for fill slopes and in proposed deep fill areas. The project geotechnical consultants must recommend provisions to reduce water infiltration into fill slopes, and a subdrainage system to convey excess water away from deep fill areas, fill slopes, or behind retaining walls. When a subdrainage system is recommended, the geotechnical consultants must provide the minimum requirements for the filter and drain material gradations and any associated geofabric. Provide details showing the size of the subdrain pipe, minimum pipe slope, perforation alignment, filter and drain material locations, all outlet locations (with elevation) and all necessary dimensions. All subdrains and all outlet locations must be shown on the grading plans. The project geotechnical consultant will be required to verify subdrain design requirements, descriptions, details, and subdrain outlet locations on the development plans and as-built maps.

3.3.7.3 Cut/Fill Transition Areas

All building pads located in cut/fill or bedrock/soil transition areas should be over-excavated a minimum of 3 feet below the proposed bottom of footings. Structural mitigation may be permitted in lieu of over-excavation, if data and analyses are provided to show the proposed work will meet County minimum standards.

Reaches of conduits (i.e., storm drains, sewer lines, etc.) located in transition areas shall be supported by a minimum of 3 feet of compacted fill or constructed with rubber gasket joints for a minimum of 24 feet on each side of transition. Alternatives to these requirements may be permitted on a case-by-case basis and will be evaluated on infiltration/exfiltration impacts on to the conduit stability when pipe separations exceed County standards.

3.3.7.4 Existing Fills

The geotechnical consultant must provide geotechnical report(s) by a licensed soils engineer detailing observations, density testing, compaction tests, and limits, in order to consider existing fills as certified engineered fills. For existing fills outside of the proposed building's footprint, the project geotechnical consultant must delineate areas where there is undocumented fill. These areas must be labeled as "Uncertified Fill – not suitable for support of structure(s)" on the development plans and geotechnical maps of the report.

3.3.7.5 Fill Slopes

The project geotechnical consultants must reference the CLABC, Chapter 18, Soils and Foundations, and Appendix J – Grading, for fill slope requirements. The project consultants should also review the Los Angeles County's Grading Guidelines provided by Public Works, BSD.

The project geotechnical consultants are responsible for providing grading recommendations for all fill slopes. At a minimum, recommendations for keyway, benching, and drainage should all be included in the geotechnical consultant's report and must meet Los Angeles County's Grading Guidelines. Slope stability analyses may be required based on the design of fill slopes, geologic conditions, subsurface water, subsurface effluent, or soil shear parameters.

All dimensions and details of the keyway, benches, subdrains, surface drains, and required soil compaction must be placed on the development plans, geotechnical maps, and cross sections for fill slopes and buttresses.

3.3.7.6 Drainage

The project geotechnical consultant should provide recommendations for drainage and maintenance practices for satisfactory performance of foundations, slabs, retaining walls, and slopes. The geotechnical report should provide recommendations for slope gradients away from foundations, management of landscape watering, and maintenance guidelines for property owners. Additionally, the geotechnical consultant should provide recommendations for free draining soils behind walls and beneath storm drains.

The geotechnical report should clarify the reasons for the need of drainage devices and recommended maintenance. This will be especially true for areas where there are natural slopes, landslides, or a history of ground movements such as settlement, hydro-collapse, slope erosion, or soil expansion.

Proper drainage should be discussed as it relates to the final developed conditions. It is important that all surface run-off be controlled and drainage devices maintained throughout the life of the development.

3.3.7.7 Construction Observation and Testing

Based on the requirements from the grading or building plan approval, a final report may be required at the conclusion of the construction phase for verification of work completed and compliance to the geotechnical/geologic recommendations. The final report will be required to be submitted to GMED for review and approval as part of the BSD or LDD requirements checklist for final sign-off of the permit. Conditions of approval and requirements of in-progress and final reports will be outlined in GMED's review sheet.

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GME-0/https://lacounty-my.sharepoint.com/personal/mchung_dpw_lacounty_gov/Documents/Melissa/GMED GEOTECHNICAL MANUAL 2024/GMED GEOTECHNICAL MANUAL 2024 (YM Revised 8.15.2024).docx

APPENDIX A – GS POLICY MEMORANDUMS

GS001.0 – UNGRADED SITE LOTS

GS002.0 – SUBDIVISION – "REMAINDER PARCEL" FOR TENTATIVE AND FINAL MAPS

GS004.0 – GRADING IN AREAS OF GEO HAZARD

GS010.0 – PRIVATE WASTEWATER DISPOSAL SYSTEM REQUIREMENTS

GS045.0 – LIQUEFACTION/LATERAL SPREAD

GS047.0 – SURFICIAL SLOPE STABILITY FOR NATURAL SLOPES

GS063.0 – RESTRICTED USE AREAS

GS073.0 – CORRECTIVE GEOLOGIC BONDS FOR SUBDIVISIONS

GS086.0 – SUBDIVISIONS IMPACTED BY EXISTING LANDSLIDES

GS087.0 – FINAL PARCEL MAP RECORDATION WAIVERS

GS101.0 – MITIGATING LANDSLIDES BY THE USE OF DEBRIS BASINS

GS200.1 – LOW IMPACT DEVELOPMENT BEST MANAGEMENT PRACTICE GUIDELINE FOR DESIGN, INVESTIGATION, AND REPORTING

S001.0 – ALTERNATE SETBACK AND CLEARANCE FROM DESCENDING SLOPE

S002.0 – SETBACKS FROM DESCENDING SLOPES

S004 – SEISMIC EARTH PRESSURES ON RETAINING WALLS

APPENDIX B – REFERENCES

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