December 18, 2006
BMI Project No. 06S-412

Mr. Robert Geringer
Shasta Red LLC
9595 Wilshire Boulevard, #1000
Beverly Hills, California 91212

Subject: Preliminary Geotechnical Investigation and Limited Geologic Hazards Evaluation Proposed Residential Subdivision Chatham Ranch Shasta County, California

Dear Mr. Geringer:

Brown & Mills is pleased to present the attached preliminary geotechnical investigation and limited geologic hazards evaluation report for a proposed residential subdivision to be located north of Boyle Road (and west of Deschutes Road) in the Redding area of Shasta County, California. Results of our study did not indicate the presence of any geologic-related hazard which would significantly restrict site development. Further, it is our professional opinion the site may be developed for the proposed residential subdivision generally using conventional grading and foundation construction techniques. However, due to certain site conditions identified by our field exploration program, special design and/or construction provisions will likely be required for some project features. A brief summary of these conditions is provided below.

- Sedimentary rock of the Tehama Formation was initially encountered in the test pits performed for this preliminary investigation at depths as shallow as about 1 to 5 feet below existing site grade. Further, backhoe refusal on this rock occurred in a majority of the test pits performed for this preliminary investigation at depths varying from about 2-1/2 to 10 feet below existing site grade. Based on conditions encountered within the test pits as well as our general knowledge of the site area, we anticipate even shallow trench excavations within some areas of the site will be difficult (if not impossible) with a conventional backhoe (such as a Case 580 or equivalent). Therefore, a large, track-mounted excavator (such as a Caterpillar 320 or equivalent), possibly equipped with a single ripper tooth, hydraulic percussion hammer, rock wheel, or other similar equipment specifically intended for rock removal, will likely be required to advance some on-site excavations.

9940 Business Park Drive, Suite 140, Sacramento, California 95827 Phone (916)362-5541 FAX (916)362-3454

- Excavations required for general site grading are anticipated to be possible over a majority of the site and to depths of about 5 to 10 feet below existing site grade using heavy earthwork equipment (such as a Caterpillar D8 or equivalent). However, where rock is encountered, initial ripping will likely be required to facilitate removal of these materials.

- In addition to possible excavation difficulties, perched water may develop above on-site rock subsequent to wet weather. The presence of perched groundwater could hinder trenching and/or earthwork operations, requiring temporary dewatering to facilitate even shallow excavations.

- We anticipate the possible presence of shallow perched water may also adversely impact post-construction project improvements, such as pavements or other features sensitive to the nearby presence of subsurface water. In general, surface drainage provisions (such as grading the site to facilitate surface water runoff away from foundation areas and pavement edges) can reduce the amount of perched water present. However, depending on the nature of site grading (which was unknown at the time this report was prepared), it may also be necessary to install trench drains. Typically, such drains would placed between future pavements, structures, or other features sensitive to the nearby presence of water and areas of uncontrolled surface drainage and/or which are topographically elevated. Since it currently is not possible to identify where these conditions may occur, the location and design of these drains (if any) will need to be evaluated by the project Geotechnical Engineer once final grading plans have been completed or at the time of construction.

- Structures constructed in areas which have rock present within a portion of the building subgrade may be susceptible to excessive differential settlement. In our opinion, this condition would be the most pronounced in areas where a portion of a single continuous footing is founded on native soil (or engineered fill) and the remaining portion on less-weathered rock. In this situation, we anticipate the maximum differential settlement (i.e., 1/2-inch) could occur within an interval less than 10 feet. In the event any continuous footings will span across a soil/rock transition, we typically would recommend all such footings include additional steel reinforcement. Typically, additional steel reinforcement would be designed by the project Structural Engineer or Architect with the intent of reducing differential settlement due to nonuniform foundation subgrade conditions.

Specific comments regarding the conditions outlined above, as well as preliminary recommendations related to the geotechnical aspects of project planning, are presented in the following report.

December 18, 2006
BMI Project No. 06S-412

Important Note: Conclusions and preliminary recommendations provided in this report are based on the assumption that a final geotechnical investigation will be conducted by Brown & Mills once development plans have been completed. The purpose of that investigation will be to provide project-specific recommendations related to the geotechnical aspects of project design and construction. Under no circumstances should the conclusions and preliminary recommendations provided in this report be used for detailed design, cost estimates, regulatory approval, or construction.

We appreciate the opportunity of providing our services for this project. If you have questions regarding this report, or if we may be of further assistance, please contact the undersigned.

Sincerely,

Brown & Mills, Inc.

REGISTERED PROFESSIONAL ENGINEER
R KEITH BROWN
No. 2141
Exp 12/31/07
GEOTECHNICAL
STATE OF CALIFORNIA

R. Keith Brown, P.E.
Principal 12/18/06

cc: Client (4 bound copies)

TABLE OF CONTENTS

PRELIMINARY GEOTECHNICAL INVESTIGATION AND LIMITED GEOLOGIC HAZARDS EVALUATION PROPOSED RESIDENTIAL SUBDIVISION CHATHAM RANCH SHASTA COUNTY, CALIFORNIA

INTRODUCTION

GENERAL

This report presents the results of our preliminary geotechnical investigation and limited geologic hazards evaluation for a proposed residential subdivision to be located north of Boyle Road (and west of Deschutes Road) in the Redding area of Shasta County, California. The purpose of our preliminary investigation was to explore and evaluate conditions within the site area in order to assess potential geologic hazards which could affect the site or proposed project as well as to develop preliminary recommendations related to the geotechnical aspects of project planning.

The approximate site location relative to existing topographic features and roads is shown on Plate 1.

PROPOSED CONSTRUCTION

We understand the proposed project will involve developing approximately 750 acres of agricultural land for residential development. Appurtenant construction is anticipated to include asphalt-concrete-paved vehicular roadways, concrete walkways, and underground utilities.

Grading plans were not available at the time this report was prepared; however, as site topography generally varies from relatively level to gently sloping, we anticipate earthwork cuts and fills required solely to achieve level building pads and provide for vehicular access will generally be less than about 4 feet in vertical extent. Excavations for underground utilities are not anticipated to exceed about 5 feet below final site grades.

A plot plan indicating the proposed project area is shown on Plates 2A (northern portion of site) and 2B (southern portion of site).

SCOPE OF SERVICES

The scope of our services was outlined in our proposal dated September 15, 2006, and included the following:

- Exploration of site subsurface conditions using 11 exploratory test pits.

- Preparation of this report which includes:

  - A description of the proposed project;

  - A summary of our field exploration program;

  - A description of the site's geologic and seismic setting based on a review of readily available literature;

  - A description of site surface and subsurface conditions encountered during our field investigation;

  - Our comments regarding potential geologic hazards which could affect the site or proposed project; and

  - Conclusions and preliminary recommendations related to the geotechnical aspects of site preparation, temporary excavations, earthen slopes, and foundation design.

Note: The scope of our services for this project did not include the evaluation of, or recommendations pertaining to, asphalt concrete pavements. We understand these services will be provided by others or at a later date. Further, conclusions and preliminary recommendations provided in this report are based on the assumption that a final geotechnical investigation will be conducted by Brown & Mills once development plans have been completed. The purpose of that investigation will be to provide project-specific recommendations related to the geotechnical aspects of project design and construction. Under no circumstances should the conclusions and preliminary recommendations provided in this report be used for detailed design, cost estimates, regulatory approval, or construction.

FIELD INVESTIGATION

Subsurface conditions at the site were explored on October 13, 2006, by excavating 11 test pits (designated TP-1 through TP-11) to depths of about 2-1/2 to 10 feet below existing site grade. Test pits were excavated using a JCB 214 tractor-mounted backhoe equipped with an 18-inch-wide bucket. The approximate locations of test pits performed for this investigation are shown on Plates 2A and 2B.

Note: A majority of the test pits performed for this investigation were prematurely terminated (i.e., reached depths less than initially planned) due to essential refusal on rock.

Our technician maintained a log of the test pits, visually classified the earth materials encountered according to the Unified Soil Classification System (see Plate 3) or Rock Classification Legend (see Plate 4), and obtained representative samples of the subsurface materials. After the test pits were completed, they were loosely backfilled with the excavated material. Logs of the exploratory test pits performed for this investigation are presented on Plates 5 through 15.

SITE CONDITIONS

GEOLOGIC SETTING

The project site is located within the northern portion of the Great Valley geomorphic province, a large elongated northwest-trending asymmetric structural trough that has been filled with a tremendously thick sequence of sediments ranging in age from Jurassic to Recent. Within the site vicinity, the Great Valley is bounded on the east by the Cascade Ranges, on the north by the Klamath Mountains, and on the west by the Coast Ranges. Sediments that form the thick valley section were largely derived from erosion of these surrounding mountain ranges.

Previous mapping by Helley and Harwood[1] indicated the site is underlain by Pleistocene-age surficial deposits of the Red Bluff Formation. The Red Bluff Formation is described by Helley and Harwood as a thin veneer of highly-weathered red gravels beveling and overlying the Tehama, Tuscan, and Laguna Formations. Results of our subsurface investigation

---

[1] Reference: U.S. Geologic Survey map entitled: "Geologic Map of the Late Cenozoic Deposits of the Sacramento Valley and Northern Sierran Foothills, California," by Edward J. Helley and David S. Harwood, 1985.

generally confirmed the presence of a thin veneer of highly-weathered sands and gravels underlain by weathered sedimentary rock of the Tehama Formation (described by Helley and Harwood as Pliocene-age sandstone and siltstone with lenses of crossbedded pebble and cobble conglomerate derived from the Coast Ranges and Klamath Mountains).

SEISMIC SETTING

Shasta County is located within an area of California generally not characterized by an abundance of active faulting. No significant active faults (or fault zones) are located within the immediate site vicinity, nor is the site within a current Earthquake Fault Hazard Zone (formerly known as an Alquist Priolo Special Studies Zone). In general, seismic ground shaking at the site would be due movement on more distant faults.

In 1996, the California Division of Mines and Geology, in conjunction with the U.S. Geological Survey, developed a Probabilistic Seismic Hazard Assessment for the State of California[2] in which the Battle Creek fault (the closest known fault to the site) was included as a Class B fault system, suggesting that this fault is considered to be active, even though a specific Earthquake Hazard Zone has not been established for this fault. Appendix A (California Fault Parameters) of the report indicates the Battle Creek fault has a Mmax Moment Magnitude (Mw) of 6.5 and an estimated recurrence interval of approximately 1319 years. Based on the latitudinal/longitudinal end points of the various fault segments presented in Appendix A, the site is located approximately 17 miles north-northwest from the Battle Creek fault.

SURFACE

The project site consists of an irregularly-shaped parcel located north of Boyle Road (and west of Deschutes Road) in the Redding area of Shasta County, California. At the time of our field investigation, the site was mostly vacant of visible past development and was vegetated with grasses and scattered oak and pine trees. Existing topography within a majority of the site area varied from relatively level to gently sloping. However, within the east-central portion of the site, two north-south trending surface drainages traverse the site which have resulted locally in moderately-to-steeply sloping ground in the immediate vicinity of these surface drainage features.

---

[2] Petersen et al., "Probabilistic Seismic Hazard Assessment for the State of California," California Division of Mines and Geology, Open File Report 96-08, 1996.

SUBSURFACE

Near-surface soils encountered in test pits performed for this investigation consisted predominantly of medium dense clayey sand and silty gravel (with some cobbles) to depths of about 1 to 5 feet below existing site grade. Below these near-surface soils, highly-to-moderately-weathered, friable-to-moderately-strong sedimentary rock of the Tehama Formation was generally encountered to the maximum depth explored (approximately 10 feet below existing site grade).

No free groundwater was encountered during our field investigation. However, it should be recognized that groundwater conditions can vary depending on the season, irrigation and/or groundwater pumping practices (both on- and off-site), precipitation, runoff conditions, the level of nearby bodies of water (including ponds, canals, creeks, and rivers), and possibly other factors. Further, during the winter or spring season, or shortly after significant precipitation, perched groundwater (or groundwater seepage) may be present above on-site rock. Therefore, groundwater conditions presented in this report may not be representative of those which may be encountered during or subsequent to construction.

A more detailed description of the subsurface conditions encountered during our field investigation is provided on the attached logs.

GEOLOGIC HAZARDS

FAULTING AND SEISMICITY

Ground Rupture

No significant active faults (or fault zones) are located within the immediate site vicinity, nor is the site within a current Earthquake Fault Hazard Zone (formerly known as an Alquist Priolo Special Studies Zone). Therefore, it is our opinion that the potential for ground rupture at the site in the event of a seismic event is highly unlikely.

Site Characterization

Previous mapping of the Redding area[3] as well as the results of our field investigation indicates the site is located within an area of shallow sedimentary rock of the Tehama Formation. Given the presence of shallow (and weathered rock), it is our opinion the site may be characterized as a "soft rock[4]" site.

Estimated Peak Ground Acceleration

In order to assess potential ground motions at the site due to seismic activity, we utilized the California Geological Survey Probabilistic Seismic Hazards Mapping Ground Motion database. Values of attenuated ground motion compiled within this database are based on the closest distance between the site and various measures of fault-plane rupture for each fault in the source model. For a "soft rock" site, a peak ground accelerations (PGA) of 0.18g (where "g" equals 32.2 feet per second per second) was obtained for the design-basis earthquake event (i.e., 10 percent probability of exceedance in 50 years).

Seismic Parameters

In the event the California Building Code (CBC, 2001 edition) is used for the seismic analysis or design, it is our opinion a Type S_C soil profile would be appropriate for site soil conditions. Further, the subject site is located within Seismic Zone 3; hence, corresponding Seismic

---

[3] U.S. Geologic Survey map entitled: "Geologic Map of the Late Cenozoic Deposits of the Sacramento Valley and Northern Sierran Foothills, California," by Edward J. Helley and David S. Harwood, 1985.

[4] Earth materials with average shear wave velocities on the order of 360 to 760 meters per second.

Coefficients would be 0.33 and 0.45 for C_a and C_v, respectively. Finally, since the site is located in Seismic Zone 3, near-source factors are not applicable (or required) for design purposes.

Liquefaction

Liquefaction is a phenomenon whereby loose, saturated, granular soil deposits lose a significant portion of their shear strength due to excess pore water pressure buildup resulting from cyclic loading, such as that caused by an earthquake. Among other effects, liquefaction can result in densification of such deposits after an earthquake as excess pore pressures are dissipated (and hence settlements of overlying deposits). The primary factors deciding liquefaction potential of a soil deposit are: (1) the level and duration of seismic ground motions; (2) the type and consistency of the soils; and (3) the depth to groundwater.

Site soils encountered during our field investigation generally consisted of medium dense clayey sand and silty gravel (with some cobbles) underlain by highly-to-moderately-weathered, friable-to-moderately-strong sedimentary rock of the Tehama Formation. No free groundwater was encountered during our field investigation.

Based on the relatively dense nature of the soils encountered during our field investigation as well as the presence of rock at relatively shallow depths, it is our professional opinion the potential for liquefaction at the site during or subsequent to a seismic event would be low.

Seismically-Induced Ground Subsidence

Ground subsidence within the site area would typically be due to densification of subsurface soils during or subsequent to a seismic event. Generally, loose, granular soils would be most susceptible to densification, resulting in ground subsidence.

Based on the relatively dense nature of the soils encountered during our field investigation as well as the presence of rock at relatively shallow depths, it is our professional opinion the potential for significant ground subsidence at the site during or subsequent to a seismic event would be low.

LANDSLIDES

The project site is not located within an area of known landslide activity, nor were any landslides noted during our preliminary field investigation. However, landslide development can be promoted by site grading. Hence, we would recommend the potential for landslides be reevaluated once development plans have been completed in order to provide project-specific conclusions related to this potential geologic hazard.

VOLCANIC HAZARDS

The project site is located south of the Cascade Range, an active volcanic chain which extends northward into British Columbia. The most recent volcanic activity within the site vicinity was in 1914-1917, when eruptions of Lassen Peak (located approximately 42 miles east-southeast of the site) produced lava flows on the flank of the crater, numerous ash falls, and a large mudflow.

Based on our review of published information pertaining to potential volcanic hazards (i.e., Miller, C.D., 1989, "Potential Hazards from Future Volcanic Eruptions in California," U.S. Geological Survey Bulletin 1847), the project site does not appear to be within a volcanic hazard zone. Therefore, we consider potential impacts to the planned project due to volcanic activity to be minimal.

CONCLUSIONS AND PRELIMINARY RECOMMENDATIONS

GENERAL

Results of our study did not indicate the presence of any geologic-related hazard which would significantly restrict site development. Further, it is our professional opinion the site may be developed for the proposed residential subdivision generally using conventional grading and foundation construction techniques. However, due to certain site conditions identified by our field exploration program, special design and/or construction provisions will likely be required for some project features. A brief summary of these conditions is provided below.

- Sedimentary rock of the Tehama Formation was initially encountered in the test pits performed for this preliminary investigation at depths as shallow as about 1 to 5 feet below existing site grade. Further, backhoe refusal on this rock occurred in a majority of the test pits performed for this preliminary investigation at depths varying from about 2-1/2 to 10 feet below existing site grade. Based on conditions encountered within the test pits as well as our general knowledge of the site area, we anticipate even shallow trench excavations within some areas of the site will be difficult (if not impossible) with a conventional backhoe (such as a Case 580 or equivalent). Therefore, a large, track-mounted excavator (such as a Caterpillar 320 or equivalent), possibly equipped with a single ripper tooth, hydraulic percussion hammer, rock wheel, or other similar equipment specifically intended for rock removal, will likely be required to advance some on-site excavations.

- Excavations required for general site grading are anticipated to be possible over a majority of the site and to depths of about 5 to 10 feet below existing site grade using heavy earthwork equipment (such as a Caterpillar D8 or equivalent). However, where rock is encountered, initial ripping will likely be required to facilitate removal of these materials.

- In addition to possible excavation difficulties, perched water may develop above on-site rock subsequent to wet weather. The presence of perched groundwater could hinder trenching and/or earthwork operations, requiring temporary dewatering to facilitate even shallow excavations.

- We anticipate the possible presence of shallow perched water may also adversely impact post-construction project improvements, such as pavements or other features sensitive to the nearby presence of subsurface water. In general, surface drainage provisions (such as grading the site to facilitate surface water runoff away from foundation areas and pavement edges) can reduce the amount of perched water present. However, depending on the nature of site grading (which was unknown at the time this report was prepared), it may also be necessary to install trench drains. Typically, such drains would placed between future pavements, structures, or other features sensitive to the nearby presence of water and areas of uncontrolled surface drainage and/or which are topographically elevated. Since it currently is not possible to identify where these conditions may occur, the location and design of these drains (if any) will need to be evaluated by the project Geotechnical Engineer once final grading plans have been completed or at the time of construction.

- Structures constructed in areas which have rock present within a portion of the building subgrade may be susceptible to excessive differential settlement. In our opinion, this condition would be the most pronounced in areas where a portion of a single continuous footing is founded on native soil (or engineered fill) and the remaining portion on less-weathered rock. In this situation, we anticipate the maximum differential settlement (i.e., 1/2-inch) could occur within an interval less than 10 feet. In the event any continuous footings will span across a soil/rock transition, we typically would recommend all such footings include additional steel reinforcement. Typically, additional steel reinforcement would be designed by the project Structural Engineer or Architect with the intent of reducing differential settlement due to nonuniform foundation subgrade conditions.

Specific comments regarding the conditions outlined above, as well as preliminary recommendations related to the geotechnical aspects of project planning, are presented in the following sections of this report.

Important Note: Conclusions and preliminary recommendations provided in this report are based on the assumption that a final geotechnical investigation will be conducted by Brown & Mills once development plans have been completed. The purpose of that investigation will be to provide project-specific recommendations related to the geotechnical aspects of project design and construction. Under no circumstances should the conclusions and preliminary recommendations provided in this report be used for detailed design, cost estimates, regulatory approval, or construction.

ON-SITE ROCK

Anticipated Excavation Conditions

Sedimentary rock of the Tehama Formation was initially encountered in the test pits performed for this preliminary investigation at depths as shallow as about 1 to 5 feet below existing site grade. Further, backhoe refusal on this rock occurred in a majority of the test pits performed for this preliminary investigation at depths varying from about 2-1/2 to 10 feet below existing site grade. Based on conditions encountered within the test pits as well as our general knowledge of the site area, we anticipate even shallow trench excavations within some areas of the site will be difficult (if not impossible) with a conventional backhoe (such as a Case 580 or equivalent). Therefore, a large, track-mounted excavator (such as a Caterpillar 320 or equivalent), possibly equipped with a single ripper tooth, hydraulic percussion hammer, rock wheel, or other similar equipment specifically intended for rock removal, will likely be required to advance some on-site excavations.

Excavations required for general site grading are anticipated to be possible over a majority of the site and to depths of about 5 to 10 feet below existing site grade using heavy earthwork equipment (such as a Caterpillar D8 or equivalent). However, where rock is encountered, initial ripping will likely be required to facilitate removal of these materials.

Possible Perched Groundwater Conditions

In addition to possible excavation difficulties, perched water may develop above on-site rock subsequent to wet weather. We anticipate the presence of perched groundwater could hinder trenching and/or earthwork operations, requiring temporary dewatering to facilitate even shallow excavations.

We anticipate the possible presence of shallow perched water may also adversely impact post-construction project improvements, such as pavements or other features sensitive to the nearby presence of subsurface water. In general, surface drainage provisions (such as grading the site to facilitate surface water runoff away from foundation areas and pavement edges) can reduce the amount of perched water present. However, depending on the nature of site grading (which was unknown at the time this report was prepared), it may also be necessary to install trench drains. Typically, such drains would placed between future pavements, structures, or other features sensitive to the nearby presence of water and areas of uncontrolled surface drainage and/or which are topographically elevated. Since it currently is not possible to identify where these conditions may occur, the location and design of these drains (if any) will need to be evaluated by the project Geotechnical Engineer once final grading plans have been completed or at the time of construction.

Engineered Fill Considerations

We anticipate on-site rock may require special handling and/or processing to reduce the size of the excavated material to meet typical requirements for engineered fill (i.e., engineered fill should be generally less than 3 inches in maximum dimension). In order to use on-site rock for engineered fill, we anticipate these materials will either need to be: (1) processed (i.e., pulverized) with heavy equipment to reduce individual rock fragments to generally less than about 3 inches in maximum dimension; or (2) screened, raked, or selectively processed to remove individual rock fragments more than about 3 inches in maximum dimension. In general, we typically would recommend all rock in excess of about 3 inches in maximum dimension be disposed of off-site or outside the construction limits.

In addition to special handling and or processing procedures to meet typical requirements for engineered fill, rock removed from some utility excavations may not meet typical size requirements for trench backfill. Therefore, we anticipate rock materials excavated from some utility trenches may need to be selectively removed, disposed of off-site or outside the construction limits, and replaced with imported materials or finer-grained on-site soils.

Foundation Considerations

Structures constructed in areas which have rock present within a portion of the building subgrade may be susceptible to excessive differential settlement. In our opinion, this condition would be the most pronounced in areas where a portion of a single continuous footing is founded on native soil (or engineered fill) and the remaining portion on less-weathered rock. In this situation, we anticipate the maximum differential settlement (i.e., 1/2-inch) could occur within an interval less than 10 feet. In the event any continuous footings will span across a soil/rock transition, we typically would recommend all such footings include additional steel reinforcement. Typically, additional steel reinforcement would be designed by the project Structural Engineer or Architect with the intent of reducing differential settlement due to nonuniform foundation subgrade conditions.

SITE PREPARATION

Stripping and Grubbing

Prior to general site grading and/or construction of future improvements, any existing vegetation, organic topsoil, or debris will typically need to be stripped (or otherwise removed) and disposed of off-site or outside the construction limits. Deep stripping or grubbing will be required where concentrations of organic soils, tree roots, or debris are encountered. Stripped topsoil (less any debris or large tree roots) generally may be stockpiled and reused for landscape purposes; however, this material typically should not be incorporated into any engineered fill.

Exploratory Test Pit Backfill

Backfill used to fill exploratory test pits performed for this investigation was loosely-placed and may be susceptible to future subsidence. If future improvements will be located over these areas, we typically would recommend all backfill associated with these test pits be excavated and replaced with engineered fill. Approximate locations of test pits performed for this investigation are shown on Plates 2A and 2B.

Scarification and Compaction

Following site stripping and any required grubbing or overexcavation, all areas to receive engineered fill will need to be scarified to a depth of 8 inches, uniformly moisture-conditioned to between 0 and 5 percent above the optimum moisture content, and compacted to at least 90 percent of the maximum dry density as determined by ASTM (American Society for Testing and Materials) Test Method D 1557[5]. In the event the exposed subgrade consists of undisturbed, cemented soil or on-site rock, scarification and compaction could be omitted if approved by the project Geotechnical Engineer.

Wet/Unstable Soil Conditions

If site preparation or grading is performed in the winter or spring season, or shortly after significant precipitation, near-surface site soils may be significantly over optimum moisture content. Further, during these same periods, perched groundwater (or groundwater seepage) may be encountered above on-site rock. These conditions could hinder construction equipment as well as efforts to compact site soils to a specified level of compaction. If over optimum soil moisture content conditions are encountered during construction, disking to aerate, replacement with imported material, chemical treatment, stabilization with a geotextile fabric, grid or coarse aggregates (such as cobbles or boulders), and/or other methods will likely be required to facilitate earthwork operations. The applicable method will depend on the contractor's capabilities as well as other project-related factors beyond the scope of this study. Therefore, if over-optimum soil conditions are encountered during construction, the project Geotechnical Engineer will need to review these conditions (as well as the contractor's capabilities) and, if appropriate, provide recommendations for their treatment.

---

[5] This test procedure should be used wherever relative compaction, maximum dry density, or optimum moisture content is referenced within this report.

TEMPORARY DEWATERING

Though no free groundwater was encountered during our field investigation, we anticipate even shallow excavations may encounter groundwater perched over on-site rock during or subsequent to wet weather. If perched groundwater is encountered during construction, dewatering may be required to facilitate construction.

SUBDRAINS

If any on-site drainage swale (or swales) are to be infilled with fill, it may be desirable to install a subdrain along the bottom of these swales (or swale, if any) prior to fill placement. The purpose of these drains would be to intercept and remove subsurface water which would otherwise accumulate within these areas. We recommend the need for subdrains be evaluated by the project Geotechnical Engineer during grading and after any loose soil or vegetation has been cleared from these areas. If subdrains are required, we typically recommend they be constructed in accordance within the detail provided on Plate 16.

KEY AND BENCH REQUIREMENTS

If fill is to be placed on slopes steeper than 5(h):1(v), the slope (or slopes) to receive this material will typically need to be benched and, depending on the slope and fill configuration, a keyway constructed at the toe of slope. In general, benches will need to extend through any loose, soft or disturbed soil or rock, extend a minimum of 2 feet (measured horizontally) into the existing slope and be offset no more than 5 feet vertically. A typical key and bench detail is presented on Plate 17.

ENGINEERED FILL

Materials - General

Engineered fill should generally consist of soil and/or soil-aggregate mixtures less than 3 inches in maximum dimension, nearly-free of organic or other deleterious debris, and essentially non-plastic. Typically, well-graded mixtures of gravel, sand, non-plastic silt, and low plasticity clay are acceptable for use as engineered fill. In general, we anticipate a majority of the near-surface, on-site soils, free of organic or other deleterious debris, may be used for engineered fill.

Oversize Materials

On-site soils contain some oversize material (i.e., cobbles in excess of 3 inches in maximum dimension). In general, we anticipate this material could be used for engineered fill provided individual pieces are spaced to prevent nesting and, if possible, placed within the lower portions of deep fills.

On-Site Rock Materials

In general, we anticipate on-site rock, free of organic or other deleterious debris, may be used for engineered fill. However, we anticipate on-site rock may require special handling and/or processing to reduce the size of the excavated material to meet typical requirements for engineered fill (i.e., engineered fill should be generally less than 3 inches in maximum dimension). In order to use on-site rock for engineered fill, we anticipate these materials will either need to be: (1) processed (i.e., pulverized) with heavy equipment to reduce individual rock fragments to generally less than about 3 inches in maximum dimension; or (2) screened, raked, or selectively processed to remove individual rock fragments more than about 3 inches in maximum dimension. In general, we typically would recommend all rock in excess of about 3 inches in maximum dimension be disposed of off-site or outside the construction limits.

Use of Oversize Rock Materials

Depending on the contractor's capabilities, as well as specific project requirements beyond the scope of this study, it may be possible to utilize rock material in excess of about 3 inches in maximum dimension within some engineered fills. In general, individual boulders and/or rock fragments (regardless of size) could be placed within the lowest portion of deep fills provided individual pieces are spaced to prevent nesting and finer-grained soil is jetted, hand-tamped, or otherwise placed to infill all voids surrounding these rocks. If mixed with soil, fill materials composed of limited quantities of boulders and/or rock fragments (which are less than 12 inches in maximum dimension) could be used for engineered fill without consideration of depth.

Placement and Compaction

Soil and/or soil-aggregate mixtures used for engineered fill are typically uniformly moisture-conditioned to between 0 and 5 percent above the optimum moisture content, placed in horizontal lifts less than 8 inches in loose thickness, and compacted to at least 90 percent relative compaction. Within pavement areas, these materials will need to be compacted to at least 95 percent relative compaction within 12 inches of finished subgrade.

EARTHEN SLOPES

General

We anticipate earthen cut and fill slopes (not subject to a free water surface) may be constructed at a gradient of 2(h):1(v) or flatter. In the event earthen cut or fill slopes will be subjected to a free water surface (such as in a water detention basin, adjacent to a creek or seasonal drainage, or other similar condition), we typically would recommend these slopes be constructed at a gradient of 3(h):1(v) or flatter.

Cut Slopes in Rock

We anticipate cut slopes within the planned project may be constructed at a gradient of 2(h):1(v) or flatter. However, we typically recommend all cut slopes composed predominately of rock be reviewed during grading by the project Geotechnical Engineer for the presence of adverse bedding or fracturing conditions. If adverse bedding or fracturing conditions are encountered, a flatter slope, buttressing of the slope, or an earth retaining wall may be required to provide adequate stability.

Erosion Protection

In general, all cut and fill slopes will need to be revegetated with deep-rooted, perennial grasses or other suitable method or material soon after construction. To further reduce the potential for erosion, we typically recommend surface runoff not be allowed to flow onto, over, or across any on-site slope(s) more than a few feet in height. Typically, surface runoff water may be intercepted and redirected using a small berm, drainage swale, or shallow gutter (placed at the top of the slope), or by grading adjacent areas to drain away from the top of all downward trending slopes.

Scour Protection

Preliminary recommendations provided above (for erosion protection) do not consider possible scour of earthen slopes adjacent to surface water drainage courses. If applicable, the project Civil Engineer may need to review any and all slopes which are adjacent to surface water drainage courses to determine the appropriate method (if any) to prevent scour (and/or resulting undermining) of these slopes.

Slope Toe Drains

In the event the proposed project will include significant earthen fill slopes, it may be desirable to install a trench drain at the toe of such slopes. The purpose of these proposed drains would be to intercept subsurface water which may become perched above on-site rock and accumulate at the toe of these slopes. Should the project include earthen fill slopes which are in excess of 5 feet in vertical height and: (1) sloped at a gradient of 4(h):1(v) or steeper; or (2) located immediately adjacent to areas which will contain improvements sensitive to the nearby presence of water (i.e., buildings, pavements, walkways, etc.), we would generally recommend a trench drain be installed at these locations. A detail showing a typical trench drain that may be used for this purpose is presented on Plate 18.

Setbacks

Structures located near the top (or bottom) of a slope steeper than 3(h):1(v) will need to maintain a minimum set-back in accordance with requirements outlined in Section 1806.5 of the Uniform Building Code (UBC, Volume 2, 1997 edition), or 3 feet (measured horizontally from the top or bottom of slope to the closest point of approach of the structure), whichever is greater.

FOUNDATIONS

General

In our opinion, shallow spread footings, constructed of reinforced concrete and founded on undisturbed native soil, completely-to-highly-weathered on-site rock, and/or engineered fill, could be used for support of future structures. In general, we typically would recommend all such footings be a minimum of 12 inches wide and embedded a minimum of 12 inches the lowest adjacent final subgrade[6].

Nonuniform Foundation Subgrade Conditions

Structures constructed in areas which have rock present within a portion of the building subgrade may be susceptible to excessive differential settlement. In our opinion, this condition would be the most pronounced in areas where a portion of a single continuous footing is founded on native soil (or engineered fill) and the remaining portion on less-weathered rock. In this situation, we

[6] Within this report, final subgrade refers to the top surface of undisturbed native soil or on-site rock, on-site soil compacted during site preparation, or engineered fill.

anticipate the maximum differential settlement (i.e., 1/2-inch) could occur within an interval less than 10 feet. In the event any continuous footings will span across a soil/rock transition, we typically would recommend all such footings include additional steel reinforcement. Typically, additional steel reinforcement would be designed by the project Structural Engineer or Architect with the intent of reducing differential settlement due to nonuniform foundation subgrade conditions.

Allowable Bearing Pressure

We anticipate an allowable bearing pressure of at least 1,500 pounds per square foot (psf) will be possible for the design of future, on-site spread foundations.

ADDITIONAL SERVICES

We recommend Brown & Mills prepare a final geotechnical investigation once development plans have been completed to develop and provide project-specific recommendations related to the geotechnical aspects of site preparation and engineered fill, temporary excavations and trench backfill, foundation design and construction, concrete slabs supported-on-grade, and asphalt concrete pavements.

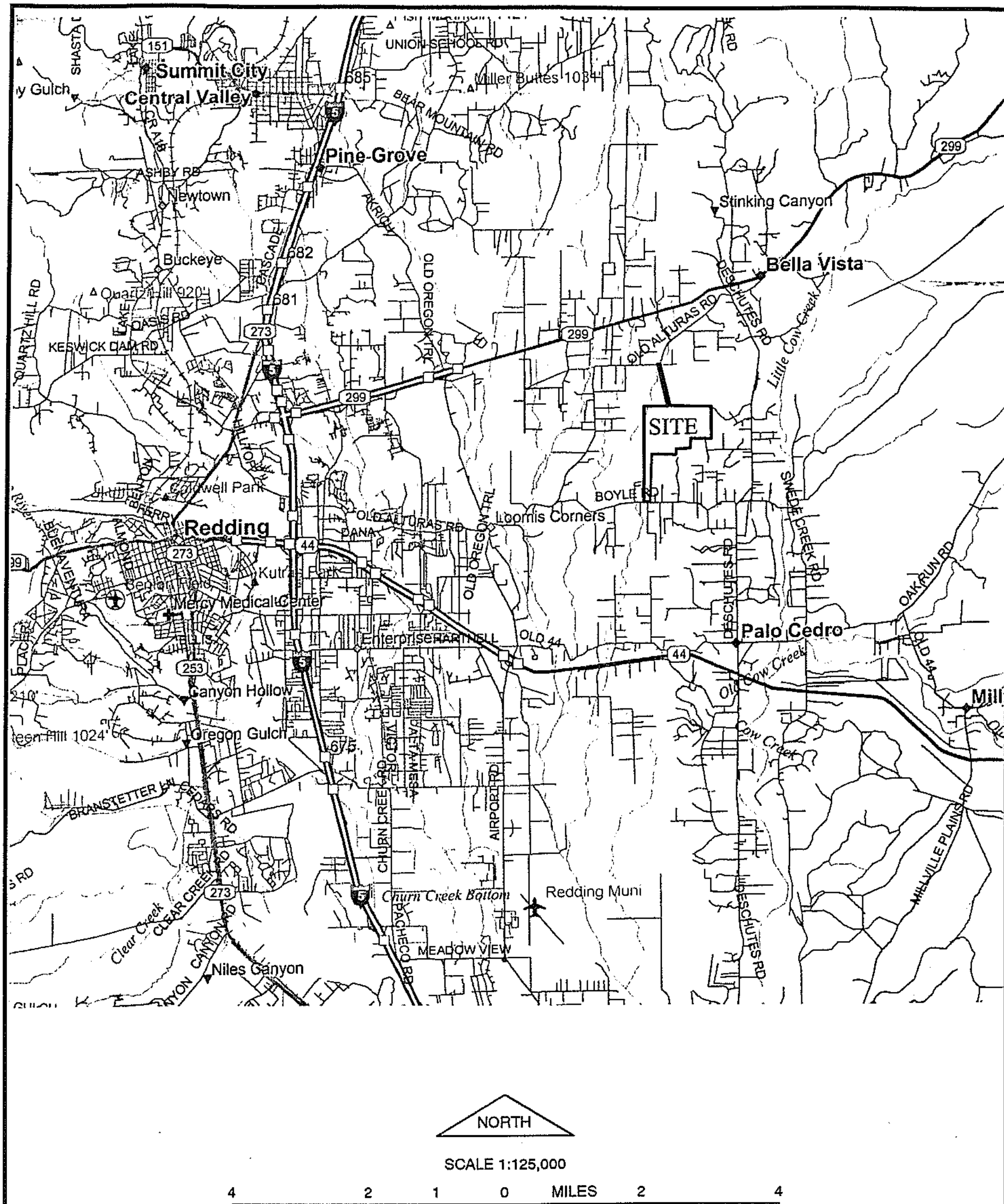
LIMITATIONS

This report has been prepared in substantial accordance with the generally accepted geotechnical engineering practice as it existed in the site area at the time our services were rendered. No warranty is either expressed or implied.

Conclusions and preliminary recommendations provided in this report are based on the assumption that a final geotechnical investigation will be conducted by Brown & Mills once development plans have been completed. The purpose of that investigation will be to provide project-specific recommendations related to the geotechnical aspects of project design and construction. Under no circumstances should the conclusions and preliminary recommendations provided in this report be used for detailed design, cost estimates, regulatory approval, or construction.

The scope of services provided by Brown & Mills for this project did not include the investigation and/or evaluation of toxic substances, or soil or groundwater contamination of any type. If such conditions are encountered during site development, additional studies may be required. Further, services provided by Brown & Mills for this project did not include the investigation and/or evaluation of soil corrosivity. Depending on pipe types, bedding conditions, and other factors beyond the scope of this study, it may be appropriate to evaluate soil corrosivity prior to development.

This report may be used only by our client and only for the purposes stated herein, within a reasonable time from its issuance. Any party other than our client who wishes to use all or any portion of this report shall notify Brown & Mills of such intended use. Based on the intended use as well as other site-related factors, Brown & Mills may require that additional studies be conducted and that an updated or revised report be issued. Failure to comply with any of the requirements outlined above by the client or any other party shall release Brown & Mills from any liability arising from the unauthorized use of this report.



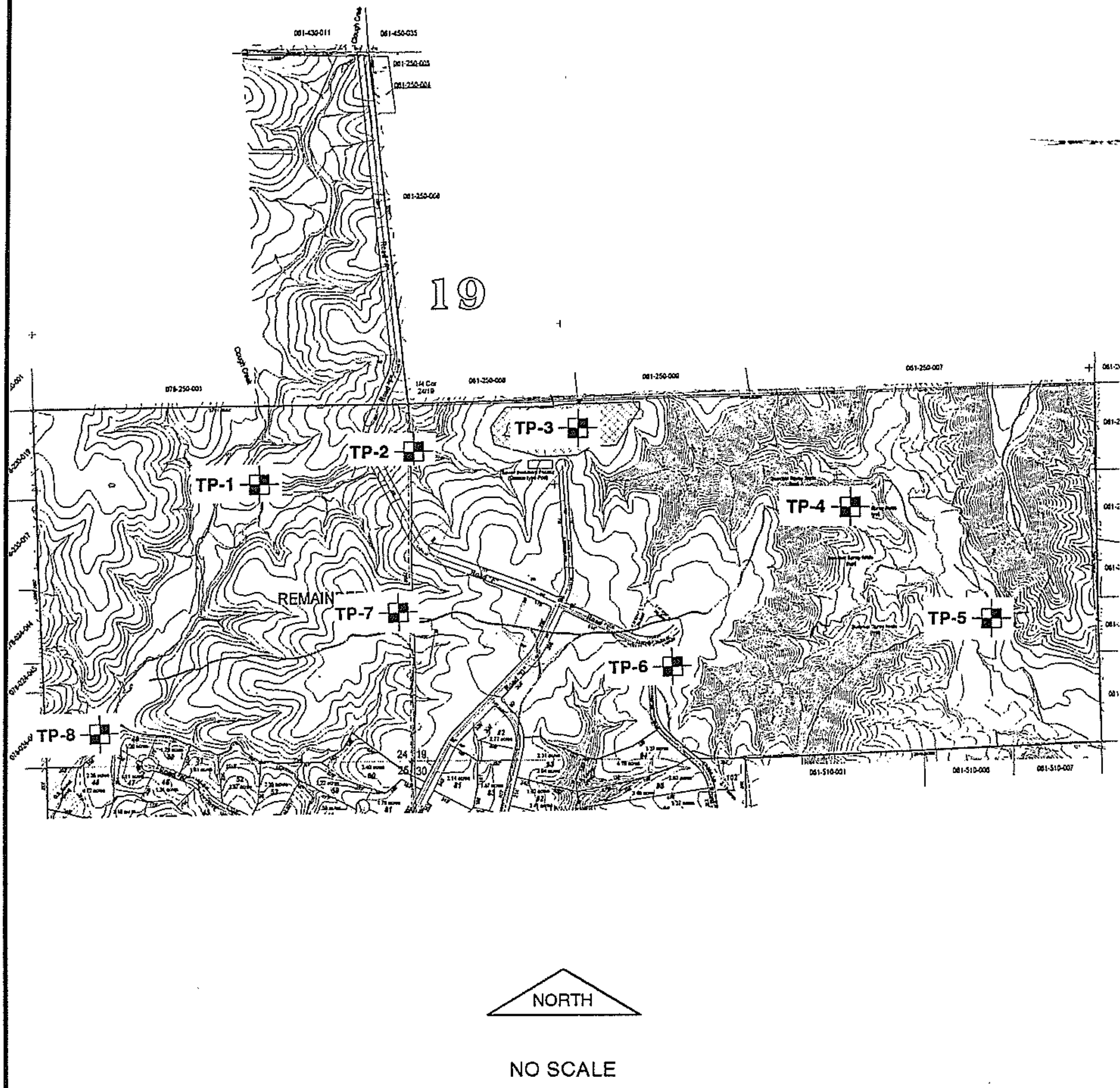
BMI

BMI PROJECT NO. ▶ 06S-412

VICINITY MAP
PROPOSED RESIDENTIAL SUBDIVISION
CHATHAM RANCH
SHASTA COUNTY, CALIFORNIA

PLATE

1



LEGEND

APPROXIMATE TEST PIT LOCATION

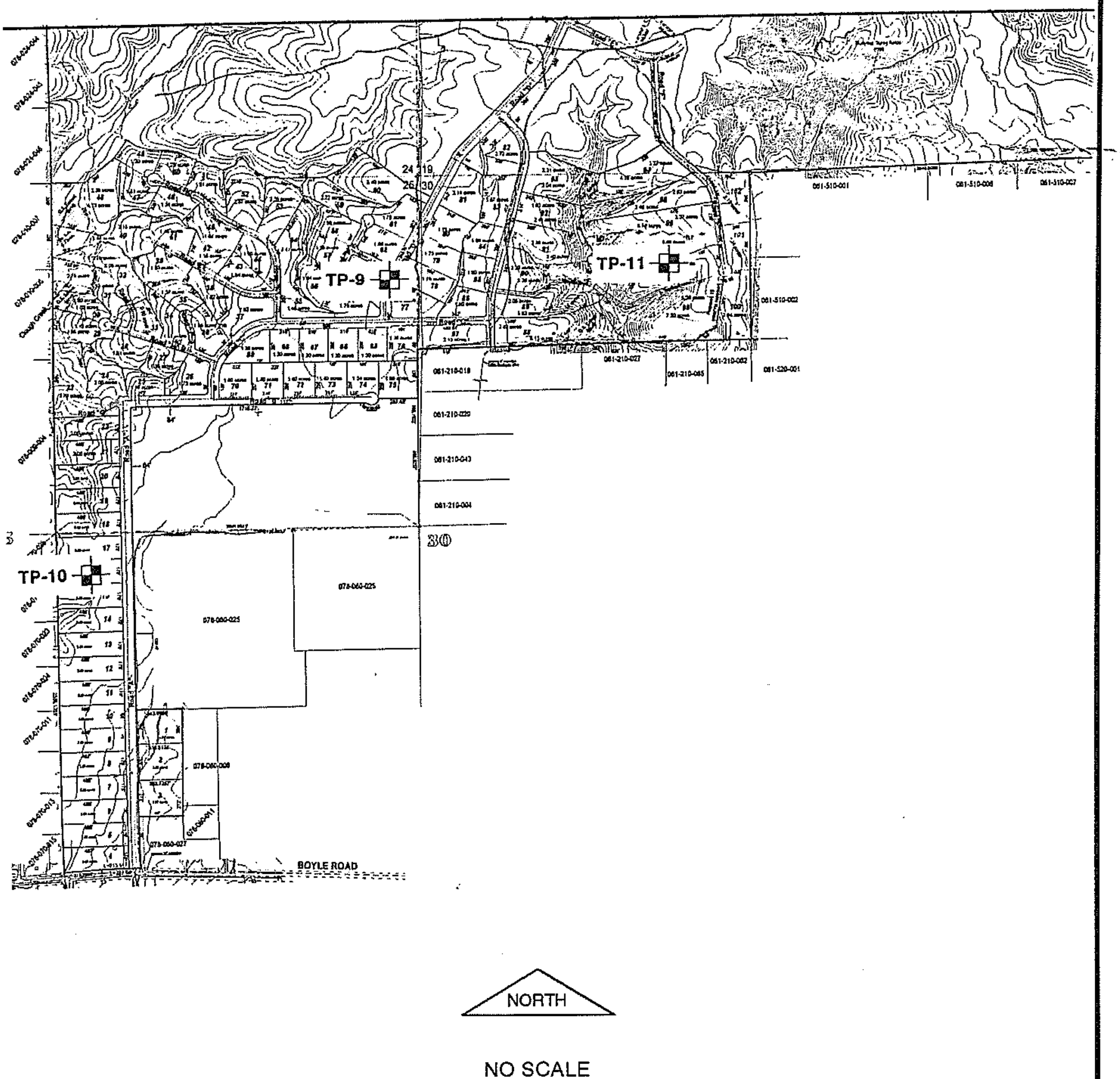
NOTE: Test pits were located in the field by visual methods. Therefore, the locations of the test pits shown on this plan should be considered highly approximate.

REFERENCE: Plan prepared by Lehmann & Associates titled: "TENTATIVE SUBDIVISION MAP," Sheet No. T1 of 1, dated Septmeber 2006.

BMI PROJECT NO. 06S-412

SITE PLAN
PROPOSED RESIDENTIAL SUBDIVISION
CHATHAM RANCH
SHASTA COUNTY, CALIFORNIA

PLATE **2A**



LEGEND

APPROXIMATE TEST PIT LOCATION

NOTE: Test pits were located in the field by visual methods. Therefore, the locations of the test pits shown on this plan should be considered highly approximate.

REFERENCE: Plan prepared by Lehmann & Associates titled: "TENTATIVE SUBDIVISION MAP," Sheet No. T2 of 1, dated Septmeber 2006.

BMI PROJECT NO. ▶ 06S-412

SITE PLAN
PROPOSED RESIDENTIAL SUBDIVISION
CHATHAM RANCH
SHASTA COUNTY, CALIFORNIA

PLATE

2B

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			SYM.	DESCRIPTION
COARSE-GRAINED SOILS MORE THAN 50% OF MATERIAL IS GREATER THAN NO. 200 SIEVE	**GRAVELS** MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	**GRAVELS** (LITTLE OR NO FINES)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
			GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
		GRAVELS (APPRECIABLE FINES)	GM	Silty gravels, poorly-graded gravel-sand-silt mixtures
			GC	Clayey gravels, poorly-graded gravel-sand-clay mixtures
	SANDS MORE THAN 50% OF COARSE FRACTION PASSES NO. 4 SIEVE	**SANDS** (LITTLE OR NO FINES)	SW	Well-graded sands, gravelly sands, little or no fines
			SP	Poorly-graded sands, gravelly sands, little or no fines
		SANDS (APPRECIABLE FINES)	SM	Silty sands, poorly-graded sand-gravel-silt mixtures
			SC	Clayey sands, poorly-graded sand-gravel-clay mixtures
FINE-GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE	**SILTS AND CLAYS** LIQUID LIMIT LESS THAN 50		ML	Inorganic silts and very fine sands, silty or clayey fine sands, clayey silts with slight plasticity
			CL	Inorganic clays of low-to-medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	Organic silts and clays of low plasticity
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic silts and clays of high plasticity
HIGHLY ORGANIC SOILS			PT	Peat, humus, swamp soils with high organic content

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

LOG SYMBOLS AND DEFINITIONS

FIELD

STANDARD PENETRATION SPLIT-SPOON SAMPLER (2-INCH OUTSIDE DIAMETER)

CALIFORNIA SAMPLER (3-INCH OUTSIDE DIAMETER)

MODIFIED CALIFORNIA SAMPLER (2.5-INCH OUTSIDE DIAMETER)

BAG/BULK

THIN-WALLED SHELBY TUBE (3-INCH OUTSIDE DIAMETER)

WATER LEVEL (LEVEL ESTABLISHED AS NOTED ON LOGS)

WATER OR SEEPAGE ENCOUNTERED (LEVEL NOT ESTABLISHED)

LABORATORY

-4	% PASSING NO. 4 SIEVE (ASTM TEST METHOD C 136)
-200	% PASSING NO. 200 SIEVE (ASTM TEST METHOD C 117)
LL	LIQUID LIMIT (ASTM TEST METHOD D 4318)
PI	PLASTICITY INDEX (ASTM TEST METHOD D 4318)
R-VAL	RESISTANCE VALUE (CALTRANS TEST 301)
EI	EXPANSION INDEX (UBC STANDARD 29-2)
COL	COLLAPSE POTENTIAL (ASTM TEST METHOD D 5333)
SP	SWELL POTENTIAL (under a specified load) (ASTM TEST METHOD D 4546)
SL	SWELL PRESSURE (no consolidation) (ASTM TEST METHOD D 4546)

GENERAL NOTES:

1. Lines separating soil or rock strata on logs are approximate boundaries only. Actual transitions may be gradual and, in the case of selectively sampled borings, may vary by as much as the sample interval.
2. In general, Unified Soil Classification designations were evaluated using visual methods only. Actual designations (based on laboratory tests) may vary.
3. Logs represent general soil conditions on the date and at the location indicated. No warranty is provided as to the continuity of soil conditions between individual sample locations.
4. Unconfined compressive strengths reported on the logs (if any) were obtained using a pocket penetrometer.

BMI PROJECT NO. ▶ 06S-412

LOG LEGEND
PROPOSED RESIDENTIAL SUBDIVISION
CHATHAM RANCH
SHASTA COUNTY, CALIFORNIA

PLATE 3

FRACTURING	
LOG TERM	DEFINITION
Very Widely	>6 feet
Widely	2 to 6 feet
Moderately	8 to 24 inches
Closely	2-1/2 to 8 inches
Very Closely	3/4 to 2-1/2 inches

ROCK QUALITY DESIGNATION (RQD)	
RQD (%)	ROCK QUALITY
90 - 100	Excellent
75 - 90	Good
50 - 75	Fair
25 - 50	Poor
0 - 25	Very Poor

WEATHERING	
LOG TERM	DESCRIPTION / DEFINITION
Fresh	No visible sign of decomposition or discoloration. Rings under hammer impact.
Slightly Weathered	Slight discoloration inwards from open fractures; otherwise similar to fresh.
Moderately Weathered	Discoloration throughout. Strength less than fresh rock; specimens cannot be broken by hand or scraped with knife.
Highly Weathered	Specimens can be broken by hand with effort and shaved with knife. Texture becoming indistinct but fabric preserved.
Completely Weathered	Minerals decomposed to soil but fabric and structure preserved. Specimens easily crumbled or penetrated.

COMPETENCY			
CLASS	LOG TERM	DESCRIPTION / DEFINITION	APPROXIMATE RANGE OF UNCONFINED COMPRESSIVE STRENGTHS (tsf)
I	Extremely Strong	Many blows with geologic hammer required to break intact specimens.	>2000
II	Very Strong	Hand-held specimens break with pick-end of hammer under more than one blow.	1000 - 2000
III	Strong	Hand-held specimens can be broken with single, moderate blow with pick-end of hammer.	500 - 1000
IV	Moderately Strong	Specimens can be scraped with knife; light blow with pick-end of hammer causes indentations.	250 - 500
V	Weak	Specimens crumble under moderate blow with pick-end of hammer.	10 - 250
VI	Friable	Specimens crumble in hand.	N/A

BMI PROJECT NO. ▶ 06S-412

ROCK CLASSIFICATION LEGEND
PROPOSED RESIDENTIAL SUBDIVISION
CHATHAM RANCH
SHASTA COUNTY, CALIFORNIA

PLATE **4**

EXPLORATION DATE	LOGGED BY	TOTAL DEPTH	TEST PIT NO.
October 13, 2006	Mark Mills	10 feet	**TP-1**
EXPLORATION EQUIPMENT		BACKFILL MATERIAL	
JCB 214 backhoe equipped with an 18-inch-wide bucket		Excavated soil	

SURFACE CONDITIONS: Gently sloping; grasses

GROUNDWATER CONDITIONS: No free groundwater encountered

APPROX. GROUND SURFACE ELEVATION (IN FEET): N/A

DEPTH (IN FEET)	SAMPLE TYPE	SAMPLE NO.	BLOWS/FOOT	UNCONFINED COMP. STRENGTH (TSF)	USCS LETTER SYMBOL	DESCRIPTION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	OTHER LAB TESTS SEE LOG LEGEND FOR ABBREVIATION DEFINITIONS
0–3	X	1			SC	***Clayey SAND:*** Light brown, dry, medium dense, fine-to-coarse grained, with some silt and fine gravel			
3–5	X	2			GM	***Silty GRAVEL:*** Light brown, dry, medium dense, fine-to-coarse grained, with some clay, fine-to-coarse sand, and cobbles to 4 inches in maximum dimension			
5–10	X	3				***SEDIMENTARY ROCK:*** Consisting predominantly of a pebbly conglomerate, olive-brown, gray and orange-brown, highly weathered, little-to-no visible fracturing, friable-to-weak			
~8						grades highly weathered, weak			
~9.5						grades highly-to-moderately weathered, weak-to-moderately strong			
10						*Test pit terminated at a depth of approximately 10 feet below existing site grade due to essential refusal on rock.*			

LOG OF EXPLORATORY TEST PIT
PROPOSED RESIDENTIAL SUBDIVISION
CHATHAM RANCH
SHASTA COUNTY, CALIFORNIA

BMI PROJECT NO. 06S-412

PLATE 5

EXPLORATION DATE	LOGGED BY	TOTAL DEPTH	TEST PIT NO.
October 13, 2006	Mark Mills	6-1/2 feet	**TP-2**
EXPLORATION EQUIPMENT		BACKFILL MATERIAL	
JCB 214 backhoe equipped with an 18-inch-wide bucket		Excavated soil	

SURFACE CONDITIONS: Gently sloping; grasses

GROUNDWATER CONDITIONS: No free groundwater encountered

APPROX. GROUND SURFACE ELEVATION (IN FEET): N/A

DEPTH (IN FEET)	SAMPLE TYPE	SAMPLE NO.	BLOWS/FOOT	UNCONFINED COMP. STRENGTH (TSF)	USCS LETTER SYMBOL	DESCRIPTION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	OTHER LAB TESTS SEE LOG LEGEND FOR ABBREVIATION DEFINITIONS
0–1	X	1			SC	***Clayey SAND:*** Light brown, dry, medium dense, fine-to-coarse grained, with some silt and fine gravel			
1–3	X	2			GM	***Silty GRAVEL:*** Light brown, dry, medium dense, fine-to-coarse grained, with some clay, fine-to-coarse sand, and cobbles to 4 inches in maximum dimension			
3–6-1/2	X	3				***SEDIMENTARY ROCK:*** Consisting predominantly of sandstone/siltstone, light olive-gray with some red-brown mottling, highly weathered, little-to-no visible fracturing, weak grades moderately weathered, moderately strong			
						Test pit terminated at a depth of approximately 6-1/2 feet below existing site grade due to essential refusal on rock.			

BMI

BMI PROJECT NO. 06S-412

LOG OF EXPLORATORY TEST PIT
PROPOSED RESIDENTIAL SUBDIVISION
CHATHAM RANCH
SHASTA COUNTY, CALIFORNIA

PLATE 6

EXPLORATION DATE	LOGGED BY	TOTAL DEPTH	TEST PIT NO.
October 13, 2006	Mark Mills	2-1/2 feet	**TP-3**

EXPLORATION EQUIPMENT	BACKFILL MATERIAL
JCB 214 backhoe equipped with an 18-inch-wide bucket	Excavated soil

FIELD						DESCRIPTION	LABORATORY			
DEPTH (IN FEET)	SAMPLE TYPE	SAMPLE NO.	BLOWS/FOOT	UNCONFINED COMP. STRENGTH (TSF)	USCS LETTER SYMBOL	SURFACE CONDITIONS: Relatively level; grasses GROUNDWATER CONDITIONS: No free groundwater encountered APPROX. GROUND SURFACE ELEVATION (IN FEET) ▶ N/A	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	OTHER LAB TESTS	SEE LOG LEGEND FOR ABBREVIATION DEFINITIONS
0–2	⊠	1			GM	***Silty GRAVEL:*** Light brown, dry, medium dense, fine-to-coarse grained, with some clay, fine-to-coarse sand, and cobbles to 6 inches in maximum dimension				
2–2-1/2	⊠	2				***SEDIMENTARY ROCK:*** Consisting predominantly of sandstone/siltstone, light olive-gray with some red-brown mottling, moderately weathered, little-to-no visible fracturing, moderately strong				
						Test pit terminated at a depth of approximately 2-1/2 feet below existing site grade due to essential refusal on rock.				

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

LOG OF EXPLORATORY TEST PIT
PROPOSED RESIDENTIAL SUBDIVISION
CHATHAM RANCH
SHASTA COUNTY, CALIFORNIA

BMI PROJECT NO. ▶ 06S-412

PLATE 7

EXPLORATION DATE	LOGGED BY	TOTAL DEPTH	TEST PIT NO.
October 13, 2006	Mark Mills	7 feet	**TP-4**
EXPLORATION EQUIPMENT		BACKFILL MATERIAL	
JCB 214 backhoe equipped with an 18-inch-wide bucket		Excavated soil	

FIELD						DESCRIPTION	LABORATORY		
DEPTH (IN FEET)	SAMPLE TYPE	SAMPLE NO.	BLOWS/FOOT	UNCONFINED COMP. STRENGTH (TSF)	USCS LETTER SYMBOL	SURFACE CONDITIONS: Gently sloping; grasses GROUNDWATER CONDITIONS: No free groundwater encountered APPROX. GROUND SURFACE ELEVATION (IN FEET) ▶ N/A	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	OTHER LAB TESTS SEE LOG LEGEND FOR ABBREVIATION DEFINITIONS
0–1					SC	***Clayey SAND:*** Light brown, dry, medium dense, fine-to-coarse grained, with some silt and fine gravel			
1–2	☒	1				***SEDIMENTARY ROCK:*** Consisting predominantly of a pebbly conglomerate, red-brown, highly weathered, little-to-no visible fracturing, friable-to-weak			
5						grades highly weathered, weak			
7						grades highly-to-moderately weathered, weak-to-moderately strong			
7						*Test pit terminated at a depth of approximately 7 feet below existing site grade due to essential refusal on rock.*			

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

BMI

BMI PROJECT NO. ▶ 06S-412

LOG OF EXPLORATORY TEST PIT
PROPOSED RESIDENTIAL SUBDIVISION
CHATHAM RANCH
SHASTA COUNTY, CALIFORNIA

PLATE **8**

EXPLORATION DATE	LOGGED BY	TOTAL DEPTH	TEST PIT NO.
October 13, 2006	Mark Mills	10 feet	**TP-5**
EXPLORATION EQUIPMENT: JCB 214 backhoe equipped with an 18-inch-wide bucket		BACKFILL MATERIAL: Excavated soil	

SURFACE CONDITIONS: Relatively level; grasses

GROUNDWATER CONDITIONS: No free groundwater encountered

APPROX. GROUND SURFACE ELEVATION (IN FEET): N/A

DEPTH (IN FEET)	SAMPLE TYPE	SAMPLE NO.	BLOWS/FOOT	UNCONFINED COMP. STRENGTH (TSF)	USCS LETTER SYMBOL	DESCRIPTION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	OTHER LAB TESTS SEE LOG LEGEND FOR ABBREVIATION DEFINITIONS
0–2					SC	***Clayey SAND:*** Light brown, dry, medium dense, fine-to-coarse grained, with some silt and fine gravel			
2–4					GM	***Silty GRAVEL:*** Light brown, dry, medium dense, fine-to-coarse grained, with some clay, fine-to-coarse sand, and cobbles to 4 inches in maximum dimension			
4–10						***SEDIMENTARY ROCK:*** Consisting predominantly of a pebbly conglomerate, olive-brown, gray and orange-brown, highly weathered, little-to-no visible fracturing, friable-to-weak			
~7						grades highly weathered, weak			

BMI

BMI PROJECT NO. 06S-412

LOG OF EXPLORATORY TEST PIT
PROPOSED RESIDENTIAL SUBDIVISION
CHATHAM RANCH
SHASTA COUNTY, CALIFORNIA

PLATE 9

EXPLORATION DATE	LOGGED BY	TOTAL DEPTH	TEST PIT NO.
October 13, 2006	Mark Mills	5-1/2 feet	**TP-6**
EXPLORATION EQUIPMENT		BACKFILL MATERIAL	
JCB 214 backhoe equipped with an 18-inch-wide bucket		Excavated soil	

FIELD / **DESCRIPTION** / **LABORATORY**

SURFACE CONDITIONS: Relatively level; grasses

GROUNDWATER CONDITIONS: No free groundwater encountered

APPROX. GROUND SURFACE ELEVATION (IN FEET): N/A

DEPTH (IN FEET)	SAMPLE TYPE	SAMPLE NO.	BLOWS/FOOT	UNCONFINED COMP. STRENGTH (TSF)	USCS LETTER SYMBOL	DESCRIPTION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	OTHER LAB TESTS SEE LOG LEGEND FOR ABBREVIATION DEFINITIONS
0–1					SC	***Clayey SAND:*** Light brown, dry, medium dense, fine-to-coarse grained, with some silt and fine gravel			
1–3	Bulk (at ~2–2.5)	1			SC	***Clayey SAND:*** Brown-red, moist, medium dense, weakly-to-moderately cemented, fine-to-medium grained, with some silt			
3–5.5						***SEDIMENTARY ROCK:*** Consisting predominantly of sandstone/siltstone, light olive-gray with some red-brown mottling, highly weathered, little-to-no visible fracturing, weak grades moderately weathered, moderately strong			
5.5–10						*Test pit terminated at a depth of approximately 5-1/2 feet below existing site grade due to essential refusal on rock.*			

LOG OF EXPLORATORY TEST PIT
PROPOSED RESIDENTIAL SUBDIVISION
CHATHAM RANCH
SHASTA COUNTY, CALIFORNIA

BMI PROJECT NO. ▶ 06S-412

PLATE **10**

EXPLORATION DATE	LOGGED BY	TOTAL DEPTH	TEST PIT NO.
October 13, 2006	Mark Mills	7-1/2 feet	**TP-7**
EXPLORATION EQUIPMENT		BACKFILL MATERIAL	
JCB 214 backhoe equipped with an 18-inch-wide bucket		Excavated soil	

FIELD | **DESCRIPTION** | **LABORATORY**

SURFACE CONDITIONS: Relatively level; grasses

GROUNDWATER CONDITIONS: No free groundwater encountered

APPROX. GROUND SURFACE ELEVATION (IN FEET) ▶ N/A

DEPTH (IN FEET)	SAMPLE TYPE	SAMPLE NO.	BLOWS/FOOT	UNCONFINED COMP. STRENGTH (TSF)	USCS LETTER SYMBOL	DESCRIPTION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	OTHER LAB TESTS SEE LOG LEGEND FOR ABBREVIATION DEFINITIONS
0–1					SC	***Clayey SAND:*** Light brown, dry, medium dense, fine-to-coarse grained, with some silt and fine gravel			
1.5–5					SC	***Clayey SAND:*** Brown-red, moist, medium dense, weakly-to-moderately cemented, fine-to-medium grained, with some silt			
5–7.5						***SEDIMENTARY ROCK:*** Consisting predominantly of a pebbly conglomerate, red-brown and olive-brown, highly weathered, little-to-no visible fracturing, weak grades highly-to-moderately weathered, weak-to-moderately strong			
7.5						*Test pit terminated at a depth of approximately 7-1/2 feet below existing site grade due to essential refusal on rock.*			

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

BMI

BMI PROJECT NO. ▶ 06S-412

LOG OF EXPLORATORY TEST PIT
PROPOSED RESIDENTIAL SUBDIVISION
CHATHAM RANCH
SHASTA COUNTY, CALIFORNIA

PLATE 11

EXPLORATION DATE	LOGGED BY	TOTAL DEPTH	TEST PIT NO.
October 13, 2006	Mark Mills	9 feet	**TP-8**
EXPLORATION EQUIPMENT		BACKFILL MATERIAL	
JCB 214 backhoe equipped with an 18-inch-wide bucket		Excavated soil	

FIELD						DESCRIPTION	LABORATORY		
DEPTH (IN FEET)	SAMPLE TYPE	SAMPLE NO.	BLOWS/FOOT	UNCONFINED COMP. STRENGTH (TSF)	USCS LETTER SYMBOL	SURFACE CONDITIONS: Relatively level; grasses GROUNDWATER CONDITIONS: No free groundwater encountered APPROX. GROUND SURFACE ELEVATION (IN FEET): N/A	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	OTHER LAB TESTS SEE LOG LEGEND FOR ABBREVIATION DEFINITIONS
0					GM	***Silty GRAVEL:*** Light brown, dry, medium dense, fine-to-coarse grained, with some clay, fine-to-coarse sand, and cobbles to 6 inches in maximum dimension			
1									
2									
3						grades with more gravel and cobbles			
4									
5						***SEDIMENTARY ROCK:*** Consisting predominantly of sandstone/siltstone, light olive-gray with some red-brown mottling, highly weathered, little-to-no visible fracturing, weak			
6									
7						grades weak-to-moderately strong			
8									
9									
10									

BMI

BMI PROJECT NO. ▶ 06S-412

LOG OF EXPLORATORY TEST PIT
PROPOSED RESIDENTIAL SUBDIVISION
CHATHAM RANCH
SHASTA COUNTY, CALIFORNIA

EXPLORATION DATE	LOGGED BY	TOTAL DEPTH	TEST PIT NO.
October 13, 2006	Mark Mills	8 feet	**TP-9**

EXPLORATION EQUIPMENT	BACKFILL MATERIAL
JCB 214 backhoe equipped with an 18-inch-wide bucket	Excavated soil

FIELD | **DESCRIPTION** | **LABORATORY**

SURFACE CONDITIONS: Relatively level; grasses

GROUNDWATER CONDITIONS: No free groundwater encountered

APPROX. GROUND SURFACE ELEVATION (IN FEET) ▶ N/A

DEPTH (IN FEET)	SAMPLE TYPE	SAMPLE NO.	BLOWS/FOOT	UNCONFINED COMP. STRENGTH (TSF)	USCS LETTER SYMBOL	DESCRIPTION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	OTHER LAB TESTS SEE LOG LEGEND FOR ABBREVIATION DEFINITIONS
0–1					SC	***Clayey SAND:*** Light brown, dry, medium dense, fine-to-coarse grained, with some silt and fine gravel			
1–5					SC	***Clayey SAND:*** Brown-red, moist, medium dense, weakly-to-moderately cemented, fine-to-medium grained, with some silt grades with some fine gravel			
5–8						***SEDIMENTARY ROCK:*** Consisting predominantly of sandstone/siltstone, light olive-gray with some red-brown mottling, highly weathered, little-to-no visible fracturing, weak grades moderately weathered, moderately strong			
8						*Test pit terminated at a depth of approximately 8 feet below existing site grade due to essential refusal on rock.*			

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

BMI

BMI PROJECT NO. ▶ 06S-412

LOG OF EXPLORATORY TEST PIT
PROPOSED RESIDENTIAL SUBDIVISION
CHATHAM RANCH
SHASTA COUNTY, CALIFORNIA

PLATE 13

EXPLORATION DATE	LOGGED BY	TOTAL DEPTH	TEST PIT NO.
October 13, 2006	Mark Mills	10 feet	**TP-10**
EXPLORATION EQUIPMENT		BACKFILL MATERIAL	
JCB 214 backhoe equipped with an 18-inch-wide bucket		Excavated soil	

FIELD — Depth (in feet) / Sample Type / Sample No. / Blows/Foot / Unconfined Comp. Strength (TSF) / USCS Letter Symbol

DESCRIPTION

SURFACE CONDITIONS: Relatively level; grasses

GROUNDWATER CONDITIONS: No free groundwater encountered

APPROX. GROUND SURFACE ELEVATION (IN FEET): N/A

LABORATORY — Dry Density (PCF) / Moisture Content (%) / Other Lab Tests / See Log Legend for Abbreviation Definitions

Depth (in feet)	Sample Type	Sample No.	Blows/Foot	Unconfined Comp. Strength (TSF)	USCS Letter Symbol	Description	Dry Density (PCF)	Moisture Content (%)	Other Lab Tests
0					SC	***Clayey SAND:*** Light brown, dry, medium dense, fine-to-coarse grained, with some silt and fine gravel			
1									
2						grades with more gravel			
3									
4									
5						***SEDIMENTARY ROCK:*** Consisting predominantly of sandstone/siltstone, light olive-gray with some red-brown mottling, highly weathered, little-to-no visible fracturing, weak			
6									
7									
8						grades highly-to-moderately weathered, weak-to-moderately strong			
9						grades moderately weathered, moderately strong			
10						*Test pit terminated at a depth of approximately 10 feet below existing site grade due to essential refusal on rock.*			

BMI PROJECT NO. 06S-412

LOG OF EXPLORATORY TEST PIT
PROPOSED RESIDENTIAL SUBDIVISION
CHATHAM RANCH
SHASTA COUNTY, CALIFORNIA

PLATE **14**

EXPLORATION DATE	LOGGED BY	TOTAL DEPTH	TEST PIT NO.
October 13, 2006	Mark Mills	8 feet	**TP-11**
EXPLORATION EQUIPMENT		BACKFILL MATERIAL	
JCB 214 backhoe equipped with an 18-inch-wide bucket		Excavated soil	

SURFACE CONDITIONS: Relatively level; grasses

GROUNDWATER CONDITIONS: No free groundwater encountered

APPROX. GROUND SURFACE ELEVATION (IN FEET): N/A

FIELD						DESCRIPTION	LABORATORY		
DEPTH (IN FEET)	SAMPLE TYPE	SAMPLE NO.	BLOWS/FOOT	UNCONFINED COMP. STRENGTH (TSF)	USCS LETTER SYMBOL		DRY DENSITY (PCF)	MOISTURE CONTENT (%)	OTHER LAB TESTS SEE LOG LEGEND FOR ABBREVIATION DEFINITIONS
0–1					SC	***Clayey SAND:*** Light brown, dry, medium dense, fine-to-coarse grained, with some silt and fine gravel			
1–4					GM	***Silty GRAVEL:*** Light brown, dry, medium dense, fine-to-coarse grained, with some clay, fine-to-coarse sand, and cobbles to 4 inches in maximum dimension			
4–8						***SEDIMENTARY ROCK:*** Consisting predominantly of sandstone/siltstone, light olive-gray with some red-brown mottling, highly weathered, little-to-no visible fracturing, weak			
~7						grades highly-to-moderately weathered, weak-to-moderately strong			

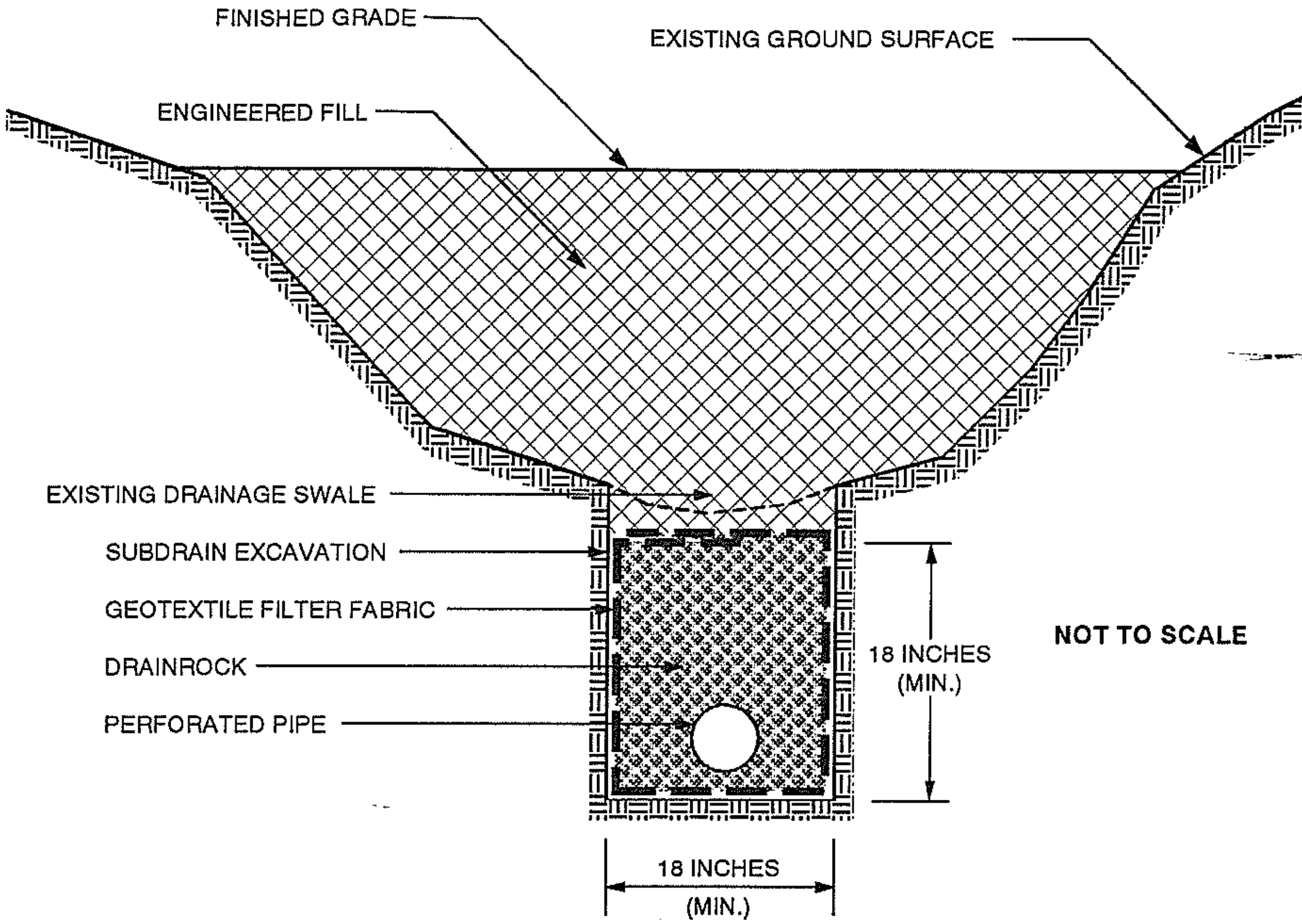
Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

BMI

BMI PROJECT NO. ▶ 06S-412

LOG OF EXPLORATORY TEST PIT
PROPOSED RESIDENTIAL SUBDIVISION
CHATHAM RANCH
SHASTA COUNTY, CALIFORNIA

PLATE 15



NOTES:

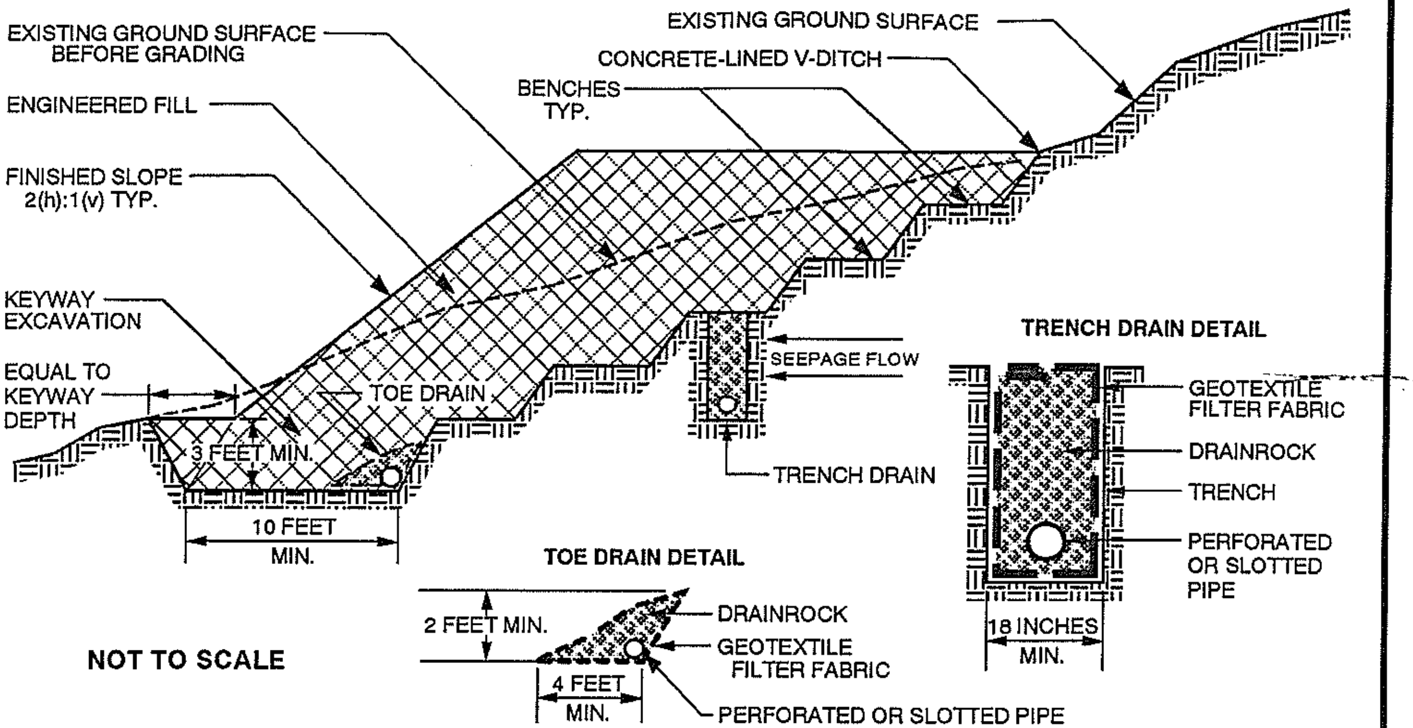
1. Subdrain excavations should remove all loose, soft, and/or disturbed soil or rock as well as any organic material, vegetation, deleterious matter, sharp rocks, or other protuberances which could puncture or otherwise damage the geotextile fabric.
2. Subdrain dimensions indicated above are minimums. Actual dimensions may vary depending on conditions encountered in the field during construction. The project Geotechnical Engineer should review all subdrain excavations to verify subgrade conditions and dimensions.
3. Geotextile filter fabric should consist of Mirafi 140 NC, AMOCO 4546, or other equivalent fabric approved by the project Geotechnical Engineer.
4. Geotextile filter fabric should be stored, handled, and installed in accordance with the manufacturer's recommendations.
5. Perforated pipe should be at least 4 inches in diameter (for drains less than 200 feet in length), or 6 inches in diameter for drains in excess of 200 feet in length. In general, drains should not exceed 500 feet in length.
6. Pipe should consist of plastic or other corrosion resistant material. Specific pipe types and material specifications should be determined by the project Architect or Civil Engineer.
7. All pipe should be joined using methods recommended by the manufacturer for a water tight connection.
8. The bottom of all perforated pipes should be placed within 1 to 3 inches of the trench bottom. All perforated pipes should be centered (horizontally) within the trench, with perforations placed down (if applicable).
9. Drainrock should consist of poorly-graded, durable stone, sized such that 100 percent passes the 1-inch sieve and less than 5 percent passes the No. 4 sieve.
10. Perforated pipe and any solid conduit collector pipes should be sloped a minimum of two percent (2%) to drain.
11. Depending on project-related factors beyond the scope of this study, it may be advisable to install drain line cleanouts at regular intervals. The design and location of cleanouts should be determined by the project Architect or Civil Engineer. All cleanouts should be secured to prevent vandalism or tampering.
12. Water collected by the perforated pipe should be directed by solid conduit (of similar type to perforated) to a sump, ditch, storm drain, or other suitable area for disposal.

BMI PROJECT NO. ▶ 06S-412

TYPICAL SUBDRAIN DETAIL
PROPOSED RESIDENTIAL SUBDIVISION
CHATHAM RANCH
SHASTA COUNTY, CALIFORNIA

PLATE

16



NOTES:

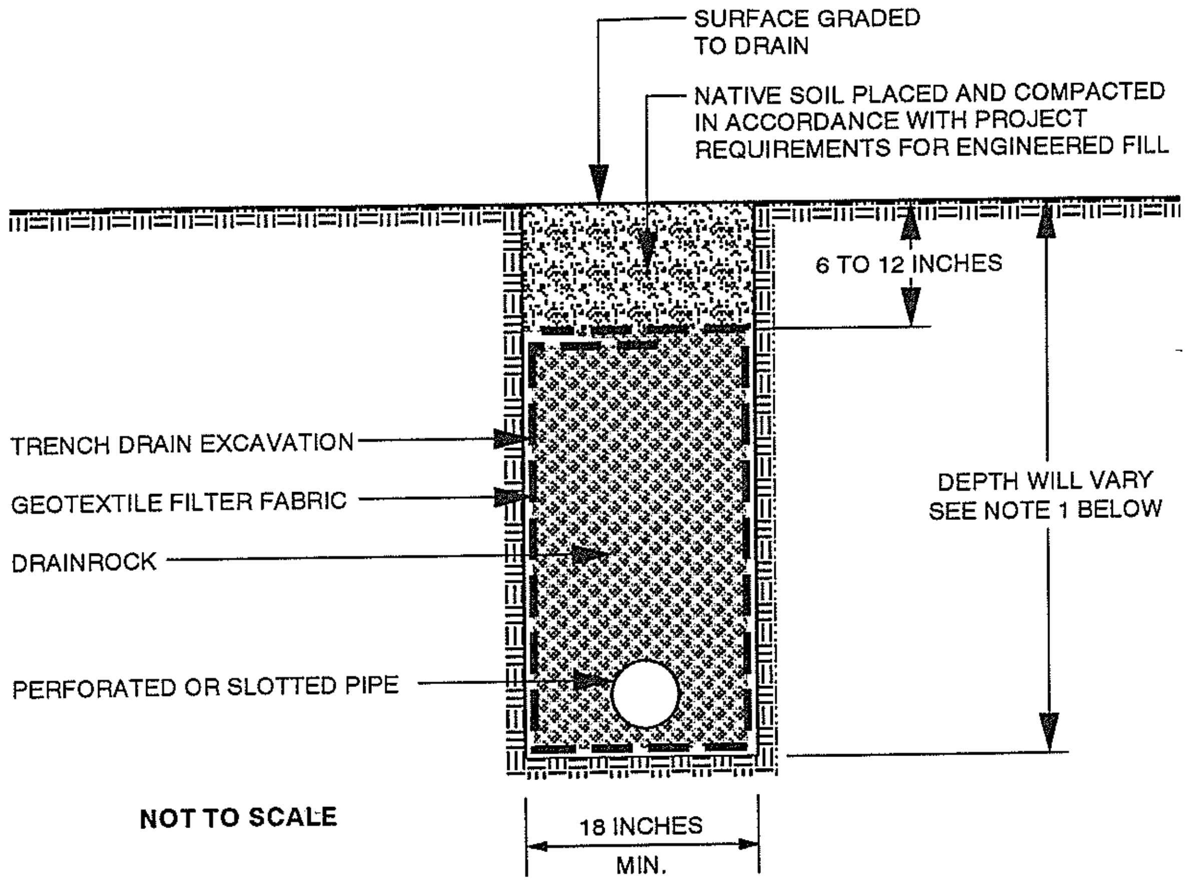
1. Excavations for benches and keyway should remove all loose, soft, and/or disturbed soil or rock, as well as any organic material or vegetation.
2. Keyway depth indicated above is a minimum. Actual depth may vary depending on field conditions. Keyway depth may be reduced to less than 3 feet if hard rock is encountered.
3. In general, cut slopes between benches should be no steeper than 3/4(h):1(v) or flatter depending on the materials encountered and should meet all federal and state OSHA requirements. The maximum vertical offset between adjacent benches should be less than 5 feet. All benches should extend at least 2 feet (horizontally) into the slope.
4. The bottom of the keyway should be sloped downward at least 2 percent and towards the toe drain indicated above.
5. A toe drain should be placed at the bottom of the keyway at the location indicated above. This drain should extend the entire length of the keyway and be constructed in accordance with the detail above and requirements provided below.
6. If water, fractured rock, pervious soils, or other subsurface conditions are exposed during grading which would indicate the potential for future water seepage into the fill, trench drains should be installed at these locations in accordance with the detail above and requirements provided below.

- Drain trench depth(s) will vary depending on the subsurface conditions encountered during construction. As a minimum, trench depth(s) should be at least as great as the height of the adjoining, downslope cut; actual depth(s) should be determined in the field by the project Geotechnical Engineer. The trench wall should be free of obstructions, sharp rocks, or other protuberances which could puncture or otherwise damage the geotextile filter fabric.
- Geotextile filter fabric should consist of Mirafi 140 NC, AMOCO 4546, or other equivalent fabric approved by the project Geotechnical Engineer.
- Geotextile filter fabric should be stored, handled, and installed in accordance with the manufacturer's recommendations.
- Perforated or slotted pipe should be at least 4 inches in diameter (for drains less than 200 feet in length), or 6 inches in diameter for drains in excess of 200 feet in length. Pipe should consist of perforated or slotted, high strength plastic (or other similar material) capable of sustaining overburden pressures (as well as any induced loading due surface loads, nearby foundations, etc.) without noticeable deformations. Pipe type, connections details, and installation methods should be determined and specified by the project Engineer or Architect.
- The bottom of all perforated or slotted pipes should be placed within 1 to 3 inches of the trench or excavation bottom. Perforated or slotted pipes placed within a trench excavation should be centered (horizontally) within the excavation, with perforations or slots placed down or to the side. Pipe perforations or slots should be no more than 1/4-inch in diameter or width.
- Water collected by the perforated or slotted pipes should be directed by solid conduit (of similar type to perforated or slotted) to a sump, ditch, storm drain, or other suitable location for disposal.
- Drainrock should consist of poorly-graded, durable stone, sized such that 100 percent passes the 1-inch sieve and less than 5 percent passes the No. 4 sieve.
- Perforated pipe and any solid conduit collector pipes should be sloped a minimum of two percent (2%) to drain.
- Depending on project-related factors beyond the scope of this study, it may be advisable to install drain line cleanouts at regular intervals. The design and location of cleanouts should be determined by the project Engineer or Architect. All cleanouts should be secured to prevent vandalism or tampering.

BMI PROJECT NO. ▶ 06S-412

TYPICAL KEY AND BENCH DETAIL
PROPOSED RESIDENTIAL SUBDIVISION
CHATHAM RANCH
SHASTA COUNTY, CALIFORNIA

PLATE **17**



NOT TO SCALE

NOTES:

1. EXCAVATIONS FOR PROPOSED TRENCH DRAINS SHOULD EXTEND AT LEAST 6 INCHES INTO DENSE, CEMENTED SOIL OR ROCK. THE PROJECT GEOTECHNICAL ENGINEER SHOULD VERIFY TRENCH DEPTHS AND BOTTOM CONDITIONS AT THE TIME OF CONSTRUCTION.
2. EXCAVATIONS FOR ALL TRENCH DRAINS SHOULD BE FREE OF ROOTS, ANGULAR ROCKS, OR OTHER SHARP OBJECTS WHICH COULD PUNCTURE THE GEOTEXTILE FILTER FABRIC.
3. GEOTEXTILE FILTER FABRIC SHOULD CONSIST OF MIRAFI 140 NS, AMACO 4546, OR OTHER EQUIVALENT FABRIC APPROVED BY THE PROJECT GEOTECHNICAL ENGINEER.
4. GEOTEXTILE FILTER FABRIC SHOULD BE STORED, HANDLED, AND INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
5. PERFORATED OR SLOTTED PIPE SHOULD BE AT LEAST 4 INCHES IN DIAMETER (FOR DRAINS LESS THAN 200 FEET IN LENGTH) OR 6 INCHES IN DIAMETER (FOR DRAINS IN EXCESS OF 200 FEET IN LENGTH). PIPE SHOULD CONSIST OF PERFORATED OR SLOTTED, HIGH STRENGTH PLASTIC (OR OTHER SIMILAR MATERIAL) CAPABLE OF SUSTAINING OVERBURDEN LOADS (AS WELL AS INDUCED LOADING DUE SURFACE LOADS, NEARBY FOUNDATIONS, ETC.) WITHOUT NOTICEABLE DEFORMATIONS. PIPE TYPE, PRELIMINARY FLOWLINE ELEVATIONS, CONNECTION DETAILS, AND INSTALLATION METHODS SHOULD BE DETERMINED AND SPECIFIED BY THE PROJECT ENGINEER OR ARCHITECT.
6. PIPE PERFORATIONS OR SLOTS SHOULD BE NO MORE THAN 1/4-INCH IN MAXIMUM DIAMETER OR WIDTH.
7. THE BOTTOM OF THE PERFORATED OR SLOTTED PIPE SHOULD BE PLACED WITHIN 1 TO 3 INCHES OF THE TRENCH BOTTOM. THE PIPE SHOULD BE CENTERED (HORIZONTALLY) WITHIN THE TRENCH EXCAVATION, WITH PERFORATIONS OR SLOTS ORIENTATED DOWN OR TO THE SIDE.
8. DRAINROCK SHOULD CONSIST OF POORLY-GRADED, DURABLE STONE, SIZED SUCH THAT 100 PERCENT PASSES THE 1-INCH SIEVE AND LESS THAN 5 PERCENT PASSES THE NO. 4 SIEVE.
9. WATER COLLECTED BY THE PERFORATED OR SLOTTED PIPE SHOULD BE DIRECTED BY SOLID CONDUIT (OF SIMILAR TYPE TO PERFORATED OR SLOTTED) TO A SUMP, DITCH, STORM DRAIN, OR OTHER SUITABLE LOCATION FOR DISPOSAL.
10. PERFORATED OR SLOTTED PIPE AND ANY SOLID CONDUIT COLLECTOR PIPES SHOULD BE SLOPED A MINIMUM OF TWO PERCENT (2%) TO DRAIN.

BMI BMI PROJECT NO. ▶ 06S-412	**TYPICAL TRENCH DRAIN DETAIL** **PROPOSED RESIDENTIAL SUBDIVISION** **CHATHAM RANCH** **SHASTA COUNTY, CALIFORNIA**	PLATE **18**