COUNTY OF SAN DIEGO

GUIDELINES FOR DETERMINING SIGNIFICANCE

UNIQUE GEOLOGY

LAND USE AND ENVIRONMENT GROUP

Department of Planning and Land Use
Department of Public Works

July 30, 2007

APPROVAL

I hereby certify that these **Guidelines for Determining Significance for Unique Geology** are a part of the County of San Diego, Land Use and Environment Group's Guidelines for Determining Significance and were considered by the Director of Planning and Land Use, in coordination with the Director of Public Works on the 30th day of July, 2007.

ERIC GIBSON
Interim Director of Planning and Land Use

JOHN SNYDER
Director of Public Works

I hereby certify that these **Guidelines for Determining Significance for Unique Geology** are a part of the County of San Diego, Land Use and Environment Group's Guidelines for Determining Significance and have hereby been approved by the Deputy Chief Administrative Officer (DCAO) of the Land Use and Environment Group on the 30th day of July, 2007. The Director of Planning and Land Use is authorized to approve revisions to these Guidelines for Determining Significance for Unique Geology except any revisions to the Guidelines for Determining Significance presented in Section 4.0 must be approved by the DCAO.

Approved, July 30, 2007

CHANDRA WALLAR
Deputy CAO

EXPLANATION

These Guidelines for Determining Significance for Unique Geology and information presented herein shall be used by County staff for the review of discretionary projects and environmental documents pursuant to the California Environmental Quality Act (CEQA). These Guidelines present a range of quantitative, qualitative, and performance levels for particular environmental effects. Normally (in the absence of substantial evidence to the contrary), non-compliance with a particular standard stated in these Guidelines will mean the project will result in a significant effect, whereas compliance will normally mean the effect will be determined to be "less than significant." Section 15064(b) of the State CEQA Guidelines states:

> "The determination whether a project may have a significant effect on the environment calls for careful judgment on the part of the public agency involved, based to the extent possible on factual and scientific data. An ironclad definition of significant effect is not always possible because the significance of an activity may vary with the setting."

The intent of these Guidelines is to provide a consistent, objective and predictable evaluation of significant effects. These Guidelines are not binding on any decision-maker and do not substitute for the use of independent judgment to determine significance or the evaluation of evidence in the record. The County reserves the right to modify these Guidelines in the event of scientific discovery or alterations in factual data that may alter the common application of a Guideline.

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List of Acronyms

CEQA	California Environmental Quality Act
NEPA	National Environmental Policy Act
NRI	Natural Resources Inventory of San Diego County

INTRODUCTION

This document provides guidance for evaluating adverse environmental effects that a proposed project may have on unique geological features. Specifically, this document addresses the following question listed in the State CEQA Guidelines, Appendix G, Section V., Cultural Resources:

Would the project:

c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?

Unique geologic features in this document are those that are unique to the field of geology. Geologic features with high aesthetic appeal would be covered under the "Guidelines for Determining Significance for Visual Resources." These would include geologic features that are part of a scenic view and topographic features that look like an object or person. Unique paleontological resources are covered by the "Guidelines for Determining Significance for Paleontological Resources" and are not included in this document. Minerals may be unique geologic features. If they are of economic interest they are included in the "Guidelines for Determining Significance for Mineral Resources."

1.0 GENERAL PRINCIPLES AND EXISTING CONDITIONS

1.1 Defining a Unique Geologic Feature

Unique geologic features are not common in San Diego. The geologic processes are generally the same as those in other parts of the state, country, and even the world. Each rock unit tells a story of the natural processes operating at the time it was formed. The rocks and geologic formations exposed at the earth's surface or revealed by drilling and excavation are our only record of that geologic history. However, some features stand out as being unique in one way or another within the boundaries of the County.

What makes a geologic unit or feature unique can vary considerably. A geologic feature is unique if it:

- Is the best example of its kind locally or regionally;
- Embodies the distinctive characteristics of a geologic principle that is exclusive locally or regionally;
- Provides a key piece of geologic information important in geology or geologic history;
- Is a "type locality" of a geologic feature;
- Is a geologic formation that is exclusive locally or regionally;
- Contains a mineral that is not known to occur elsewhere in the County; or
- Is used repeatedly as a teaching tool.

The type locality is the place where a geologic feature (such as an ore occurrence, a particular kind of igneous rock, or a particular geologic formation) was first recognized and described, and from which the feature usually takes its name. A type locality is unique and exists only at one location. These sites are the basis for categorizing geologic features and are extremely important to the field of geology, however, finding documentation of all the type localities in the unincorporated County would require extensive research.

San Diego County is world-renowned for its minerals, including its gemstones. Museum quality minerals and gemstones are rare, but many have been found in San Diego County. Mindat, a mineralogy database, lists 185 minerals from 655 sites in San Diego County (Mindat 2006), many of which are gemstones. Minerals can be found throughout the County, but gemstones are generally found in a diagonal band across the County. The band of gem producing pegmatites runs from the Pala area, through Mesa Grande, Ramona, and Julian, to the Jacumba area, and into Baja California.

Field trips are extremely important tools in studying geology. Papers and even books are often written about particular field trip stops. The University of California, San Diego and San Diego State University both have geology programs.

1.2 Unique Geologic Features Inventory

Geologic formations, their structure and the fossils in them provide information about past environments. Therefore, rocks are of scientific, educational and recreational value. They also allow us to develop our knowledge of history beyond the written record. For these reasons fossil localities and other significant geologic features were identified in the County's Natural Resources Inventory prepared in the early 1970s, which included the entire County including incorporated areas. This list is now included in the Conservation Element of the General Plan.

For the Natural Resources Inventory, the locations of the features were obtained from published reports and interviews with geologists and paleontologists who did field work in San Diego County up to the early 1970s. In cataloging the unique geologic features, the focus was on fossil localities and less emphasis was given to unique landforms and geologic structures. The inventory list was intended to be updated.

Table 1 lists Unique Geologic Resources in the County. The list varies from the Conservation Element because only those unique geologic features within the unincorporated areas of the County are listed since they are the only ones that would be evaluated by the County during CEQA analyses. In addition, the original inventory has been divided into two tables. Table1 lists those geologic resources for which County staff were able to find the reasons for uniqueness, and several new localities that are considered unique (Walawender 2007). Table 2 lists those geologic resources that were on the original list, but for which further investigation is necessary to determine if they still exist, where they are, or whether they are indeed unique according to the criteria in Section 1.1.

Table 1
Unique Geologic Features in Unincorporated San Diego County*

Geologic Feature	Reason for Uniqueness	Locality
Borrego Badlands (Borrego Formation)	Exposures of wind and water erosion features that are unusual in San Diego County.	Imperial Valley, Anza-Borrego State Park east of Borrego Springs, Ocotillo Wells south of Route 78 near the Imperial County border.
Ocotillo conglomerate in the Northern Borrego Badlands.	Exposures of wind and water erosion features that are unusual in San Diego County.	Near Ocotillo.
San Onofre breccia	The only exposure of these rocks in San Diego County. During the middle Miocene, from Oceanside north to the Orange County line, exotic breccia was deposited along an ancient beach. These rocks, the San Onofre breccia, had their origin in the west, from an unknown island in the Pacific Ocean. The unit contains clasts of metamorphic rocks, predominantly blue-gray glaucophane schist that is relatively rare in southern California. Layering of the clasts indicates they came from the west, fossils indicate they came from shallow marine waters, and angularity indicates they came from nearby. Deposited 100 mya. (Bergen et al. 1996)	San Onofre Hills.
Monterey shale	Only place this rock is exposed.	Along sea cliffs southeast of San Onofre.
Petrified forest with logs in place. Exposures of the prebatholithic volcanics and sedimentary rocks containing leaf imprints.	Petrified wood is extremely rare in the County.	Lusardi Canyon near Rancho Santa Fe, near junction with San Dieguito River.
Folded slates – steep dips and primary structures.	Probably the County's best location for viewing these types of features.	Lusardi Canyon near Rancho Santa Fe, near junction with San Dieguito River.
Unusual occurrence of orbicular gabbro, where apparently the orbicles are the result of banding around xenoliths in the original rock.	An unusual occurrence of orbicular gabbro.	Dehesa Road, west of the Harbison Canyon Road intersection.
Stonewall quartz diorite.	Oldest igneous rock in the County.	Stonewall Peak; Cuyamaca Region.
A major bend in the Elsinore fault that includes augen gneiss.	Unusual occurrence. Augen gneiss is a coarse-grained gneiss, interpreted as resulting from metamorphism of granite, which contains characteristic elliptic or lenticular shear bound feldspar porphyroclasts, normally microcline, within the layering of the quartz, biotite and magnetite bands.	Overland Stage Route west of Vallecito.
Dos Cabazas marble.	Unusual tight folding in marble, alternating bands of calcite,	Vicinity San Diego and Arizona Eastern

	finely disseminated graphite and garnet. Some schist and green diopside. Only place in the County to find Wollastonite.	Railroad to west of the Imperial County line.
Stratigraphic relationship between Jacumba volcanic rocks (Alverson andesite) and "Table Mountain gravels"; reworked younger gravels well exposed.	Indications of volcanism and rifting from 18 mya.	Table Mountain, west of Jacumba.
Los Pinos Mountain.	Only accessible gabbro pluton. Has unique comb layers and orbicular structures.	Los Pinos Mountain, approximately two miles northwest of Morena Reservoir
A combination of gem-bearing dikes and geologic features such as migmatites, folds, and metamorphic rocks intruded by granite.	Educational field trips visit this location.	Sacatone Springs, Mt. Tule.
Contact zone in road cuts	Major divide between rocks that are older than 105 my and those that are younger than 95 my. Educational field trips visit this location.	Highway 80 and Interstate 8 just west of the intersection with Kitchen Creek Road.
Andalusite-bearing schist.	Only occurrence in San Diego County.	Sunrise Highway (S-1) east of Lake Cuyamaca
Ridge between Blair and Little Blair Valleys	Intermontane basins, exposures of pegmatite dikes, prebatholithic rocks, and La Posta granites	Blair Valley and Little Blair Valley east of S-2 in Anza-Borrego State Park.
Potrero Peak gabbro.	Contains orbicular structures.	Potrero Peak located east of S-94 in the unincorporated community of Potrero
Orbicular diorite and abandoned W-bearing rocks	Contains orbicular structures. Orbicular structures are unusual to find.	Northeast of the intersection of Buckman Springs Road and Interstate 8.
Piñon Mountains	Only exposures of a detachment fault and associated alteration in San Diego County	Anza-Borrego State Park

Table 2
Potentially Unique Geologic Features Requiring Further Investigation

Geologic Feature	Locality
Indian Mountain leucogranodiorite	Banks of San Luis Rey River, a few miles southwest of Pala.
Bonsall tonalite	Bonsall, west central San Luis Rey Quad.
Lake Wohlford leucogranodiorite	Lake Wohlford, between Escondido and Lake Wohlford only.
San Marcos gabbro.	San Marcos Mountains, San Luis Rey Quad.
Woodson Mountain granodiorite.	Woodson Mountain, a few miles southwest of Ramona.
Swarm of distinctly oriented inclusion in Lakewood Mountain tonalite composing outer ring dike. Core is Green Valley tonalite.	East of Ramona.
Area of prebatholic metamorphics, especially quartzite exhibiting swirls	Vicinity Highway 78 and San Pasqual.

of magnetite and biotite which may represent relic crossbedding.	
Green Valley tonalite.	Southeast San Luis Rey Quad. Green Valley between U.S. Highway 395 and Ramona.
Interesting relationship between granitic intrusive rock and large schlieran (streaks of dark minerals).	Unknown
Excellent view of Elsinore fault, canyon eroded along fault, and tributaries offset in a right lateral sense. Typical exposure of Julian schist.	Julian, Santa Ysabel Quadrangle.
Tight isoclinal folding in metasedimentary rocks.	Unknown
Folded metasedimentary rock. Folded pegmatite dikes are evidence that folding occurred after dikes were formed.	Unknown
Localities indicating age of Santiago Peak volcanics. Flame structures, flute castes and graded bedding.	San Dieguito, vicinity of San Dieguito River.
Exposure of an old unnamed fanglomerate composed of metamorphic rocks, one of the highest surfaces of the “high terrace” cut into Stadium conglomerate, and a “contact breccia” migmatite zone.	East and west sides of Highway 67, south of Poway Road and west of San Vicente Reservoir.
Basal contact of Ballena gravels sloping eastward; mechanically folded border of Woodson Mountain granodiorite agains narrow screen of metamorphic rocks and banded structures in gabbro on other side.	Vicinity of Wildcat Canyon Road just east of San Vicente Creek.
An unusual occurrence of dumortierite, sillamanite and associated minerals.	Junction of Dehesa Road and Tavern Road.
An unusual occurrence of orbicular gabbro. Apparently the orbicles are the result of banding around xenoliths in the original rock.	Dehesa Road west of the Harbison Canyon Road intersection.
Prebatholithic metavolcanics can be seen especially well along Interstate 8. In selected places coarse pyroclastic and blastoporphyritic fabrics as well as original bedding are visible. Often very gneissic.	Old road cut which is mostly grown over by vegetation. Vicinity of Interstate 8 northeast of Johnstown and south of Lake Jennings.
A very interesting zone of mixed rock and roof pendants in the prebatholic metavolcanics.	Vicinity of la Cresta Road east of Green field.
Contact of Woodson mountain granodiorite and Green Valley tonalite. Notable for zone of coarse inclusions.	Vicinity of la Cresta Road east of Green field.
Good place to see roof pendant of metavolcanics in the Green Valley tonalite.	Vicinity of San Diego River west of El Capitan Reservoir.
La Posta quartz diorite.	La Posta Valley.

2.0 EXISTING REGULATIONS AND STANDARDS

The following list details the most significant Federal, State and local laws, regulations, policies and programs that have been adopted to protect unique geologic features.

2.1 Federal Regulations and Standards

National Environmental Policy Act of 1969 (NEPA) as amended [Pub. L. 91-190, 42 U.S.C. 4321-4347, January 1, 1970, as amended by Pub. L. 94-52, July 3, 1975, Pub. L. 94-83, August 9, 1975, and Pub. L. 97-258, § 4(b), Sept. 13, 1982 http://www4.law.cornell.edu/uscode/42/ch55.html]
The National Environmental Policy Act of 1969 requires that geological resources be considered in assessing the environmental impact of proposed federal projects.

2.2 State Regulations and Standards

California Environmental Quality Act [Public Resources Code 21000-21178; California Code of Regulations, Guidelines for Implementation of CEQA, Appendix G, Title 14, Chapter 3, §15000-15387 http://ceres.ca.gov/topic/env_law/ceqa/]
Under **Appendix G, Section V of CEQA**, lead agencies are required to consider impacts to unique geologic features. The CEQA Guidelines are concerned with assessing impacts associated with the loss of unique geologic features that are of value to the region or state.

2.3 Local Regulations and Standards

Conservation Element (Part X) of the San Diego County General Plan [http://ceres.ca.gov/planning/counties/San_Diego/plans.html]
The Conservation Element of the San Diego County General Plan provides policies for the protection of natural resources. These policies provide guidance for the preservation of unique geological features. The Natural Resources Inventory (NRI) of San Diego County identified 67 unique geologic features that are now listed in the Conservation Element. This preliminary list includes stratigraphic formations, igneous rocks, and structural features.

San Diego County Natural Resource Inventory, Section 3 – Geology
The County of San Diego, Environmental Development Agency's Natural Resource Inventory discusses geologic provinces and the features that are unique to each of them. The inventory also makes some preliminary recommendations as to the preservation of specific sites for many of the unique geologic features identified by the Inventory. This inventory was compiled in the early 1970s and few copies are known to still exist. However, the list of unique geologic features presented in the Conservation Element of the General Plan was copied directly from the inventory.

3.0 TYPICAL ADVERSE EFFECTS

Typical adverse impacts to unique geologic features include material impairment through the destruction, permanent covering, or alteration of a unique geologic feature. Two types of typical adverse effects occur in relation to unique geologic features, direct and indirect impacts. Direct impacts are caused by and are immediately related to a project. An example of a direct impact includes the destruction of a unique geologic feature through grading. Indirect impacts are not immediately related to the project, but they are caused indirectly by a project. An example of an indirect impact includes human encroachment (rock hunting) into an open space easement such that the geologic resources are impacted not directly by the project but because of the project. An indirect impact is to be considered only if it is a reasonably foreseeable impact that may be caused by the project. The direct and indirect destruction of unique geologic features has clear definable physical effects – the destruction or material alteration of the actual resource. However, the less obvious adverse effects include the loss of geologic history and any associated scientific value or the characteristic changes to a community when the unique natural environment is destroyed.

4.0 GUIDELINES FOR DETERMINING SIGNIFICANCE

The following significance guidelines should guide the evaluation of whether a significant impact to a unique geologic feature will occur as a result of project implementation. A project will generally be considered to have a significant effect if it proposes any of the following, absent specific evidence to the contrary. Conversely, if a project does not propose any of the following, it will generally not be considered to have a significant effect on a unique geologic feature, absent specific evidence of such an effect.

1. **The project, as designed, will materially impair a unique geologic feature by destroying or altering those physical characteristics that convey the uniqueness of the resource. A geologic feature is unique if it meets one of the following criteria:**

    a. Is the best example of its kind locally or regionally;
    b. Embodies the distinctive characteristics of a geologic principle that is exclusive locally or regionally;
    c. Provides a key piece of geologic information important in geology or geologic history;
    d. Is a "type locality" of a formation;
    e. Is a geologic formation that is exclusive locally or regionally;
    f. Contains a mineral that is not known to occur elsewhere in the County; or
    g. Is used repeatedly as a teaching tool.

Direct and indirect impacts of the project must be evaluated. In addition, cumulative effects of the project must be assessed. Loss of a portion of a widespread unique geologic feature may not be significant in itself, but when added to other projects that

would impact a widespread feature, the cumulative impact may be significant. Since some unique geologic features span large areas (sometimes an entire project site) a cumulatively significant impact may not be mitigable and needs to be evaluated case-by-case.
When a lead agency determines that a project may have a potentially adverse effect on a unique geologic feature, a geologic reconnaissance may need to be completed by a County approved geologist or certified geologist to evaluate impacts to unique geologic features.

5.0 STANDARD MITIGATION AND PROJECT DESIGN CONSIDERATIONS

A project will be evaluated for its effect on unique geologic features under the criteria specified in Section 4.0. If mitigation or project design factors are identified that could reduce a significant effect, those shall be incorporated into the project. While project design elements and/or mitigation shall be incorporated into a project, it may not always be possible to reduce the impact to below a level of significant. In general, if mitigation or project redesign does not reduce a significant impact to unique geologic features to below a level of significant, the impact will be considered significant and unmitigable.

The primary goal of these guidelines is to protect and preserve unique geological features from destruction, damage or loss, whenever feasible. The standard mitigation and design factors for impacts to unique geologic features are meant to ensure that the feature will not be destroyed or materially impaired. If it can be demonstrated that a project will cause damage to a unique geologic feature, reasonable efforts must be made to mitigate the impact to below a level of significant. Measures may involve design considerations to avoid the unique geologic features and deeding the unique geologic features to the County in a permanent open space easement.

6.0 REFERENCES

California Public Resources Code
California Environmental Quality Act (PRC §21000-21178).

County of San Diego
General Plan, Part X, Conservation Element, pp. X-72, April 2002

Peterson, John. Geologist, Department of Planning and Land Use, Personal Communication, 1999-2002.

San Diego County Natural Resource Inventory, Section 3 - Geology. Early 1970s; exact date unknown.

Wallawender, Michael, PhD. Professor of Geological Sciences, San Diego State University, Personal Communication, May 14, 2002 and June 11, 2007

[APPENDIX A]

Definitions

Augen – large, lenticular mineral grains or aggregates that in cross section have the shape of an eye. Found in foliate metamorphic rocks.

Blastoporphyritic – a relict texture in a metamorphic rock in which traces of an original porphyritic texture remain.

Breccia – rock composed of sharp-angled fragments embedded in a fine-grained matrix.

Clast – an individual constituent, grain or fragment of a sediment or rock, produced by the weathering of a larger rock mass.

Dumortierite - a glassy pink, green, violet, or blue aluminum borosilicate mineral, used in spark-plug ceramics and as imitation lapis lazuli.

Gabbro - Any of a group of dark, dense, phaneritic, intrusive rocks that are the plutonic equivalent to basalt.

Isocline – a fold with limbs that are parallel.

Lenticular – having the shape of a double-convex lens.

Migmatite - A rock that incorporates both metamorphic and igneous materials.

Orbicule – A more or less spherical body, from microscopic size to several centimeters in diameter, whose components are arranged in concentric layers.

Pluton – An intrusive rock, as distinguished from the preexisting country rock that surrounds it.

Schist – A metamorphic crystalline rock which can be split along approximately parallel lines.

Tonalite – An intrusive rock like granodiorite, but containing less quartz (20-60%) and plagioclase feldspar well in excess of alkali feldspar.