APPENDIX C

CULTURAL AND PALEONTOLOGICAL CONSIDERATIONS

APPENDIX C1

HISTORIC PROPERTIES TREATMENT PLAN

HISTORIC PROPERTIES TREATMENT PLAN

Appendix C1 is a confidential appendix that will contain the Historic Properties Treatment Plan (HPTP) that is being developed for the projects. As required by the Programmatic Agreement (PA), the HPTP will provide information on the following:

- A brief description of the proposed actions
- A list of the properties where data recovery is to be carried out
- A list of properties that will require archaeological monitoring during construction
- Research questions to be addressed
- Methods to be used during fieldwork for data recovery
- An archaeological monitoring plan during construction
- A cultural resource discovery plan
- Methods to be used during analysis
- Reporting and curation of artifacts
- Schedule for the submission of progress reports
- Recommendations for treatment of cultural resources during operation and maintenance of the project
- Qualifications of consultants employed to undertake the work

APPENDIX C2

PALEONTOLOGIC RESOURCES LITERATURE REVIEW AND TREATMENT PLAN

This paleontologic resources literature review and treatment plan was completed by San Bernardino County Museum Division of Geological Sciences (SBCM) in July 2006. As a point of explanation for this appendix, it should be noted that the project areas which are now separately designated as the SWIP – Southern Portion and the SWIP – Central Portion in this COM Plan were referred to collectively as the SWIP by SCBM at the time this paleontologic resources literature review and treatment plan was prepared.

PALEONTOLOGIC RESOURCES LITERATURE REVIEW AND TREATMENT PLAN

Appendix C2 – Paleontologic Resources Literature Review and Treatment Plan was prepared by the San Bernardino County Museum Division of Geological Science in 2006 and contains information concerning the potential for the proposed projects to affect paleontological resources and the methods that will be employed to treat them. Specifically, the plan contains:

- A management summary
- Legal citations regarding the protection of paleontologic resources
- A section interpreting and defining paleontologic sensitivity
- A discussion of the geological and paleontological background of the project areas
- Applicable research questions
- A treatment plan containing mitigation measures, recordation requirements, monitoring protocols, worker education, and procedures for discovery situations
- Methods for the recovery of specimens
- Curation requirements
- Mitigation recommendations based on geologic units

Appendix C2 also contains a summary of the results of a field reconnaissance of the overall project area including the SWIP – Southern Portion and SWIP – Central Portion that was conducted in 2006. This summary recommends that areas of undetermined or high paleontologic sensitivity will require a Class III field assessment prior to construction and includes a map delineating the location of these areas.

PALEONTOLOGIC RESOURCES LITERATURE REVIEW AND TREATMENT PLAN

SOUTHWEST INTERTIE PROJECT

COUNTIES OF CLARK, LINCOLN, NYE, AND WHITE PINE, NEVADA

Prepared for:

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July, 2006

MANAGEMENT SUMMARY

The Division of Geological Sciences of the San Bernardino County Museum (SBCM) has prepared this *Paleontologic Resources Literature Review and Treatment Plan (PLRTP)* for the Southwest Intertie Project, Nevada. The PLRTP reviews the paleontologic sensitivity of sediments exposed within proposed areas of development. The results of this review demonstrate that exposures of numerous fossil-bearing rock formations are present and may be impacted by development of the Southwest Intertie Project. These formations include rocks dating to the Precambrian Period, the Paleozoic Era, and the Cenozoic Era. These formations have either high or undetermined potential to contain significant nonrenewable paleontologic resources throughout their extent, and are therefore assigned high paleontologic sensitivity.

Mitigation measures recommended within the PLRTP include:

PA-1: Preparation and presentation of an orientation workshop to explain paleontologic mitigation guidelines and procedures to construction personnel.

PA-2: Pre-construction field reconnaissance of the Southwest Intertie Project site and all associated areas of potential impact by qualified professional vertebrate paleontologists with regional experience and under permit from the Bureau of Land Management, to reconnoiter exposures of rock units having high or undetermined paleontologic sensitivity in order to assess the potential for these units to yield significant fossil remains.

PA-3: Paleontologic monitoring in rock units determined to have high paleontologic sensitivity by a qualified professional vertebrate paleontologist with regional experience, under permit from the Bureau of Land Management where appropriate. Salvage will include recovery of exposed resources and sampling to recover microfossil remains.

PA-4: Stabilization, documentation and reburial of resources that cannot safely be recovered or otherwise preserved (e.g., avoided).

PA-5: Preparation of recovered paleontologic resources to a point of identification and permanent preservation, including stabilization of large remains and screen washing of fossiliferous sediments to recover significant microfossil remains.

PA-6: Preservation and curation of recovered significant fossil resources, including all associated contextual data, at a qualified professional repository with long-term retrievable storage.

PALEONTOLOGIC RESOURCES LITERATURE REVIEW AND TREATMENT PLAN SOUTHWEST INTERTIE PROJECT CLARK COUNTY, NEVADA

Prepared by:

SAN BERNARDINO COUNTY MUSEUM
DIVISION OF GEOLOGICAL SCIENCES

1: INTRODUCTION

1.1 SCOPE AND PURPOSE OF PLAN

The Division of Geological Sciences of the San Bernardino County Museum (SBCM) has reviewed the pertinent paleontologic and geologic literature and prepared this *Paleontologic Resources Literature Review and Treatment Plan* (PLRTP) for the Southwest Intertie Project (SWIP) in Clark County, Nevada. The proposed project is mapped on portions of the following United States Geological Survey 7.5' topographic quadrangle maps:

Arrow Canyon NW, NV
Arrow Canyon SE, NV
Arrow Canyon SW, NV
Badger Hole Spring, NV
Bailey Wash, NV
Blackjack Springs, NV
Bristol Well, NV
Caliente NW, NV
Combs Creek, NV
Coyote Spring, NV
Delamar, NV
Delamar NW, NV
Delamar Lake, NV
Delamar 3 NW, NV
Delamar 3 SW, NV
Douglas, NV
Dry Lake, NV
Dry Lake NW, NV
Ely Springs, NV
Forest Home, NV
Forest Home NE, NV
Gap Mountain, NV
Giroux Wash, NV
Hot Creek Butte, NV
Lower Pahranagat Lake, NV
Lower Pahranagat Lake SE, NV
Marking Corral Summit, NV
Monte Neva Hot Springs, NV
Moorman Spring, NV
Moorman Spring NW, NV
Mule Deer Ridge, NV
Pahroc Spring NE, NV
Pahroc Spring SE, NV
Preston Reservoir, NV
Railroad Crossing Dam, NV
Riepetown, NV
Robinson Summit, NV
Silver King Mine, NV
Silver King Mountain, NV
Steptoe, NV
Steptoe Ranch, NV
Sunnyside NW, NV
Telegraph Peak, NV
The Bluffs, NV
Timber Mountain Pass, NV
Waldy Pond, NV
Wells Station, NV
Wildcat Wash NW, NV
Wildcat Wash SW, NV

This PLRTP is intended to detail the procedures employed to mitigate the impacts and effects of development-related excavation within the proposed development areas upon scientifically significant paleontologic resources. It provides for the discovery and retrieval of paleontologic resources, evaluation of the scientific significance of said resources, and mitigation of adverse impacts/effects to these resources as caused by excavation and construction-related activities.

The PLRTP also reviews existing relevant paleontologic locality information, discusses the geologic and paleontologic context of sediments present within the area of potential effect, and presents guidelines for paleontologic site evaluations and mitigation through data recovery, thereby providing important background and contextual information useful for the paleontologic resources management program. The logistics, procedures and methods outlined herein ensure compliance with Federal regulations subject to review by the Bureau of Land Management (BLM).

The PLRTP is a work plan for all of the paleontologic activities that will ensue during the course of development of the Southwest Intertie Project. It is not the intent to present herein a comprehensive list of sites with discussions of all significant taxa that have been recovered from the vicinity of the Southwest Intertie Project and its environs. A full treatment of all resource sites and taxa from the area of potential effect will be presented as a part of the final report of findings generated as a result of paleontologic mitigation activities. The PLRTP offers a research-oriented framework and accompanying logistical guidelines to ensure that significant nonrenewable paleontologic resources unearthed by development of the Southwest Intertie Project will be managed appropriately and in a timely manner, thereby effectively mitigating adverse impacts to said resources.

1.2 LEGAL CITATIONS REGARDING THE PROTECTION OF PALEONTOLOGIC RESOURCES

1.2.1 Federal Regulations

Statutes of the United States of America that incorporate provisions for the protection of paleontologic resources include:

Federal Antiquities Act of 1906 (P.L. 59-209, 32 Stat. 225).

Forbids and establishes criminal sanctions for disturbance of any object of antiquity on Federal land without a permit issued by an authorizing authority.

National Environmental Policy Act of 1969

(P.L. 91-190, 83 Stat. 852, 42 USC 4321-4327). Mandates policies to “preserve important historic, cultural and natural aspects of our national heritage” (Section 101.b4).

1.2.2 State of Nevada Regulations

Statutes of the State of Nevada which incorporate provisions for the protection of paleontologic resources include the following:

State of Nevada Antiquities Law of 1959 (Nevada Revised Statutes 381.195-227).

Made the Board of Trustees of the Nevada State Museum responsible for the preservation of prehistoric and historic sites on state lands through the issuance of antiquities permits to qualified persons and institutions.

2: INTERPRETING PALEONTOLOGIC SENSITIVITY

2.1 PALEONTOLOGIC RESOURCES

Paleontologic resources are the fossilized evidence of past life found in the geologic record. Despite the tremendous volume of sedimentary rock deposits preserved world-wide, and the enormous number of organisms that have lived through time, preservation of plant or animal remains as fossils is an extremely rare occurrence. Because of the infrequency of fossil preservation, fossils – particularly vertebrate fossils – are considered to be nonrenewable resources. Because of their rarity, and because of the scientific information they can provide, fossils are highly significant records of ancient life. They can provide information about the interrelationships of living organisms, their ancestry, their development and change through time, and their former distribution. Progressive morphologic changes observed in fossil lineages may provide critical information on the evolutionary process itself – that is, the ways in which new species arise and adapt to changing environmental circumstances. Fossils can also serve as important guides to the ages of the rocks and sediments in which they are contained, and may prove useful in determining the temporal relationships of rock deposits from one area to another and the timing of geologic events. Time scales established by fossils provide chronologic frameworks for geologic studies of all kinds.

The United States Federal Government has officially recognized fossils as nonrenewable resources having scientific, educational and (in some cases) recreational value. In May of 2000, Secretary of the Interior Bruce Babbitt released the report "Assessment of Fossil Management on Federal & Indian Lands." The Secretary of the Interior was assisted in the production of this report by the BLM as well as by the United States Forest Service (USFS), the National Park Service (NPS), the Fish and Wildlife Service (FWS), the Bureau of Reclamation (BOR), the Bureau of Indian Affairs (BIA), and the Smithsonian Institution (SI). This landmark report determined that the following principles and recommendations should be uniformly applied to fossils occurring on Federal lands:

Principle 1: Fossils on Federal Lands are a Part of America's Heritage

- -- Fossils are unique resources. Without fossils, human beings would have little understanding of the development of ancient life on earth.
- -- Of all the organisms that have ever lived, only a tiny proportion have been preserved, exposed to view, discovered and appropriately collected.
- -- The condition, availability and scientific significance of the fossils on federal lands are among the best in the world.
- -- Federal agencies' current management practices further the paramount scientific and educational values of fossils.

*<u>Recommendation</u>**:** Future actions should reaffirm the current use of federal fossils for their scientific, educational and, where appropriate, recreational values.*

Principle 2: Most Vertebrate Fossils are Rare

-- Relatively few sites worldwide contain dense accumulations of vertebrate fossils, and only a fraction of these sites are located on federal lands in the United States. Advocates for increased collection of vertebrate fossils on federal lands often overestimate these fossils' abundance.
-- Federal agencies therefore uniformly limit the collection of vertebrate fossils to qualified scientific and/or educational personnel.

Recommendation: Future actions should reaffirm the restriction of vertebrate fossil collection to qualified personnel, with the fossils remaining in federal ownership in perpetuity.

Principle 3: Some Invertebrate and Plant Fossils are Rare

-- Although invertebrate and plant fossils generally are more abundant than vertebrate fossils, some are nonetheless extremely rare.
-- The agencies' varying collection policies for invertebrate and plant fossils reflect the agencies' missions and attempt to satisfy the wide range of public interest in these fossils.
-- The agencies will work to reduce the potential public confusion about the varying collection policies.

Recommendation: Future actions should reaffirm mission-specific agency approaches to the management of plant and invertebrate fossils.

Principle 4: Penalties for Fossil Theft Should Be Strengthened

-- Hundreds of fossils are stolen from federal lands every year. Such thefts reduce access by scientists and the general public to scientifically significant and/or instructive fossils and destroy the contextual information critical for interpreting the fossils.
-- The difficulties of establishing the commercial value of a stolen or damaged fossil may hinder effective prosecutions of fossil theft and damage. Commercial value also does not necessarily reflect the scientific and educational values of fossils.
-- Agency efforts to enhance awareness on the part of the public, scientists and law enforcement personnel about the various values of fossils and the damage caused by fossil theft would eventually facilitate effective prosecutions. This, in turn, would more effectively deter future theft and damage.
-- Notwithstanding public education campaigns and increased penalty provisions, fossils will continue to be stolen from federal lands unless agencies can place more trained personnel in the field.

Recommendation: Future actions should penalize the theft of fossils from federal lands in a way that maximizes the effectiveness of prosecutions and deters future thefts. Penalties should take into account, among other factors, the value of fossils themselves, as well as any damage resulting from their illegal collection. Future program strategies should emphasize education of federal managers, prosecutors, law enforcement personnel and the judiciary regarding the value of fossils and the techniques for the appropriate protection of fossil resources.

Principle 5: Effective Stewardship Requires Accurate Information

- -- Inventories and monitoring of fossils on federal lands are critical for sound fossil management. Thorough inventory data enables informed decision making and enhances interagency collaboration.
- -- New technologies, the help of amateurs and volunteers and partnerships can improve the cost effectiveness of information gathering and analysis. However, on-the-ground inventories by professionals will remain important in assessing agency fossil resources.

Recommendation: Future actions should acknowledge the need for gathering and analyzing information about where fossils occur, in particular the critical role of inventory in the effective management of fossil resources. Increased emphasis on fossil inventory should take into consideration, where possible, regional approaches across agency lines, using modern technology such as Geographic Information Systems (GIS). Such work could also address specific issues, such as the impact of erosion on the loss of resources.

Principle 6: Federal Fossil Collections Should be Preserved and Available for Research and Public Education

- -- Scientifically valuable fossils must remain in public ownership in order to be adequately preserved and available for science and public education.
- -- Federal agencies currently strive to meet the needs of scientists and the general public by housing fossils in both large research institutions and small community-based institutions, as well as federal repositories.
- -- Enhanced use of online databases, images and other information technology would maximize the availability of existing and future museum fossil collections to scientists and the public.

Recommendation: Future actions should affirm the importance of curating scientifically valuable fossils as federal property, often in partnership with non-federal institutions. Future program approaches should emphasize the use of modern technology to improve curation and access, as well as the sharing of information between and among government agencies and other institutions.

Principle 7: Federal Fossil Management Should Emphasize Opportunities for Public Involvement

- -- The public, including properly-trained amateurs and volunteers, have been and should continue to be a critical part of the management of fossils on federal lands.
- -- Public education is critical in the management of fossils on federal lands.

Recommendation: Future actions should include an emphasis on public education and participation in the stewardship of fossil resources. Future program approaches should emphasize the use of technology to increase public education and awareness of the importance and benefit of fossil resources.

2.2 DEFINING PALEONTOLOGIC SIGNIFICANCE

As stated previously, preservation of plant or animal remains as fossils is an extremely rare occurrence. Because of the infrequency of fossil preservation, fossils are considered to be nonrenewable resources. Because of their rarity, and because of the scientific information they provide, fossils can be highly significant records of ancient life. Given this, fossils can be considered to be of significant scientific interest if one or more of the following criteria apply:

1. The fossils provide data on the evolutionary relationships and developmental trends among organisms, both living and extinct;

2. The fossils provide data useful in determining the age(s) of the rock unit or sedimentary stratum, including data important in determining the depositional history of the region and the timing of geologic events therein;

3. The fossils provide data regarding the development of biological communities or interaction between paleobotanical and paleozoological biotas;

4. The fossils demonstrate unusual or spectacular circumstances in the history of life;

5. The fossils are in short supply and/or in danger of being depleted or destroyed by the elements, vandalism, or commercial exploitation, and are not found in other geographic locations.

As so defined, significant paleontologic resources are determined to be fossils or assemblages of fossils that are unique, unusual, rare, uncommon, diagnostically or stratigraphically important, and/or those that add to an existing body of knowledge in specific areas – stratigraphically, taxonomically, and/or regionally. They can include fossil remains of large to very small aquatic and terrestrial vertebrates (including animal trackways), remains of plants and animals previously not represented in certain portions of the stratigraphy, and fossils that might aid stratigraphic correlations, particularly those offering data for the interpretation of tectonic events, geomorphologic evolution, paleoclimatology, and the relationships of aquatic and terrestrial species.

2.3 DETERMINATIONS OF ROCK UNIT SENSITIVITY

Sedimentary units that are paleontologically sensitive are those units with a high potential for containing significant paleontologic resources – that is, rock units within which vertebrate fossils or significant invertebrate fossils have been determined by previous studies to be present or likely to be present. These units include, but are not limited to, sedimentary formations that contain significant paleontologic resources anywhere within their geographical extent, as well as sedimentary rock units temporally or lithologically suitable for the preservation of fossils. Determinations of paleontologic sensitivity must therefore consider not only the potential for yielding abundant vertebrate fossils but also the potential for production of a few significant fossils, large or small, vertebrate or invertebrate, that may provide new and significant

taxonomic, phylogenetic, and/or stratigraphic data. Areas that may contain datable organic remains older than Recent and areas that may contain unique new vertebrate deposits, traces, and/or trackways must also be considered paleontologically sensitive.

2.4 DEFINITIONS

Literature research and institutional records searches presented herein have resulted in the designation of excavation areas associated with development of the Southwest Intertie Project as having high, low or undetermined paleontologic sensitivity. Provisions for mitigation of adverse impacts to significant nonrenewable paleontologic resources exposed during development-related construction along the project corridor are based upon these determinations of potential paleontologic sensitivity. The terms “high sensitivity,” “low sensitivity” and “undetermined sensitivity” are described below.

2.4.1 High Sensitivity

Sedimentary units with a high potential for containing significant nonrenewable paleontologic resources are determined to have high paleontologic sensitivity. In these cases the sedimentary rock unit contains a high density of recorded vertebrate fossil sites, has produced vertebrate fossil remains in the near vicinity of the project, and is very likely to yield additional remains during excavation associated with project development.

2.4.2 Low Sensitivity

The rock unit contains no or very low density of recorded resource localities, has produced little or no fossil remains in the vicinity of the project, and is not likely to yield any fossil remains. [Note: sedimentary exposures with few or no prior recorded sites can prove abundantly fossiliferous during paleontologic mitigation activities. For example, the Diamond Valley Lake site in Hemet, Riverside County, California was originally determined to have “low to moderate” sensitivity, but subsequently has yielded thousands of well-preserved fossils of terrestrial Pleistocene Epoch vertebrates (Springer and Scott 1994; Scott, 1997; Springer and others, 1998, 1999)].

2.4.3 Undetermined Sensitivity

The rock unit has limited exposure(s) in the project area, is poorly studied, and contains no recorded paleontologic resource localities. However, in other areas, the same or a similar rock unit contains sufficient paleontologic resource localities to suggest that exposures of the unit in the project area would have at least a moderate potential for yielding fossil remains.

3: GEOLOGIC/PALEONTOLOGIC BACKGROUND

3.1 INTRODUCTION

This section of the PLRTP briefly reviews the general geology and paleontology of the Southwest Intertie Project alignment, in order to provide a context for understanding the types, nature, and scientific significance of the paleontologic resources present within this region. The nature, age, and preservation of paleontologic resources presumed to be present in the subsurface will be variable, given that different rock units are exposed within the study area.

3.2 CHARACTERISTICS OF THE STUDY REGION

3.2.1 Geologic Background

3.2.1.1 Precambrian Rocks

In White Pine County, Precambrian rocks of the McCoy Group and equivalent rocks, exclusive of the Stella Lake Quartzite (see below), are present in the northern part of the Egan Range (Hose and Blake, 1976), along the alignment of the proposed SWIP. These metamorphic rocks, the oldest rocks exposed in White Pine County, have low potential to contain fossil resources, and so are assigned low paleontologic sensitivity.

Precambrian rocks are not recorded along or near the proposed SWIP alignment in Nye, Lincoln, or Clark Counties (Longwell and others, 1965; Tschanz and Pampeyan, 1970; Kleinhampl and Ziony, 1985).

3.2.1.2 Paleozoic Rocks

Cambrian rocks in White Pine County, including those exposed along or near the proposed SWIP alignment, were grouped into a lower part, a middle part, and an upper part by Hose and Blake (1976). The lower part includes the Stella Lake Quartzite, the Prospect Mountain Quartzite, and the Pioche Shale. These rocks are weakly to moderately metamorphic, and so have low potential to contain fossil resources.

The middle part of the Cambrian complex described by Hose and Blake (1976) for White Pine County includes limestone rocks that are equivalent to the Pole Canyon Limestone, the Lincoln Peak Formation, and the Johns Wash Limestone (listed in ascending order); this terminology, employed for rocks of this age in the Snake Range by Whitebread (1969), was also applied to the Egan Range by Hose and Blake (1976). Rocks assigned to these formations in the Snake Range are fossiliferous. The Pole Canyon Limestone has yielded abundant fossils of the alga *Girvanella*, while the Lincoln Peak Formation has yielded fossil remains of the agnostid trilobite *Lejopyge* in the Snake Range (Hose and Blake, 1976).

The upper part of the Cambrian complex described by Hose and Blake (1976) includes the Dunderberg Shale and the Windfall Formation. The Dunderberg Shale consists primarily of olive-grey silty shale; fossils from this formation include abundant trilobites. The Windfall

Formation is a limestone rock unit with potential to form cave deposits; these deposits have potential to contain significant paleontologic resources, and so the Windfall Formation has undetermined, potentially high, paleontologic sensitivity.

Cambrian rocks are not mapped (Kleinhampl and Ziony, 1985) along the proposed corridor of the SWIP in Nye County. In Lincoln County, Cambrian rocks are by far the thickest system of rocks, and include (from oldest to youngest) the Chisholm Shale (lower Cambrian), the Highland Peak Formation (middle Cambrian), and undifferentiated limestone and dolomite including the Dunderberg Shale (upper Cambrian) (Tschanz and Pampeyan, 1970). Of these rocks, the Chisholm Shale may contain marine invertebrate fossils. The Highland Peak Formation is "remarkably unfossiliferous" (Tschanz and Pampeyan, 1970:18), but has been reported to yield occasional fossils such as trilobites. The Dunderberg Shale, as discussed previously, has yielded marine invertebrate fossils including abundant trilobites (Tschanz and Pampeyan, 1970; Hose and Blake, 1976).

Ordovician rocks along the proposed SWIP corridor include the Eureka Quartzite, which is present in White Pine, Nye, Lincoln, and Clark Counties; the Pogonip Group, which occurs in White Pine, Lincoln, and Clark Counties; and the Ely Springs Dolomite, which is present in all but Nye County. Of these rocks, the Pogonip Group has yielded abundant fossils (Longwell and others, 1965; Tschanz and Pampeyan, 1970; Hose and Blake, 1976).

Silurian rocks exposed at the surface along the SWIP corridor include the Laketown Dolomite and the Lone Mountain Dolomite, as well as other undifferentiated dolomitic outcrops (Tschanz and Pampeyan, 1970; Hose and Blake, 1976; Kleinhampl and Ziony, 1985). These rocks generally have low potential to contain significant paleontologic resources, although marine invertebrates have been recovered from some outcrops (Tschanz and Pampeyan, 1970).

Devonian rocks along the SWIP project corridor include the Simonson Dolomite in White Pine, Nye, and Lincoln Counties; the Sevy Dolomite and the Guilmette Formation in White Pine and Lincoln Counties; the White Pine Group (including the Pilot Shale, the Joana Limestone, and the Chainman Shale) in White Pine County; the Devils Gate Limestone in Nye County; and the Sultan Limestone in Clark County (Longwell and others, 1965; Tschanz and Pampeyan, 1970; Hose and Blake, 1976; Kleinhampl and Ziony, 1985). Of these, the Simonson Dolomite and the Sevy Dolomite are generally poorly fossiliferous, while the Pilot Shale, the Joana Limestone, the Guilmette Formation, the Devils Gate Limestone, and the Sultan Limestone have yielded marine invertebrate fossils. As with other limestone formations discussed herein, it is possible that solution cave deposits may form; if such caves are present in limestone rock units, they have potential to contain vertebrate fossils. Wood rat middens may also be locally present.

Rocks of Mississippian age along the SWIP corridor include the Joana Limestone as well as rocks equivalent to the Eleana Formation in Nye County, the Scotty Wash Quartzite and undifferentiated limestone rocks (including the Joana, Mercury, and Bristol Pass Limestones) in Lincoln County, and the Monte Cristo Limestone in Clark County (Longwell and others, 1965; Tschanz and Pampeyan, 1970; Hose and Blake, 1976; Kleinhampl and Ziony, 1985). Of these formations, the Joana Limestone, the Scotty Wash Quartzite, and the Monte Cristo Limestone have yielded marine invertebrates, including crinoids. Pleistocene cave deposits are also recorded from southern Nevada near the contact of the Monte Cristo Limestone and the older Sultan Limestone (Reynolds and others, 1991b).

Pennsylvanian-age rocks present along the proposed SWIP corridor include the Ely Limestone in White Pine and Nye Counties, the Riepe Spring Limestone in White Pine County, undivided limestones in Lincoln County, and the Bird Spring Formation in Clark County. As with the above-listed limestone rock formations, these units are likely to contain the fossil remains of marine invertebrates (Longwell and others, 1965; Tschanz and Pampeyan, 1970; Hose and Blake, 1976; Kleinhampl and Ziony, 1985). Solution caves may also form in these limestone rocks; is such caves are present, they may contain vertebrate fossils. Wood rat middens may also occur in these rock units.

Rocks of Permian age exposed along the proposed SWIP corridor include the Park City Group in White Pine County as well as undifferentiated limestones in Lincoln County (Tschanz and Pampeyan, 1970; Hose and Blake, 1976). The Park City Group includes the Kaibab Limestone, the Plympton Formation, and the Gerster Limestone; of these the Gerster Limestone contains conspicuous and distinctive brachiopod fossils (Hose and Blake, 1976).

3.2.1.3 Mesozoic Rocks

Cretaceous or early Tertiary volcanic rocks exposed in Lincoln County (Tschanz and Pampeyan, 1970) have no potential to contain fossil resources, and so are assigned low paleontologic sensitivity. Mesozoic rocks are not mapped (Longwell and others, 1965; Hose and Blake, 1976; Kleinhampl and Ziony, 1985) along the remainder of the SWIP alignment.

3.2.1.4 Cenozoic Rocks

Tertiary Units

Sediments of Tertiary age [incorporating the Paleocene through the Pliocene Epochs, from 65 million years before present (BP) to ~1.8 million years BP] are present along the proposed SWIP corridor in White Pine County (Hose and Blake, 1976), particularly in the central and southern portions of the Egan Range and the southern White Pine Range. Mapping of this region by Hose and Blake (1976) does not subdivide these sediments into their component units, and so determining paleontologic sensitivity along the proposed SWIP alignment is problematic. These undifferentiated sediments include the Sheep Pass Formation, which dates to the Eocene Epoch. Fossils from this formation include ostracods, freshwater gastropods, and vertebrate remains Hose and Blake, 1976). For this reason, older Tertiary sediments in White Pine County, including the Sheep Pass Formation, are assigned high paleontologic sensitivity. Similarly, younger Tertiary sediments in the southern portion of White Pine County may also be fossiliferous, depending upon their lithology; however, in this case, mapping by Hose and Blake (1976) lumps both potentially-fossiliferous sediments with nonfossiliferous volcanic rocks. These exposures will need to be examined directly to determine their paleontologic potential.

In addition to the above-listed formations, other rock outcrops of Tertiary age in White Pine County consist of older volcanic rocks, ash flow tuffs, and intrusive igneous rocks. These outcrops have no potential to contain fossil resources, and so are assigned low paleontologic sensitivity. However, ash tuffs found in the vicinity of sediments yielding fossils may provide helpful data for constraining the age of the fossils.

In Nye County, exposures of the fossiliferous Sheep Pass Formation are present along the proposed SWIP corridor, particularly along the eastern and central portions of the Horse Range and the Grant Range. As stated previously, these sediments have high potential to contain significant fossil resources, and so are assigned high paleontologic sensitivity. Additionally, younger Tertiary sedimentary formations also occur in the Grant Range. These formations may include the Horse Camp Formation of Miocene-Pliocene age (Kleinhampl and Ziony, 1985). If present at the surface or at depth along the SWIP alignment, this formation would have high paleontologic sensitivity.

In Lincoln and Clark Counties, Tertiary sediments are present at the surface and in the subsurface in the flat-lying valleys along the SWIP corridor, particularly in Dry Lake Valley, Delamar Valley, and Coyote Spring Valley; this situation differs somewhat from that observed in White Pine and Nye Counties, where Tertiary sediments were often present in the more uplifted portions of the project alignment. In Lincoln County, geologic mapping (Tschanz and Pampeyan, 1970) does not break these Tertiary sediments out individually, and so determining paleontologic sensitivity along the proposed SWIP alignment is again problematic. However, these Tertiary beds may include the fossiliferous Panaca Formation and Muddy Creek Formation, as well as unnamed lake deposits (Tschanz and Pampeyan, 1970). These formations have high paleontologic sensitivity. In contrast, Tertiary igneous rocks in the North Pahroc and South Pahroc Ranges have no potential to contain fossil resources, and so are assigned low paleontologic sensitivity. In Clark County, sediments of the Muddy Creek Formation are potentially present in the subsurface, overlain by Holocene alluvium; if these sediments are encountered, they have high paleontologic sensitivity.

Fossilized animal trackways may also occur within and adjacent to the area of potential effect in Tertiary rocks along the proposed Southwest Intertie Project. Trackways, or **ichnites**, represent *in situ* evidence of the dynamic activity of extinct animals during life; they can provide information on the number and diversity of animals were present in a particular area, as well as the speed and direction of their movement -- information that is otherwise difficult or impossible to obtain from bony remains (Gillette and Lockley, 1989). Fossil trackways are known from Tertiary rock units such as the Muddy Creek Formation; these resources, if encountered, are highly paleontologically sensitive and require preservation (through avoidance, recovery or replication).

3.2.1.5 Quaternary Alluvium (Pleistocene/Recent)

Geologic mapping of the proposed SWIP corridor (Longwell and others, 1965; Tschanz and Pampeyan, 1970; Hose and Blake, 1976; Kleinhampl and Ziony, 1985) generally does not break out Quaternary sediments into Pleistocene and Holocene components. As a result, it is difficult to determine from this mapping where paleontologically-sensitive sediments of Pleistocene age occur at the surface. These sediments, which occur thoughout the valleys and low-lying portions of the proposed SWIP alignment, have undetermined paleontologic sensitivity. Further, in areas where surface alluvium is of Holocene age, this alluvium may very well overlie undisturbed sediments of older, fossil-bearing rock units. In these cases, should such uneroded fossiliferous sediments be present at depth, they would have high paleontologic sensitivity (see above).

3.2.1.6 Pleistocene/Holocene Cave Deposits

In addition to the fossil-bearing rock units described above, there is also potential to encounter fossil deposits that have accumulated in caves opened into the earlier limestone rocks. Such highly-significant fossil accumulations, most of which date to the later Pleistocene Epoch, have been previously reported from several localities in or near southern Nevada, including Kokoweef Cave in the Ivanpah Mountains (Goodwin and Reynolds, 1986; Force, 1991; Reynolds and others, 1991b; Scott, 1997), Antelope Cave in the Mescal Range (Reynolds and others, 1991c; Scott, 1997) Devil Peak in the southern Spring Mountains (Reynolds and others, 1991d), and Gypsum Cave in the foothills of Frenchman Mountain (Harrington, 1933; Harris, 1985; Poinar and others, 1998; Rowland and Needham, 2003; Weinstock and others, 2005). An early Holocene-age vertebrate fauna has also been reported from Quien Sabe Cave in the Ivanpah Mountains (Whistler, 1991). These fossil accumulations, which are frequently of large size, exhibit significant species diversity, and trend towards preservation of microvertebrates, are cached in caves opened into the existing limestone; Kokoweef Cave, for example, developed as "a large, steeply-dipping solution chamber etched along the brecciated zones parallel to the Clark Mountain Fault and near the contact of the ... Sultan Limestone and the ... Monte Cristo Limestone" (Reynolds and others, 1991b, p. 97).

3.2.1.7 Pleistocene/Holocene Wood Rat Middens

In addition to the above-named modes of fossil preservation, there is also the possibility that wood rat middens – that is, plant middens amassed through many years by wood rats (*Neotoma* sp.) – may also be present within the area of potential effect. *Neotoma* middens have been known to accumulate through decades, centuries and even millennia as successive generations of packrats add collected plant matter to the midden. These middens can in some cases be paleontologic "treasure troves" in that they can provide:

-- sequences of well-preserved plant fossils that enable reconstructions of past climatic conditions;

-- potentially, time-stratified sequences of radiometric dates that enable more accurate interpretations of paleoenvironmental change through time; and

-- occasionally, identifiable microfossil bones that permit comparisons with other, undated microfossil faunas to be advanced.

Wood rat middens have been previously employed to track climatic shifts and changes in plant distribution in the Great Basin and the Mojave Desert throughout the later part of the Pleistocene Epoch (± 40,000 years BP to ± 11,000 years BP), as well as through much of the Holocene Epoch (< 11,000 years BP) (Van Devender, 1977; Van Devender and others, 1987; Spaulding and others, 1990; Spaulding, 1995). Such middens are therefore highly paleontologically sensitive. If encountered, such middens will need to be salvaged and studied in order to determine their age and potential paleontologic significance.

3.2.2 Review of Existing Localities

A review of the Regional Paleontologic Locality Inventory (RPLI) was conducted by the staff of the Division of Geological Sciences, SBCM. The results of this review indicate that no paleontologic resource localities are recorded anywhere within the area of potential effect of the Southwest Intertie Project. Additionally, the online locality database of the University of California Museum of Paleontology (UCMP), Berkeley, California was consulted, to determine if paleontologic resources were recorded therein from along the proposed SWIP corridor. Unfortunately, while numerous vertebrate, invertebrate, and plant fossil localities were listed in this database from White Pine, Nye, Lincoln, and Clark Counties, detailed positional data for these localities was not available online. The recommended field assessment for the SWIP should include a review of these records at the UCMP.

4: RESEARCH QUESTIONS

4.1 INTRODUCTION

The significance of paleontologic resources can be determined by placing the recovered fossils and their associated contextual data in a pertinent research framework. A broad-based, initial research framework can be established that presents questions of scientific interest that can be asked of any sizeable paleontologic assemblage.

4.2 CATEGORIES FOR POTENTIAL RESEARCH

The criteria advanced for interpretations of paleontologic resource significance constitute the foundation for any research design. Since a fossil is not generally considered to be significant unless it corresponds to one or more of these classes, any research program must be designed to reflect this fact. Research questions that do not incorporate one or more of the significance criteria should not be considered or included in the research design.

As has been previously stated, resource significance can be determined by examining the recovered fossils in light of the following criteria:

1. The resources provide data on the evolutionary relationships and developmental trends among organisms, both living and extinct;

2. The resources provide data useful in determining the age(s) of the rock unit or sedimentary stratum, including data important in determining the depositional history of the region and the timing of geologic events therein;

3. The resources provide data regarding development of paleobiological communities and/or the interaction between paleobotanical and paleozoological biotas;

4. The resources represent unusual or spectacular circumstances in the history of life;

5. The resources are in short supply and/or in danger of being depleted or destroyed by the elements, vandalism, or commercial exploitation, and are not found in other geographic locations.

Based upon these criteria, then, several broad and basic categories for potential research are presented here as being of significant scientific interest, as well as being pertinent to the geologic and paleobiologic history of the many fossil strata that might be impacted by development of the Southwest Intertie Project. These categories do not in and of themselves comprise a complete research framework; rather, they provide a starting point from which to address the significance of any assemblage(s) identified from the project property. These categories include:

-- Faunal composition of the assemblage

-- Age(s) of the assemblage

-- Depositional environment of the sedimentary sequence

-- Taphonomic factors influencing the assemblage

-- Population structure/dynamics of individual species within the assemblage

-- Paleoenvironment of the region at the time(s) of deposition

-- Questions specific to individual species represented within the assemblage

In addition to these general categories, specific research questions may be asked in advance of excavation within Paleozoic rocks and Tertiary and Quaternary fluvial and lacustrine sediments. For limestone formations, as discussed above, the recovery of a representative sample of diagnostic fossils from exposures of each rock unit in the area of potential effect of the Southwest Intertie Project might very likely help refine and augment understanding of the time of deposition of these formations. Also, the recovery of such samples from the area of potential effect of the Southwest Intertie Project would enable more complete faunal and lithologic correlations to be advanced.

For Tertiary and Quaternary sediments, research questions would likely focus upon: 1) advancing accurate generic and specific identifications; 2) identifying diagnostic microfaunal remains to augment to macrofossil assemblage already reported from the formation; 3) correlating species identified among various sedimentary formations, both locally and throughout the southwestern United States; and 4) elucidating the taphonomic factors that have affected fossil preservation. With these questions in mind, the mitigation program must in turn focus upon recovering, not every fossil and/or fossil fragment encountered, but rather those fossils that are sufficiently complete and diagnostic to enable generic and specific identifications to be made. The program must also endeavor to recover microfossil remains through screen-washing of exposed sediments. Finally, detailed lithologic and positional data should be recorded at the time the fossil resources are exposed; sediments samples should be collected and preserved, and sites should be photodocumented.

5: PALEONTOLOGIC RESOURCES TREATMENT PLAN

5.1 MITIGATION MEASURES

The following are mitigation guidelines to be employed during construction conducted in association with development of the Southwest Intertie Project. The mitigation measures will effectively mitigate adverse impacts to paleontologic resources to less than significant levels. These measures are summarized below as Paleontology Actions (PA) 1 through 6. The specifics of the mitigation efforts, including monitoring of excavation, curation, preparation of the final report and storage of specimens, are detailed subsequently (Section 6). These mitigation measures are subject to review by the BLM, and may be amended following completion of the field reconnaissance (PA-2, below).

Prior to Construction

PA-1 An orientation workshop shall be prepared, reviewed by the BLM, and presented by a professional paleontologist to explain paleontologic mitigation guidelines and procedures to the contractor and construction workers. This workshop can be presented in conjunction with any pre-grade meetings conducted prior to excavation. The workshop will review the Paleontologic Resources Mitigation Plan (PLRTP), and will endeavor to explain the nature, appearance and importance of fossil vertebrates, invertebrates and plants. The responsibilities of construction personnel in a paleontologic mitigation context will also be detailed. Construction workers shall not collect any fossils found during construction before their significance can be assessed by a qualified paleontologist. An outline for the paleontology workshop is provided in Appendix A (attached). A document entitled "Checklist for Paleontologic Resources and Guidelines for Construction Personnel" has also been prepared for this task and is also provided in Appendix A. These documents are subject to review by the BLM.

All construction inspectors and environmental monitors shall be briefed on the locations of high sensitivity areas for paleontologic resources as part of a training program including information on all aspects of the project. This training program will cover items addressed in the paleontology workshop, but more training and detail will be included. It will be stated during the paleontology briefing that it is unlawful for construction inspectors or environmental monitors to collect fossils from the grade separation or any other construction area during construction, as these fossils belong to the public and will be placed in a recognized curation facility such as a museum or university, where they will be treated, stored, maintained and made available for scientific study.

PA-2 A field reconnaissance of the area of potential effect for the proposed Southwest Intertie Project shall be conducted in advance of excavation, under permit from the BLM. This survey will examine existing rocks and sediments exposed within the area of potential effect of the project, as well as any recorded localities in the immediate vicinity that might be impacted by the development of new access roads or other construction-related activities. The survey will be divided into two parts: a vehicular "drive-by" survey, to establish the logistics and determine the most efficient approach for the on-foot survey, and a subsequent detailed foot reconnaissance. The surveys will traverse the length of the proposed SWIP corridor, including up to one (1) mile to either side of the ROW centerline, to confirm and augment geologic mapping, locate and recover any significant nonrenewable paleontologic resources exposed at the surface, and assess paleontologic sensitivity with more precision. Particular attention will be paid to Tertiary and Quaternary fluvial and lacustrine sediments, as well as Paleozoic limestone outcrops (in the latter case, to assess whether openings or fissures with the potential to contain Pleistocene fossils, or to open into caves containing Pleistocene fossils, are present). The presence of wood rat middens will also be assessed. The results of the field reconnaissance will be presented in report form at the conclusion of the study.

During Construction

PA-3 If paleontologic resources are found at any time during construction, work shall be redirected to another area nearby so that the scientific significance of the find may be assessed. Construction monitors shall notify the onsite construction monitoring coordinator. As part of the monitoring procedure, a qualified professional vertebrate paleontologist with regional experience shall then assess the significance of the find and recommend additional mitigation measures, as necessary. The paleontologist shall be retained to perform inspection of the excavation and to salvage exposed fossils. A standard sample [2,724 kg (= 6,000 lbs or 2.4 cubic meters) of fossiliferous sediment may be collected for recovery and identification of terrestrial microvertebrates (rodents, birds, rabbits). Monitors shall also determine whether the fossil is part of an archaeological deposit; if so, it shall then be considered a cultural resource discovery and treated according to the procedures specified in the Cultural Resource Monitoring Plan prepared prior to construction.

This measure will be implemented by requiring paleontologic monitoring in rock units designated as having high potential to contain paleontologic resources. The paleontologic monitoring plan calls for the placement of one paleontologic monitor at each construction location in all areas of high paleontologic sensitivity. Monitors will be qualified vertebrate paleontologists with regional experience, under permit from the BLM. Paleontologic monitors are empowered to determine significance in the field and recover the data immediately. Paleontologic monitors may, upon direct examination of rock or sediment outcrops, and based upon their professional experience, determine that the paleontologic sensitivity of the formation or rock unit in question differs from previous reports (e.g., a formation designated "high sensitivity" may be downgraded to "low sensitivity"

based upon field examination, and monitoring then reduced or eliminated appropriately).

If significant fossils are discovered by environmental monitors and/or construction personnel in areas of undetermined paleontologic sensitivity, work shall be redirected so that the scientific significance of the find may be assessed. Finds of this nature may include cave deposits or wood rat middens in Paleozoic limestone rocks. Where such fossils are encountered at any time during construction, crew members should proceed as outlined in Section 5.3.1, below.

If fossils are discovered by environmental monitors and/or construction personnel in areas of low paleontologic sensitivity, work shall be redirected to another area nearby so that the scientific significance of the find may be assessed. Construction crew members should proceed as outlined in Section 5.3.1, below.

In rock units where significant invertebrate fossils are anticipated (e.g., Paleozoic limestone), rocks containing a representative sample of the overall fossil assemblage will be salvaged. Rock quarrying may be necessary in these instances, in which case construction personnel may be requested to provide appropriate equipment for most efficient and timely removal of the resource(s).

In rock units where vertebrate fossils are anticipated (e.g., Tertiary and Quaternary fluvial and lacustrine sediments), fossils will be salvaged only when determined upon examination in the field to be diagnostic or potentially diagnostic. Large vertebrate fossils exposed by excavation will be expeditiously jacketed with plaster bandages or strips of burlap saturated with plaster, then removed and returned to the paleontology laboratory for preparation, identification and permanent storage. Standard samples [2,724 kg (= 6,000 lbs or 2.4 cubic meters) of sediment, as modified from Wolff (1975)] of fossiliferous sediments will be salvaged from designated microfossil sampling localities. For this project, the not-to-exceed quantity is one standard sample [2,724 kg (= 6,000 lbs)] of sediment per fossiliferous member or formation that has been demonstrated to produce vertebrate fossils. This sedimentary matrix will be stockpiled on-site, and subsequently processed; recovered specimens will be identified and curated. Fossil animal trackways, if encountered, will be avoided where feasible. If avoidance is not possible, impacts to the trackways will be mitigated by either recovery or replication. Contextual data associated with the resources will be recorded in the field, and sites will be photodocumented.

PA-4 The preservation of significant fossils (if found during construction) by removal will occur as described in PA-3, unless it is not feasible. Due to the potential for rapid deterioration of exposed surface fossils, preservation by avoidance is generally not an acceptable mitigation measure (except, in some cases, for exposed fossil animal trackways). In cases where the fossil(s) cannot be removed immediately, the location of the fossil(s) shall be stabilized to prevent further deterioration prior to data recovery under the direction of a qualified vertebrate paleontologist. Stabilization in these cases can (as necessary and safely feasible) include the following: removal of overburden; exposure of the resource(s); application of an appropriate hardening agent (e.g., Vinac for

vertebrate fossils); and (in those cases where the resource cannot be recovered at all) reburial of the resource. Data recovery in these cases will include documentation of pertinent data (lithology, stratigraphy, taphonomy, etc.) as well as photodocumentation where possible. This measure will be further implemented by the mobilization of additional paleontologic field monitors if unusually large finds are encountered during excavation. This procedure will optimize data recovery and avoid delays.

After Construction

PA-5 For all macro- and microfossils (vertebrate, invertebrate and/or plant) recovered during the field reconnaissance or during construction, a data recovery program shall be undertaken that includes preparation of recovered specimens to a point of identification and permanent preservation (including screen washing of fossiliferous sediment samples to recover small to microscopic vertebrate fossils); preparation of large vertebrate fossils recovered in plaster jackets; long-term stabilization of all recovered significant fossils; and analysis. The paleontologic monitoring and salvage team shall include an expert in vertebrate paleontology. A final report, including an itemized and accessioned inventory of recovered specimens, shall be prepared by a professional vertebrate paleontologist and distributed to the appropriate lead agencies. This report shall include any important megainvertebrate fossil localities and/or fossil plant localities. These items and procedures are discussed elsewhere under "Curation Plan."

PA-6 All fossil remains recovered during construction and associated development activity shall be curated at the expense of the developer at a qualified research facility (e.g., the Nevada State Museum or SBCM). A Memorandum of Agreement (MOA) for curation shall be reviewed and approved among the developers, the BLM, and the designated curation facility providing rights to these materials for guaranteed future research access.

5.2 FIELD MONITORING PROCEDURES

The SBCM has established the following procedures and guidelines to ensure the proper protection, salvage and recovery of paleontologic resources as they are encountered. Procedures for monitoring and fossil recovery by qualified paleontologic field monitors are addressed as well as guidelines for construction personnel and excavation contractors who may encounter paleontologic resources in the course of their activities during excavation.

A qualified, professional vertebrate paleontologist trained in paleontologic salvage guidelines and techniques will be on-site during all excavation activities conducted in rock units that have been identified to have high paleontologic sensitivity. Field monitoring and fossil salvage will be conducted under permit from the BLM. Paleontologic monitors will be equipped to efficiently salvage fossils as they are unearthed in order to avoid excavation/construction delays. Field paleontologists may, based upon their experience and upon consultation with senior paleontologic staff, amend determinations of sensitivity and accordingly reduce or eliminate

monitoring/mitigation activities, as dictated by the nature of the exposed rock outcrop(s).

Paleontologic monitors and/or their necessary equipment (including trucks) will be working in the area(s) of active excavation. Construction equipment operators will be instructed to give these monitors a wide berth (≈ six meters/twenty feet at least) for safety reasons. The paleontologic monitors will be prepared to quarry rock samples where necessary, and to remove samples of sediments that are likely to contain the remains of small to microscopic fossil invertebrates and vertebrates; the monitors may enlist the assistance of construction personnel and equipment in this undertaking, in order to avoid delays in excavation activities. The monitors will be empowered to temporarily halt or divert equipment to allow removal of abundant or large specimens.

The paleontologic monitors will be provided with appropriate safety materials (hard hats, orange vests with reflective yellow tape, steel-toed boots, et cetera) in order to promote safety and to facilitate ease of observation by the equipment operators.

Because the monitors will be performing their duties in close proximity to the excavation equipment, they have been trained to make themselves visible to equipment operators while in the field, and will usually endeavor to make eye contact with the operators prior to entering a potentially hazardous area. They will frequently be required to operate vehicles or equipment near active excavation areas. For this reason, the operators must be alert at all times to the presence of paleontologic monitors and their equipment in the excavation area.

5.3 CONSTRUCTION PERSONNEL PROCEDURES

As addressed in the attached document, "Guidelines for Construction Personnel and Supervisors" (provided in Appendix A), crews and supervisors should be on the lookout at all times for fossils, bones, animal trackways, charcoal, ash or other paleontologic resources exposed during all excavation activities. Although paleontologic monitors will be present at all times during excavation in rock units with high fossil potential, and additionally will spot-check excavation in rock units with undetermined potential, onsite personnel and/or other construction contractors may provide invaluable assistance in the salvage and recovery of these resources.

Upon encountering an exposed fossil or other paleontologic resource, the paleontologic monitor(s) will stake off and flag an area of ± two (2) meters on all sides of the find, in order to alert equipment operators to the presence of a potential resource. The monitor(s) will then further expose the find in order to assess the potential significance of the find and determine the appropriate recovery requirements. Construction crews must avoid these staked off/flagged areas by a minimum of six (6) meters until the paleontologists have authorized continued excavation.

5.3.1 Fossils Discovered By Construction Personnel During Excavation

As stated above, a qualified paleontologic monitor will be on-site initially during all excavation activities conducted in rock units that have been identified to have high paleontologic sensitivity. However, it is possible that construction crew members or equipment operators may be the first

individuals to observe paleontologic resources exposed by excavation. It is also possible that fossils or other resources will be encountered in areas of low or undetermined paleontologic sensitivity, at times when no paleontologic monitor is present. In these cases, *it is unlawful for construction workers and other construction contractor personnel to collect fossils from any construction area during construction*. The following guidelines are therefore to be employed in these cases.

5.3.1.1 Areas of High Paleontologic Sensitivity

In the event that the construction crew or the equipment operators suspect that they've uncovered fossils or other resources, preservation of the resource(s) and notification of the paleontologic monitor are of prime importance. Upon uncovering a potential resource in these sensitive areas, construction personnel should immediately divert excavation activities away from the potential site. Suspected resource localities should be avoided by a *minimum* of six (6) meters until the paleontologic monitor has approved further excavation. Subsequent to diverting construction equipment, operators and crew members must *immediately* endeavor to catch the attention of the paleontologic monitor. The sooner the paleontologic monitor is alerted to the presence of the find, the sooner he or she can stake off and flag the area, assess the significance of the remains, recover the resource (if necessary), and permit excavation to continue in that area. Excavation in the affected area must not continue until authorized by the paleontologic monitor.

If the paleontologic monitor is not in the immediate vicinity, the operator or crew member should immediately stake off and flag the affected area, so that subsequent excavation equipment does not further damage or destroy the resource. Equipment operators are advised to carry lathe stakes and colored flagging with them at all times, to facilitate this mitigation effort. Once the affected area is staked off and flagged (if possible), the operator or crew member must then *immediately* contact the construction inspector. It is this inspector's responsibility to contact the paleontologic monitor in this situation. The paleontologic monitor will respond to the construction inspector's request for assistance as soon as it is possible for him or her to do so. Construction crews and their supervisors must keep in mind that the paleontologic monitor may be involved in recovering resources elsewhere in the excavation, so an immediate response may not always be possible.

5.3.1.2 Areas of Low Paleontologic Sensitivity

In the event that fossils are exposed in sediments exposed during excavation in areas that were initially determined to have low paleontologic sensitivity, treatment of these fossils will be the same as that established for areas of high sensitivity. The operator or crew member should immediately stake off and flag the affected area, so that subsequent excavation equipment does not further damage or destroy the resource. Equipment operators are advised to carry lathe stakes and flagging with them at all times, to facilitate this mitigation effort. Once the affected area is staked off and flagged (if possible), the operator or crew member must then *immediately* contact the construction inspector. It is the construction inspector's responsibility to contact the paleontologist in this situation. Paleontologic field monitors will respond to the construction inspector's request for assistance as soon as it is possible for them to do so.

5.3.1.3 Areas of Undetermined Paleontologic Sensitivity

In the event that fossils are exposed in rocks that were initially determined to have undetermined paleontologic sensitivity, treatment of these fossils will be similar to that established for areas of high sensitivity. Initial identification of such resources may differ somewhat in these cases, however, because such fossils may be anticipated in cave openings or fissures. The appearance of such fissures or openings is therefore a matter of paleontological concern. Where such features and/or any associated fossil resources are encountered or anticipated to be likely to be encountered, operators and crew members should immediately stake off and flag the affected area, so that subsequent excavation equipment does not further damage or destroy the resource. Equipment operators are advised to carry lathe stakes and flagging with them at all times, to facilitate this mitigation effort. Once the affected area is staked off and flagged (if possible), the operator or crew member must then *immediately* contact the construction inspector. It is the construction inspector's responsibility to contact the appropriate paleontologist in this situation. Paleontologists will respond to the construction inspector's request for assistance as soon as it is possible for them to do so.

In every case, supervisors and crew members should *avoid moving or disturbing the resource(s)* until the paleontologist(s) have determined the significance of the find. Again, *it is unlawful for construction workers or other construction contractor personnel to collect fossils from any construction areas during construction*. Work may not continue in the affected area until the paleontologic monitor(s) have removed or otherwise mitigated impacts to the find(s) and authorized further excavation.

5.3.2 Resources Identified In Spoils Piles By The Paleontologic Monitor

Fossil resources discovered in the spoils piles by the paleontologic monitor will be flagged off and collected by the monitors for salvage and removal. Construction personnel must not back-fill exposed auger holes until the stakes and flagging have been pulled by the paleontologist on site. Stakes and flagging will be removed subsequent to resource recovery, and back-filling of the auger hole will then be allowed to proceed.

When bulk samples of sedimentary matrix need to be recovered during excavation, the most

expeditious and cost-effective manner to remove this material is to employ the construction crew members and equipment for a brief period to remove the sediment in bulk (in the case of a spoils pile, that task has already been accomplished). Exceptionally large fossils or assemblages of fossils are also most easily and economically recovered in this manner.

The paleontologic mitigation program is designed to recover not only exposed paleontologic resources, but also significant contextual data associated with these resources. For this reason, site paleontologists will often be required to stake off and flag some areas within the excavation in order to plot resource localities, measure stratigraphic sections, map fossiliferous horizons, photograph exposures, and so forth. Again, the equipment operators must avoid these staked off and flagged areas until the paleontologists have authorized continued excavation.

5.4 RECORDATION AND DOCUMENTATION OF PALEONTOLOGIC RESOURCES

All paleontologic field monitors are trained in standardized methods and procedures to ensure that data collection is equitable among all identified paleontologic resource localities. All data collection and recordation techniques, as well as standard safety equipment and safety procedures will be reviewed prior to the project start-up.

During the paleontologic mitigation monitoring program, all observed pertinent data will be recorded on waterproof field notebooks with permanent ink on-site at the time the resource has been exposed and recovered. All paleontologic field notes will be retained at the appropriate paleontologic resource repository; photocopies will be generated frequently to ensure that there are always permanent copies in the event a field notebook is lost or misplaced.

Monitors will be equipped with Brunton or equivalent compasses with built-in clinometers to permit precise elevational siting of fossil horizons; it is imperative that accurate stratigraphic information is obtained in this way. The use of Global Positioning System (GPS) units will allow monitors to accurately plot paleontologic resource localities on project maps that will be provided for them.

Characterization of the sedimentary lithology is important in paleontologic studies. The character of the sediment surrounding the resources provides many clues as to the environment of deposition. Lithologic description is enhanced by the use of rock color charts to uniformly assess sediment color. Additionally, details such as grain size, shape, sorting, roundness, and sphericity of lithologic samples will be determined by the monitor in the field with a hand lens. Small samples of sediment will be collected at each resource site. Monitors will also sketch measured stratigraphic sections of the area surrounding a resource locality. Photodocumentation will be conducted where judged appropriate by the field monitor.

For taphonomic studies, magnetic north will be noted using a Brunton or equivalent compass and written on the fossil specimens (or plaster jackets that encase them) so that the original orientation of the specimen(s) in the sediment is preserved. Other taphonomic data (evidence of trampling, weathering, etc) will be noted where pertinent; however, in most cases these determinations are better performed in the laboratory.

For safety purposes, paleontologic field monitors will be equipped with hard hats, bright orange

vests with a reflective coating, and steel-toed boots.

5.5 RECOVERY OF PALEONTOLOGIC RESOURCES

5.5.1 Megafaunal Sampling Plan

The distribution of large vertebrate fossils that are unearthed by the excavation equipment is herein considered random. The megafaunal sampling plan will therefore be strictly dictated by the excavation activities planned for a given development project. The paleontologists will monitor *only* in the areas that are being excavated in rock units that have high (or, in some cases, undetermined) paleontologic potential. Excavation equipment will unearth fossil resources while the paleontologic field monitor is observing the excavation; the quantity and quality (which in some cases will be diminished by the equipment) of the fossils cannot be known *a priori*. Based upon previous studies, however, it can be proposed that the potential for vertebrate fossils is relatively high where exposures of Tertiary and Quaternary fluvial and lacustrine sediments are present at the surface or in the subsurface within the area of potential effect of the Southwest Intertie Project.

As discussed above, *it is not the goal of the megafaunal sampling plan to collect all paleontologic resources that are discovered*. The paleontologic monitor determines whether the find should be collected at the time of discovery. The criteria for this task are very clear. Monitors collect only fossils possessing articulated surfaces or other diagnostic features that aid in precise identification. Bones or bone fragments of an indeterminate or unidentifiable nature are not collected, save in those areas where fossil bones have not previously been recorded. Where a paleontologic monitor discovers a megafaunal resource locality exposed by excavation, the fossils will be expeditiously jacketed with plaster bandages or strips of burlap saturated with plaster, then removed and returned to the appropriate, professionally-recognized and accredited curatorial facility for preparation, identification and permanent storage.

5.5.2 Microfaunal Sampling Plan

The sampling of microvertebrates is critical to understanding both the temporal and the paleoecological aspects of the sediments encountered in conjunction with development. Microvertebrates (especially rodents) can be useful to paleontologists in determining the age of the sediments in which they are deposited; this relative age dating application is called biochronology. This method is ideally utilized in conjunction with methods of absolute dating such as the radiometric dating of ashes, charcoal or dating of bone collagen to obtain a clear picture of the age of the sediments. Recovery and analysis of fossil pollen can potentially enable determination of changes in plant distributions and microclimate through time.

Microfauna are also extremely useful in determining the paleoenvironment in existence at the time the sediments were deposited. Small animals such as amphibians and reptiles are very specific to certain environments (pond turtles, for instance, live near water). Amphibians in a sample are also indicative of a wet environment since they must reproduce in water. Analysis of the microfauna can therefore enable us to determine what the climate was like during the time periods that span the rock units exposed during development. Large vertebrates are less useful for paleoenvironmental analysis, due to their proclivity for traveling large distances during their

lifetime; it follows, therefore, that small animals which have restricted geographic ranges would be more likely to yield environmental data.

5.5.2.1 Details of Microfaunal Sampling Plan

The microfaunal sampling plan is designed to allow for the recovery of microvertebrates at appropriate locales within the area of potential effect of the Southwest Intertie Project.

The recovery of bulk samples of sediment that contain microvertebrate remains has been standardized by Wolff (1975). Standard samples of fossiliferous matrix are generally accepted to be 2,724 kg (6,000 lbs = 2.4 cubic meters) per lithologic horizon. As discussed in PA-3 above, the sampling calls for standard samples of matrix to be collected within members or formations that have proved to produce terrestrial vertebrate fossils, or that have undetermined potential to produce such fossils. Sedimentary matrix will be stockpiled on-site, and subsequently processed; recovered specimens will be identified and curated.

5.5.3 Marine Invertebrate Sampling Plan

In addition to the above-named fossil-bearing formations, which are likely to yield scientifically-significant remains of terrestrial vertebrates, many Precambrian and Paleozoic rocks are also fossiliferous and have potential to yield significant marine invertebrate fossils. Samples of these rocks containing representative samples of fossil assemblages contained therein will be recovered from areas of potential impact (possibly by quarrying if necessary) and removed for laboratory preparation and storage. The size and nature of the recovered samples will be determined during preconstruction field reconnaissance.

5.5.4 Recovery/Replication of Fossil Trackways

Unique fossil trackways may occur within the area of potential effect of the Southwest Intertie Project, or adjacent to the project property. Trackways are highly visible and are subject to removal by unauthorized collection. In the event that trackways cannot be avoided, overburden will be removed to expose the trackways, which will be then either be removed (preferred) or replicated for curation. Recovered specimens will be curated at an approved repository in accordance with appropriate federal, state and county permits.

5.6 CURATION PLAN

Curation of fossil specimens collected during the paleontologic mitigation program includes the preparation of recovered specimens to a point of identification and permanent preservation, including screen washing of fossiliferous sediment samples to recover small to microscopic vertebrate fossils. Large specimens encased in plaster jackets taken from the site will be prepared in the paleontology laboratory.

5.6.1 Processing and Curation Techniques

The curation plan calls for laboratory preparation of recovered fossil remains to a point of identification and permanent preservation (*not* exhibition). This preparation generally requires exposure of the recovered resource(s) by removal of the surrounding sedimentary matrix from the jacket; this matrix is saved for later microfossil processing. Once the matrix has been removed and the specimen has been cleaned, the fossil is hardened with Vinac, a modified polyvinyl acetate homopolymer, which has been thinned with acetone in order to enable the hardener to more fully penetrate the fossil. Vinac may be applied several times before the fossil is deemed to be sufficiently sturdy for permanent storage. Excess plaster from the jacket is then trimmed, to reduce the amount of storage space required by the specimen.

The curation plan also includes the processing of standard samples of fossiliferous matrix. Sedimentary matrix will be water-washed through stacked sets of 20- and 30-mesh screens and sun-dried; select sediment samples may be washed through more finely-meshed screens to enable the recovery of microscopic ostracodes or fossil pollen, where appropriate. To accelerate the breakdown of fossiliferous matrix, sediments will be oven-roasted to promote drying, then re-submerged in water to facilitate disaggregation of clays and fine silts. Subsequent screen washing will remove these fine sediments and leave fossil specimens in a clean concentrate. This concentrate will be visually examined – when necessary with the aid of binocular microscopes – and hand-sorted to remove fossil specimens.

The curation plan further includes sampling for fossil pollen. In those cases where pollen is identified from bulk samples in the field, additional sampling should be initiated where warranted in a series of more precise (e.g., 2 cm) sampling horizons; this will potentially enable determination of changes in plant distributions and microclimate through time.

Should plant macrofossils be exposed or identified during a mitigation program, such fossils should be collected and prepared to a point of identification and permanent preservation (*not* exhibition). Preparation generally requires full exposure of the recovered resource(s) by splitting of thin sedimentary layers along their bedding planes, followed by application of a hardening agent. Misting with a 10:1 water/white glue mixture is usually sufficient for preserving such fossils; application of nitrocellulose thinned with acetone is also recommended in some instances (Lepage and Basinger, 1993). In some cases, at the discretion of the Principal Investigator, select rock slabs thought to contain fossilized plant remains will be left intact for future researchers.

Other curatorial tasks will include the identification, curation and accessioning of all recovered specimens into the retrievable storage collections of an approved, accredited curation facility. All data pertaining to the specimens will be recorded in the collections database of the repository. Resource locality information will also be plotted on topographic maps and entered into a computerized locality database. Card stock printouts of all pertinent faunal, floral, locational, and lithologic data pertaining to each resource locality will be produced and filed. Card stock files from the locality database will also be printed and kept on file.

Following preparation, fossils will be stored in steel cabinets with steel geologic specimen trays. Accession and locality data will be printed in archival ink on acid-free paper tags associated with each specimen, generated from the specimen database. Accession numbers of large fossils will be written on the bone in permanent ink. Large fossils will be stored in their plaster jackets

where necessary to help retain the integrity of the bone; excess plaster will be cut away prior to storage, to maximize storage space. Microfossils will be stored in glass vials with cork stoppers; extremely small specimens (e.g., ostracodes) will be placed in gelatin capsules within the glass vials. Accession data slips inside each of the glass vials, also generated from the computer database, will prevent inadvertent shuffling of the collection and provide a means of "earthquake-proofing" the collection. The glass vials will be placed in cardboard jewelers' boxes with their data slips, then permanently stored in the geologic specimen trays. Labels bearing accession number data shall be glued to rock slabs bearing marine invertebrates or fossil plant remains, in such a manner so as not to damage or obscure the fossil(s).

Specimens recovered during the course of the mitigation program will be identified by professional paleontologists who have appropriate expertise in vertebrate and invertebrate paleontology and paleobotany.

The fossils will be curated and stored and accessioned into the permanent retrievable collections of a recognized, accredited repository. All paleontologic resources will be catalogued and accessioned under a unique number, which would identify the appropriate property and/or development project as the source of the fossils.

A final report of methods and results of the paleontologic mitigation plan will be provided at the cessation of each mitigation program. The report will include a detailed discussion of how the research goals of the project have been met, in addition to descriptions of significant finds, discussion of the curation of the resources, and results of sampling and analysis as well as an itemized accession inventory of all specimens recovered. A discussion of the significance of each taxon discovered will be provided where feasible. All resource locality information will be presented as a confidential appendix and a printout of all locality data, as well as pull-out maps with all paleontologic resource localities plotted.

6: MITIGATION RECOMMENDATIONS

This section summarizes the results of the literature search and review of the Regional Paleontologic Locality Inventory (RPLI), and applies the mitigation measures described in the previous section to the potential project excavation areas according to broad geologic units. These measures apply to the length of the proposed SWIP project corridor, as well as to all accompanying areas of potential impact (power lines, access roads, rail loops, etc.). These measures can be finalized upon receipt of the final construction plans. Preconstruction surveying of the areas where development-related excavation is planned (mitigation recommendation PA-2) is expected to provide additional, more precise geologic detail for assessing paleontologic sensitivity.

6.1 GEOLOGIC DEPOSITS: PRECAMBRIAN ROCKS

Sensitivity: ***UNDETERMINED***

Recommendations: The "Prior to Construction" general mitigation measures should be applied to this rock unit. These measures include worker education and briefing of construction personnel (PA-1) and pre-construction reconnaissance of the area(s) of potential impact (PA-2). Samples containing a representative sample of the fossil assemblage may be recovered from areas of potential impact (possibly by quarrying if necessary) and removed for laboratory preparation and storage (PA-3). The size and nature of the recovered samples will be determined during preconstruction field reconnaissance. If cave openings or significant rock fissures are encountered at any time, PA-3 through PA-6 may apply, as determined by a professional paleontologist. If significant fossils (including wood rat middens) are encountered, PA-4 through PA-6 will apply.

6.2 GEOLOGIC DEPOSITS: PALEOZOIC ROCKS

Sensitivity: ***UNDETERMINED***

Recommendations: The "Prior to Construction" general mitigation measures should be applied to this rock unit. These measures include worker education and briefing of construction personnel (PA-1) and pre-construction reconnaissance of the area(s) of potential impact (PA-2). Samples containing a representative sample of the fossil assemblage(s) may be recovered from areas of potential impact (possibly by quarrying if necessary) as deemed appropriate, and removed for laboratory preparation and storage (PA-3). The size and nature of the recovered samples will be determined during preconstruction field reconnaissance. If cave openings or significant rock fissures are encountered, PA-3 through PA-6 may apply, as determined by a professional paleontologist. If significant fossils (including wood rat middens) are encountered, PA-4 through PA-6 will apply.

6.3 GEOLOGIC DEPOSITS: MESOZOIC ROCKS

Sensitivity: ***LOW***

Recommendations: Worker education and briefing of archaeologists and construction inspectors (PA-1) should be conducted prior to excavation. No other monitoring or mitigation protocols are anticipated from Mesozoic rocks along the proposed SWIP corridor.

6.4 GEOLOGIC DEPOSITS: TERTIARY DEPOSITS

Sensitivity: ***HIGH*** (fluvial and lacustrine sediments);
LOW (volcanics, intrusive granitics, tuffs)

Recommendations: In fluvial and/or lacustrine sediments of Tertiary age, the "Prior to Construction" general mitigation measures should be applied to this area of excavation. These measures include worker education and briefing of construction personnel (PA-1) and pre-construction reconnaissance of the area(s) of potential impact (PA-2). In areas of high sensitivity, monitoring of construction by a professional paleontologist under permit from the BLM (PA-3) is also required. Field monitoring should be initiated full time, with the provision that – as warranted by field examination of sediments exposed by excavation – the field effort may be reduced to part-time monitoring or spot-checking where feasible as the project proceeds. Large vertebrate fossils will be jacketed and recovered. Sediments yielding remains of aquatic or terrestrial vertebrates will be screened in the field to determine the potential for the recovery of significant resources and the efficacy of more detailed sampling. Sediments yielding invertebrate remains will be screened in the field, and sampled only in those cases where significant data are likely to be yielded. Fossil animal trackways, if not avoided, will be either collected or replicated. If significant fossils are recovered, PA-4 through PA-6 will apply.

6.5 GEOLOGIC DEPOSITS: QUATERNARY DEPOSITS

Sensitivity: ***HIGH*** (fluvial and lacustrine sediments of Pleistocene age);
LOW (Pleistocene volcanics, intrusive granitics, tuffs; recent alluvium)

Recommendations: In fluvial and/or lacustrine sediments of Pleistocene age, the "Prior to Construction" general mitigation measures should be applied to this area of excavation. These measures include worker education and briefing of construction personnel (PA-1) and pre-construction reconnaissance of the area(s) of potential impact (PA-2). In areas of high sensitivity, monitoring of construction by a professional paleontologist under permit from the BLM (PA-3) is also required. Field monitoring should be initiated full time, with the provision that – as warranted by field examination of sediments exposed by excavation – the field effort may be reduced to part-time monitoring or spot-checking where feasible as the project proceeds. Large vertebrate fossils will be jacketed and recovered. Sediments yielding remains of aquatic or terrestrial vertebrates will be screened in the field to determine the potential for the recovery of significant resources and the efficacy of more detailed sampling. Sediments yielding invertebrate remains will be screened in the field, and sampled only in those cases where significant data are likely to be yielded. Fossil animal trackways, if not avoided, will be either collected or replicated. If significant fossils are recovered, PA-4 through PA-6 will apply.

NOTE: **Recent sediments present at the surface throughout the extent of the area of potential effect of the Southwest Intertie Project may be underlain throughout their extent by fossil-bearing rock units. Excavation in the younger alluvium may expose paleontologically-sensitive rocks or sediments.**

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Division of Geological Sciences
San Bernardino County Museum
21 July 2006

APPENDIX A

Outline of Orientation Meeting for Construction Personnel,

Checklist for Paleontologic Resources

and

Guidelines for Construction Personnel and Supervisors: Field Recovery of Paleontologic Resources, Southwest Intertie Project

ORIENTATION MEETING FOR CONSTRUCTION PERSONNEL AND SUPERVISORS

FIELD RECOVERY OF PALEONTOLOGIC RESOURCES SOUTHWEST INTERTIE PROJECT

Prepared by:

DIVISION OF GEOLOGICAL SCIENCES
SAN BERNARDINO COUNTY MUSEUM

I. INTRODUCTION

- Project Location and Description
- Scope and Purpose of Paleontologic Resource Mitigation Plan
  - -- What is a paleontologist?
  - -- What is "paleontologic mitigation?"
  - -- What do paleontologic monitors do?

II. FOSSIL RESOURCES

- What are paleontologic resources?
- Why are fossils important?
  - -- Definitions of a "significant resource"
- How do we determine rock unit sensitivity?
  - -- High sensitivity
  - -- Low sensitivity
  - -- Undetermined sensitivity

III. GEOLOGY / PALEONTOLOGY OF THE SOUTHWEST INTERTIE PROJECT

- Precambrian rocks
- Paleozoic rocks
- Tertiary fluvial and/or lacustrine sediments
- Pleistocene fluvial and/or lacustrine sediments
- Recent alluvium

IV. PALEONTOLOGIC RESOURCE MONITORING PLAN

- Mitigation measures
- Field monitoring procedures
- Construction personnel procedures
  - -- How do I recognize fossils?
  - -- What do I do if I find a fossil?
- Recovery of paleontologic resources and associated contextual data
  - -- Megafaunal sampling
  - -- Microfaunal sampling
  - -- Trackways

V. SUMMARY

CHECKLIST FOR PALEONTOLOGIC RESOURCES
SOUTHWEST INTERTIE PROJECT

CONSTRUCTION CREWS -- BE ALERT FOR THESE ITEMS / CONDITIONS

Materials:

____ Bones
____ Ancient plant remains (chunks of fossil wood, branches, logs, etc.)
____ Charcoal
____ Shells, in sediments or in rock (limestone)
____ Stones which appear to have been shaped or which have an unusual shape
____ Any objects which appear to be unusual or out of place.
___ Animal trackways

Conditions:

____ Ash or ash-like sediments (grey to white, very fine-grained; often powdery in texture and appearance)
____ Lake sediments (greenish, fine-grained; silts & clays)
____ Marine sediments (fine sands and silts; ancient limestone)
____ Stream or river sediments (grey to reddish gravels; water-rounded pebbles and/or cobbles)
____ Playa sediments (red-brown, fine-grained clays and silts w/ mud cracks)
____ Any unusual or out-of-place sedimentary layers or strata.
____ Openings or fissures in marine limestone

**IF YOU UNCOVER ANY OF THE ABOVE MATERIALS / CONDITIONS --
OR OTHER OBJECTS YOU SUSPECT MIGHT BE PALEONTOLOGIC RESOURCES:**

CONTACT THE SITE PALEONTOLOGIST
OR YOUR CONSTRUCTION MONITOR IMMEDIATELY!

NOTE: IT IS *UNLAWFUL* FOR CONSTRUCTION MONITORS OR OTHER CONSTRUCTION CONTRACTOR PERSONNEL TO COLLECT FOSSIL RESOURCES FROM THE RIGHT-OF-WAY OR FROM ANY OTHER EXCAVATION AND/OR CONSTRUCTION AREAS DURING CONSTRUCTION!!

GUIDELINES FOR CONSTRUCTION PERSONNEL AND SUPERVISORS: FIELD RECOVERY OF PALEONTOLOGIC RESOURCES SOUTHWEST INTERTIE PROJECT

Prepared by:

SAN BERNARDINO COUNTY MUSEUM
DIVISION OF GEOLOGICAL SCIENCES

Excavation conducted in conjunction with development of the proposed Southwest Intertie Project has high potential to encounter significant nonrenewable paleontologic resources (= fossils) that are likely to be destroyed unless proper monitoring and mitigation procedures are employed. For this reason, qualified professional vertebrate paleontologists with regional experience will provide paleontologic monitoring on-site at all times during all phases of excavation in sediments that have been targeted to contain fossil resources. To aid in this endeavor, the following procedures have been formulated and established by the SBCM, subject to review by the Bureau of Land Management (BLM), to instruct and assist development personnel and/or other construction contractors in the proper protection, salvage and recovery of these resources as they are encountered.

In brief, the following guidelines should be applied at all times during excavation:

-- Be alert for paleontologic monitors and/or their equipment (including trucks) in the area(s) of active excavation and the along haul roads. When monitors are excavating a find, give them a wide berth (~ six meters or more).

-- Be alert for fossils and other significant resources (see attached checklist). *Immediately* alert the paleontologic monitors in the event that paleontologic resources are encountered. If the monitors are not in the vicinity, stake the affected area off with lathe stakes and colored flagging. *Immediately* thereafter, contact your designated construction inspector. Avoid moving or disturbing the resource(s) until the paleontologists have determined the significance of the find.

-- Be alert for areas that have been flagged and/or staked off by the paleontologic monitors. Give these areas a wide berth (~ six meters or more) regardless of whether or not a paleontologist is present.

FIELD PROCEDURE FOR MONITORING AND RECOVERY

Professional, qualified paleontologic field monitors will be on-site during all excavation activities conducted in potentially-fossiliferous sediments. These monitors will be equipped to salvage fossils as they are unearthed, in order to avoid excavation/construction delays. The paleontologic monitors will also be prepared to remove samples of sediments that are likely to contain the remains of small to microscopic fossil invertebrates and vertebrates; the monitors may enlist the assistance of construction personnel and equipment in this undertaking, in order to avoid delays in excavation activities. The monitors will be empowered to temporarily halt or divert equipment to allow removal of abundant or large specimens.

FIELD MONITORING

1.) ***Construction crews and supervisors must be alert for paleontologic monitors and/or their equipment in the area(s) of active excavation.***

Paleontologic monitors will be present in the field as necessary for all grading, trenching, augering, or other excavation in high potential sediments. They will be provided with appropriate safety materials (hard hats, orange vests w/ reflective yellow tape, steel-toed boots, etc.) in order to promote safety and to facilitate ease of observation by the equipment operators. The paleontologic monitors will also be provided by the developers with hand-held radios if deemed necessary to streamline communications with construction personnel.

Monitors will perform their duties in close proximity to the excavation equipment. They are trained to make themselves visible to equipment operators while in the field, and will usually endeavor to make eye contact with the operators prior to entering a potentially hazardous area. They will frequently be required to operate vehicles or equipment in the excavation or along the haul roads. For this reason, the operators must be alert at all times to the presence of paleontologic monitors and their equipment in the excavation area.

2.) ***Construction crews and supervisors must be alert for fossils and other significant resources.***

Construction crews and supervisors should be on the lookout at all times for fossils, bones, charcoal, ash or other paleontologic resources exposed during excavations. Although paleontologic monitors will be present at all times during excavation in moderate to high potential sediments, development personnel and/or other construction contractors may provide invaluable assistance in the salvage and recovery of these resources as they are encountered. All personnel have a responsibility to protect paleontologic resources on the project. ***This is everyone's responsibility.*** Be on the lookout for:

-- Bones
-- Ancient plant remains (chunks of wood, branches, logs, etc.)

-- Charcoal
-- Ash or ash-like sediments
-- Stones that appear to have been shaped
-- Fossil-bearing horizons or strata (see attached checklist)
-- Openings, caves, or fissures in marine limestone rocks
-- Wood rat middens

3.) ***Construction crews must divert or stop work <u>immediately</u> when they encounter what they suspect to be a fossil, a group of fossils, or other paleontologic resources.***

In the event that the construction crew or the equipment operators *suspect* that they've uncovered fossils or other resources during excavation activities, they should immediately divert excavation activities away from the potential site. Suspected resource localities should be avoided by a *minimum* of six (6) meters until the paleontologic monitor has approved further excavation.

Upon uncovering a potential resource and diverting equipment, operators and crew members should then *immediately* endeavor to catch the attention of the paleontologic monitor. The sooner the monitor is alerted to the presence of the find, the sooner he or she can stake off and flag the area, assess the significance of the remains, recover the resource (if necessary), and permit excavation to continue in that area. *Excavation in the affected area will not continue until authorized by the paleontologic monitor!* Stakes and flagging will be removed subsequent to resource recovery, and excavation will then be allowed to proceed.

If the monitor is not in the vicinity, the operator or crew member should immediately stake off and flag the affected area, so that subsequent excavation equipment does not further damage or destroy the resource. (Note: Operators are advised to carry lathe stakes and flagging with them at all times, to facilitate this mitigation effort.) Once the affected area is staked off and flagged (if possible), the operator or crew member must then *immediately* contact the construction inspector. It is the construction inspector's responsibility to contact the paleontologic monitor in this situation. (Note: The nearest paleontologic monitor will respond to the supervisor's request for assistance as soon as it is possible for him or her to do so. However, the construction crews and their supervisors must keep in mind that the monitors may be involved in recovering resources elsewhere in the excavation, so an immediate response may not always be possible.)

In the event that fossils are exposed in sediments that were determined to have low paleontologic sensitivity (or to have undetermined sensitivity for paleontologic resources), the operator or crew member should immediately stake off and flag the affected area so that subsequent excavation equipment does not further damage or destroy the resource. Equipment operators are advised to carry lathe stakes and flagging with them at all times, to facilitate this mitigation effort. Once the affected area is staked off and flagged (if possible), the operator or crew

member must then *immediately* contact the construction inspector. It is the construction inspector's responsibility to contact the paleontologist in this situation. Paleontologic field monitors will respond to the construction inspector's request for assistance as quickly as they possibly can.

In every case, supervisors and crew members should *avoid moving or disturbing the resource(s)* until the paleontologists have determined the significance of the find. Work should not continue in the affected area until the paleontologic monitors have removed the find and authorized continued excavation.

RESOURCE RECOVERY

1.) ***Construction crews and supervisors must be alert for areas that have been flagged and/or staked off by the paleontologic monitor(s).***

Upon encountering an exposed fossil or other paleontologic resource, the monitor(s) will stake off and flag an area of ± two (2) meters on all sides of the find, in order to alert equipment operators to the presence of a potential resource. The monitor(s) will then further expose the find in order to assess the potential significance of the find and determine the appropriate recovery requirements. Vertebrate fossils, plant fossils and representative samples of vertebrate and invertebrate fossil resources will be collected and preserved in this manner. Samples of marine fossils may be quarried. Construction crews must avoid all such staked off/flagged areas by a minimum of six (6) meters until the paleontologists have authorized continued excavation.

2.) ***Construction crews and supervisors may be required to assist paleontologic personnel in the recovery of fossiliferous sediments and/or of unusually large or abundant resources.***

When bulk samples of sedimentary matrix need to be recovered during excavation for vertebrate/invertebrate microfossil sampling, the most expeditious and cost-effective manner to remove this material is to employ the construction crew members and equipment for a brief period to remove the sediment in bulk (spoils piles from the augering facilitate this task). Exceptionally large fossils, assemblages of fossils, or fossil horizons are also most easily and economically recovered in this manner.

3.) ***Construction crews and their supervisors must avoid disturbing areas that have been staked off for data acquisition (sediment profiles, stratigraphic studies, photodocumentation, etc.) until these areas have been cleared for further excavation by the paleontologic monitor.***

The paleontologic mitigation program is designed to recover not only exposed paleontologic resources, but also significant contextual data associated with these resources. For this reason, site paleontologists will often be required to stake off and flag some areas within the excavation in order to plot resource localities, measure stratigraphic sections, map fossiliferous horizons, photograph

exposures, and so forth. Again, the equipment operators must avoid these staked off and flagged areas until the paleontologists have authorized continued excavation.

APPENDIX B

Results of Paleontology Reconnaissance Survey – Southwest Intertie Project (White Pine to Harry Allen 500 kV Transmission Line)

31 October 2006

EPG
Attn: Glenn Darrington
4141 North 32th Street, Suite 102
Phoenix, Arizona 85018

Re: Results of Paleontology Reconnaissance Survey – Southwest Intertie Project (White Pine to Harry Allen 500 kV Transmission Line)

Dear Dr. Darrington:

The Division of Geological Sciences at the San Bernardino County Museum has completed the reconnaissance survey for paleontologic resources along the Southwest Intertie Project right-of-way. The cursory survey, along with the literature review results has enabled us to pinpoint which areas along the transmission line possess high, undetermined or low paleontologic sensitivity. The following table delineates those designations along the route. The areas of undetermined or high paleontologic sensitivity will require a Class III field assessment.

Tower Structure	Paleontologic Sensitivity	Lithology	Pedestrian Survey
1-84	Low	Coarse fan, volcanics	No
84-112	Undetermined	Tys (undet. seds)	Yes
112-138	Low	Coarse fans	No
138-148	Undetermined	Tys (undet. seds)	Yes
148-175	Low	Volcanic	No
Jakes Wash access	Undetermined	Tys (undet. seds)	Yes
175-205	Undetermined	Tys (undet. seds)	Yes
205-227	Low	Volcanics	No
227-241	Undetermined	Tys (undet. seds)	Yes
241-267	Low	Volcanic	No

267-278	High	Tos (older seds)	Yes
278-365	Low	Pz rocks and fan	No
365-418	High	Lake/spring seds	Yes
418-479	Low	Volcanics	No
479-535	High	Lake seds	Yes
550-560	Undetermined	Possible lake seds	Yes
561-650	Low	Coarse fan	No
650-718	Undetermined	Possible lake seds	Yes
718-760	Low	Volcanic	No
760-907	Undetermined	Undetermined seds	Yes
907-983	Low	Coarse fan	No

Additionally, we have sent under separate cover a CD with an image of Figure 1 (Project Location) upon which the paleontologic sensitivity has been mapped.

Please contact me if you have any questions for require further clarification.

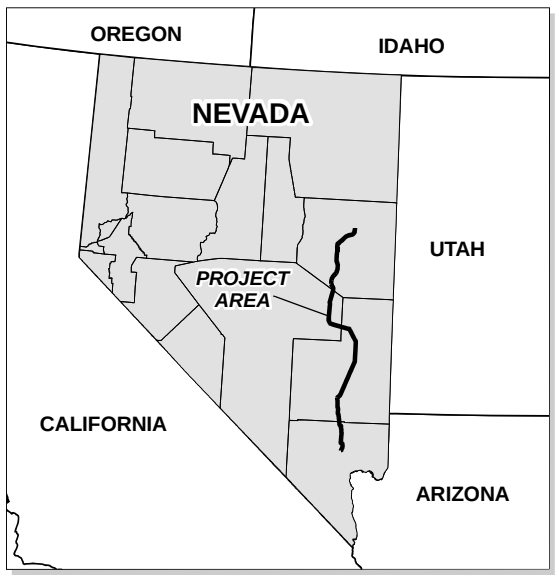
Sincerely,

Kathleen Springer, Senior Curator

Division of Geological Sciences

San Bernardino County Museum

REGIONAL LOCATION



WHITE PINE ENERGY STATION
THIRTYMILE SUBSTATION
HARRY ALLEN SUBSTATION
291
293
310
340
362
363
669
670
672
673
690
700
720
810
820
318
675
McGill
Ely
Preston
Currant
Duckwater
Duckwater Indian Reservation
Baker
Great Basin National Park
Pioche
Panaca
Caliente
Alamo
Nellis Air Force Bombing and Gunnery Range
Indian Springs
Moapa
Overton
Lake Mead
Desert National Wildlife Range
Humboldt-Toiyabe National Forest
WHITE PINE COUNTY
NYE COUNTY
LINCOLN COUNTY
CLARK COUNTY
50
93
15
NEWARK VALLEY
LONG VALLEY
BUTTE MOUNTAINS
BUTTE VALLEY
EGAN RANGE
SCHELL CREEK RANGE
STEPTOE VALLEY
SPRING VALLEY
SNAKE RANGE
JAKES VALLEY
PANCAKE RANGE
GRANT RANGE
RIVER VALLEY
WHITE RIVER VALLEY
RAILROAD VALLEY
CAVE VALLEY
SCHELL CREEK
LAKE VALLEY
FORTIFICATION RANGE
LIMESTONE HILLS
MOSS CREEK RANGE
GOLDEN GATE RANGE
SEAMAN RANGE
NORTH PAHROC RANGE
PAHROC RANGE
SAND SPRINGS VALLEY
TIKABOO VALLEY
GROOM RANGE
MT IRISH RANGE
DELAMAR VALLEY
DELAMAR MOUNTAINS
CLOVER MOUNTAINS
MEADOW VALLEY MOUNTAINS
MORMON MOUNTAINS
TULE DESERT
EMIGRANT VALLEY
RAHRANAGAT RANGE
EAST DESERT RANGE
THREE LAKES VALLEY
PINTWATER RANGE
INDIAN SPRINGS VALLEY
SPOTTED RANGE
BURIES HILLS
DESERT RANGE
SHEEP RANGE
ARROW CANYON RANGE
VIRGIN VALLEY

Paleontologic Sensitivity
- High
- Undetermined
- Low

Land Juristiction
- Bureau of Indian Affairs
- Bureau of Land Management
- Bureau of Reclamation
- Department of Defense
- Department of Energy
- Fish and Wildlife Service
- Forest Service
- National Park Service
- State of Nevada
- Private

Electrical Transmission Facilities
- SWIP 500kV Transmission Line
- 820 Transmission Line Link/Segment Number (EIS)
- Link Node
- Proposed White Pine Energy Station
- Proposed Thirtymile Substation
- Harry Allen Substation

General Reference Features
- County Boundary
- Major Transportation

Sources
BLM - Nevada State Office, Land Ownership 2005
USGS, 30 meter Digital Elevation Models
San Bernardino County Museum

0 5 10 20 Miles

SOUTHWEST INTERTIE PROJECT
500kV Transmission Line
Southern & Central Portions

Great Basin Transmission, LLC

Paleontologic Sensitivity Map

August 2008

Figure C2-1

epg

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