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SOCIAL AND ECONOMIC RESEARCH PROGRAM FOR THE GEYSERS-CALISTOGA KNOWN GEOTHERMAL RESOURCE AREA

MASTER

Charles Hall
Kerry O'Banion

March 27, 1979

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FOREWORD

This research program was prepared by the Lawrence Livermore Laboratory Environmental Sciences Division and the Lawrence Berkeley Laboratory Regional Studies Program in cooperation with Geothermal Research Information and Planning Services, a California Joint Powers Agency composed of Lake, Mendocino, Napa, and Sonoma Counties.

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SOCIAL AND ECONOMIC RESEARCH PROGRAM FOR THE GEYSERS-CALISTOGA KNOWN GEOTHERMAL RESOURCE AREA

ABSTRACT

The Geysers-Calistoga known geothermal resource area (KGRA), currently producing 502 MWe of electric power annually, can be further developed, perhaps to over 2500 MWe by 1990. Two of the four KGRA counties currently have inadequate regulatory structures with which to manage geothermal and induced urban development.

The purpose of this study is to assess the economic and social effects of projected geothermal resource development for both direct use and electric power generation and to analyze local regulatory policy options designed to mitigate adverse effects. The key issues are land use, fiscal and public infrastructure systems, demography, and the local economy. The study has seven elements: a computer-based inventory and analysis of land characteristics, constraints, sensitivity, and suitability for various land uses; projections of direct and electric geothermal development; primary and induced economic activity using an input-output model; demographic changes; the land and infrastructural demand created; an assessment of the economic and social effects of various configurations in land use that could result; and an analysis of various local regulatory policy options to mitigate adverse effects.

The study is a cooperative effort among two national laboratories, a regional agency, and the four Geysers-area counties (Lake, Mendocino, Napa, and Sonoma). The assessment results are intended to guide Department of Energy planners on the environmental consequences of program implementation. The regulatory policy analysis is intended for local officials who are implementing development-management policy.

INTRODUCTION

BACKGROUND

Planning for socioeconomic assessment research in The Geysers Region by Lawrence Livermore Laboratory (LLL) began late in 1977 with the Overview Program. A small task force convened on December 16, 1977, at Sonoma State College. The task force identified preliminary issues, data sources, constituent interest groups, and information-user groups and needs and made research recommendations. This was followed by a workshop on June 9, 1978, at St. Helena. A broad spectrum of major interests in the four-county area was represented and included County Boards of Supervisors and Planning Commissions; a four-

county joint powers agency;* planning, public-works, social service, and assessor department heads; citizens; growers; vintners; energy industry; State Energy Commission; Bureau of Land Management; landowners; citizen interest groups; State Department of Finance; school-district representatives; consultants; and research organizations, as well as Department of Energy (DOE) officials.

*Geothermal Resource Impact Projection Study (GRIPS), renamed Geothermal Research Information and Planning Services, a joint powers agency.

Issues important to local communities were thoroughly examined during the workshop. After an extensive listing and description of a wide range of issues, the workshop participants ranked more than 160 specific issues. In broad categories, the priorities, beginning with the most critical, were land use, fiscal, demographic, and economic issues. Research recommendations, based on this priority ranking, were made by the joint overview staff from LLL and GRIPS.

Representatives from LLL presented a research-program plan to the GRIPS Technical Advisory Committee (TAC) on February 23, 1979, on the basis of the joint overview work. A revised plan was received favorably at a TAC meeting March 16, 1979; this program plan outlines a program built on cooperation among staff from LLL, Lawrence Berkeley Laboratory (LBL), and local agencies (see Appendix A). Research products include a series of economic and demographic forecasts and associated land requirements, an analysis in map form of land sensitivity and suitability for various uses, and an assessment of the consequences of projected geothermal resource development based on a series of potential configurations of direct and indirect land use. A feature designed especially for the needs of local land-use management is a consideration of mitigating policy options to reduce significant adverse impacts. The effects assessments, mitigating policy options, and resulting land-use configurations are intended for county and GRIPS use to help them design and implement policy tools to manage geothermal and urban growth. Possible policy applications include geothermal or energy elements of general plans, area-specific plans, use-permit performance standards, and zoning. This approach involves the cooperation of local agencies in the design of a major research program whose products may be used in their own policy documents. Maximum local participation is encouraged so that the results will be locally validated and acceptable.

PROBLEM STATEMENT

The DOE is actively supporting commercialization of geothermal energy resources in The Geysers-Calistoga KGRA through a variety of research programs and the Geothermal Loan Guarantee Program. The DOE therefore requires

an assessment of probable environmental consequences of geothermal energy development in The Geysers region. The four counties, represented by their planning and permitting bodies and an inter-county joint powers agency, GRIPS, are faced with responsibilities for local, site-specific, and regional, cumulative development planning, management, and regulation. Local planning must respect environmental, legal, and social constraints and also consider the rights of those who control geothermal energy resources to develop a viable emerging energy source, an alternate to fossil fuels, with incremental but widely distributed benefits. All of these agencies have an immediate need for comprehensive analyses of regulatory policy alternatives and associated consequences.

GOAL

The goal of the socioeconomic research program is to facilitate geothermal energy development in The Geysers-Calistoga KGRA by assisting DOE and local agencies in regulatory policy design and development management that respects environmental constraints. Socioeconomic constraints include those imposed by federal and state statute, local ordinance, policy, regulation, or custom.

OBJECTIVES

The following objectives are established to accomplish the socioeconomic research-program goal:

- Design a research program built on the Geothermal Environmental Overview Program that incorporates extensive local agency participation and whose results will be truly useful to the primary benefactors: DOE and the local governing agencies.
- Refine socioeconomic issues in the four Geysers-region counties that were identified in the Geothermal Environmental Overview Program.
- Define credible ranges of geothermal energy development for direct use and electric power generation.
- Collect and assess existing data that describe past trends and existing conditions, cooperate with local agencies to validate the credibility of existing data, and collect additional, needed data.

- Forecast future economic and demographic conditions given several alternative levels of geothermal energy development, including a baseline condition (no further geothermal energy development).

- Assess the socioeconomic consequences of alternate levels and patterns of geothermal energy development, comparing no further development as the baseline with a variety of alternate, credible levels of geothermal energy development for direct use and electric power generation.

- Identify a variety of mitigation options that may reduce the impacts that are identified as critical issues.

- Apply mitigation options, refine land-use configurations, and analyze the socioeconomic consequences; prepare final land-use configurations as input to local efforts to develop and implement energy and urban development policy.

- Prepare a report for the DOE describing social and economic consequences of geothermal resource development in The Geysers-Calistoga KGRA and the local policy responses necessary to mitigate significant adverse effects. Effects and local responses may be prototypical of other KGRA's.

SCOPE OF WORK

ISSUES

The scope of issues for which the research is planned incorporates those commonly included in the socioeconomic section of a comprehensive environmental study:

- Land use, aesthetics;
- Demographics, social effects;
- Private economic system;
- Public facilities and services;
- Public fiscal system.

GEOGRAPHY

The research program will include the four counties in The Geysers-Calistoga KGRA: Lake, Mendocino, Napa, and Sonoma. Much of the data collection, forecasting, and analysis is conveniently performed on a county basis. However, the four counties differ substantially in land use, population, economic base, extent, character, and probable timing of geothermal resource development, local citizen attitudes toward such development, and

development of regulatory structure.

Therefore, we feel it prudent to concentrate the major product effort on Lake County because this county possesses most of the untapped resource, will experience the greatest near-term impacts from development, and has the greatest need to establish a current regulatory mechanism for geothermal resource development. Mendocino County may be second in priority for requiring regulatory implementation. However, Mendocino County is not yet subject to pressures for extensive commercial development of its geothermal resources; the majority of its resources are in the southeastern, least populated section of the county. Sonoma County has a well-developed geothermal field in the eastern, less populated portion of the county; although future development may quadruple current field use, the relative effects will be much less than those Lake County will probably experience. Napa County does not possess large known geothermal resources; further, a well-established agricultural land use will be protected with very strict land-use, emissions, and geophysical constraints on geothermal resource development.

METHOD OF APPROACH

RESEARCH PLAN

Figure 1 outlines the research plan and was used as the basis of the TAC presentation on

March 16, 1979. Two parallel efforts are indicated: the upper emphasizes land use, constraints, and policy control, and the lower deals with the

FIG. 1. The research plan consists of two parallel efforts. Geothermal, economic, and demographic projection tasks for all four Geyser area counties are shown in the shaded area. The upper portion shows tasks for the land-based analyses to be applied to Lake County. The triangles indicate major products and the termination of work units.

demographic and economic bases for land and infrastructure requirements. The triangles represent major products and indicate the termination of major work units.

Land and Public Infrastructure Capability: Sensitivity and Suitability

The research plan begins with an investigation of the physical characteristics of the land and of the local infrastructure (see Appendix B) to be displayed in a set of individual maps (Product 1). These characteristics will then be combined, along with criteria and constraints prescribed by local citizens and officials, to produce composite land-sensitivity and -suitability maps for each of several land uses (Product 4).

Geothermal, Economic, and Demographic Forecasts

Forecasting will begin by identifying the geothermal resource location and physical characteristics such as temperature, pressure, reservoir size, and inhibiting fluid chemistry. Data on the location of resources are required to define the land characteristics. The data on fluid characteristics will support projections of geothermal development for direct use and electric power production. These studies will be documented in a report (Product 2). Economic and demographic consequences will then be projected, assuming a baseline continuation of existing trends and a series of projections of geothermal resource development. Product 3, a report, will document this work. These products will cover the four-county Geysers region.

Potential Land-Use Configurations

For each projection, the economic and demographic forecasts will be used to forecast land and infrastructure demand quantitatively. These will be integrated with the land-suitability map to develop potential land-use configurations for each projection, i.e., the physical consequences of each level of geothermal development. Local officials, staff, and citizens will contribute to this work, which will be displayed in map form as Product 5.

Assessment of Socioeconomic Effects

The land-use configurations will be assessed for their social and economic effects. The assessment report, Product 6, will contain a discussion of land use and aesthetic, economic, public infrastructure, fiscal, and demographic impacts.

Evaluation of Mitigating Policy Options

Significant adverse impacts will be analyzed for possible mitigation measures with emphasis on policy options such as land-use planning, zoning, permit conditions, and performance standards. These mitigating policy options will be evaluated by local agency representatives for their efficacy and their effects on geothermal and other land-use development. The potential land-use patterns may be altered by applying mitigation options, and the altered land-use patterns may, in turn, alter the impacts, which will be assessed. Impacts significantly changed by the mitigation options may themselves require further modification of mitigating policy.

Alternative Land Use Outcomes

The final outcome of the policy analysis will be Product 7. This product will consist of maps and text describing potential patterns of future land use based on forecasted baseline growth, geothermal resource development for direct and electric use, and induced land use located according to constraints and planning policies determined with local agency cooperation. This final product can be used as the basis for local agencies to design and implement development policy to manage geothermal resource and urban development, e.g., geothermal or other elements of comprehensive land-use plans. This product, supported by Products 1 through 6, will be limited to Lake County.

COOPERATIVE RESEARCH: LOCAL AGENCY PARTICIPATION

The research is designed as a cooperative effort among LLL/LBL, GRIPS, and each of the four counties: Lake, Mendocino, Napa, and Sonoma. LLL was assigned as the lead laboratory with technical and managerial responsibility for the project. GRIPS and the counties were given a number of opportunities to critique the study design and suggest improvements. Throughout the project, most of the work units will be performed cooperatively. Every work unit shown on Fig. 1 will depend on cooperative local participation with the exceptions of actual geothermal, economic, and demographic modeling, computer manipulation of land-use data, and effects assessment. However, the project will depend heavily on continuous local data

input during the study in all work units. In addition, each product will be presented to GRIPS and the four counties for review and comment. Specific assignments will be outlined in the Statement of Work section below.

Each county will have a research representative, who is also a member of the GRIPS

Technical Advisory Committee. The research representatives (TAC members) and GRIPS staff will be the participating team in the research program. The county research representatives will probably call on county- and city-staff specialists, as appropriate, during data collection and review.

STATEMENT OF WORK

METHODOLOGIES

Data Collection

Data on land use, infrastructure, fiscal, and demographic parameters will be collected cooperatively, primarily from local sources. A series of meetings with county staff members, research representatives, and the GRIPS TAC, as appropriate, will be scheduled to assemble available data.

Land and Public Infrastructure Capability, Land Sensitivity and Suitability, Land-Use Patterns and Outcomes, Viewshed Analyses

Data will be digitized using California geographic coordinates, transverse Mercator system, or other standard reference system. A computer program will be used to manipulate and display the data in a "grid-cell" format at 16 ha resolution (4 ha in developed areas). This program will provide the flexibility to analyze conflicting constraints, suitability criteria, land and infrastructure demands, and alternate mitigation-policy options easily and rapidly. A firm specializing in geobased information systems will be contracted to perform this work.

Geothermal Resource Characterization and Development Projections

Information will be drawn from the extensive, detailed studies that have been conducted in The Geysers-Calistoga KGRA. Little additional public information is available to refine these existing estimates significantly. The study will assume, in the absence of data to the contrary, that existing resource projections have a sufficiently realistic base for credible forecasts and assessments. Estimates

will be made of direct uses as well as electric power production. Direct use forecasts will be based on local industrial development potential, resource base, transportation system, and local development plans.

Economic and Demographic Projections

Economic data will be taken from state and national sources updated to 1977 and will be corrected where appropriate with locally derived data. Economic analyses and forecasts will be performed using an input-output model that includes a special geothermal sector. This model permits estimation of indirect induced effects, sectoral output, employment, and wages. This work will be accomplished with the assistance of a consulting economist.

Demographic projections will be based on employment projections and current demographic trends. A cohort-survival or similar forecasting methodology will be used. Adjustments will be made for in- and out-migration resulting from retirement, seasonal recreation use, and other factors that are validated by the county research representatives.

Constraints and Suitability Criteria

These important elements will be generated almost entirely by local representatives. A series of meetings, possibly concurrent with data-gathering sessions, will be held to determine, refine, and, for purposes of the study, prescribe appropriate constraints and criteria.

Land and Public Infrastructure Requirements

Land-use and public infrastructure requirements will be estimated from factors determined cooperatively with county research representatives.

This information (e.g., residential lot size, vehicle trips per capita) will be applied to the demographic and economic projections to estimate the kind and amount of development required to support forecasted baseline growth, geothermal resource development, and induced secondary development.

Assessments of Social and Economic Effects

Many of the assessments will be made while forecasting and analyzing land use, infrastructure, demographic, and economic conditions. The study on fiscal effects will require a separate cost-revenue study. Certain aesthetic analyses will require the services of a specialist to be contracted.

Mitigation Options

Identification and evaluation of mitigating policy options depend heavily upon the analysis by county research representatives and GRIPS staff. The Lab will support this effort by analyzing the efficacy of suggested policies with the aid of the computer-graphics program.

Reports and Maps

LLL will assume the responsibility of preparing final maps and reports and publishing this material.

OUTLINE OF WORK UNITS

Table 1 contains a list of work units and the research groups that are responsible for the tasks.

TASKS REQUIRING LOCAL PARTICIPATION

The success of the socioeconomic research program depends upon local review, critique, and direction. Local participation, would contribute significantly to key program elements such as data collection and evaluation, criteria, constraints, and the development of mitigation options according to the following suggested tasks:

Data Collection, Evaluation, and Validation (Work Units 1, 2, 3, and 6)

- Research representatives
 - Act as contact person for Labs,
 - Coordinate attendance of appropriate

staff members at data-collection meetings,

- Arrange meeting facilities,
- Coordinate data requests with appropriate staff members,
- Preside jointly over data-collection meetings,
- Coordinate evaluation and validation of local data, particularly in land capability, economic, and demographic variables, in- and out-migration rates, local industrial and commercial development plans, land and public infrastructure demands.

● County, city, school, other local agency staff members

- Assemble required data (see Appendix B) in meaningful form, e.g., raw data analyzed for departmental reports,

- Explain data and analyses at data-collection meetings,
- Assemble other data from files as needed,
- Participate in evaluation and validation of local data.

● GRIPS Executive Director and Staff

- Participate in data collection, evaluation, and validation and attend meetings if desired.

Constraints and Criteria (Work Unit 4)

● Research representatives

- Act as contact person for Labs,
- Coordinate attendance of appropriate community representatives (elected officials, staff, citizens, landowners and other representatives of the economic system, etc.) at meetings,

- Arrange meeting facilities,
- Coordinate local participation and response to solicited constraints and criteria, e.g., questionnaires,
- Preside jointly over meetings.

● Community representatives

- Participate in constraints and criteria surveys,
- Discuss survey responses in meetings with other community and research representatives.

● GRIPS Executive Director and Staff

- Participate in the definition of constraints and criteria and attend meetings if desired.

TABLE 1. Work units for the social and economic research program for The Geysers-Calistoga KGRA.

Work unit	Product responsibility
1. Land and infrastructure <ul style="list-style-type: none"> • Compile data on land sensitivity and infrastructure capacity from federal and local sources (see Appendix B); • Digitize source data; • Develop maps of capability factors. 	<div>LLL, GRIPS, counties</div> <div>LLL</div> <div>LLL</div> <div> ^a</div>
2. Projections of geothermal resource development <ul style="list-style-type: none"> • Characterize resource using published data; • Develop alternative development projections for electric power and direct use; • Prepare report. 	<div>LLL, LBL</div> <div>LBL</div> <div>LBL</div> <div> </div>
3. Economic and demographic projections <ul style="list-style-type: none"> • Compile economic data for regional input-output model (see Appendix B); • Develop baseline projection based on no further geothermal development; • Forecast direct and induced economic changes for each geothermal development projection; • Assemble locally validated demographic data; • Forecast demographic changes for baseline and each geothermal development projection; • Prepare report. 	<div>LLL, GRIPS, counties</div> <div>LLL</div> <div>LLL</div> <div>LBL, GRIPS, counties</div> <div>LBL</div> <div>LLL, LBL</div> <div> </div>
4. Constraints and criteria <ul style="list-style-type: none"> • Determine technological constraints on geothermal resource development (locations of type of resource, substations, etc.), digitize; • Determine legal and local political constraints (land-use plans and controls, etc.); • Determine local criteria to evaluate land suitability for development (see sample, Appendix B). 	<div>LLL, LBL</div> <div>LLL, GRIPS, counties</div> <div>LLL, GRIPS, counties</div>
5. Suitability of land for development <ul style="list-style-type: none"> • Incorporate criteria determined in Work Unit 4 to "overlay" capability factors and constraints, construct map indicating areas sensitive to development and those suitable for each type of land use (geothermal, residential, industrial, etc.). 	<div>LLL</div> <div> </div>
6. Potential land-use configurations <ul style="list-style-type: none"> • Forecast land and infrastructure demands in each geothermal resource development projection based on forecasts of economic and demographic changes (Work Unit 3); • Generate land-use configurations based on land suitability (Work Unit 5) and forecast demand (Work Unit 6). 	<div>LLL, GRIPS, counties</div> <div>LLL</div> <div> </div>
7. Fiscal 1979 Annual Report	LLL
8. Socioeconomic assessments <ul style="list-style-type: none"> • Assess effects of geothermal resource development on <ul style="list-style-type: none"> – Land use and aesthetics, – Economics, – Demographic and social structure, – Infrastructure and fiscal systems; • Prepare assessment report. 	<div>LLL</div> <div>LLL</div> <div>LBL</div> <div>LLL, LBL</div> <div>LLL, LBL</div> <div> </div>
9. Options for mitigation <ul style="list-style-type: none"> • Devise alternative policy options to mitigate adverse effects (see sample, Appendix B) • Program options for computer analysis, generate new land-suitability maps; • Generate new land use configurations to assess impact of options (Note: the computer will allow iterations of steps in Work Unit 9 to test various combinations of options); • Modify effects assessments for major changes in impacts resulting from alternative mitigating policies; • Evaluate efficacy and effects of policy options. 	<div>LLL, GRIPS, counties</div> <div>LLL</div> <div>LLL</div> <div>LLL, LBL</div> <div>LLL, GRIPS, counties</div>
10. Land use outcomes <ul style="list-style-type: none"> • Prepare final land-use configurations for baseline and each geothermal development projection; • Prepare accompanying text. 	<div>LLL</div> <div>LLL, GRIPS, counties</div> <div> </div>
11. Fiscal 1980 Annual Report	LLL

^a Δ = product, see Fig. 1.

Options for Mitigation (Work Units 9 and 10)

- Research representatives
 - Act as contact person for the Labs,
 - Coordinate attendance of appropriate staff members at meetings,
 - Arrange meeting facilities,
 - Review effects assessment and devise mitigating policy options,
 - Evaluate and refine policy options,
 - Preside jointly over meetings to devise and evaluate mitigating policy options,
 - Contribute to report (Product 7).
- County, city, school, other local agency staff members
 - Review effects assessment and devise mitigating policy options,
 - Evaluate and refine policy options,
 - Contribute to report (Product 7), if desired.

- GRIPS Executive Director and Staff
 - Review effects assessment and participate in devising mitigating policy options,
 - Participate in evaluating and refining policy options.

Product Review

- GRIPS Staff
 - Coordinate product-review meetings with TAC members,
 - Arrange meeting facilities,
 - Preside over review meetings,
 - Review products when completed,
 - Coordinate timely presentation of review comments to Labs.
- Research representatives, appropriate city, county, school, other local agency staff members
 - Review products when completed,
 - Review and comment on completed products at meetings.

PROGRAM MANAGEMENT

ORGANIZATION

The socioeconomic research program at LLL and LBL is funded by the DOE Office of Technology Impacts Division of Technology Assessments. The two labs are funded separately, but are combining technical resources, adopting common research objectives and tasks, and sharing responsibility for products in the program for which LLL has the responsibility as the lead laboratory in technology and management.

The labs, under the overall program coordination of LLL, will meet with the GRIPS Executive Director, staff, county research representatives, and other staff during the course of the program to conduct work units, collect data, and hold review sessions of completed products. Personnel of the participating agencies are listed in Appendix A.

SCHEDULE

Figure 2 contains the research-program schedule. Meetings are scheduled with the counties

and with GRIPS during the course of the program for a variety of purposes. Initially, meetings are scheduled with the four-county research representatives to assemble data on a county-by-county basis. These meetings will probably also involve key county and city staff personnel who are knowledgeable in the appropriate areas of interest.

A meeting or meetings with the four-county research representatives and the GRIPS staff is scheduled to address criteria and constraints.

During the development and evaluation of mitigation options, numerous meetings will be held with each county representative and the four counties and GRIPS staff as appropriate.

After completing each product, a presentation-and-review meeting is scheduled with the GRIPS TAC. These meetings are scheduled 2 to 3 weeks after completion to permit attendees to review the material.

FIG. 2a. Schedule of the Geysers-Calistoga KGRA social and economic research program for Fiscal Year 1979.

FIG. 2b. Schedule of the Geysers-Calistoga KGRA social and economic research program for Fiscal Year 1980.

APPENDIX A. PROGRAM PERSONNEL

RESEARCH PERSONNEL

Lawrence Livermore Laboratory

Lynn Anspaugh, Section Leader, Analysis and Assessment
Paul Phelps, Geothermal Environmental Overview Management
Charles Hall, Regional Economics
Kerry O'Banion, Regional Planning
Computer Support Personnel

Lawrence Berkeley Laboratory

Kendall F. Haven, Resources Management
Yvonne Ladson, Public Policy Analysis
Computer Support Personnel

Consultants

Everard Lofting, Consulting economist
Roger Twiss, Consulting recreation-resource specialist
Environmental Systems Research Institute, Geobased information processing.

COOPERATING PARTICIPANTS

Geothermal Research, Information, and Planning Services

Robert F. Van Horn, Executive Director
Paula Blaydes, Research Analyst

Lake County Research Representative

Mary Jadiker, Member, Lake County Planning Commission

Mendocino County Research Representative

Jerry Heath, Senior Planner, Mendocino County Planning Department

Napa County Research Representative

James H. Hickey, Director, Napa County Conservation, Development and Planning Department

Sonoma County Research Representative

Thomas E. Cordill, Environmental Administrator, Planning Division,
Sonoma County Community and Environmental Services

APPENDIX B. DATA ON LAND AND INFRASTRUCTURAL CAPABILITY

Source Data

- Topography (from USGS maps)
- Surface hydrology (USGS)
- Geology and seismic faults (California geology maps)
- Soils (SCS general soils maps)
- Vegetation (photointerpretation)
- Areas of special biological importance (California Department of Fish and Game maps)
- Floodplains (Housing and Urban-Development insurance maps)
- Major roads (USGS maps, updated with American Automobile Association maps)
- Sewer and water systems (county maps)
- Critical vantage points
- Designated open space excluded from development
- Present land use (photointerpretation)

Interpretive Data (derived from source data)

- Slope
- Viewsheds from critical vantage points
- Watersheds
- Slope stability
- Agricultural soil quality
- Soil-infiltration capacity and aquifer-recharge potential
- Erosion potential
- Fire hazard
- Proximity to major roads
- Critical and significant ecological areas

We also plan to incorporate other source data (e.g., potential archaeological areas) if and when they become available.

APPENDIX C. SOCIOECONOMIC DATA

Economic data

- Sector description and output
- Sector employment
- Wages
- Intersector multiplier
- Final demand per sector at given years
- Emphasis on government and geothermal sectors

Demographic data

- Age
- Sex
- Education
- Ethnicity
- Mobility and residency length
- Mortality and birth rates
- Job classification and skills, employment
- Place of residence
- Place of work
- Housing characteristics
 - Rooms
 - Value
- Household size
- In- and out-migration

Police and fire: public protection

- Locations and descriptions
- Number of responding units and descriptions
- Population or units served: trends and forecasts
- Standards of service
- Funding situation
- Current capacity

Schools

- Locations and descriptions
- Capacity
- Programs
- Current financial situation
- Enrollment trends and projections
- Standard of performance

Public health and emergency service

- Locations and descriptions
- Capacity
- Financial situation and funding source (county, town)
- Standard of service
- Client trends and projections

Social Services; other services

- Locations and descriptions
- Client trends and projections
- Capacity
- Funding and funding source
- Standards of service
- Qualifications of clients

APPENDIX D. SAMPLE: MITIGATION POLICY OPTIONS†

Zoning

- Conventional
- Overlay zones

Public easements

- Visual
- Recreational

Compensation for impacts

- Direct to landowners
- Indirect to public body

Mitigation (permit conditions)

Incentives

Moratoria and time phasing

Transferable development rights

†See Fig. 1.