ECONOMIC EFFECTS OF CRITICAL HABITAT DESIGNATION FOR THE CALIFORNIA TIGER SALAMANDER IN SONOMA COUNTY

Prepared For

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I EXECUTIVE SUMMARY

I.1 PURPOSE AND APPROACH

The U.S. Fish & Wildlife Service (Service) is proposing 74,223 acres of critical habitat for the Sonoma County population of the California tiger salamander, *Ambystoma Californiense*, (CTS) pursuant to the Endangered Species Act of 1973. This report attempts to quantify the economic effects associated with the proposed designation of critical habitat. It does so by taking into account the cost of conservation-related measures that are likely to be associated with future economic activities that may adversely affect the habitat within the proposed boundaries. The report combines information on current and projected land uses within critical habitat areas with a defined economic model of land development and pricing to calculate these impacts. This report also disaggregates individual critical habitat units defined by the Service to identify the sub-regions where most economic impacts occur.

This information is intended to assist the Secretary of the Interior in determining whether the benefits of excluding particular areas from the designation outweigh the biological benefits of including them.[1] In addition, this information allows the Service to address the requirements of Executive Orders 12866 and 13211, and the Regulatory Flexibility Act (RFA), as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA).[2] The small business analysis is included in this report. This report also complies with direction from the U.S. 10th Circuit Court of Appeals that "co-extensive" effects should be included in the economic analysis to inform decision-makers regarding which areas to designate as critical habitat.[3]

I.2 REPORT ORGANIZATION

Following the Executive Summary is an outline of the analytical framework and approach used in the analysis and an overview of the socioeconomic conditions in the affected counties. The impacts to land development, public projects, and private activities are presented next, followed by an evaluation of the regional costs and impacts to small businesses.

I.3 DESCRIPTION OF HABITAT IN SONOMA COUNTY

The primary constituent elements used to determine suitable habitat fall into three categories: Standing bodies of fresh water (including natural and manmade (e.g., stock) ponds, vernal pools,

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[1] 16 U.S.C. §1533(b)(2).

[2] Executive Order 12866, "Regulatory Planning and Review," September 30, 1993; Executive Order 13211, "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use," May 18, 2001; 5 U.S.C. §§601 *et seq* ; and Pub Law No. 104-121.

[3] In 2001, the U.S. 10th Circuit Court of Appeals instructed the Service to conduct a full analysis of all of the economic impacts of proposed CHD, regardless of whether those impacts are attributable co-extensively to other causes (*New Mexico Cattle Growers Ass'n v. U.S.F.W.S.*, 248 F.3d 1277 (10th Cir. 2001)).

and other ephemeral or permanent water bodies); upland habitats adjacent to breeding ponds that contain small mammal burrows; and barrier-free upland dispersal habitat between occupied locations.

The Service has designated 74,223 acres across Sonoma County, or 7.9% of the county. A variety of economic activities are undertaken within the county, from housing construction to farming. For profiles of the socioeconomic conditions in Sonoma County, please see Section III.

I.4 IMPACTS ON REAL ESTATE DEVELOPMENT

Critical habitat designation for the tiger salamander is expected to have the largest impacts on real estate development. Critical habitat occurs in a number of rapidly growing areas. Regulatory requirements to avoid onsite impacts and mitigate offsite affect the welfare of both producers and consumers. In the scenario presented here, mitigation requirements increase the cost of development and avoidance requirements are assumed to reduce the construction of new housing. In this scenario, critical habitat is expected to impose losses of over $336 million relating to lost development opportunities. Table IV-2: Characteristics of New Housing in Affected Tracts shows the predicted losses to Sonoma County.

The impacts of critical habitat designation vary widely even within the county. That is, the impacts of designation are frequently localized. This finding is sensible from an economic point of view and is consistent with the teachings of urban economics. Housing prices vary over urban areas, typically declining as the location of the house becomes more remote. Critical habitat is not evenly distributed across the landscape, and large impacts may result if a particular area has a large fraction of developable land in critical habitat. Some areas have few alternate sites for development, or have highly rationed housing resulting in high prices. Any of these factors may cause the cost of critical habitat designation to increase.

The disaggregated spatial scale of the analysis permits identification of specific locations, or parts of individual critical habitat units, that result in the largest economic impacts. The maps contained at the end of this section are instructive in this regard. The maps identify the Census tracts within the counties where the impacts are predicted to occur.

I.5 PUBLIC SECTOR ACTIVITIES

The California Department of Transportation is planning several projects to build, upgrade, and maintain the state's transportation network in areas of tiger salamander critical habitat. After determining the number of affected critical habitat acres, the typical mitigation requirements were applied to determine the impacts on this type of activity. The total costs to transportation projects are estimated to be $7.97 million. This figure does not include the costs of project delays, as we lack information on benefits from these projects.

The report also considers potential impacts on the energy sector. This analysis examines planned power production facilities within the study area for proximity to proposed critical habitat. It finds the sites fall into one of two categories: either they are too far from critical habitat to be affected, or are within or near habitat but have already completed the environmental mitigation

process for tiger salamander habitat. In both cases, the incremental impacts of designation are zero; the regulation is not expected to impact energy production.

There are no overlaps between critical habitat and land managed by the Department of the Defense, Bureau of Land Management, Bureau of Reclamation, the Forestry Service, the Fish and Wildlife Service, and the Bureau of Indian Affairs. It is determined that the impacts from designation on public land management are zero.

I.6 Regional Economic Effects

Designation of critical habitat alters the level of economic activity. As a result, regulation has impacts that spread beyond the sectors directly affected. Indirect and induced impacts of the regulation are calculated using the standard IMPLAN model. Critical habitat designation has little effect on the regional economy. New residential construction is reduced by approximately $557,000 annually, which causes output in other industries to decrease by approximately $379,000 annually. These combined reductions represent only 0.01 percent of the region's output. Included among the industries most affected are wholesale trade and architectural/engineering services.

I.7 Small Business Impacts

Critical habitat is not expected to result in significant small business impacts since revenue losses are less than one percent of total small business revenues in affected areas. Large businesses greatly dominate greenfield development, and it is estimated that no more than a single small business will be affected annually as a consequence of designation.

II RELEVANT BACKGROUND AND ANALYTICAL FRAMEWORK

II.1 REPORT PURPOSE

The U.S. Fish & Wildlife Service (Service) proposes 74,223 acres for critical habitat for the Sonoma County population of the California tiger salamander, *Ambystoma Californiense*, (CTS) pursuant to the Endangered Species Act of 1973. This report attempts to quantify the economic effects associated with the proposed designation of critical habitat. It does so by taking into account the cost of conservation-related measures that are likely to be associated with future economic activities that may adversely affect the habitat within the proposed boundaries. The report combines information on current and projected land uses within critical habitat areas with a defined economic model to calculate these impacts. This report also disaggregates individual critical habitat units defined by the Service to identify the sub-regions where most economic impacts occur.

This information is intended to assist the Secretary of the Interior in determining whether the benefits of excluding particular areas from the designation outweigh the biological benefits of including them.[4] In addition, this information allows the Service to address the requirements of Executive Orders 12866 and 13211, and the Regulatory Flexibility Act (RFA), as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA).[5] The small business analysis is included in this report. This report also complies with direction from the U.S. 10th Circuit Court of Appeals that "co-extensive" effects should be included in the economic analysis to inform decision-makers regarding which areas to designate as critical habitat.[6]

This section provides the framework for this analysis. First, it describes the general analytic approach to estimating economic effects, including both efficiency and distributional effects. Next, it discusses the scope of the analysis, including the link between existing and critical habitat-related protection efforts and economic impacts. Finally, it describes the information sources employed to conduct this analysis. For an extensive description of the methods used in the preparation of the report, please see Appendix A.

II.2 APPROACH TO ESTIMATING ECONOMIC EFFECTS

This economic analysis considers both the economic efficiency and distributional effects that may result from species and habitat protection. Economic efficiency effects generally reflect

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[4] 16 U.S.C. §1533(b)(2).

[5] Executive Order 12866, "Regulatory Planning and Review," September 30, 1993; Executive Order 13211, "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use," May 18, 2001; 5 U.S.C. §§601 *et seq* ; and Pub Law No. 104-121.

[6] In 2001, the U.S. 10th Circuit Court of Appeals instructed the Service to conduct a full analysis of all of the economic impacts of proposed CHD, regardless of whether those impacts are attributable co-extensively to other causes (*New Mexico Cattle Growers Ass'n v. U.S.F.W.S.*, 248 F.3d 1277 (10th Cir. 2001)).

"opportunity costs" associated with the commitment of resources required to accomplish species and habitat conservation. For example, if activities on private lands are limited as a result of the designation or the presence of the species, and thus the market value of the land is reduced, this reduction in value represents one measure of opportunity cost or change in economic efficiency. Similarly, the costs incurred by a Federal action agency to consult with the Service under section 7 represent opportunity costs of habitat conservation.

This analysis also addresses the distribution of impacts associated with the designation, including an assessment of any local or regional impacts of habitat conservation and the potential effects of conservation activities on small entities, the energy industry, or governments. This information may be used to determine whether the effects of the designation unduly burden a particular group or economic sector. For example, while habitat conservation activities may have a small impact relative to the national economy, individuals employed in a particular sector of the regional economy may experience a significant level of impact. The difference between economic efficiency effects and distributional effects, as well as their application in this analysis, are discussed in greater detail below.

II.3 EFFICIENCY EFFECTS

At the guidance of the Office of Management and Budget (OMB) and in compliance with Executive Order 12866 "Regulatory Planning and Review," Federal agencies measure changes in economic efficiency in order to discern the implications on a societal level of a regulatory action. For regulations specific to the conservation of the CTS, efficiency effects represent the opportunity cost of resources used, or benefits foregone, by society as a result of the regulations. Economists generally characterize opportunity costs in terms of changes in producer and consumer surplus in affected markets.[7]

In some instances, compliance costs may provide a reasonable approximation of the efficiency effects associated with a regulatory action. For example, a lead Federal agency may enter into a consultation with the Service to ensure that a particular activity will not adversely modify critical habitat. The end result of the consultation may be a small amount of additional mitigation for on-site impacts of the proposed activity. The cost of the additional mitigation would have been spent on alternative activities if the proposed project not been designated critical habitat. In the case that compliance activity is not expected to significantly affect markets – that is, not result in a shift in the quantity of a good or service provided at a given price, or in the quantity of a good or service demanded given a change in price – the measurement of compliance costs provides a reasonable estimate of the change in economic efficiency.

Where habitat protection measures are expected to significantly impact a market, it may be necessary to estimate changes in producer and consumer surpluses. For example, a designation

[7] For additional information on the definition of "surplus" and an explanation of consumer and producer surplus in the context of regulatory analysis, see Gramlich, Edward M., *A Guide to Benefit-Cost Analysis (2nd Ed.)*, Prospect Heights, Illinois: Waveland Press, Inc., 1990; and U.S. 240-R-00-003, September 2000, available at http://yosemite.epa.gov/ee/epa/eed.nsf/ webpages/Guidelines.html.

that precludes the development of large areas of land may shift the price and quantity of housing supplied in a region. In this case, changes in economic efficiency (i.e., social welfare) can be measured by considering changes in producer and consumer surplus in the real estate market.

This analysis begins by measuring costs associated with measures taken to protect species and habitat. However, if the cost of conservation measures is expected to significantly impact markets, the analysis will consider welfare impacts to affected markets.

II.4 Distributional and Regional Economic Effects

Measurements of changes in economic efficiency focus on the net impact of conservation activities, without consideration of how certain economic sectors or groups of people are affected. Thus, a discussion of efficiency effects alone may miss important distributional considerations. OMB encourages Federal agencies to consider distributional effects separately from efficiency effects.[8] This analysis considers several types of distributional effects, including impacts on small entities; impacts on energy supply, distribution, and use; and regional economic impacts. It is important to note that these are fundamentally different measures of economic impact than efficiency effects, and thus cannot be added to or compared with estimates of changes in economic efficiency.

This analysis considers how small entities, including small businesses, organizations, and governments, as defined by the RFA, may be affected by the proposed critical habitat designation.[9] In addition, in response to Executive Order 13211 "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use," section V.2 considers the impacts of critical habitat on the energy industry and its customers.[10]

Regional economic impact analysis produces a quantitative estimate of the potential magnitude of the initial change in the regional economy resulting from a regulatory action. Regional economic impacts are commonly measured using input / output models. These models investigate the effects of a change in one sector of the economy on economic output, income, or employment in other local industries. These economic data provide a quantitative estimate of the magnitude of shifts of jobs and revenues in the local economy.

Regional input / output models may overstate the long-term impacts of a regulatory change because they provide a static view of the regional economy. That is, they measure the initial impact of a regulatory change on an economy but do not consider long-term adjustments that the economy will make in response. For example, these models provide estimates of the number of

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[8] U.S. Office of Management and Budget, "Circular A-4," September 17, 2003, available at http://www.whitehouse.gov/omb/circulars/a004/a-4.pdf.

[9] 5 U.S.C. § 601 *et seq.*

[10] Executive Order 13211, "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use," May 18, 2001.

jobs lost as a result of a regulatory change, but do not consider re-employment of these individuals over time or other adaptive responses by affected businesses. In addition, the flow of goods and services across the regional boundaries defined in the model may change as a result of the regulation, compensating for a potential decrease in economic activity within the region.

Despite these and other limitations, in certain circumstances regional economic impact analysis may provide useful information about the scale and scope of localized impacts. It is important to remember that measures of regional economic effects generally reflect shifts in resource use rather than efficiency losses. Thus, these types of distributional effects are reported separately from efficiency effects (i.e., not summed). In addition, measures of regional economic impact cannot be compared with estimates of efficiency effects, but should be considered as distinct measures of impact.

II.5 SCOPE OF THE ANALYSIS

This analysis identifies those economic activities believed to most likely threaten the listed species and its habitat and, where possible, quantifies the economic impact to avoid, mitigate, or compensate for such threats within the boundaries of critical habitat. In instances where critical habitat is being proposed after a species is listed, some future impacts may be unavoidable, regardless of the final designation and exclusions under 4(b)(2). However, due to the difficulty in making a credible distinction between listing and critical habitat effects within critical habitat boundaries, this analysis considers all future conservation-related impacts to be coextensive with the designation.[11,12]

Coextensive effects may also include impacts associated with overlapping protective measures of other Federal, State, and local laws that aid habitat conservation in the areas proposed for designation. Of particular importance to this analysis are the wetland regulation provisions of the Clean Water Act. As discussed in detail below, breeding habitat for the CTS is frequently regulated under Section 404 of the Clean Water Act. Thus, these effects are considered to be co-extensive to the effects of critical habitat. USFWS policy is that habitat conservation efforts affording protection to a listed species likely contribute to the efficacy of designation of critical habitat, the impacts of these actions are considered relevant for understanding the full effect of the proposed critical habitat. Enforcement actions taken in response to violations of the Endangered Species Act, however, are not included.

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[11] In 2001, the U.S. 10th Circuit Court of Appeals instructed the Service to conduct a full analysis of all of the economic impacts of proposed CHD, regardless of whether those impacts are attributable co-extensively to other causes (New Mexico Cattle Growers Assn v. U.S.F.W.S., 248 F.3d 1277 (10th Cir. 2001)).

[12] In 2004, the U.S. 9th Circuit invalidated the Service's regulation defining destruction or adverse modification of critical habitat (Gifford Pinchot Task Force v. United States Fish and Wildlife Service). The Service is currently reviewing the decision to determine what effect it (and to a limited extent Center for Biological Diversity v. Bureau of Land Management (Case No. C-03-2509-SI, N.D. Cal.)) may have on the outcome of consultations pursuant to section 7 of the Act.

II.5.1 Sections of the Act Relevant To the Analysis

The analysis focuses on activities that are influenced by the Service through sections 4, 7, 9, and 10 of the Act. Section 4 of the Act focuses on the listing and recovery of endangered and threatened species, as well as CHD. According to section 4, the Secretary is required to list species as endangered or threatened "solely on the basis of the best available scientific and commercial data."[13]

The protections afforded to threatened and endangered species and their habitat are described in sections 7, 9, and 10 of the Act, and economic impacts resulting from these protections are the focus of this analysis:

- Section 7 of the Act requires Federal agencies to consult with the Service to ensure that any action they authorize, fund, or carry out will not likely jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of the species' designated critical habitat. The administrative costs of these consultations, along with the costs of project modifications resulting from these consultations, represent compliance costs associated with the listing of the species and the designation of critical habitat.[14]
- Section 9 defines the actions that are prohibited by the Act. In particular, it prohibits the "take" of endangered wildlife, where "take" means to "harass, harm, pursue, or collect, or to attempt to engage in any such conduct."[15] The economic impacts associated with this section manifest themselves in sections 7 and 10.
- Under section 10(a)(1)(B) of the Act, an entity (i.e., a landowner or local government) may develop a Habitat Conservation Plan (HCP) for an endangered animal species in order to meet the conditions for issuance of an incidental take permit in connection with the development and management of a property.[16] The requirements posed by the HCP may have economic impacts associated with the goal of ensuring that the effects of incidental take are adequately minimized and mitigated. The designation of critical habitat does not require completion of an HCP; however, the designation may influence conservation measures provided under HCPs. Federal agencies are not typically the sole

[13] 16 U.S.C. §1533.

[14] The Service notes, however, that a recent Ninth Circuit judicial opinion, Gifford Pinchot Task Force v. United States Fish and Wildlife Service, has invalidated the Service's regulation defining destruction or adverse modification of critical habitat. The Service is currently reviewing the decision to determine what effect it (and to a limited extent Center for Biological Diversity v. Bureau of Land Management (Case No. C-03-2509-SI, N.D. Cal.)) may have on the outcome of consultations pursuant to section 7 of the Act.

[15] 16 U.S.C. §1538 and 16 U.S.C. §1532.

[16] U.S. Fish and Wildlife Service, "Endangered Species and Habitat Conservation Planning," http://endangered.fws.gov/hcp/.

stakeholder agency involved with development of an HCP. Federal agencies, however, can be the lead agency on a multi-jurisdictional HCP.

II.5.2 Other Relevant Protection Efforts

The protection of listed species and habitat is not limited to the Act. Other Federal agencies, as well as State and local governments, may also seek to protect the natural resources under their jurisdiction.[17]

The California Environmental Quality Act (CEQA) is a California State statute that requires State and local agencies (known here as "lead agencies") to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible. Projects carried out by Federal agencies are not subject to CEQA provisions. CEQA regulations require a lead agency to initially presume that a project will result in a potentially significant adverse environmental impact and to prepare an Environmental Impact Report (EIR) if the project may produce certain types of impacts, including when:

> "[T]he project has the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of an endangered, rare, or threatened species, or eliminate important examples of the major periods of California history or prehistory."[18]

State law instructs the lead agency (typically a county or city community development or planning department in the case of land development projects) to examine impacts from a very broad perspective, taking into account the value of animal and plant habitats to be modified by the project. The lead agency must determine which, if any, project impacts are potentially significant and, for any such impacts identified, whether feasible mitigation measures or feasible alternatives will reduce the impacts to a level less than significant. It is within the power of a lead agency to decide that negative impacts are acceptable in light of economic, social, or other benefits generated by the project.

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[17] For example, the Sikes Act Improvement Act (Sikes Act) of 1997 requires Department of Defense (DOD) military installations to develop Integrated Natural Resources Management Plans (INRMPs) that provide for the conservation, protection, and management of wildlife resources (16 U.S.C. §§ 670a - 670o). These plans must integrate natural resource management with the other activities, such as training exercises, taking place at the facility.

[18] California Natural Resources Code §15065(a)

II.5.3 Additional Analytic Considerations

Previous economic impact analyses prepared to support critical habitat decisions have considered other types of economic impacts related to critical habitat, including time delay. This analysis considers these economic impacts and has determined that the proposed critical habitat for CTS will cause economic impacts of this nature. These impacts are described in detail in the section on residential real estate development. This section includes a discussion of indirect benefits that may result from the designation of critical habitat.

II.5.4 Analytic Time Frame

The analysis examines activities taking place both within and adjacent to the proposed designation. Estimates of post-designation impacts are based on activities that are "reasonably foreseeable," including, but not limited to, activities that are currently authorized, permitted, or funded, or for which proposed plans are currently available to the public. The analysis estimates economic impacts to activities from 2005 to 2025, twenty years from the year of final designation.

II.6 INFORMATION SOURCES

The primary sources of information for this report were communications with and data provided by the Service. In addition, the analysis relies on information from the following entities.

- DataQuick Information Systems;
- U.S. Census 1990 and Census 2000;
- U.S. Department of Commerce, Bureau of Economic Analysis;
- U.S. Department of Labor, Bureau of Labor Statistics;
- California Department of Finance;
- California Department of Transportation;
- California Department of Fish and Game;
- California Employment Development Department;
- Federal Highway Administration;
- Ebbin, Moser + Skaggs;
- California Department of Conservation Farmland Mapping and Monitoring Program;
- U.S. Bureau of Land Management;
- Federal Emergency Management Agency;
- U.S. Geological Survey;
- Stoel Rives, LLP;
- Marshall & Swift;

- Wildlands, Inc.;
- IMPLAN;
- Sheppard, Mullin, Richter & Hampton;
- Dun & Bradstreet;
- Robert Morris Associates;
- Association of Bay Area Governments (ABAG);
- City of Santa Rosa;
- County of Sonoma;
- San Francisco Bay Area Metropolitan Transportation Commission

II.7 Species And Habitat Descriptions

The California tiger salamander is a large and stocky terrestrial salamander with small eyes and a broad, rounded snout.[19] Adults may reach a total length of 208 millimeters (mm) (8.2 inches (in)), with males generally averaging about 203 mm (8 in) in total length, and females averaging about 173 mm (6.8 in) in total length. For both sexes, the average snout-to-vent length is approximately 91 mm (3.6 in). Coloration consists of white or pale yellow spots or bars on a black background on the back and sides. The belly varies from almost uniform white or pale yellow to a variegated pattern of white or pale yellow and black.

The CTS inhabits, in Sonoma County, low-elevation (typically below 1,500 feet (ft) (460 m)), vernal pools, vernal pool complexes, and seasonal ponds in associated annual grasslands, oak savannah, and coastal scrub plant. The CTS spends most of its lifetime in upland habitats, within the underground burrows of small mammals, especially those of California ground squirrels (*Spermophilus beecheyi*) and valley pocket gophers (*Thomomys bottae*). These burrows provide food for California tiger salamanders, as well as protection from the sun and wind associated with the dry California climate that can cause desiccation of amphibian skin.

During its breeding phase, the CTS requires aquatic habitats that remain inundated for a minimum of 12 weeks to allow for successful metamorphosis. In some areas, stock ponds have largely replaced vernal pools as breeding pools (due to the loss of vernal pools) and provide important habitat for the species. The larvae feed on zooplankton, small crustaceans, and aquatic insects for about six weeks after hatching, after which they switch to larger prey. The longer the inundation period, the larger the larvae and metamorphosed juveniles are able to grow, and the more likely they are to survive and reproduce. The larvae perish if a site dries before they complete metamorphosis. Lifetime reproductive success for California and other tiger salamanders is low. Previous research has found that the average female breeds 1.4 times and produces 8.5 young that survived to metamorphosis per reproductive effort. This resulted in

[19] Specie and habitat descriptions summarized from the rule published in the Federal Register on March 19, 2003 (50 CFR Part 17). Additional information obtained through communication with Service staff.

roughly 11 metamorphic offspring over the lifetime of a female. Juveniles do not typically return to the breeding pools until they reach sexual maturity at two years of age at a minimum and survival to adulthood may be low. Tiger salamanders do not always return to the same breeding pond every year. Documented dispersers have moved up to 2,200 ft (670 m), and, based on a projected exponential relationship between dispersal probability and distance, less than 1 percent of dispersers are likely to move between ponds separated by 0.70 mile (mi) (1,160 m).

II.7.1 Primary Constituent Elements

In identifying areas as critical habitat for the CTS, the Service considered those physical and biological habitat features that are essential to the conservation of the species. These essential features are referred to as the species' primary constituent elements (PCEs). Areas which do not contain any PCEs at the time of critical habitat designation are not considered critical habitat, whether or not they occur within a mapped critical habitat unit.

Critical habitat for the Sonoma population includes essential aquatic habitat, essential upland nonbreeding habitat with underground refugia, and dispersal habitat connecting occupied California tiger salamander locations to each other. The Service determined the following three PCEs:

(1) Standing bodies of fresh water (including natural and manmade (e.g., stock) ponds, vernal pools, and other ephemeral or permanent water bodies) along with their associated geographic, topographic, and edaphic features that support the hydrological functioning of the water body that typically become inundated during winter rains. These hydrologic features contribute to the filling and drying of the water body and maintain suitable periods of inundation, water quality, and soil moisture for the species to complete the aquatic portion of its life cycle.

(2) Upland habitats adjacent to breeding ponds that contain small mammal burrows, including but not limited to burrows created by the Botta's pocket gopher. Small mammals are essential in creating the underground habitat that California tiger salamanders depend upon for food, shelter, and protection from the elements and predation.

(3) Barrier-free upland dispersal habitat between occupied locations and areas with small mammal burrows that allow for movement between such sites. Agricultural lands such as row crops, orchards, vineyards, and pastures do not constitute barriers to the dispersal of California tiger salamanders.

When determining proposed critical habitat boundaries, the Service made every effort to avoid proposing the designation of developed areas such as buildings, paved areas, extensive vineyards, parks and golf courses, and other structures that lack PCEs for the California tiger salamander. Any such structures inadvertently left inside proposed critical habitat boundaries are not considered part of the proposed unit. This also applies to the land on which such structures sit directly. Therefore, Federal actions limited to these areas would not trigger section 7 consultations, unless they affect the species and/or primary constituent elements in adjacent critical habitat.

II.8 PROPOSED CRITICAL HABITAT

The Service has designated approximately 74,223 acres of critical habitat in Sonoma County. All of the designated acres fall into one unit, known as the Santa Rosa Plain. Located in central Sonoma County, the unit is bordered on the west by the Laguna de Santa Rosa, on the south by Skillman Road northwest of Petaluma, on the east by the 200 foot elevation contour of the foothills of the Coast Range, and on the north by Windsor Creek. Vernal pools, seasonal wetlands, and associated grassland habitat characterize the Santa Rosa Plain. The majority of the acres are privately-owned, with approximately 887 acres managed by the State of California.

II.9 REPORT OUTLINE

The next section provides an overview of the baseline economic conditions in Sonoma County, including a description of past and projected employment conditions, housing growth, and population changes. Subsequent sections will quantify the economic effects on the land development markets, as well as identify the effects on a regional level.

III SOCIOECONOMIC PROFILE OF SONOMA COUNTY

To understand the economic impacts of critical habitat designation for the California Tiger Salamander, it is essential to have an accurate picture of current and projected economic activity. This section presents a summary of the current conditions and forecasts for Sonoma County by examining population growth, employment sectors and patterns, and housing trends.

Sonoma County is located on the northern California coast and borders Mendocino, Napa, Solano, and Marin counties. Between 1990 and 2000, the county population grew by 18 percent, which represented the addition of 70,392 residents. Over the same ten years, the number of housing units increased by approximately 14 percent (22,091 units). For comparison, the State of California experience14 percent and 9 percent increases in population and housing units, respectively.[20] The largest cities in the County, ranked by population, include Santa Rosa, Petaluma, and Rohnert Park. The square miles and 2004 population of the cities in the County are displayed in Table III-1: City Profiles, 2004. The county changes in population, housing units, and jobs between 1990 and 2000 and the change in the unemployment rate can be found in Table III-2: Select Socioeconomic Characteristics of Sonoma County.

As of 2004, approximately 32 percent of residents lived within the unincorporated areas, which total 1,500 of the 1,580 county acres. The majority of the county land – 72 percent – is dedicated to agriculture (active, non-active, and preserved) and open-space contracts.[21] According to data in the 2003 Crop Report, published by the County Agricultural Commissioner, 55,496 acres were dedicated to fruit and nut cultivation, which represented 63 percent of Sonoma County agriculture. Wine grape production accounted for 52,176 acres and in 2003, the harvest was valued at $313,076,600. The second leading crop was market milk, which was worth $79,321,800 in 2003.[22] The other industries in the area, characterized by their 2002 annual payrolls and number of establishments, are described in Table III-3. Ranked by number of employees in 2002, the principal industries in Sonoma County were trade, transportation, and utilities; government; and, manufacturing (see Table III-4: Largest Employers in Sonoma County.)

Sonoma County produces some of the most highly valued wine grapes in California. Major appellations in Sonoma County include the Russian River Valley, Dry Creek Valley, Sonoma Valley, Green Valley, Alexander Valley, Chalk Hill, Rockpile, Knights Valley, Bennett Valley and Carneros. Principle varietals grown in the county include Chardonnay, Cabernet Sauvignon,

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[20] U.S. Census 1990 and Census 2000, http://factfinder.census.gov/home/saff/main.html?_lang=en and Long-Term Socioeconomic Forecasts by County 2003-2020, California Department of Transportation, Office of Transportation Economics, May 2000, http://www.dot.ca.gov/hq/tpp/offices/ote/socio-economic.htm.

[21] "Citizens Guide to County Government," Sonoma County Administrator's Office, http://www.sonoma-county.org/cao/citizens_guide/environment.htm, accessed May 17, 2005.

[22] "Sonoma County Agricultural Crop Report, 2003," Sonoma County Agricultural Commissioner, http://www.sonoma-county.org/agcomm/crop_report.htm.

Pinot Noir, Zinfandel, Merlot and Sauvignon Blanc. With small exceptions, these regions are located outside the boundaries of critical habitat. Roughly 60,000 acres of wine grapes were harvested in 2003, over 168,000 acres of Sonoma County are suitable for vineyard development. Given the urban characteristic of much of the land designated as critical habitat, and given the relative abundance of substitute vineyard sites, this analysis does not consider the impact of critical habitat designation on vineyard development. It should be noted, however, that some forecasted rural residential development, which is considered in the analysis, will contain small vineyards attached to dwelling units.

Sonoma County is forecasted to add 53,786 jobs between 2000 and 2020, which represents a change of 34 percent over the twenty-year timeframe. Santa Rosa and Petaluma are identified as the largest areas of growth for the sub-region defined by Sonoma, Napa, Lake, and Mendocino counties.[23] According to the San Francisco Bay Area Metropolitan Transportation Commission, out of all of the cities in the nine-county region, the City of Santa Rosa will rank fourth in job growth obtained between 2000 and 2030.[24] The population of Sonoma County is expected to increase by 31 percent between 2000 and 2020, which is slightly above the 29 percent increase predicted for the entire State of California.

The median new home price in 2004 was $532,858.[25] Between 2000 and 2020, Sonoma County is predicted to add 35,424 housing units, which represents a 19 percent increase. The cities of Petaluma, Cloverdale, and Sebastopol are expected to accept a large share of the new construction.[26] Housing in Sonoma County is predicted to remain unaffordable to the majority of wage earners through the next twenty years. By 2020, 4.48 wage earners will be required to purchase a home in the County. This value is an increase over the 2.81 statistic calculated from year-2000 numbers.[27]

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[23] "Wine Country Interregional Partnership, Final Report," Mendocino Council of Governments, June 30, 2004, pp. 22, 24.

[24] "Draft Transportation Plan," Metropolitan Transportation Commission, November 2004, p. 24.

[25] DataQuick Information Systems, Assessor Database, www.dataquick.com

[26] "Sonoma County, 2004 Economic & Demographic Profile," The Center for Economic Development, CSU, Chico, p. 67.

[27] "Wine Country Interregional Partnership, Final Report," Mendocino Council of Governments, June 30, 2004, p. 23.

Table III-1: City Profiles, 2004

Cities	Square Miles	Population
Cloverdale	2.5	7,925
Cotati	1.9	7,025
Healdsburg	3.9	11,600
Petaluma	13.7	55,900
Rohnert Park	6.5	42,150
Santa Rosa	40.6	154,400
Sebastopol	1.9	7,750
Sonoma	2.6	9,675
Windsor	6.7	24,800
Incorporated Total	80.1	320,625
Unincorporated	1500.0	151,600
County Total	**1580.0**	**472,700**

Source: U.S. Census; California Department of Finance; and, County of Sonoma, Administrator's Office.

Table III-2: Select Socioeconomic Characteristics of Sonoma County

Geography	Change in Population, 1990-2000	Percent Change in Population, 1990-2000	Change in Housing Units, 1990-2000	Percent Change in Housing Units, 1990-2000	Change in Number of Jobs, 1990-2000	Change in Unemployment Rate, 2004-2000[28]
Sonoma	70,392	18.1	22,091	13.7	67,624	1.9
State	4,111,627	14	1,031,667	9.2	2,660,826	1.2

Sources: U.S. Census 1990 and U.S. Census 2000; U.S. Bureau Economic Analysis, Regional Economic Information System; and, U.S. Bureau of Labor Statistics.

[28] The unemployment numbers are not seasonally adjusted.

Table III-3: Sonoma County Top Industries

Industry	Annual Payroll	Percent Annual Payroll	Number of Establishments
Forestry, Fishing, Hunting, and Agriculture Support	$18,007	0.3%	85
Mining	$13,449	0.2%	14
Utilities	$46,415	0.8%	16
Construction	$541,243	9.1%	2,003
Manufacturing	$1,206,009	20.4%	855
Wholesale Trade	$305,304	5.2%	617
Retail Trade	$662,770	11.2%	1,885
Transportation and Warehousing	$79,636	1.3%	265
Information	$241,565	4.1%	231
Finance and Insurance	$524,771	8.9%	714
Real Estate, Rental, and Leasing	$87,368	1.5%	651
Professional, Scientific, and Technical Services	$421,623	7.1%	1,520
Management of Companies and Enterprises	$128,208	2.2%	48
Admin, Support, Waste Management, and Remediation Services	$287,740	4.9%	678
Educational Services	$47,946	0.8%	161
Health Care and Social Assistance	$810,941	13.7%	1,474
Arts, Entertainment, and Recreation	$47,782	0.8%	196
Accommodation and Food Services	$220,851	3.7%	1,071
Other Services, except Public Administration)	$172,160	2.9%	1,097
Auxiliaries	$57,983	1.0%	19
Unclassified Establishments	$1,751	0.0%	66
Total	**$5,923,522**	**100.0%**	**13,666**

Source: 2002 Sonoma County Business Patterns, U.S. Census Burea

Table III-4: Largest Employers in Sonoma County

Top Industries	Number of Employees	Percent of Total Employees in County
Agriculture	6,600	3%
Natural Resources and Mining	300	0%
Construction	13,400	7%
Manufacturing	26,700	14%
Trade, Transportation, and Utilities	34,200	18%
Information	4,100	2%
Financial Activities	4,200	2%
Professional and Business Services	19,300	10%
Educational and Health Services	23,800	12%
Leisure and Hospitality	19,900	10%
Other Services	6,700	3%
Government	28,400	15%
Industry Employment Total	**194,000**	**100%**

Source: California Employment Development Department, 2002 County Snapshots.

IV ECONOMIC IMPACTS ON LAND DEVELOPMENT

This section of the analysis discusses the economic impacts of critical habitat designation for the California Tiger Salamander on the markets for land, housing and commercial development. The methodology used to estimate these impacts is described below, followed by a discussion of the calculated results. The section concludes with an estimate of the total costs of critical habitat designation attributable to regulation of land development.

IV.1 BACKGROUND

This portion of the analysis considers the effects of designation on the linked markets for land and improvements to land such as housing and commercial buildings. Following the guidance of the OMB and in compliance with Executive Order 12866 "Regulatory Planning and Review," Federal agencies measure changes in economic efficiency in order to understand how society, as a whole, will be affected by a regulatory action.[29] In the context of this regulatory action, these efficiency effects represent the overall welfare gained or lost by society as a result of critical habitat designation. Economists generally characterize welfare in terms of changes in producer and consumer surpluses in affected markets.[30]

IV.1.1 Compliance with Section 7 of the Act

The measurement of direct compliance costs focuses on the implementation of Section 7 of the Act. This section requires Federal agencies to consult with the Service to ensure that any action authorized, funded, or carried out will not likely jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat. The costs of project modifications and mitigation requirements resulting from these consultations represent the direct compliance costs of designating critical habitat.

The estimate of total Section 7 impacts presented in this analysis does not differentiate between consultations that result from the listing of the species (i.e., the jeopardy standard) and consultations that result from the presence of critical habitat (i.e., the adverse modification standard). Consultations resulting from the listing of the species, or project modifications meant specifically to protect to the species as opposed to its habitat, may occur even in the absence of critical habitat. However, in 2001, the 10th Circuit Court of Appeals instructed the Service to

[29] Executive Order 12866, "Regulatory Planning and Review," September 30, 1993; Executive Order 13211, "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use," May 18, 2001; 5 U.S.C. §§ 601 *et seq*; and Pub Law No. 104–121; and 2 U.S.C. §§658–658g and 1501–1571.

[30] For additional information on the definition of "surplus" and an explanation of consumer and producer surplus in the context of regulatory analysis, see Gramlich, Edward M., *A Guide to Benefit-Cost Analysis (2nd Ed.)*, Prospect Heights, Illinois: Waveland Press, Inc., 1990; and U.S. Environmental Protection Agency, *Guidelines for Preparing Economic Analyses*, EPA 240-R-00-003, September 2000, available at http://yosemite.epa.gov/ee/epa/eed.nsf/webpages/Guidelines.html.

conduct a full analysis of all of the economic impacts of critical habitat designation, regardless of whether those impacts are attributable co-extensively to other causes.[31]

IV.1.2 Benefits

As previously mentioned, the economics literature has documented that social welfare benefits can result from the conservation and recovery of endangered and threatened species. Preservation of the species itself may be valuable to some; in other cases indirect benefits may be more significant. One example of an indirect benefit is the protection of undeveloped areas that contain essential habitat and are left as open space.

In the case of CTS, these benefits can be examined using hedonic regression. The CTS mitigation sites are known and in some cases are nearby areas of residential and commercial development. Thus, if residents valued these areas in their present undeveloped state, such values should be reflected in the market price of housing, That is, homes in close proximity to these mitigation sites should be more valuable than homes that are not, controlling for other factors. Appendix A contains a hedonic regression of home prices in Sonoma County that is based on over 2,000 recent sales of new homes in and near to the area of CTS critical habitat. The effect of proximity to CTS mitigation sites is statistically insignificant, implying that there is no evidence that preservation of these particular mitigation areas increases home values. The most likely explanation for this finding is that there is an abundance of open space in Sonoma County, as well as in neighboring Marin County. The addition of a relatively small amount of open space as a result of CTS conservation increases home values, if at all, by an amount that is too small to be reliably measured.

In its guidance for implementing Executive Order 12866, OMB acknowledges that often, it may not be feasible to monetize, or even quantify, the benefits of environmental regulations. Where benefits cannot be quantified, OMB directs agencies to describe the benefits of a proposed regulation qualitatively.[32] This report provides insight into the potential economic benefits of critical habitat designation based on information obtained in the course of developing the economic analysis. It is not intended to provide a complete analysis of all of the benefits that could result from the designation. Given these limitations, the Service believes that the benefits of critical habitat designation are best expressed in biological terms that can be weighed against the expected cost impacts of the rulemaking.

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[31] *New Mexico Cattle Growers Ass'n v. U.S.F.W.S.*, 248 F.3d 1277 (10th Cir. 2001).

[32] U.S. Office of Management and Budget, "Draft 2003 Report to Congress on the Costs and Benefits of Federal Regulations; Notice," 68 *Federal Register* 5492, February 3, 2003; and U.S. Office of Management and Budget, "Appendix 4: Guidelines to Standardize Measure of Costs and Benefits and the Format of Accounting Statements," in *Report to Congress on the Costs and Benefits of Federal Regulations,* March 22, 2000.

IV.1.3 Defining the Baseline

OMB guidelines for conducting economic analysis of environmental regulation direct Federal agencies to measure the costs of a regulatory action against a baseline.[33] In its guidance, OMB states, the "baseline should be the best assessment of the way the world would look absent the proposed action" (i.e., absent the designation of critical habitat). In other words, the baseline includes the currently existing regulatory and socioeconomic burden imposed on landowners and managers potentially affected by the designation of critical habitat. The baseline burden may include, for example:

- Local zoning and other land use regulations;
- State natural resource laws;
- Enforceable management plans and best management practices applied by other State and Federal agencies.

This analysis describes impacts that are expected to occur above and beyond the baseline. To comply with USFWS policy regarding consideration of co-extensive effects, economic impacts attributable to Section 404 of the Clean Water Act that impact CTS breeding habitat are not considered as part of the baseline.

IV.1.4 Time Frame

The analysis examines activities taking place both within and adjacent to the proposed designation. It measures impacts based on activities that are "reasonably foreseeable," including, but not limited to, activities that are currently authorized, permitted, or funded, or for which proposed plans are currently available to the public. Accordingly, the analysis bases estimates on activities that are likely to occur within a 20-year time frame, beginning on the day that the current proposed rule becomes available to the public.

Twenty years is an optimal time frame for this analysis for several reasons. First, the scale of the proposed critical habitat designation requires the use of regional and county level growth data. In the State of California, this data is readily available beyond the ten year horizon. A 20-year time frame is very common among a number of planning and development tools including: California State-mandated jurisdictional General Plans, population and employment projections by regional associations of governments, and project planning and the calculation of absorption rates and financial rates of return by real estate developers.

In addition, speculative real estate transactions in high growth communities in California frequently involve land not yet annexed into cities and land upon which development is not likely to occur for 15 to 20 years. Master planned communities consisting of hundreds, if not

[33] U.S. Office of Management and "Draft 2003 Report to Congress on the Costs and Benefits of Federal Regulations; Notice," 68 Federal Register 5492, February 3, 2003; and U.S. Office of Management and Budget, "Appendix 4: Guidelines to Standardize Measure of Costs and Benefits and the Format of Accounting Statements," in Report to Congress on the Costs and Benefits of Federal Regulations, March 22, 2000.

thousands, of acres of raw land increasingly require more than ten years to receive planning approvals from local, State and Federal agencies. Certain land development interests that precede the ownership by the eventual land developer, therefore, often financially control property more than a decade in advance of the first project application. Farming or ranching may continue, but critical habitat designation has the potential to affect development potential and associated speculative land value at a very early stage in the development process.

IV.2 METHODOLOGY

The total economic impact of critical habitat designation depends on a variety of factors, including the size of the designation, the nature of pre-existing markets and regulation, and geographical features of the designated land itself. Because these factors vary by region, the methodology adopts the Census tract as its baseline unit of analysis. This modeling choice invests the results with a high degree of spatial precision.

The steps followed to determine the impacts of critical habitat designation on housing markets are:

- Determine the effects and significance of prior regulation of land development in affected areas;
- Determine the intersection of future development and critical habitat determination;
- Determine the incremental, project-level regulatory requirements resulting from critical habitat designation;
- Calculate the market effects of critical habitat and estimate economic costs for these areas.

Each step is discussed in greater detail below.

IV.2.1 Prior Regulation in Affected Areas

Markets for land, housing and commercial real estate are highly regulated by governments at the local, state and federal levels. The welfare impacts of critical habitat designation are affected by the nature and extent of prior interventions such as zoning, urban growth boundaries and other policies.

Zoning and urban limits can reduce the stock of developable land and increase the price of land that is suitable for development. Local regulations such as density controls and even imperfections such as permitting bottlenecks can also directly limit the construction of new housing. Zoning and density limits can, in concert, also effectively cap the number of new housing units that can be constructed in a particular location.

As explained in Appendix A, when the pre-designation number of new housing units constructed is limited by prior regulation, there is a “shadow value” of housing that is not necessarily incorporated in the price of land. These rents are earned by providers of fixed factors to the homebuilding process. When critical habitat designations impose further restrictions on an

already constrained homebuilding process, welfare impacts can be larger than if the number of housing units constructed is not directly controlled by regulation.

Recent research has uncovered methods to test for the existence of rationing in the market for new housing.[34] Such testing entails a comparison of the "extensive" and "intensive" margin values of land which are loosely defined as the value of land with a house on it and the willingness of homebuyers to pay for an additional unit of lot size. In the conventional case where regulation may limit the supply of land but not the number of housing units built, extensive and intensive margin values should be the same since density will adjust to equate the two. When housing is directly limited by regulation, the extensive margin value will exceed the intensive margin value. The rationale is that the extensive margin value incorporates the shadow value of housing while the intensive margin value is simply the value of additional lot size.

This test was implemented using the already-described data on newly constructed homes in Sonoma County. Test results are described in Appendix A and strongly indicate that the number of new homes built in Sonoma County is indeed constrained by prior regulation. Thus, the market for new housing is rationed even before the imposition of incremental regulations related to critical habitat.

Following this line of reasoning, the analysis considers a scenario in which critical habitat results in a reduction in the housing stock in Census tracts where avoidance requirements place some land off-limits to development. In this case, critical habitat will result in housing price increases to clear the market and potential gains to developers and landowners who benefit from the increased price. These potential producer gains must be counterbalanced against the requirement for mitigation expenditures resulting from development in critical habitat areas, and profits lost through the reduction in housing units constructed. The listing of the species can also result in significant mitigation requirements. In a rationed market, the cost of mitigation will usually be borne by developers and landowners since the price of new housing is not determined simply by marginal cost.

IV.2.2 Critical Habitat Likely To Be Developed

Forecasts of both the quantity and location of future land development are needed to assess the economic impact of critical habitat designation. To determine the quantity of residential and commercial development, the analysis relies on data from the Association of Bay Area Governments (ABAG) for census tract-level estimates of population and household growth, as well as acres of greenfield residential and commercial development.

In order to allocate these development projections within the census tract, the analysis utilizes the Sonoma County General Plan Land Use map and the location of the Urban Growth Boundaries (UGBs). Sonoma's general plan provides an overview of the planned build-out

[34] David Sunding and Aaron Swoboda, *Does Regulation Ration Housing?*, UC Berkeley Working Paper, 2004, and Ed Glaeser and Joseph Gyourko, *The Impacts of Building Restrictions on Housing Affordability*, Federal Reserve Board of New York Economic Policy Review, 2003.

pattern for the county. Land areas are zoned as residential, commercial, industrial, agricultural, city, or public. Residential zones have accompanying density constraints above which residential development will not be permitted.

Development is allocated within each census tract so as to satisfy each of the above constraints. Specifically, the model allocates development such that

1. Total new households equal the ABAG projection;
2. Total acres of greenfield development equals the ABAG projection;
3. Greenfield residential development occurs at or below the maximum allowable density set forth in the general plan.

The analysis also takes into consideration the importance of the UGBs. Within each Census tract, forecasted greenfield development of new housing is first allocated to land zoned as urban residential within the UGB. If this land is insufficient to accommodate forecasted greenfield development, it is next allocated to land zoned as agricultural but lying within the UGB. The remainder of forecasted development is allocated to rural residential.

Commercial development is allocated in a similar fashion to residential development, however as forecasts are generally only available on a per-acre basis, constraints 1 and 3 of the above model are irrelevant. Hence, commercial acreage is allocated to satisfy the ABAG greenfield projection and is placed within commercial zones as defined by the General Plan.

IV.2.3 Avoidance, Mitigation and Indirect Effects of Critical Habitat

The analysis considers that mitigation requirements for development within critical habitat vary according to its proximity to tiger salamander populations, as described in section 5.3.2.1 "Interim Mitigation" of the draft Santa Rosa Plain Conservation Strategy (SRPCS).[35] In particular,

- Projects within 500 feet of a known breeding site must mitigate at a ratio of 3:1.
- Projects greater than 500 feet but less than 2,200 feet from a known breeding site, or within 500 feet of an adult occurrence, must mitigate at 2:1.
- Projects greater than 2,200 feet but less than 1.3 miles from breeding habitat must mitigate at 1:1.

Other development that occurs within critical habitat but outside of the 1.3-mile buffer may choose to survey for tiger salamander populations and mitigate at 1:1 if they are found on the project site. Accordingly, the analysis eliminated all land within critical habitat where salamander populations are known to be extirpated or nonexistent and assumed remaining

[35] Santa Rosa Plain Conservation Strategy. August 3, 2005 draft. http://www.fws.gov/pacific/sacramento/es/documents/Santa_Rosa_Conservation/draft_santa_rosa_plain_conservation_strategy.pdf

development would be subject to mitigation.[36] To model the coextensive effects of Clean Water Act requirements, it was assumed that projects in the 500 foot buffer around breeding habitat would also be subject to 1:1 on-site avoidance requirement.

Projects may fulfill the requirement for compensation by purchasing conservation credits from a conservation bank, purchasing suitable habitat and managing that habitat in perpetuity, or dedicating land already owned by the project applicant and having suitable habitat. The analysis uses land acquisition prices developed by Wildlands Inc., a mitigation banking firm, to estimate the mitigation costs associated with section 7 requirements.[37] The prices, shown in Table IV-1: Land Acquisition Prices by Conservation Area vary according to the SRPCS conservation area in which the land is being acquired. Per the SRPCS, the analysis assumes that any development which occurs within a conservation area shall mitigate within that conservation area. Since development which occurs outside the conservation areas can mitigate in any of them, mitigation for these projects is computed using the lowest estimated land acquisition price, $50,000.

Mitigation which occurs as the result of an impact on breeding habitat incurs additional costs due to the need to restore equivalent habitat. Net of land acquisition costs, the additional expenditure required to create breeding habitat were calculated by Wildlands, Inc. to be $120,362 per acre. Mitigation which occurs within the 500-feet buffer around breeding sites is assumed to incur these costs and well as the above costs of land acquisition.

IV.3 Calculation of Market Effects and Welfare Losses

Estimates of welfare impacts on the markets for land, housing and commercial development proceed directly from the spatial and socioeconomic data described above. This analysis adopts a supply and demand approach based on partial equilibrium to assess those impacts.

Estimating the regulatory impact requires several steps within the context of this framework:

1. Identify the supply and demand functions and determine the market equilibrium "but for" the regulatory action.
2. Determine the effects of regulation on supply, demand and relevant constraints.
3. Estimate the resulting new market equilibrium and resultant changes in producer and consumer surplus.

New residents' demand for housing in each Census tract is specified as linear and of unit price elasticity as suggested by the academic literature.[38] The number of new housing units is taken

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[36] Data on the location of current populations was obtained from the California Department of Fish and Game in coordination with the SRPCS.

[37] See "Sonoma Analysis Report, Preliminary Draft," Wildlands, Inc. October 11, 2004.

[38] The seminal analysis of Muth (1964) suggested that the price elasticity of demand for residential land could be expressed as $\varepsilon_L = -k_N\sigma + k_L\varepsilon_H$, where ε_L and ε_H are the own-price elasticities of residential land and

from the population growth forecasts and new home prices are taken from DataQuick as described above.

The Section 7 consultation process may result in time delays and other effects that have impacts that are incremental to direct compliance costs. The analysis considers the cost of time delays associated with Section 7 consultation or other requirements triggered by the designation above and beyond project delays resulting from baseline regulatory processes. Delay costs are measured as the incremental carrying costs on the underlying option to purchase land for development. The delay period is 2 years and the value of the land held was calculated using a hedonic regression of home sales (see Table A-1: Home Price Regression Results). The effect of this assumption is that delay increases development cost and reduces producer surplus, but does not affect consumer welfare. A more conservative analysis (i.e., more likely to result in larger impacts) might consider that designation of critical habitat would delay completion of the project beyond when it would have been completed without the designation of critical habitat. However, in Sonoma County, the possible presence of the CTS is widely known to developers, and it is reasonable to assume that they would initiate the development process sooner in anticipation of the extra regulation flowing from the listing of the salamander.

A sample calculation is provided to assist with understanding the model. Consider a hypothetical census tract with the following characteristics:

- 200 new homes are projected to be built at a cost of $500,000 each;
- The cost of building each of these homes is $300,000;
- Housing demand is unit elastic, meaning an increase in price will provoke an equivalent (in percent terms) reduction in demand; and
- The price of mitigation land is $100,000 per acre.

Suppose that 100 of the projected 200 homes are to be built within critical habitat, and that avoidance requirements result in the loss of 5 homes, or 2.5% of the overall pre-regulation housing stock.

Since demand is unit elastic, this output reduction implies a 2.5% increase in the overall price of new housing, so the post-regulation price of new housing is now $512,500, or

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housing, respectively, σ is the elasticity of substitution between land and capital in the production of housing, and k_L and k_N are the shares of land and non-land factors in housing production. Thorsnes (1997) has estimated the value of σ as roughly -1.0. Reid (1962) first demonstrated that the price elasticity of housing was near -1.0. While several studies have reported lower elasticities, Rosen (1979) reported a price elasticity of -1.0 using time series data. Representative cost shares for land and non-land factors of production are 0.3 and 0.7, respectively. Richard Muth, "The Derived Demand for a Factor of Production and the Industry Supply Curve," *Oxford Economic Papers* (July 1964): 221-234; Paul Thorsnes, "Consistent Estimates of the Elasticity of Substitution between Land and Non-Land Inputs in the Production of Housing," *Journal of Urban Economics* (1997): 98-108; Harvey Rosen, "Housing Decisions and the U.S. Income Tax," *Journal of Public Economics* (1979): 1-23.

$$\frac{dQ}{Q_0}\frac{P_0}{dP} = -1 \Rightarrow \frac{dQ}{Q_0} = -\frac{dP}{P_0}$$
$$\frac{dQ}{Q_0} = \frac{Q' - Q_0}{Q_0} \approx -.025 \Rightarrow \frac{dP}{P_0} = .025$$

where Q_0 is the initial quantity of housing within critical habitat and P is the pre-critical habitat price of housing.

The welfare loss calculation has three components. First are impacts to producer and consumer surplus.[39] The surplus impacts for this example total $1,031,250.

Second are mitigation costs. Suppose that developers must mitigate impacts at 2:1 at a cost of $100,000 per acre of disturbance. Calculating the total land footprint within critical habitat requires knowledge of the incremental gross urban density. Assume it is two homes per acre. Then a total of 47.5 acres of habitat must be mitigated at 2:1. This yields a total of $9.5 million in mitigation costs.

The final component of welfare loss is due to delay. Delay is calculated using a 7% discount rate for 730 days. Assume for the purpose of this example that the purchase price of land is $200,000 per acre. Then the incremental carrying cost of land is $28,000 per acre for a total of $1,330,000.

Total lost surplus in this example is then $11,861,250.

IV.4 Results of the Analysis

In the base scenario where critical habitat reduces the amount of new housing, designation of critical habitat results in over $336 million in losses to consumers and producers between the present and 2025. Table IV-2: Characteristics of New Housing in Affected Tracts describes the baseline characteristics of the census tracts within critical habitat. The housing characteristics are derived from DataQuick and Census data, while the population and household projections are due to ABAG.

Table IV-3: Greenfield Development Projections lists the results of the allocation model described in Section IV.2.2. The projections are designed to match ABAG data on acres of development whenever possible.

Table IV-4: Residential and Commercial Land Development Impacts presents measurements of the three basic types of impacts modeled: mitigation costs, delay costs and the costs of lost output. Total losses are the sum of these three basic types. Losses per Census tract range from $0

[39] As explained in the appendix, these losses are given by the expression $-\left[\frac{dP}{2} + (P - c)\right]dQ$.

to over $127 million. Mitigation costs for residential and commercial development account for the majority of impacts, owing to the relatively minor avoidance requirements observed in the study area. Total welfare impacts are $336 million over the 20-year study period. The top six most-impacted census tracts account for roughly 80% of impacts.

Figure 1 through Figure 3 display these impacts visually. Figure 1 presents the distribution of impacts as a Lorenz curve. Figure 2 shows a map of the affected tracts by total surplus lost. Figure 3 displays a distribution of impacts by tracts. The tracts making up 80% of the impacts are colored in red, and the remainder in green.

As demonstrated in Figure 3, the most impacted tracts typically lie partially within an urban growth boundary ("UGB"). Of the estimated 62,681 acres of critical habitat that are not already urbanized, roughly 22% are within a UGB. Lands within the growth boundary are responsible for roughly 41% of the $336 million impacts. With respect to their size, these lands have a disproportionately large share of overall impacts because greenfield development is typically concentrated inside the boundary. Removing these lands from critical habitat would result in a cost savings of approximately $137 million.

Table IV-1: Land Acquisition Prices by Conservation Area

Conservation Area	Land Acquisition Price Per Acre	
	Inside Conservation Area	**Adjacent to Conservation Area**
Alton	$105,000	$50,000
Wright	$115,000	$55,000
Kelly	$105,000	$55,000
Llano	$105,000	$53,000
Stony Point	$120,000	$75,000
SE Cotati	$105,000	$55,000
SW Cotati	$105,000	$50,000
NW Cotati	$125,000	$60,000

Source: Wildlands Inc.

Table IV-2: Characteristics of New Housing in Affected Tracts

FIPS[40]	Price	Square Feet	New Households	New Population
06097150603	$435,377	2,198	260	677
06097150605	$712,777	2,216	1,023	2,592
06097150606	$730,204	2,417	420	1,095
06097150901	$433,786	1,781	426	1,059
06097151000	$1,014,166	3,000	75	245
06097151100	$1,293,968	3,016	54	186
06097151201	$982,441	2,655	557	1,506
06097151203	$516,735	1,782	269	691
06097151204	$643,769	1,900	254	568
06097151301	$367,145	1,895	140	368
06097151305	$359,720	1,402	188	436
06097151306	$366,084	1,819	123	285
06097151307	$672,517	2,379	207	567
06097151308	$483,280	2,047	401	1,049
06097151309	$445,629	2,160	402	982
06097151310	$391,715	1,895	118	312
06097151311	$581,216	2,111	411	1,054
06097151401	$374,754	1,400	495	1,262
06097151402	$400,419	1,502	479	1,118
06097151502	$513,225	1,926	239	562
06097151503	$782,226	2,778	94	250
06097151504	$441,387	2,350	103	262
06097151700	$963,670	2,835	341	697
06097151800	$395,850	1,362	337	734
06097151900	$333,912	1,440	173	407
06097152000	$445,983	1,099	501	1,213
06097152100	$404,279	1,127	176	444
06097152201	$387,473	1,668	210	458
06097152203	$474,265	1,554	264	560
06097152300	$507,144	2,236	155	324
06097152400	$928,042	2,977	560	1,385
06097152701	$650,681	2,115	54	118
06097152702	$512,887	1,957	58	163
06097152801	$538,052	2,046	290	791
06097152802	$757,477	2,528	506	1,135
06097152901	$465,256	1,541	451	1,149
06097152903	$368,382	1,781	277	886
06097152904	$513,787	1,612	247	642
06097153001	$362,699	1,234	861	2,234
06097153002	$335,876	1,313	745	2,236

[40] FIPS (Federal Information Processing Standards) is a standardized code used in this report to refer to census tracts.

FIPS[40]	Price	Square Feet	New Households	New Population
06097153003	$324,367	1,706	466	1,257
06097153005	$801,025	3,293	322	901
06097153006	$412,401	1,461	514	1,345
06097153101	$447,558	1,753	671	2,056
06097153102	$324,367	1,781	199	756
06097153200	$437,412	1,730	1,239	3,534
06097153300	$463,964	1,986	1,409	3,866
06097153401	$532,068	1,857	161	448
06097153403	$525,515	1,645	77	215
06097153404	$843,887	2,741	127	274
06097153501	$670,653	2,122	18	62
06097153600	$1,002,569	2,226	29	103
06097153705	$389,948	1,706	94	236
06097153706	$544,619	1,857	109	272
06097153801	$562,280	2,073	790	2,372
06097153802	$446,423	1,587	535	1,492
06097153803	$514,648	1,799	769	2,101
Total			**20,473**	**53,992**

Sources:

(1) DataQuick
(2) ABAG

Table IV-3: Greenfield Development Projections

FIPS	Commercial	Residential
06097150603	0	17
06097150605	29	281
06097150606	95	301
06097150901	8	37
06097151000	0	93
06097151100	0	63
06097151201	65	492
06097151203	0	1
06097151204	0	0
06097151301	0	0
06097151305	0	0
06097151306	0	0
06097151307	0	23
06097151308	0	0
06097151309	0	264
06097151310	0	1
06097151311	0	62
06097151401	0	244
06097151402	12	52
06097151502	0	104
06097151503	0	56
06097151504	0	0
06097151700	0	0
06097151800	0	0
06097151900	0	0
06097152000	0	0
06097152100	0	0
06097152201	0	0
06097152203	0	0
06097152300	0	0
06097152400	0	0
06097152701	4	18
06097152702	84	13
06097152801	0	43
06097152802	0	0
06097152901	0	1
06097152903	0	0
06097152904	0	0
06097153001	0	0
06097153002	0	0
06097153003	0	1
06097153005	10	157
06097153006	0	0
06097153101	0	0
06097153102	0	0

FIPS	Commercial	Residential
06097153200	30	378
06097153300	80	938
06097153401	1	62
06097153403	1	46
06097153404	0	76
06097153501	0	29
06097153600	0	46
06097153705	0	83
06097153706	0	153
06097153801	20	581
06097153802	0	250
06097153803	0	0
Total	**439**	**4,966**

Source: CRA analysis.

Table IV-4: Residential and Commercial Land Development Impacts

FIPS	Mitigation Costs	Lost Output Costs	Delay Costs	Total Surplus Lost	Annualized Impacts
06097150603	$0	$0	$170,000	$170,000	$14,997
06097150605	$1,790,419	$0	$3,098,304	$4,888,723	$431,272
06097150606	$0	$0	$3,960,000	$3,960,000	$349,342
06097150901	$0	$0	$451,623	$451,623	$39,841
06097151000	$627	$0	$930,000	$930,627	$82,098
06097151100	$537,910	$41,367	$635,490	$1,214,768	$107,164
06097151201	$26,609,322	$433,252	$12,261,943	$39,304,516	$3,467,354
06097151203	$180,527	$2,744,910	$54,118	$2,979,555	$262,849
06097151204	$0	$0	$0	$0	$0
06097151301	$0	$0	$0	$0	$0
06097151305	$0	$0	$0	$0	$0
06097151306	$0	$0	$0	$0	$0
06097151307	$1,113,614	$0	$405,224	$1,518,838	$133,988
06097151308	$6,656	$0	$23,692	$30,347	$2,677
06097151309	$13,174,328	$0	$15,046,796	$28,221,124	$2,489,602
06097151310	$28,627	$0	$27,754	$56,381	$4,974
06097151311	$4,895,140	$0	$3,533,717	$8,428,857	$743,574
06097151401	$4,125,973	$0	$7,604,428	$11,730,401	$1,034,829
06097151402	$2,594,810	$0	$3,647,708	$6,242,519	$550,701
06097151502	$311,550	$0	$1,176,071	$1,487,621	$131,234
06097151503	$1,048	$0	$560,985	$562,033	$49,581
06097151504	$0	$0	$0	$0	$0
06097151700	$0	$0	$0	$0	$0
06097151800	$0	$0	$0	$0	$0
06097151900	$0	$0	$0	$0	$0
06097152000	$0	$0	$0	$0	$0
06097152100	$0	$0	$0	$0	$0
06097152201	$0	$0	$0	$0	$0
06097152203	$0	$0	$0	$0	$0
06097152300	$0	$0	$0	$0	$0
06097152400	$0	$0	$0	$0	$0
06097152701	$494,671	$0	$220,338	$715,009	$63,076
06097152702	$4,491,666	$0	$970,000	$5,461,666	$481,816
06097152801	$2,150,000	$0	$549,574	$2,699,574	$238,150
06097152802	$0	$0	$0	$0	$0
06097152901	$50,001	$0	$56,995	$106,997	$9,439
06097152903	$0	$0	$0	$0	$0
06097152904	$0	$0	$0	$0	$0
06097153001	$0	$0	$0	$0	$0
06097153002	$0	$0	$0	$0	$0
06097153003	$29,874	$0	$56,995	$86,869	$7,663
06097153005	$10,375,402	$0	$3,361,106	$13,736,508	$1,211,803
06097153006	$0	$0	$0	$0	$0
06097153101	$0	$0	$0	$0	$0
06097153102	$0	$0	$0	$0	$0

FIPS	Mitigation Costs	Lost Output Costs	Delay Costs	Total Surplus Lost	Annualized Impacts
06097153200	$31,601,400	$4,700,628	$14,228,360	$50,530,388	$4,457,674
06097153300	$96,455,256	$4,196,509	$26,988,730	$127,640,496	$11,260,149
06097153401	$81,934	$0	$630,000	$711,934	$62,805
06097153403	$1,115,244	$0	$470,000	$1,585,244	$139,847
06097153404	$3,023	$0	$760,000	$763,023	$67,312
06097153501	$586,181	$345	$309,672	$896,198	$79,061
06097153600	$0	$0	$460,000	$460,000	$40,580
06097153705	$0	$0	$830,000	$830,000	$73,221
06097153706	$23	$0	$1,530,000	$1,530,023	$134,975
06097153801	$7,510,960	$0	$6,174,148	$13,685,107	$1,207,269
06097153802	$0	$0	$2,500,000	$2,500,000	$220,544
06097153803	$0	$0	$0	$0	$0
Total	**$210,316,186**	**$12,117,011**	**$113,683,773**	**$336,116,969**	**$29,651,461**

Source: CRA analysis

Table IV-5: Residential and Commercial Land Development Impacts, Descending

FIPS	Total Surplus Lost	Cumulative Percentage
06097153300	$127,640,496	38.0%
06097153200	$50,530,388	53.0%
06097151201	$39,304,516	64.7%
06097151309	$28,221,124	73.1%
06097153005	$13,736,508	77.2%
06097153801	$13,685,107	81.3%
06097151401	$11,730,401	84.7%
06097151311	$8,428,857	87.3%
06097151402	$6,242,519	89.1%
06097152702	$5,461,666	90.7%
06097150605	$4,888,723	92.2%
06097150606	$3,960,000	93.4%
06097151203	$2,979,555	94.3%
06097152801	$2,699,574	95.1%
06097153802	$2,500,000	95.8%
06097153403	$1,585,244	96.3%
06097153706	$1,530,023	96.7%
06097151307	$1,518,838	97.2%
06097151502	$1,487,621	97.6%
06097151100	$1,214,768	98.0%
06097151000	$930,627	98.3%
06097153501	$896,198	98.5%
06097153705	$830,000	98.8%
06097153404	$763,023	99.0%
06097152701	$715,009	99.2%
06097153401	$711,934	99.4%
06097151503	$562,033	99.6%
06097153600	$460,000	99.7%
06097150901	$451,623	99.9%
06097150603	$170,000	99.9%
06097152901	$106,997	99.9%
06097153003	$86,869	100.0%
06097151310	$56,381	100.0%
06097151308	$30,347	100.0%
06097151306	$0	100.0%
06097151301	$0	100.0%
06097151204	$0	100.0%
06097152300	$0	100.0%
06097151305	$0	100.0%
06097152400	$0	100.0%
06097153102	$0	100.0%
06097153101	$0	100.0%
06097153006	$0	100.0%
06097153002	$0	100.0%
06097153001	$0	100.0%

FIPS	Total Surplus Lost	Cumulative Percentage
06097152904	$0	100.0%
06097152201	$0	100.0%
06097152802	$0	100.0%
06097151504	$0	100.0%
06097153803	$0	100.0%
06097152203	$0	100.0%
06097152100	$0	100.0%
06097152000	$0	100.0%
06097151900	$0	100.0%
06097151800	$0	100.0%
06097151700	$0	100.0%
06097152903	$0	100.0%
Total	**$336,116,969**	

Source: CRA analysis.

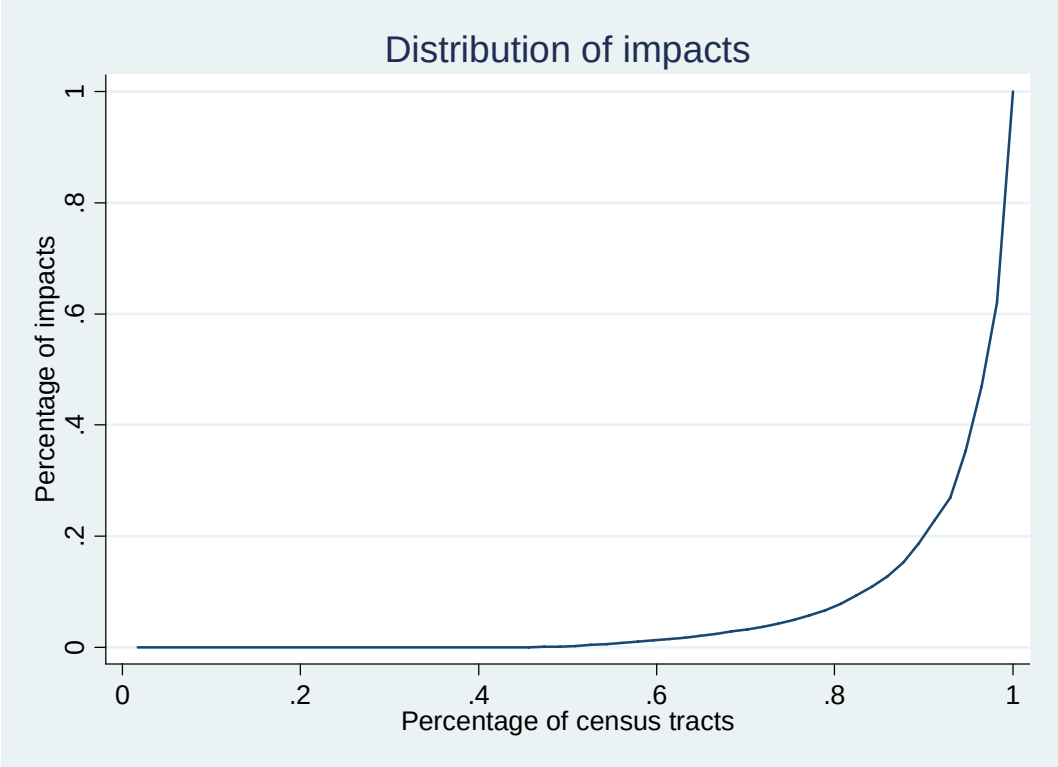

Figure 1: Distribution of Impacts

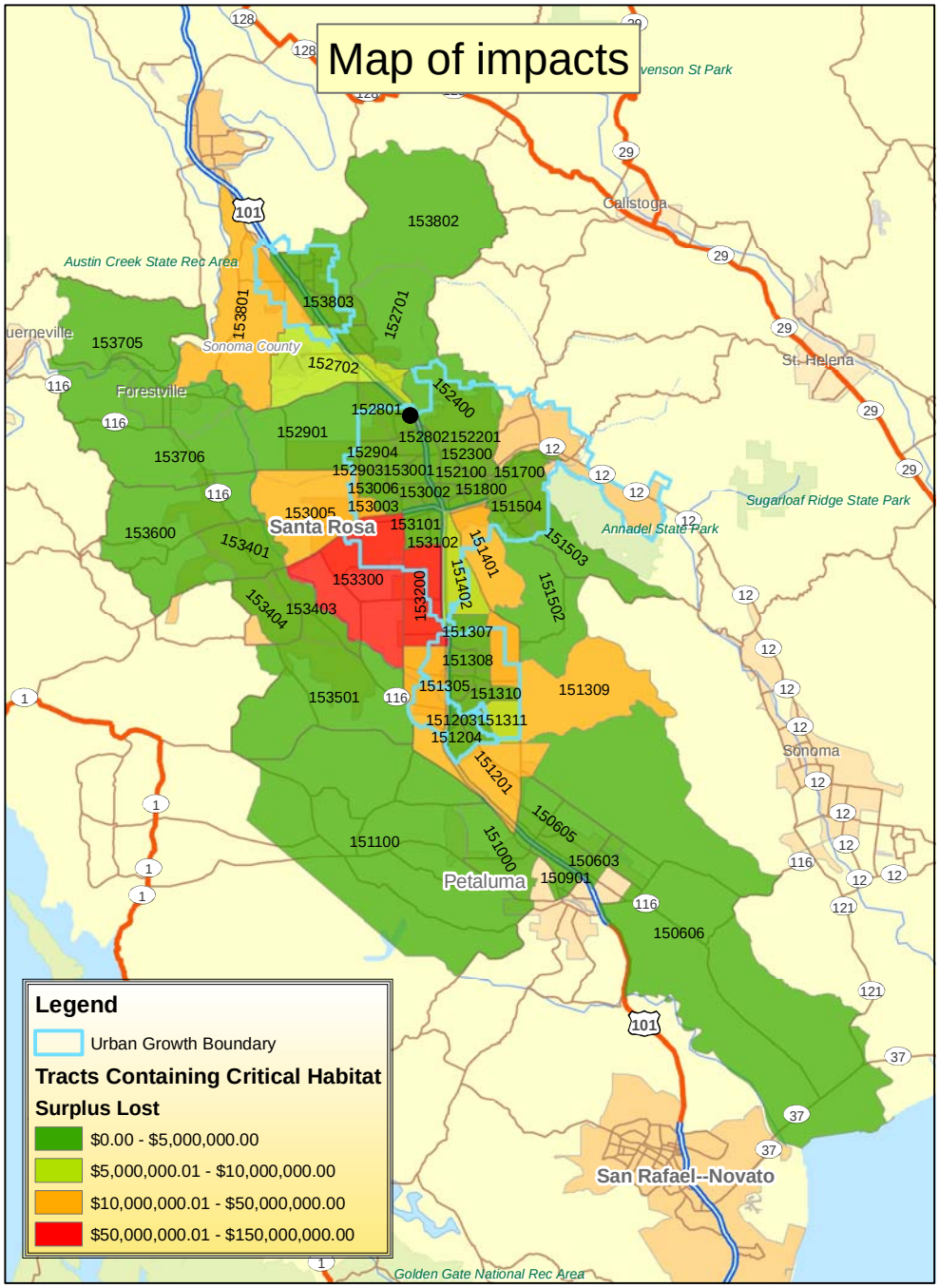

Figure 2: Map of Impacts

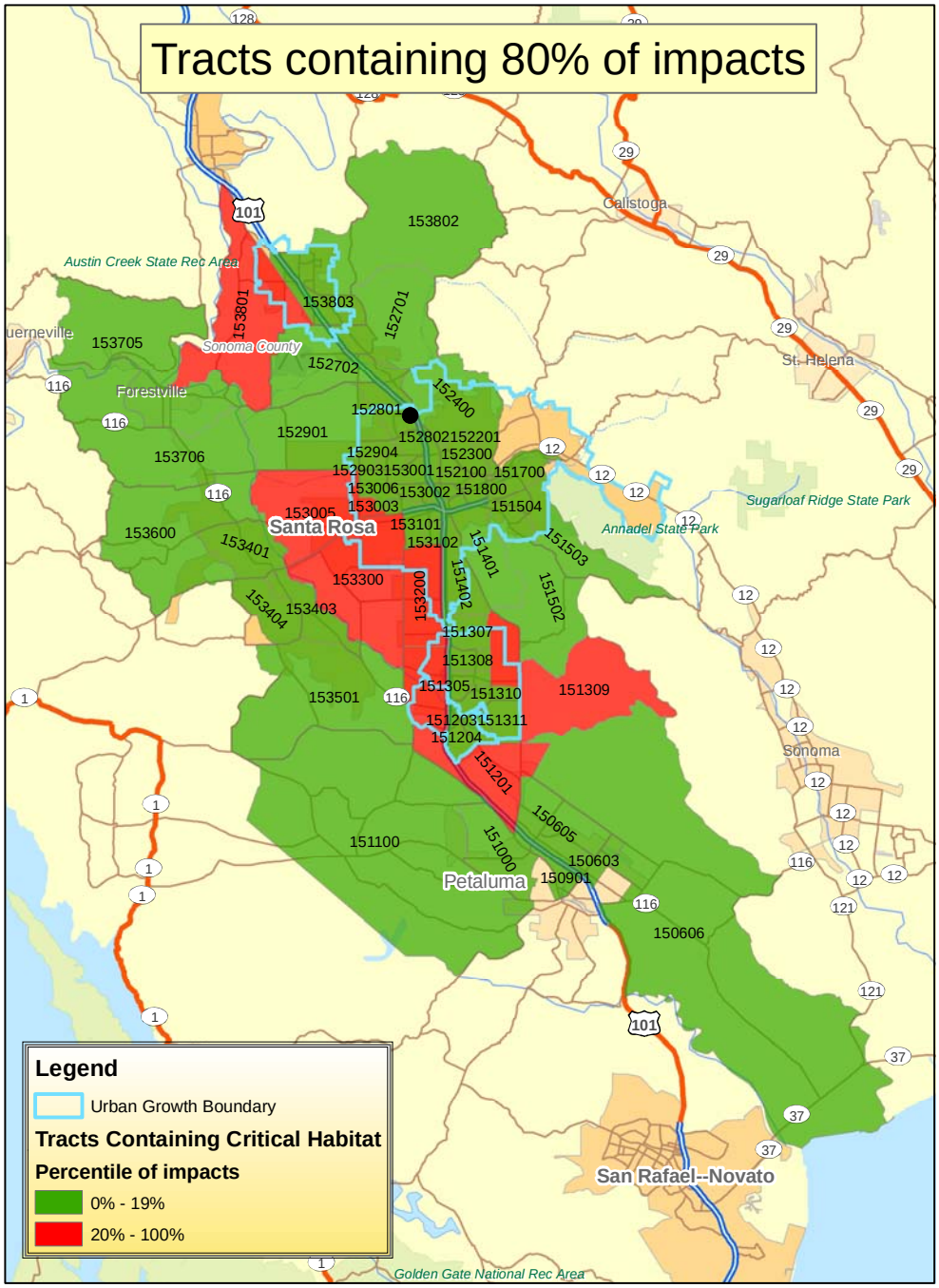

Figure 3: Map of Impacts by Distribution

V ECONOMIC IMPACTS ON PUBLIC PROJECTS AND ACTIVITIES

This section reviews the potential economic impacts on transportation projects and the energy industry as a result of critical habitat designation. In addition, the possible impacts to activities on Federal lands are examined.

V.1 ECONOMIC IMPACTS ON TRANSPORTATION PROJECTS

The Federal Highway Administration (FHA) and the California Department of Transportation maintain GIS databases of current and predicted transportation projects. The FHA data, known as the National Highway Planning Network, includes information for interstates, principal arterials, and rural minor arterials.[41] The California Department of Transportation source, known as the California Transportation Investment Tool (CTIS Tool), incorporates information about projects overseen by the State Transportation Improvement Program, the State Highway Operations and Protection Program, the Interregional Transportation Strategic Plan, the California Aviation System Plan, and various regional transportation planning organizations.[42] Aviation, rail, highway, transit, bicycle and pedestrian projects are all represented. Developed to assist transportation planners, the CTIS Tool is a Geographic Information System that displays the mapped location, as well as the timeframe and cost of the projects. Version 1.3.2 was used for this analysis; version 2.0 should be released in spring 2005.[43]

The data layers contained in the CTIS Tool were mapped onto the habitat boundary files provided by the Service to determine the number of proposed acres affected by each transportation project. No aviation, rail, bicycle, transit, or pedestrian projects overlapped with critical habitat. The highway number, miles of impacted acres, and total project cost (in 2004 dollars), of the three projects that cross the CTS habitat unit are display in Table V-1.[44]

The capital costs of all of the impacted highway projects total $116 million, in 2004 dollars. A total of 10.39 miles of California highway projects overlap with the proposed critical habitat. No impacts were identified from the overlap of the FHA data and the critical habitat maps. To determine the effects of designation, the impacts of mitigation requirements and project delays were calculated. Only projects with a start date of 2005 or later were considered.[45]

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[41] U.S. Department of Transportation, Federal Highway Administration, http://www.fhwa.dot.gov/planning/nhpn/

[42] California Department of Transportation, Office of State Planning, http://www.dot.ca.gov/hq/tpp/offices/osp/ctis.htm

[43] Version 1.3.2 is current through 2001. This analysis will be updated once Version 2.0 is released.

[44] Values were inflated to 2004 dollars by using the Producer Price Indexes for Construction Materials and Components, recorded in Table B-65 of the Economic Report of the President, published in February 2005.

[45] Start date of a project was determined by the "Line_yr" variable, which represents the "year the funding is expected to be awarded for expenditures". The "Total_Cost" variable equals the total funds set aside for the project.

The two projects planned for Highway 101 involve road widening and the construction of High Occupancy Vehicle lanes. The preliminary findings indicate the presence of CTS habitat, but at this time, the environmental assessments have not been completed.

The Route 116 project was also identified as intersecting with the critical habitat unit. This construction is slated to begin around 2020. The environmental assessment has not been completed at this time.

For projects without a completed assessment, impacts were calculated by assuming a 250-foot right-of-way buffer around each linear project and applying the model discussed in section IV.2. Overall costs due to mitigation are estimated to be $7.97 million.

To determine the costs stemming from the delays in project completion, it is necessary to calculate the forgone benefits, which are best framed in terms of changes in ridership patterns and commute times. At this time, the economic impacts due to project delays have not been evaluated.

V.2 Economic Impacts on the Energy Industry

Pursuant to Executive Order 13211, Federal agencies are required to submit a summary of the potential effects of regulatory actions on the supply, distribution, and use of energy, assuming those actions meet certain criteria outlined by the OMB:[46]

- Reductions in crude oil supply in excess of 10,000 barrels per day;
- Reductions in fuel production in excess of 4,000 barrels per day;
- Reductions in coal production in excess of 5 million tons per year;
- Reductions in natural gas production in excess of 25 million mcf per year;
- Reductions in electricity production in excess of 1 billion kilowatt-hours per year or in excess of 500 megawatts of installed capacity;
- Increases in energy use required by the regulatory action that exceed any of the thresholds above;
- Increases in the cost of energy production in excess of one percent;
- Increases in the cost of energy distribution in excess of one percent; or
- Other similarly adverse outcomes.

The "Doc_Year" identifies the year the transportation project was approved, and therefore, the base year from which the project costs are inflated to 2004 dollars (CTIS Data Dictionary, 2000).

[46] U.S. Office of Management and Budget, "Memorandum for Heads Of Executive Departments And Agencies, And Independent Regulatory Agencies," July 13, 2001.

No energy facilities are anticipated in Sonoma County. Only one energy project is planned within 50 miles of critical habitat (See Table V-2: Proposed Energy Facilities46F.) Anticipated impacts on the energy industry are zero.

V.3 Economic Impacts on Federal Lands

There are no intersections between proposed critical habitat and federal lands.

Table V-1: California Highway Projects that Intersect Critical Habitat

Highway Route	Project Length (miles)	Project Start Year	Total Cost, (thousands)	Agency	Impacted CH (miles)	Mitigation Costs (thousands)
101	7.6	2011	$31,254	Metropolitan Transportation Commission	7.65	7,547
101	4.1	2011	$69,740	Metropolitan Transportation Commission	2.45	
116	1.4	2020	$15,073	Metropolitan Transportation Commission	0.28	426
Total	**13**		**$116,067**		**10.39**	**7,974**

Sources: (1) California Transportation Investment Tool, Version 1.3.2, California Department of Transportation, Office of State Planning, http://www.dot.ca.gov/hq/tpp/offices/osp/ctis.htm; (2) Critical Habitat Boundary Files, U.S. Fish and Wildlife Service.

Note: "Total Cost" values in 2004 dollars.

Table V-2: Proposed Energy Facilities[47]

Plant	Status	Capacity (MW)	County	Nearest CHD (miles)
Valero Cogen. Unit 2	Construction On Hold	51	Solano	29

[47] Source: California Energy Commission, Energy Facilities Siting / Licensing Process. http://www.energy.ca.gov/sitingcases/index.html

VI REGIONAL ECONOMIC IMPACTS

VI.1 METHODOLOGY

The distributional effects of critical habitat designation are quantified using IMPLAN Economic Modeling Software.[48] The IMPLAN Model is a widely used tool for analysis of economic events such as a change in industrial output. IMPLAN was developed by the U.S. Forest Service, which continues to use it today, and is now also used by 1,500 agencies and companies, including the San Diego Association of Governments, the California Energy Commission, the California Departments of Finance, Transportation, Water Resources, and Labor and Employment, San Diego State, Stanford, U.C. Berkeley, and numerous private consulting companies.[49]

The core of IMPLAN is an input-output model. This type of model traces the "multiplier effect" of an industry making purchases from other industries.[50] The economy is described by 509 IMPLAN industry sectors, which are based on the North American Industry Classification System (NAICS) and the Bureau of Economic Analysis (BEA) commodity classifications. "Direct effects" are the changes in final demand being modeled (the goods and services produced or purchased from an industry). "Indirect effects" estimate inter-industry purchases. Regional purchase coefficients are used to estimate the proportion of inter-industry purchases occurring within the study area. In addition to the interactions between the 509 IMPLAN industries, "induced effects" estimate the impact of household spending caused by the change in final demand.[51] In the table and discussion that follow, the sum of indirect and induced effects are referred to as secondary effects.

IMPLAN is used to describe how this decrease in new home construction results in a decrease in the demand for inputs from other industries. The change in final demand for new housing construction is calculated as the product of building costs per house multiplied the change in number of houses built.

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[48] MIG, Inc., IMPLAN Professional Version v.2.0.1024, 1997-2004.

[49] http://www.implan.com/references.html

[50] For a detailed discussion of this modeling method see, Ronald Miller and Peter Blair, *Input Output Analysis, Foundations and Extensions*, New Jersey: Prentice Hall.

[51] Direct impacts – the direct purchases by the facility under study – and indirect impacts –the purchases made by the firms supplying the facility – are captured in the standard input-output model. Induced impacts – purchases by employees of the facility and indirect firms – are captured when the model is "closed" with respect to households. The version of IMPLAN used here is closed.

The change in building costs for Sonoma County is annualized.[52] Note that in this analysis, the direct effects are the costs associated with the construction of new homes which is different from the price paid by homebuyers for a new home. Restricting the supply of new homes may increase revenue to home sellers, but it will decrease the demand for inputs needed to construct new homes.

In addition to the IMPLAN model of the impacts on new home construction, the distributional impacts of CHD resulting from mitigation costs and a change in home prices are discussed below.

VI.2 RESULTS

Table VI-1: Distributional Effects of Designation demonstrates that the secondary impacts from decreased new home construction are small relative to the industry output of Sonoma County. Critical habitat designation of the Tiger Salamander has little effect on the regional economy. Annual industry output is reduced by approximately $560,000 directly and $375,000 secondarily. These combined reductions represent less than 0.01% of the region's output. Included among the industries most affected are wholesale trade and architectural/engineering services.

Note that mitigation costs are not accounted for in this analysis. Mitigation costs, principally land acquisition costs, are incurred by the individuals or businesses developing the land. If the land developers do not currently own the land, these costs may be borne by the landowners through a decrease in land price. The mitigation expenditures are a transfer to a conservation bank, i.e., a transfer from one landowner to another or a transfer from a land developer to a landowner.

In IMPLAN, the decrease in dollars spent on new housing construction results in decreased spending by the employees in the construction industry. IMPLAN allocates a large portion of this decrease in spending to "owner-occupied dwellings" and "real estate." Note that another larger group of consumers may increase spending in "owner-occupied dwelling" as the supply of housing is restricted and home prices increase. This group of consumers may be diverting money from entertainment, travel, or other industries in response to higher mortgage payments. These dollars flow to home sellers, who in turn may spend more on entertainment, travel, or other activities. In this regard, the diversion of one group of consumer expenditures to new housing may result in another group of consumers spending more on other activities.

[52] For simplicity, costs were annualized by dividing total costs by 20. Impacts are incurred throughout the twenty-year timeframe, and the total change in building costs divided by 20 is the average annual foregone revenue to new home construction.

Table VI-1: Distributional Effects of Designation

Industry[53]	Study Area Data: Industry Output	Model Results: Direct Effects	Model Results: Secondary Effects[54]	Impacts as a Percent of Output
	(1)	(2)	(3)	(4)=((2)+(3))/(1)
New residential 1-unit structures- nonfarm	$776,718,000	-$557,132	$0	-0.07%
Owner-occupied dwellings	$1,400,479,000	$0	-$25,740	0.00%
Wholesale trade	$927,630,000	$0	-$24,295	0.00%
Motor vehicle and parts dealers	$406,938,000	$0	-$15,827	0.00%
Real estate	$1,783,424,000	$0	-$15,363	0.00%
Architectural and engineering services	$299,528,000	$0	-$14,676	0.00%
Food and beverage stores	$478,299,000	$0	-$11,917	0.00%
Food services and drinking places	$676,396,000	$0	-$11,438	0.00%
Offices of physicians- dentists- and other health	$696,671,000	$0	-$10,374	0.00%
Total, All Industries[55]	**$28,016,450,000**	**-$557,132**	**-$378,653**	**0.00%**

Source: IMPLAN output.

[53] Only industries with "Total Effects" greater than $10,000 are listed in this table.

[54] "Secondary Effects" include indirect and induced effects.

[55] Includes industries with impacts less than $10,000 in addition to the industries listed above.

VII ECONOMIC IMPACTS ON SMALL BUSINESSES

According to the Regulatory Flexibility Act, as amended by the Small Business Regulatory Enforcement Fairness Act, an agency has to determine whether proposed legislation will have a "significant economic impact on a substantial number of small entities."[56] There are three categories of entities: small business, small government, and small nonprofit organizations. The impacts on non-profits and small governments are expected to be negligible and are not examined in this analysis.

The effects of CHD on small businesses in new home construction, however, are examined. In some census tracts, the quantity of new housing decreases as a result of CHD. This results in decreased revenue to home construction. The impact to the new home construction industry is characterized as the decrease in the number of housing units multiplied by the average building cost per housing unit. This is conservative, as some construction firms may actually gain from an increase in housing price when the supply of housing is restricted.[57] In this analysis, the total but-for revenue is equivalent to building costs per house multiplied by the pre-regulation projected number of housing units.

To isolate the revenue losses attributable to small businesses we examined the share of new housing construction permits reported in Sacramento County.[58] Small businesses accounted for 22.4 % of permits in 2004.[59]

To estimate the number of affected small businesses, the number of houses built per small firm was calculated. Next, the number of housing units lost to small businesses was calculated as the percent housing permits to small firms multiplied by the change in housing units from CRA's housing model. Then, the number of lost housing units attributable to small firms was divided by the average number of houses per small firm. This provides an estimate of the number of affected small businesses. These calculations are presented in Table VII-1: Impact of CHD on

[56] EPA, "Revised Interim Guidance for EPA Rulewriters: Regulatory Flexibility Act as Amended by the Small Business Regulatory Enforcement Fairness Act," 29 March 1999, p.11.

[57] On one hand, there a fewer homes for construction companies to build; on the other, if construction companies are selling the houses to consumers, rather than being hired by another company, then they will obtain the benefits of increased price.

[58] Sacramento County serves as a proxy for Sonoma County for both practical and empirical reasons. The county maintains electronic, readily-available (at a price) permit records. The county is also home to a large number of small businesses.

[59] Firm names are available from Department of Building Inspection, Municipal Services Agency, Sacramento County. Data are from the final week of each month, April, 2004-April, 2005. Revenue figures were obtained from internet searches for company sales revenue. We are assuming any company whose data we were unable to attain is small. This is very conservative.

New Home Construction Revenue. As shown below, the annual number of affected small firms is far less than one.[60]

[60] Note that if one firm closed in the first year, then this same firm would be affected in subsequent years. The number of small firms will not decrease every year.

Table VII-1: Impact of CHD on New Home Construction Revenue

County	Proportion of Houses built by Small Businesses[61]	Total Revenue, Annualized[62]	Total Housing Units, Annualized[63]	Average Building Cost	Average Revenue per Small Business[64]
	[1]	[2]	[3]	[4]=[2]/[3]	[5]
Sonoma	22%	$354,282,880	1,617	$219,032	$692,222

	Annual Houses built per Small Business	Annualized change in number houses[65]	Annualized change in number of houses to small businesses	Number of affected Small Businesses
	[6]=[5]/[4]	[7]	[8]=[1]*[7]	[9]=[8]/[6]
Sonoma	3.2	-2.6	-0.6	-0.2

[61] From Table 2, part A, based on data from Department of Building Inspection, Municipal Services Agency, Sacramento County. Data not available for Sonoma.

[62] From CRA's housing model.

[63] From CRA's housing model.

[64] RMA data on revenue by size class and D&B data on number of firms in each size class.

[65] From CRA's housing model.

Appendix A WELFARE IMPACTS OF CRITICAL HABITAT DESIGNATION

A.1 CONCEPTUAL MODEL

The model of urban growth and the markets for land and improvements to land is adapted from the standard Alonso-Muth-Mills framework, but accounts for the potential importance of prior regulation that can limit the quantity of new housing produced. The approach taken in this study is a partial equilibrium analysis for various portions of the overall critical habitat. Given the relatively small land and housing price changes resulting from critical habitat, the use of a partial equilibrium approach seems justified.

At each location, the housing developer is assumed to solve the following maximization problem:

$$\max_{\text{H, L, } \lambda} \; pH - k(H) + \lambda(\bar{N} - HL)$$

where p is the price of housing (taken as constant by an individual developer), H is the number of housing units constructed, k is the cost of building H units of housing, L is the amount of land per housing unit, and $\bar{N}$ is the amount of developable land at the location. Landowners earn rents equal to λ, which is determined in equilibrium. The profit-maximization conditions for the developer's problem are as follows:

$$H: p(H,L) - k_H - \lambda L = 0$$
$$L: p_L - \lambda = 0$$
$$\lambda: \bar{N} - HL = 0$$

The second term indicates that the price of land will equal the consumer's marginal valuation of lot size in equilibrium. Rearranging the first two equations, it follows that

$$p_L = \frac{p - k_H}{L}.$$

This expression implies that the intensive margin value of land (p_L) will equal the extensive margin value of land ($\frac{p - k_H}{L}$) when the quantity of developable land is fixed by geography or regulation. In this scenario, further limitations on the stock of developable land will drive up the price of land and will increase the price of housing. Comparative statics results for this case are as follows:

$$\frac{dH}{d\bar{N}} = \frac{-LHp_{LL}}{|A|} > 0$$
$$\frac{dL}{d\bar{N}} = \frac{Hk_{HH} - Hp_H}{|A|} > 0$$
$$\frac{d\lambda}{d\bar{N}} = \frac{(k_{HH} - p_H)Hp_{LL}}{|A|} > 0$$

where

$$A = \begin{bmatrix} p_H - k_{HH} & 0 & -L \\ 0 & Hp_{LL} & -H \\ -L & -H & 0 \end{bmatrix}$$

and

$$|A| = H^2 k_{HH} - p_H H^2 - L^2 H p_{LL} > 0 .$$

When the housing stock is also controlled by regulation, the developer's profit maximization problem becomes

$$\max_{H,\, L,\, \lambda, \mu} \; pH - k(H) + \lambda(\bar{N} - HL) + \mu(\bar{H} - H) .$$

The first-order conditions for this problem are

$$p(H,L) - k_H - \lambda L - \mu = 0$$
$$p_L - \lambda = 0$$
$$\bar{N} - HL = 0$$
$$\bar{H} - H = 0$$

The equivalent comparative statics with respect to the land constraint are

$$\frac{dH}{d\bar{N}} = 0$$
$$\frac{dL}{d\bar{N}} = \frac{1}{H^2} > 0$$
$$\frac{d\lambda}{d\bar{N}} = \frac{p_{LL}}{H^2} < 0$$
$$\frac{d\mu}{d\bar{N}} = \frac{-Lp_{LL}}{H} > 0$$

When new housing is rationed, the housing market equilibrium can be described with the aid of the following figure:

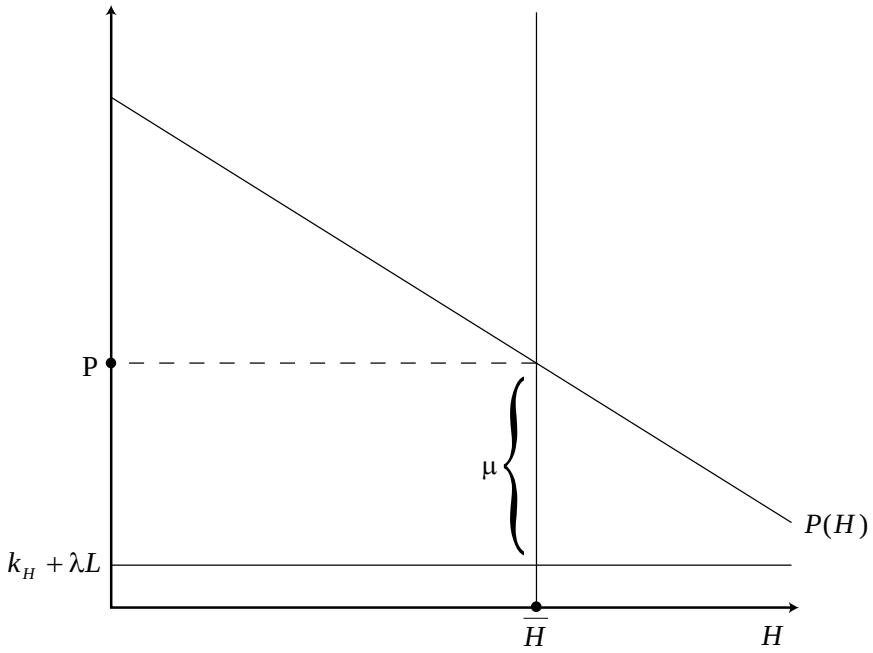

Figure 4: Rationed-Housing Model

In the context of a rationed market, critical habitat designation has three main effects on consumer and producer welfare that can be visualized easily with the aid of Figure 1. First, avoidance requirements tighten the housing constraint ($\bar{H}$), resulting in higher housing prices and lost rents to developers and landowners. Second, mitigation requirements drive up the marginal cost of housing development (k_H), subtracting from the rents earned through the production of scarce housing. Third, the need for Section 7 consultations can delay the completion of housing projects, resulting in surplus losses to consumers and producers. For this analysis, delay costs will be measured as the

incremental carrying costs on the underlying option to purchase land for development (again resulting in an increase in k_H).

A.2 A TEST FOR RATIONING OF NEW HOUSING IN SONOMA COUNTY

The conceptual model above can be used to identify a test for rationing of the housing stock prior to the imposition of critical habitat. From the first order conditions in the housing-rationed scenario, we see that

$$\lambda = p_L > \frac{p - k_H}{L} \text{ if } \mu > 0 .$$

Thus, when housing is rationed the intensive margin value of land will be less than the extensive margin value. A comparison of p_L and $\frac{p - k_H}{L}$ is equivalent to a test for rationing of the housing stock.

The extensive margin value of land is calculated by subtracting construction and development costs from the price of new housing and dividing by lot size. The median home price per census tract was obtained from DataQuick, which maintains a database of new home transactions for the state of California. Since California home prices have exhibited considerable volatility in recent years, it is necessary to inflate all home prices to present value. This was accomplished using the Freddie Mac Conventional Mortgage Home Pricing Index.

Marshall and Swift's Residential Cost Handbook provides detailed estimates of construction costs per square foot for houses of various size, material (e.g., stud framed, masonry), and quality. DataQuick data provides median square footage estimates per census tract. By using a single-story, stud-framed, stucco house estimates as the basic house profile and assigning construction quality based on median home price, building costs estimates were then generated in each census tract.

In addition to these "vertical" costs of homebuilding, it is also necessary to include development costs (not counting the developer's profit or returns to the landowner). There are two types of development costs that should be considered: "soft" costs and "hard" costs. Soft costs include the cost of design, permitting, marketing and sales. Hard costs of development include costs of grading, construction of local roads, installation of water collection systems, construction of parks, clubhouses and other amenities within the development, bringing utilities to the project, installation of streetlights, and other physical costs. For purposes of this study, total horizontal costs are assumed equal to 23% of the vertical cost of homebuilding.

The sum of the building costs, soft costs and hard costs is the builder cost of new housing.

The intensive margin value of land for each house was determined by estimating a hedonic regression of home price on lot size, the square of lot size, square footage of the house, number of bedrooms, number of bathrooms, stories, tract-level fixed effects and a constant term (see Table A-1: Home Price Regression Results.). The lot size coefficient is significant at the 1% level.

Estimated parameters were then used to calculate an inferred intensive margin value of land for each house. Extensive margin values were calculated for each new house using the method described above. Finally, extensive and intensive margin values were compared for each house in the sample. The extensive margin value exceeded the intensive margin value of land 95.59% of the time, providing a strong indication that housing is already rationed in Sonoma County prior to the designation of critical habitat. Given the importance of prior regulation, it is appropriate to utilize the rationed housing model to measure the economic effects of critical habitat designation.

In a second regression, the above model was re-estimated adding a term to account for the distance from each observation to the nearest CTS conservation area. The coefficient on this term is small and statistically insignificant, possibly reflecting the large amount of open space in Sonoma County. New home buyers may be unwilling to pay a premium for proximity to a conservation area because of an abundance of acceptable substitutes.

Table A-1: Home Price Regression Results

Variable	Coefficient
Stories	-20,844.57
	(3.50)**
Bedrooms	-5,652.70
	(2.23)*
Bathrooms	23,802.261
	(3.00)**
Square feet	114.603
	(8.17)**
Lot size (sqft.)	16.545
	(8.92)**
Constant	218,662.441
	(20.19)**
Observations	2005
R-squared	0.81
Robust t statistics in parentheses	
* significant at 5%; ** significant at 1%	

Variable	Coefficient
Stories	-20,670.02
	(3.47)**
Bedrooms	-5,991.80
	(2.27)*
Bathrooms	23,370.06
	(2.90)**
Square feet	114.319
	(8.16)**
Lot size (sqft.)	16.379
	(8.66)**
Distance to nearest conservation area (m.)	3.235
	-1.21
Constant	194,793.815
	(8.89)**
Observations	2005
R-squared	0.81
Robust t statistics in parentheses	
* significant at 5%; ** significant at 1%	