DRAFT ECONOMIC ANALYSIS OF CRITICAL HABITAT DESIGNATION FOR THE THREAD-LEAVED BRODIAEA

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EXECUTIVE SUMMARY

Introduction

1. The purpose of this report is to identify and analyze the potential economic impacts associated with the proposed critical habitat designation for the *Brodiaea filifolia* (thread-leaved brodiaea, referred to as brodiaea in this report). This report was prepared by Industrial Economics, Incorporated (IEc), under contract to the U.S. Fish and Wildlife Service's (Service) Division of Economics.

2. On October 13, 1998, the Service published the final rule listing brodiaea as threatened. The rule determined that designation of critical habitat for brodiaea was "not prudent." On July 1, 2002, the court ordered the Service to publish a new prudency determination and/or propose critical habitat for brodiaea. On December 8, 2004, the Service published the proposed critical habitat designation ("proposed rule") addressed in this report.[1]

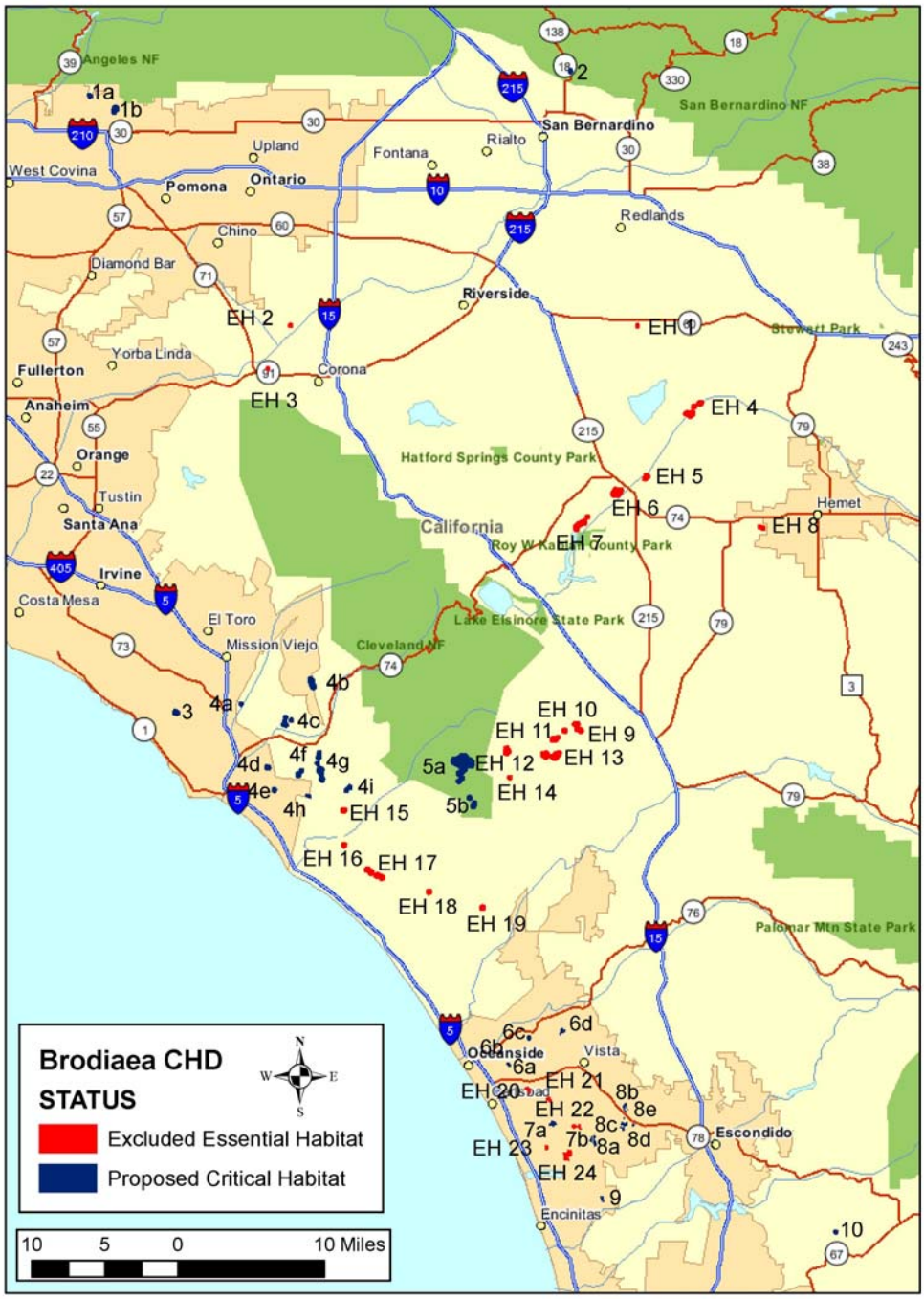
3. In the proposed rule, the Service determined that 9,403 acres of essential brodiaea habitat exists in Los Angeles, San Bernardino, Orange, Riverside, and San Diego Counties in California and proposed to designate approximately 4,690 acres across 10 units in these counties. Approximately 4,713 acres of essential habitat were excluded from the proposed designation, because those areas are currently covered by approved habitat conservation plans or are on "mission essential" Department of Defense (DOD) lands.[2] Of the total critical habitat acres proposed for designation, 28 percent are Federal lands, five percent are State lands, and the remaining 67 percent are private lands. Exhibit ES-1 shows the location of each unit or subunit of essential habitat.

[1] 69 FR 71284.

[2] One exception to this is the Fox-Miller site. The properties proposed for conservation and development in the City of Carlsbad's Habitat Management Plan (HMP) do not meet the conditions for coverage of the species due to the recent identification of 19,100 plants on the property (69 CFR 71297).

Exhibit ES-1

MAP OF ESSENTIAL BRODIAEA HABITAT



4. Exhibit ES-2 summarizes key findings of the economic analysis. Results are presented in greater detail later in this summary (see Exhibits ES-3 and ES-4).

Exhibit ES-2

KEY FINDINGS[3]

Total impacts: Future costs (2005 through 2024) associated with critical habitat units proposed for inclusion are estimated to be $12.2 million to $14.7 million on a present value basis and $12.2 to $16.9 million expressed in undiscounted dollars.

Activities most impacted: The activities affected by brodiaea protection activities may include real estate development; military activities; management of public and conservancy lands; and transportation, utility, and flood control operations.

- Development-related losses dominate forecast costs. In present value terms, future costs may range from $11.9 to $13.9 million. The costs are driven by losses in land value borne by existing landowners, accounting for approximately 75 percent of this loss. The remaining cost represents a loss in consumer surplus experienced by consumers of housing.
- Potential costs to transportation operations total between $92,000 and $510,000 in present value terms. Utility-related costs are anticipated to be about $47,000 (present value).
- Future costs to military institutions (Camp Pendleton) total between to $160,000 to $255,000 in present value terms. *Note that this estimate does not include, and this analysis does not attempt to quantify, the impact to military readiness that may result from brodiaea conservation activities.*
- Future costs associated with managing critical habitat at public and conservancy lands range from $75,000 to $118,000 in present value terms.

Units with greatest impacts: The top-ranking units include Arroyo Trabuco (4a), Arrowhead Hot Springs (2), and San Dimas (Unit 1b).

Framework for the Analysis and Regulatory Alternatives Considered

5. Section 4(b)(2) of the Endangered Species Act (Act) requires the Service to designate critical habitat on the basis of the best scientific data available, after taking into consideration the economic impact, and any other relevant impact, of specifying any particular area as critical habitat. The Service may exclude areas from critical habitat designation when the benefits of exclusion outweigh the benefits of including the areas within critical habitat, provided the exclusion will not result in extinction of the species.[4] In addition, this analysis provides information to allow 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] This report also complies with direction from the U.S. 10th Circuit Court of

[3] Unless otherwise noted, cost estimates included here are present values in today's dollars using a discount rate of seven percent, because costs occur at different times across units and affected activities. Cost estimates included are the upper-bound of cost ranges calculated in the analysis. Throughout the report, costs are provided in undiscounted dollars, and in present values terms using three and seven percent discount rates.

[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.

Appeals that, when deciding which areas to designate as critical habitat, the economic analysis informing that decision should include "co-extensive" effects.[6]

6. Executive Order 12866 directs Federal Agencies to evaluate regulatory alternatives.[7] The Service identifies 52 subunits or areas of essential habitat, and proposes 28 subunits for designation as critical habitat. An alternative to the proposed rule is the designation of all 52 subunits and areas, and the potential impacts of all are estimated in this report. In addition, as discussed in the previous paragraph, section 4(b)(2) of the Act allows the Service to exclude additional areas proposed for designation based on economic impact and other relevant impacts. As a result, the impacts of multiple combinations of essential habitat are also available to the Service.

7. To comply with the 10th Circuit's direction to include all co-extensive effects, this analysis considers the potential economic impacts of efforts to protect the brodiaea and its habitat (hereinafter referred to collectively as "brodiaea conservation activities") in potential 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. Actions undertaken to meet the requirements of other Federal, State, and local laws and policies may afford protection to the brodiaea and its habitat, and thus contribute to the efficacy of critical habitat-related conservation and recovery efforts. Thus, the impacts of these activities are relevant for understanding the full impact of the proposed designation.

8. This analysis considers both economic efficiency and distributional effects. In the case of habitat conservation, efficiency effects generally reflect the opportunity costs associated with the commitment of resources to comply with habitat protection measures (e.g., lost economic opportunities associated with restrictions on land use). This analysis also addresses how potential economic impacts are likely to be distributed (distributional effects), including the potential effects of conservation activities on small entities and the energy industry. This information can be used by decision-makers to assess whether the effects of the designation might unduly burden a particular group or economic sector. Also, this analysis looks retrospectively at costs incurred since the date the species was listed and considers those costs that may occur after the designation is finalized.

[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 critical habitat designation, 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)).

[7] Office of Management and Budget, Circular A-4, September 17, 2003, p. 7.

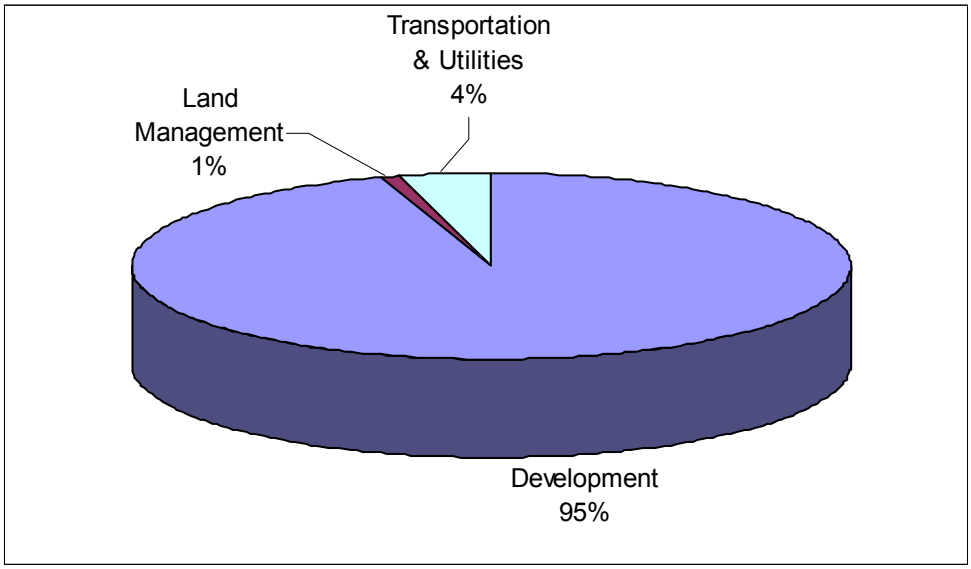
Results of the Analysis

Efficiency Impacts

9. Efficiency impacts are separated into costs associated with real estate development activities; costs to military facilities; costs affecting transportation, utility, and flood control activities; and costs to public and conservation land owners. Exhibit ES-3 presents the distribution of efficiency impacts across these activities, using the upper-bound future present value figures (based on a seven percent discount rate). As shown, potential development impacts dominate, accounting for roughly 95 percent of the anticipated costs. Costs to transportation activities represent roughly four percent of all costs while costs for management of public and conservancy lands represent about one percent.[8]

Exhibit ES-3

RELATIVE IMPACT BY AFFECTED ACTIVITY
(Total Present Value Impacts Assuming a Seven-Percent Discount Rate)



[8] The cost breakdown is largely the same when lower-bound costs are considered, although development costs increase to approximately 95 percent and transportation costs decrease by approximately two percent.

10. Exhibit ES-4 provides detailed future cost information for all activities on a unit-by-unit basis. Costs are presented by subunit, because this provides the greatest resolution for the decision-maker given the available data used to estimate costs. Maps showing the location and size of subunits relative to census tracts and municipalities are provided in Section 2 of this report.[9]

Exhibit ES-4

TOTAL FUTURE COSTS (ALL ACTIVITIES) IN ESSENTIAL BRODIAEA HABITAT UNITS

County	Unit Number	Unit Name	Census Tracts	Total Future Costs (Undiscounted Dollars)		Total Future Costs (Present Value 3%)		Total Future Costs (Present Value 7%)	
				Low	High	Low	High	Low	High
Proposed for Inclusion									
Los Angeles	1a	Glendora	400401, 400500	$39,000	$85,000	$37,000	$76,000	$34,000	$67,000
	1b	San Dimas	400303, 400402, 930000	$121,000	$2,286,000	$120,000	$1,758,000	$119,000	$1,309,000
San Bernardino	2	Arrowhead Hot Springs	011000	$1,225,000	$1,484,000	$1,224,000	$1,417,000	$1,223,000	$1,361,000
Orange	3	Aliso Canyon	042325, 062633	$22,000	$56,000	$21,000	$49,000	$19,000	$41,000
	4a	Arroyo Trabuco	032052	$1,902,000	$2,040,000	$1,901,000	$2,002,000	$1,899,000	$1,971,000
	4b	Casper's Regional Park	032041, 032043	$36,000	$83,000	$35,000	$72,000	$33,000	$63,000
	4c	Canada Gobernadora/ Chiquita Ridgeline	032056	$216,000	$409,000	$215,000	$359,000	$213,000	$317,000
	4d	Prima Deschecha	032023, 042203, 042205	$1,242,000	$1,332,000	$1,241,000	$1,307,000	$1,239,000	$1,287,000
	4e	Forster Ranch	042112	$766,000	$1,081,000	$765,000	$998,000	$763,000	$928,000
	4f	Telega/Segunda Deschecha	032023	$173,000	$264,000	$172,000	$239,000	$170,000	$218,000
	4g	Cristianitos Canyon	032023	$481,000	$691,000	$480,000	$637,000	$478,000	$594,000
	4h	Cristianitos Canyon South	032023	$72,000	$125,000	$71,000	$110,000	$69,000	$98,000
	4i	Blind Canyon	032023	$139,000	$218,000	$138,000	$196,000	$136,000	$179,000
San Diego	5a	Miller Mountain	046401, 019001	$875,000	$1,134,000	$873,000	$1,065,000	$871,000	$1,009,000
	5b	Devil's Canyon	019001	$167,000	$240,000	$166,000	$221,000	$164,000	$205,000
	6a	Alta Creek	018504, 018515	$43,000	$75,000	$41,000	$66,000	$40,000	$58,000
	6b	Mesa Drive	018510	$13,000	$44,000	$11,000	$35,000	$10,000	$28,000
	6c	Oceanside East/Mission Avenue	018513	$460,000	$509,000	$458,000	$495,000	$457,000	$484,000
	6d	Taylor/Darwin	019301	$422,000	$470,000	$420,000	$456,000	$419,000	$446,000
	7a	Fox-Miller	017806, 019806	$67,000	$101,000	$66,000	$91,000	$64,000	$83,000
	7b	Rancho Carillo	020013	$107,000	$144,000	$106,000	$133,000	$104,000	$124,000
	8a	Rancho Santa Fe Road North	020013	$724,000	$833,000	$723,000	$804,000	$721,000	$779,000
	8b	Rancho Santalina/Loma Alta	020009, 020020	$380,000	$418,000	$379,000	$408,000	$377,000	$399,000
	8c	Grand Avenue	020009	$58,000	$89,000	$57,000	$81,000	$55,000	$74,000
	8d	Upham	020009	$722,000	$767,000	$721,000	$755,000	$719,000	$745,000
	8e	Linda Vista	020009	$197,000	$231,000	$196,000	$222,000	$194,000	$214,000
	9	Double LL Ranch	017105	$453,000	$524,000	$452,000	$507,000	$450,000	$491,000
	10	Highland Valley	020801	$1,124,000	$1,177,000	$1,123,000	$1,162,000	$1,121,000	$1,149,000
Subtotal CHD				**$12,246,000**	**$16,910,000**	**$12,212,000**	**$15,721,000**	**$12,161,000**	**$14,721,000**
Annualized[a]				**$612,300**	**$845,500**	**$820,838**	**$1,056,698**	**$1,147,912**	**$1,389,558**

[9] Census tracts are small, relatively permanent subdivisions of a county. Census tracts are delineated by local census statistical areas committees and normally contain between 2,500 and 8,000 individuals. They are delineated to be relatively homogenous and do not cross county boundaries. Source: U.S. Census Bureau at http://www.census.gov/geo/www/cen_tract.html, viewed on September 1, 2005.

Exhibit ES-4

TOTAL FUTURE COSTS (ALL ACTIVITIES) IN ESSENTIAL BRODIAEA HABITAT UNITS

County	Unit Number	Unit Name	Census Tracts	Total Future Costs (Undiscounted Dollars)		Total Future Costs (Present Value 3%)		Total Future Costs (Present Value 7%)	
				Low	High	Low	High	Low	High
Excluded from Proposed Critical Habitat									
Riverside	EH1	Moreno Valley	042606	$383,000	$2,888,000	$382,000	$2,273,000	$381,000	$1,750,000
	EH2	West of Norco	040602	$6,000	$35,000	$5,000	$26,000	$4,000	$20,000
	EH3	West of Corona	041500	$5,000	$31,000	$4,000	$24,000	$3,000	$17,000
	EH4	San Jacinto Wildlife Area	042604, 042721	$5,000	$31,000	$4,000	$24,000	$3,000	$17,000
	EH5	San Jacinto River Floodplain	042719	$2,062,000	$2,590,000	$2,061,000	$2,460,000	$2,060,000	$2,351,000
	EH6	Case Road Area	042718, 042719, 042901	$718,000	$920,000	$717,000	$869,000	$716,000	$827,000
	EH7	Railroad Canyon	042718, 042901	$4,628,000	$5,779,000	$4,627,000	$5,498,000	$4,626,000	$5,259,000
	EH8	Upper Salt Creek	042723	$602,000	$9,563,000	$601,000	$7,439,000	$600,000	$5,617,000
	EH9	Santa Rosa Plateau (SRP)/Tenaja Road	043224	$5,000	$31,000	$4,000	$24,000	$3,000	$17,000
	EH10	SRP North of Tenaja Road	043224	$5,000	$31,000	$4,000	$24,000	$3,000	$17,000
	EH11	SRP South of Tenaja Road	043224	$5,000	$31,000	$4,000	$24,000	$3,000	$17,000
	EH12	East of Tenaja Guard Station	043224	$708,000	$1,056,000	$707,000	$964,000	$706,000	$888,000
	EH13	Mesa de Colorado	043224	$457,000	$518,000	$456,000	$501,000	$455,000	$487,000
	EH14	North End Redonda Mesa	043224	$286,000	$335,000	$285,000	$321,000	$284,000	$310,000
San Diego - Camp Pendleton	EH15	Bravo One	Camp Pendleton	$56,000	$89,000	$43,000	$68,000	$32,000	$51,000
	EH16	Alpha One		$56,000	$89,000	$43,000	$68,000	$32,000	$51,000
	EH17	Camp Horno		$56,000	$89,000	$43,000	$68,000	$32,000	$51,000
	EH18	Southeast Horno Summit		$56,000	$89,000	$43,000	$68,000	$32,000	$51,000
	EH19	Kilo One		$56,000	$89,000	$43,000	$68,000	$32,000	$51,000
San Diego	EH20	Calavera Heights	019803	$141,000	$180,000	$140,000	$168,000	$138,000	$159,000
	EH21	Carlsbad Highlands	019804	$9,000	$38,000	$8,000	$29,000	$6,000	$22,000
	EH22	Carlsbad Oaks	019806	$212,000	$257,000	$211,000	$244,000	$209,000	$233,000
	EH23	Poinsettia	019806	$205,000	$249,000	$204,000	$236,000	$202,000	$226,000
	EH24	Rancho Carrillo	020013	$1,567,000	$1,717,000	$1,566,000	$1,676,000	$1,564,000	$1,642,000
Subtotal EH				**$12,289,000**	**$26,725,000**	**$12,205,000**	**$23,164,000**	**$12,126,000**	**$20,131,000**
Annualized[a]				**$614,450**	**$1,336,250**	**$820,368**	**$1,556,985**	**$1,144,609**	**$1,900,224**

Note:
(a) Annualized costs are calculated using Microsoft Excel's payment function, which assumes an end of year payment. The total present value cost upon which the annualized estimate is based assumes no discounting in year 2005.

Costs Associated with Real Estate Development Activities

11. Brodiaea conservation activities may influence real estate development activities and regional real estate markets in areas that contain essential brodiaea habitat. Past costs are associated with several project or Habitat Conservation Plan (HCP)-specific consultations and represent a minor component of overall development costs.

12. Future costs are analyzed under two distinct scenarios, using an economic model derived from previous analyses of critical habitat and empirical research. The first scenario assumes that substitute land exists for development that would otherwise occur within essential brodiaea habitat. In this scenario, the supply of housing remains unchanged with the introduction of brodiaea conservation activities, and costs of the designation are borne by current landowners who experience reductions in the value of developable land within habitat areas.

13. The second scenario applies an economic model that assumes that substitute developable land is not available to offset restrictions on development within essential habitat areas. In this scenario, regulatory requirements will also impact potential purchasers of homes through increased home prices resulting from a reduction in the supply of real estate. The total economic impact is measured as a change in consumer surplus, a measure of social welfare. The consumer surplus loss is added to the land value losses estimated in Scenario One to estimate total costs under Scenario Two.

14. Applying these two approaches yields an undiscounted dollar estimate of costs for areas proposed for designation that may range from $11.8 to $15.6 million. In present value terms (seven percent discount rate) the costs may range from $11.8 to $13.9 million. Costs in both scenarios are driven by land value losses and, specifically, the number of acres conserved.

Impacts at Military Facilities

15. The analysis considers how brodiaea conservation may impact military activities at Marine Corps Base Camp Pendleton (Camp Pendleton) in San Diego County. Past costs include six formal consultations with the U.S. Marine Corps since 1996 (five of which occurred after the listing of brodiaea in 1998).[10] Accordingly, past costs are $70,000 to $112,000 in undiscounted 2005 dollars, or $86,000 to $138,000 assuming a seven percent discount rate.

16. The estimate of future administrative costs at Camp Pendleton assumes that the rate of consultation for infrastructure and military training activities will remain constant over the twenty-year period of analysis, i.e., one infrastructure-related and two training-related consultations every three years for brodiaea. These costs range from $278,000 to $446,000 in undiscounted dollars. In present value terms, this range is equivalent to $160,000 to $255,000 (assuming a seven percent discount rate). *Note that this analysis does not attempt to quantify the impact to military readiness that may result from brodiaea conservation activities.*

[10] These consultations each considered multiple species. To quantify administrative consultation costs, this analysis applies a standard cost model used to estimate a range of administrative costs of consultation (see Appendix B). These costs are considered representative of the potential range of costs experienced for a consultation regarding a single species. That is, the cost model assumes that consultations involving more than one species typically involve higher administrative costs. Accordingly, although the consultations described involve multiple species, the administrative costs are considered to be predictive of those costs due specifically to the inclusion of the brodiaea in the consultation.

Impacts to Transportation, Utility, and Flood Control Activities

17. Brodiaea conservation activities may affect transportation, utility, and flood control activities within counties that contain essential brodiaea habitat. Key impacts include the following:

- **Transportation**: Future transportation-related costs include development of the Foothill Transportation Corridor (FTC) with potential impacts to Unit 4g (Christianitos Canyon), and various potential impacts to transportation projects across the four California Department of Transportation (CALTRANS) districts that contain essential brodiaea habitat. Considered together, past and future costs associated with transportation activities total between $151,000 and $883,000 in undiscounted dollars, or $92,000 to $510,000 in present value terms (seven percent discount rate).

- **Utilities**: San Diego Gas and Electric has suggested that brodiaea conservation activities could have a minor adverse effect on routine operation and maintenance activities associated with the company's electric and natural gas transmission and distribution systems. The analysis assumes that these costs would be divided evenly across all units and subunits in San Diego and Orange County. Costs are estimated at $83,000 in undiscounted dollars, or $47,000 in present value terms (seven percent discount rate).

- **Flood Control**: Although specific cost information is not available at this time, impacts to flood control projects may include added conservation of mitigation lands; transplanting of brodiaea populations; or restrictions on maintenance projects on the San Jacinto River. This area is currently excluded from proposed critical habitat.

Costs to Owners of Public and Conservancy Lands

18. Brodiaea conservation may affect management activities on public reserve and private conservancy lands. Five units proposed as critical habitat for brodiaea are located on lands managed for their natural resources. Four units (3, 4b, 5a, and 5b) are on public lands while one (Glendora, Unit 1a) is located within a private conservancy. These units are proposed as critical habitat, because they generally do not operate under specific management guidelines that could reduce threats to brodiaea.

19. Total costs (administrative and conservation) within the affected units are expected to range from $78,000 to $123,000 in undiscounted dollars. Present value figures are only slightly lower, because most costs are assumed to occur in 2005, the year of designation.

Distributional Impacts

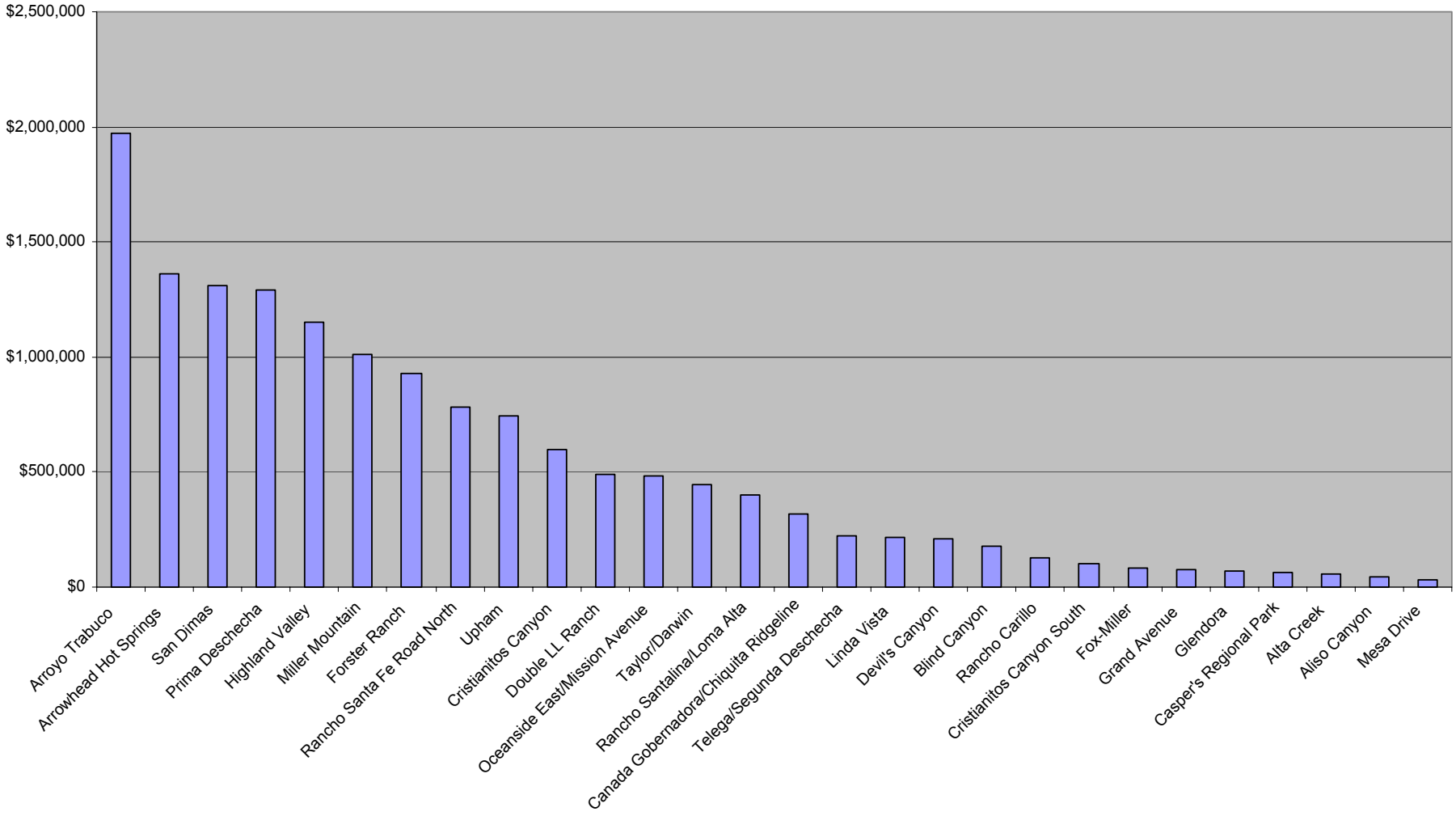
20. This analysis also analyzes whether a particular group or economic sector bears an undue proportion of the impacts. Specifically, Appendix A describes potential impacts to small entities and potential impacts on energy availability.

Areas Most Likely to Experience Impacts

21. Exhibit ES-5 illustrates the ranking of proposed critical habitat units by cost. The chart displays the present value (seven percent discount rate), high-end future costs for all units proposed for inclusion. The costs under both scenarios are driven by the land value losses and, specifically, the amount of acres anticipated for development over the next 20 years in each subunit. The ranking of units by cost exactly matches the ranking of units by number of acres not developed, with one exception. Unit 1b (San Dimas), where only 3.37 acres are affected, straddles the boundaries of two cities, Glendora and San Dimas. As a result, under the second development scenario analyzed, the housing markets in both of these growing cities are affected, causing costs in this subunit rank near the top of the list.

Exhibit ES-5

RANKING OF TOP UNITS BASED ON FUTURE PRESENT VALUE COSTS



22. Exhibit ES-6 demonstrates that the relative ranking of sites does not change significantly when lower-bound present value estimates are compared to upper-bound present value estimates of future costs. The one exception is, as mentioned, San Dimas (1b).

Exhibit ES-6

COMPARISON OF TOP SITES USING HIGH AND LOW PRESENT VALUE ESTIMATES

Ranking Based on High Present Value Estimate		Ranking Based on Low Present Value Estimate	
Unit	**Present Value Costs**	**Unit**	**Present Value Costs**
4a - Arroyo Trabuco	$1,971,000	4a - Arroyo Trabuco	$1,899,000
2 - Arrowhead Hot Springs	$1,361,000	4d - Prima Deschecha	$1,239,000
1b - San Dimas	$1,309,000	2 - Arrowhead Hot Springs	$1,223,000
4d - Prima Deschecha	$1,287,000	10 - Highland Valley	$1,121,000
10 - Highland Valley	$1,149,000	5a - Miller Mountain	$871,000
5a - Miller Mountain	$1,009,000	4e - Forster Ranch	$763,000
4e - Forster Ranch	$928,000	8a - Rancho Santa Fe Road North	$721,000
8a - Rancho Santa Fe Road North	$779,000	8d - Upham	$719,000
8d - Upham	$745,000	4g - Cristianitos Canyon	$478,000
4g - Cristianitos Canyon	$594,000	6c - Oceanside East/Mission Avenue	$457,000
9 - Double LL Ranch	$491,000	9 - Double LL Ranch	$450,000
6c - Oceanside East/Mission Avenue	$484,000	6d - Taylor/Darwin	$419,000
6d - Taylor/Darwin	$446,000	8b - Rancho Santalina/Loma Alta	$377,000
8b - Rancho Santalina/Loma Alta	$399,000	4c - Canada Gobernadora/Chiquita Ridgeline	$213,000
4c - Canada Gobernadora/Chiquita Ridgeline	$317,000	8e - Linda Vista	$194,000
4f - Telega/Segunda Deschecha	$218,000	4f - Telega/Segunda Deschecha	$170,000
8e - Linda Vista	$214,000	5b - Devil's Canyon	$164,000
5b - Devil's Canyon	$205,000	4i - Blind Canyon	$136,000
4i - Blind Canyon	$179,000	1b - San Dimas	$119,000
7b - Rancho Carillo	$124,000	7b - Rancho Carillo	$104,000
4h - Cristianitos Canyon South	$98,000	4h - Cristianitos Canyon South	$69,000
7a - Fox-Miller	$83,000	7a - Fox-Miller	$64,000
8c - Grand Avenue	$74,000	8c - Grand Avenue	$55,000
1a - Glendora	$67,000	6a - Alta Creek	$40,000
4b - Casper's Regional Park	$63,000	1a - Glendora	$34,000
6a - Alta Creek	$58,000	4b - Casper's Regional Park	$33,000
3 - Aliso Canyon	$41,000	3 - Aliso Canyon	$19,000
6b - Mesa Drive	$28,000	6b - Mesa Drive	$10,000

FRAMEWORK FOR ANALYSIS SECTION 1

23. The purpose of this report is to estimate the economic impact of actions taken to protect the federally listed *Brodiaea filifolia* (thread-leaved, referred to as brodiaea in this report) and its habitat. It 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 analysis looks retrospectively at costs incurred since the brodiaea was listed, and it attempts to predict future costs likely to occur after the proposed critical habitat designation (CHD) is finalized.

24. This information is intended to assist the Secretary in determining whether the benefits of excluding particular areas from the designation outweigh the benefits of including those areas in the designation.[11] In addition, this information allows the U.S. Fish and Wildlife Service (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).[12] This report also complies with direction from the U.S. Court of Appeals for the 10th Circuit that "co-extensive" effects should be included in the economic analysis to inform decision-makers regarding which areas to designate as critical habitat.[13]

25. This section describes the framework for the analysis. First, it describes the general analytic approach to estimating economic effects, including a discussion of both efficiency and distributional effects. Next, this section discusses the scope of the analysis, including the link between existing and critical habitat-related protection efforts and economic impacts. Then, it presents the analytic time frame used in the report. Finally, this section lists the information sources relied upon in the analysis.

[11] 16 U.S.C. §1533(b)(2).

[12] 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.

[13] In 2001, the U.S. Court of Appeals for the 10th Circuit 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)).

1.1 Approach to Estimating Economic Effects

26. This economic analysis considers both the economic efficiency and distributional effects that may result from activities to protect the brodiaea and its habitat (hereinafter referred to collectively as "brodiaea conservation activities"). Economic efficiency effects generally reflect "opportunity costs" associated with the commitment of resources required to accomplish species and habitat conservation. For example, if activities that can take place on a parcel of land 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 brodiaea conservation activities.

27. 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 and the energy industry. This information may be used by decision-makers to assess whether the effects of brodiaea conservation activities unduly burden a particular group or economic sector. For example, while conservation activities may have a relatively small impact relative to the national economy, individuals employed in a particular sector of the regional economy may experience relatively greater impacts. The difference between economic efficiency effects and distributional effects, as well as their application in this analysis, are discussed in greater detail below.

1.1.1 Efficiency Effects

28. 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 understand how society, as a whole, will be affected by a regulatory action. In the context of regulations that protect brodiaea habitat, these 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 surpluses in affected markets.[14]

29. In some instances, compliance costs may provide a reasonable approximation for the efficiency effects associated with a regulatory action. For example, a Federal land manager, such as the US Forest Service, may enter into a consultation with the Service to ensure that a particular activity will not adversely modify critical habitat. The effort required for the consultation is an economic opportunity cost because the landowner or manager's time and effort would have been spent in an alternative activity had the parcel

[14] 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.

not been included in the designation. When 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 can provide a reasonable estimate of the change in economic efficiency.

30. 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 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 market.

31. This analysis begins by measuring costs associated with measures taken to protect brodiaea and its habitat. As noted above, in some cases, compliance costs can provide a reasonable estimate of changes in economic efficiency. However, if the cost of conservation activities is expected to significantly impact markets, the analysis will consider potential changes in consumer and/or producer surplus in affected markets.

Calculating Present Value and Annualized Impacts

For each land use activity, this analysis compares economic impacts incurred in different time periods in present value terms. The present value presents the value of a payment or stream of payments in common dollar terms. That is, it is the sum of a series of past or future cash flows expressed in today's dollars. Translation of economic impacts of past or future costs to present value terms requires the following: a) past or projected future costs of brodiaea conservation activities; and b) the specific years in which these impacts have been or are expected to be incurred. With these data, the present value of the past or future stream of impacts (PV_c) of brodiaea conservation activities from year t to T is measured in 2005 dollars according to the following standard formula:[a]

$$PV_c = \sum_{t=t_0}^{t=T} \frac{C_t}{(1+r)^{t-2005}}$$

C_t = cost of brodiaea conservation activities in year t

r = discount rate[b]

Impacts of conservation activities for each activity in each unit are also expressed as annualized values. Annualized values are calculated to provide comparison of impacts across activities with varying forecast periods (T). For this analysis, however, all activities employ a forecast period of 20 years, 2005 through 2024. Annualized impacts of future brodiaea conservation activities (APV_c) are calculated by the following standard formula:

$$APV_c = PV_c \left\lfloor \frac{r}{1-(1+r)^{-(N)}} \right\rfloor$$

N = number of years in the forecast period (in this analysis, 20 years)

[a] To derive the present value of past conservation activities for this analysis, t is 1993 and T is 2004; to derive the present value of future conservation activities, t is 2005 and T is 2024.

[b] To discount and annualize costs, guidance provided by the OMB specifies the use of a real rate of seven percent. In addition, OMB recommends sensitivity analysis using other discount rates such as three percent, which some economists believe better reflects the social rate of time preference. (U.S. Office of Management and Budget, Circular A-4, September 17, 2003 and 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.)

1.1.2 Distributional and Regional Economic Effects

32. 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.[15] 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.

Impacts on Small Entities and Energy Supply, Distribution, and Use

33. This analysis considers how small entities, including small businesses, organizations, and governments, as defined by the Regulatory Flexibility Act, might be affected by future brodiaea conservation activities.[16] In addition, in response to Executive Order 13211 "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use," this analysis considers the future impacts of conservation activities on the energy industry and its customers.[17]

Regional Economic Effects

34. Regional economic impact analysis can provide an assessment of the potential localized effects of conservation activities. Specifically, 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 regional input/output models. These models rely on multipliers that represent the relationship between a change in one sector of the economy (e.g., expenditures by recreationists) and the effect of that change on economic output, income, or employment in other local industries (e.g., suppliers of goods and services to recreationists). These economic data provide a quantitative estimate of the magnitude of shifts of jobs and revenues in the local economy.

35. The use of regional input/output models in an analysis of the impacts of species and habitat conservation activities can overstate the long-term impacts of a regulatory change. Most importantly, these models provide a static view of the economy of a region. 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 to this

[15] 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.

[16] 5 U.S.C. § 601 *et seq.*

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

change. For example, these models provide estimates of the number of 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 impacted 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.

36. 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.

1.2 Scope of the Analysis

37. 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 the CHD. 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.[18,19]

38. 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. In past instances, some of these measures have been precipitated by the listing of the species and impending designation of critical habitat. Because habitat conservation activities affording protection to a listed species likely contribute to the efficacy of the CHD activities, the impacts of these actions are considered relevant for understanding the full effect of the proposed CHD. Enforcement actions taken in response to violations of the Act, however, are not included.

[18] In 2001, the U.S. Court of Appeals for the 10th Circuit 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)).

[19] In 2004, the U.S. Ninth 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.

1.2.1 Sections of the Act Relevant to the Analysis

39. This 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 the CHD. In this section, the Secretary is required to list species as endangered or threatened "solely on the basis of the best available scientific and commercial data."[20] Section 4 also requires the Secretary to designate critical habitat "on the basis of the best scientific data available and after taking into consideration the economic impact, and any other relevant impact, of specifying any particular area as critical habitat."[21]

40. 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 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 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 CHD.[22]

- 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."[23] The economic impacts associated with this section manifest themselves in sections 7 and 10. While incidental take permits are not issued for plant species such as the brodiaea, the Service is obligated to ensure that proposed activities adequately minimize impact to the species.

- Under section 10(a)(1)(B) of the Act, an entity (e.g., 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.[24] 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.

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[20] 16 U.S.C. 1533.

[21] 16 U.S.C. 1533.

[22] 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.

[23] 16 U.S.C. 1532.

[24] U.S. Fish and Wildlife Service, "Endangered Species and Habitat Conservation Planning," August 6, 2002, accessed at http://endangered.fws.gov/hcp/.

The designation of critical habitat does not require completion of an HCP; however, the designation may influence conservation measures provided under HCPs. While HCPs are not developed solely for plant species, if listed plants occur in the area subject to the HCP, the Service must consider whether the proposed activities may adversely affect or jeopardize the continued existence of the plant species. In Southern California, numerous HCPs include the brodiaea as a covered species.

1.2.2 Other Relevant Protection Efforts

41. 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.[25] For the purpose of this analysis, such protective efforts are considered to be co-extensive with the protection offered by critical habitat, and costs associated with these efforts are included in this report. In addition, under certain circumstances, the CHD may provide new information to a community about the sensitive ecological nature of a geographic region, potentially triggering additional economic impacts under other State or local laws. In cases where these costs would not have been triggered absent the designation of critical habitat, they are included in this economic analysis.

1.2.3 Additional Analytic Considerations

42. This analysis also considers the potential for other types of economic impacts that can be related to section 7 consultations in general and CHD in particular, including time delay, regulatory uncertainty, and stigma impacts.

Time Delay and Regulatory Uncertainty Impacts

43. Time delays are costs due to project delays associated with the consultation process or compliance with other regulations. Regulatory uncertainty costs occur in anticipation of having to modify project parameters (e.g., retaining outside experts or legal counsel to better understand their responsibilities with regard to CHD).

Stigma Impacts

44. Stigma refers to the change in economic value of a particular project or activity due to negative (or positive) perceptions of the role critical habitat will play in developing, implementing, or conducting that policy. For example, changes to private property values associated with public attitudes about the limits and costs of implementing a project in critical habitat are known as "stigma" impacts.

[25] 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.

1.2.4 Benefits

45. Under Executive Order 12866, OMB directs Federal agencies to provide an assessment of both the social costs and benefits of proposed regulatory actions.[26] OMB's Circular A-4 distinguishes two types of economic benefits: *direct benefits and ancillary benefits*. Ancillary benefits are defined as favorable impacts of a rulemaking that are typically unrelated, or secondary, to the statutory purpose of the rulemaking.[27]

46. In the context of CHD, the primary purpose of the rulemaking (i.e., the direct benefit) is the potential to enhance conservation of the species. The published economics literature has documented that social welfare benefits can result from the conservation and recovery of endangered and threatened species. In its guidance for implementing Executive Order 12866, OMB acknowledges that it may not be feasible to monetize, or even quantify, the benefits of environmental regulations due to either an absence of defensible, relevant studies or a lack of resources on the implementing agency's part to conduct new research.[28] *Rather than rely on economic measures, the Service believes that the direct benefits of the proposed rule are best expressed in biological terms that can be weighed against the expected cost impacts of the rulemaking.*

47. Critical habitat designation may also generate ancillary benefits. Critical habitat aids in the conservation of species specifically by protecting the primary constituent elements on which the species depends. To this end, critical habitat designation can result in maintenance of particular environmental conditions that may generate other social benefits aside from the preservation of the species. That is, management actions undertaken to conserve a species or habitat may have coincident, positive social welfare implications, such as increased recreational opportunities in a region. While they are not the primary purpose of critical habitat, these ancillary benefits may result in gains in employment, output, or income that may offset the direct, negative impacts to a region's economy resulting from actions to conserve a species or its habitat.

48. It is often difficult to evaluate the ancillary benefits of critical habitat designation. To the extent that the ancillary benefits of the rulemaking may be captured by the market through an identifiable shift in resource allocation, they are factored into the overall economic impact assessment in this report. For example, if habitat preserves are created to protect a species, the value of existing residential property adjacent to those preserves may increase, resulting in a measurable positive impact. Where data are available, this analysis attempts to capture the *net* economic impact (i.e., the increased regulatory burden less any discernable offsetting market gains), of species conservation efforts imposed on regulated entities and the regional economy.

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[26] Executive Order 12866, *Regulatory Planning and Review*, September 30, 1993.

[27] 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.

[28] Ibid.

1.2.5 Geographic Scope of the Analysis

49. The geographic scope of the analysis includes areas proposed for CHD and areas excluded from proposed critical habitat under section 4(b)(2) of the Act. The economic impacts of potential designation are estimated for each of these two categories of land identified in the proposed rule. The analysis focuses on activities within or affecting these areas.

50. Impacts are presented at the lowest level of resolution feasible given available data. For brodiaea, impacts are reported for each subunit identified in the proposed rule. Section 2 presents maps illustrating the relationship between subunit size, census tracts, and cities.

1.3 Analytic Time Frame

51. The analysis estimates 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. This analysis estimates economic impacts to activities from 1998 (year of the species' final listing) to 2024 (20 years from the year of final designation). Forecasts of economic conditions and other factors beyond the next 20 years would be speculative.

1.4 Information Sources

52. The primary sources of information for this report are communications with and data provided by personnel from the Service, Federal action agencies, affected private parties, and local and State governments within California. Specifically, the analysis relies on data collected in communication with personnel from the following entities:

- San Diego Association of Governments;
- Southern California Association of Governments;
- California Department of Transportation;
- Glendora Community Conservancy;
- Rancho Mission Viejo;
- San Diego Gas and Electric;
- Riverside County Flood Control and Water Conservation District;
- RECON Environmental;

- Public land management agencies including the US Forest Service and the Orange County Department of Harbors, Beaches and Parks;
- Private land developers; and
- County and city planning departments.

53. Publicly available data from the Census Bureau and other Department of Commerce data were relied on to characterize the regional economy. In addition, this analysis relies upon the Service's section 7 consultation records, public comments, and published journal sources. The reference section at the end of this document provides a complete list of information sources.

1.5 Structure of Report

54. This remainder of this report is organized as follows:

- Section 2: Background and Socioeconomic Overview;
- Section 3: Impacts to Development Activities;
- Section 4: Impacts to Military Activities;
- Section 5: Impacts to Transportation, Utilities, and Flood Control Activities;
- Section 6: Impacts to Public and Conservation Lands;
- References;
- Appendix A: RFA/SBREFA and Energy Impacts Screening Analysis;
- Appendix B: Administrative Unit Costs of Consultations; and
- Appendix C: Zabel and Paterson Study.

Sections 3 through 6 are organized by affected activity. For each of these activities, the analysis discusses impacts by proposed critical habitat unit and areas excluded from proposed critical habitat from critical habitat.

BACKGROUND AND SOCIOECONOMIC OVERVIEW SECTION 2

55. This section provides information on the history of the brodiaea listing and essential habitat proposed for inclusion and exclusion from the final rule, describes the socioeconomic characteristics of identified essential habitat areas, and provides regulatory background that informs the analysis.

2.1 Background of the Brodiaea Critical Habitat Designation

56. On October 13, 1998, the Service published the final rule listing brodiaea as threatened.[29] The final rule also listed the *Navarretia fossalis* (spreading navarretia) as threatened, and *Allium munzii* (munz's onion) and *Atriplex coronata var notatior* (San Jacinto Valley crownscale) as endangered. Designation of critical habitat for brodiaea in the final rule was determined "not prudent." On November 15, 2001 the Center for Biological Diversity and the California Native Plant Society filed a lawsuit against the Department of the Interior and the Service challenging the Service's "not prudent" determination of critical habitat designation for brodiaea as well as numerous other plant species. This was followed by a second lawsuit against the Department of the Interior and the Service by the Building Industry Legal Defense Foundation on November 21, 2001 that also challenged the Service's critical habitat determination. On March 19, 2002, the lawsuits were consolidated and all parties agreed to remand critical habitat determinations to the Service for further consideration. On July 1, 2002, the court ordered the Service to publish a new prudency determination and/or propose critical habitat for brodiaea on or before November 30, 2004. On December 8, 2004, the Service published the proposed critical habitat designation ("proposed rule") for brodiaea in the Federal Register.[30]

2.2 Proposed Critical Habitat Designation[31]

57. In the proposed rule, the Service determines that 9,403 acres of essential brodiaea habitat exists in Los Angeles, San Bernardino, Orange, Riverside, and San Diego counties in California and proposes to designate approximately 4,690 acres of land across

[29] 63 FR 54975.
[30] 69 FR 71284.
[31] Information in this section comes from the proposed rule (69 CFR 71284).

10 units in these counties. Approximately 4,713 acres of essential habitat are excluded from proposed critical habitat, because those areas are currently covered by habitat conservation plans (HCPs) or are on "mission essential" Department of Defense (DOD) lands.[32] Specifically, essential brodiaea habitat excluded from proposed critical habitat is currently covered by the approved Western Riverside Multiple Species Habitat Conservation Plan (MSHCP), the approved Villages of La Costa HCP, and the City of Carlsbad Habitat Management Plan (HMP). In addition, a number of additional HCPs are in progress that, when approved, will provide additional protection to the species.

58. Exhibit 2-1 provides information concerning identified essential habitat, eligible habitat excluded from proposed critical habitat, and eligible habitat proposed as critical habitat. Exhibit 2-2 provides summary information describing land ownership within proposed critical habitat for the species by county. Finally, Exhibit 2-3 summarizes acreage for each category of essential habitat excluded from proposed critical habitat from the final rule.

Exhibit 2-1

SUMMARY OF ESSENTIAL HABITAT FOR BRODIAEA

County	Total Eligible Habitat (acres)	Eligible Habitat Excluded (acres)	Proposed Critical Habitat (acres)	Percent of Eligible Habitat Excluded from Proposed Critical Habitat
Los Angeles	294	0	294	0%
San Bernardino	89	0	89	0%
Orange	2,011	0	2,011	0%
Riverside	3,314	3,267	47*	99%
San Diego	3,695	1,446	2,249	39%
Total	**9,403**	**4,713**	**4,690**	

Source: 69 FR 71291.
*All proposed critical habitat in Riverside County is located on National Forest lands.

[32] One exception to this is the Fox-Miller site. The properties proposed for conservation and development in the City of Carlsbad draft Habitat Management Plan (HMP) do not meet the conditions for coverage of the species due to the recent identification of 19,100 plants on the property (69 CFR 71297).

Exhibit 2-2

SUMMARY OF LAND OWNERSHIP IN PROPOSED CRITICAL HABITAT FOR BRODIAEA
(acres)

County	Federal	State or Local	Private	Total
Los Angeles	20	0	274	294
San Bernardino	0	0	89	89
Orange	0	219	1,792	2,011
Riverside[a]	47	0	0	47
San Diego	1,239	0	1,010	2,249
Total	**1,306**	**219**	**3,165**	**4,690**

Source: 69 FR 71290.
(a) All proposed critical habitat in Riverside County is located on National Forest lands.

Exhibit 2-3

APPROXIMATE ELIGIBLE HABITAT, EXCLUDED HABITAT, AND PROPOSED HABITAT FOR BRODIAEA FILIFOLIA

Category	Acres
Total essential brodiaea habitat	**9,403**
Excluded essential habitat:	
Western Riverside County MSHCP (Riverside County)	3,267
City of Carlsbad HMP (San Diego County)	321
Villages of La Costa HCP (San Diego County)	208
"Mission-essential" DOD lands (Camp Pendleton, San Diego County)	917
Total excluded essential habitat	**4,713**

Source: 69 FR 71296.

59. Exhibits 2-4 through 2-9 provide maps showing the location of each subunit relative to census tracts. It also shows the location of Federal Information Processing Standards (FIPS) places, which generally follow the boundaries of incorporated areas. In other words, FIPS places generally are equivalent to municipalities.

Exhibit 2-4

LOS ANGELES COUNTY, CALIFORNIA
(Units 1a-1b)

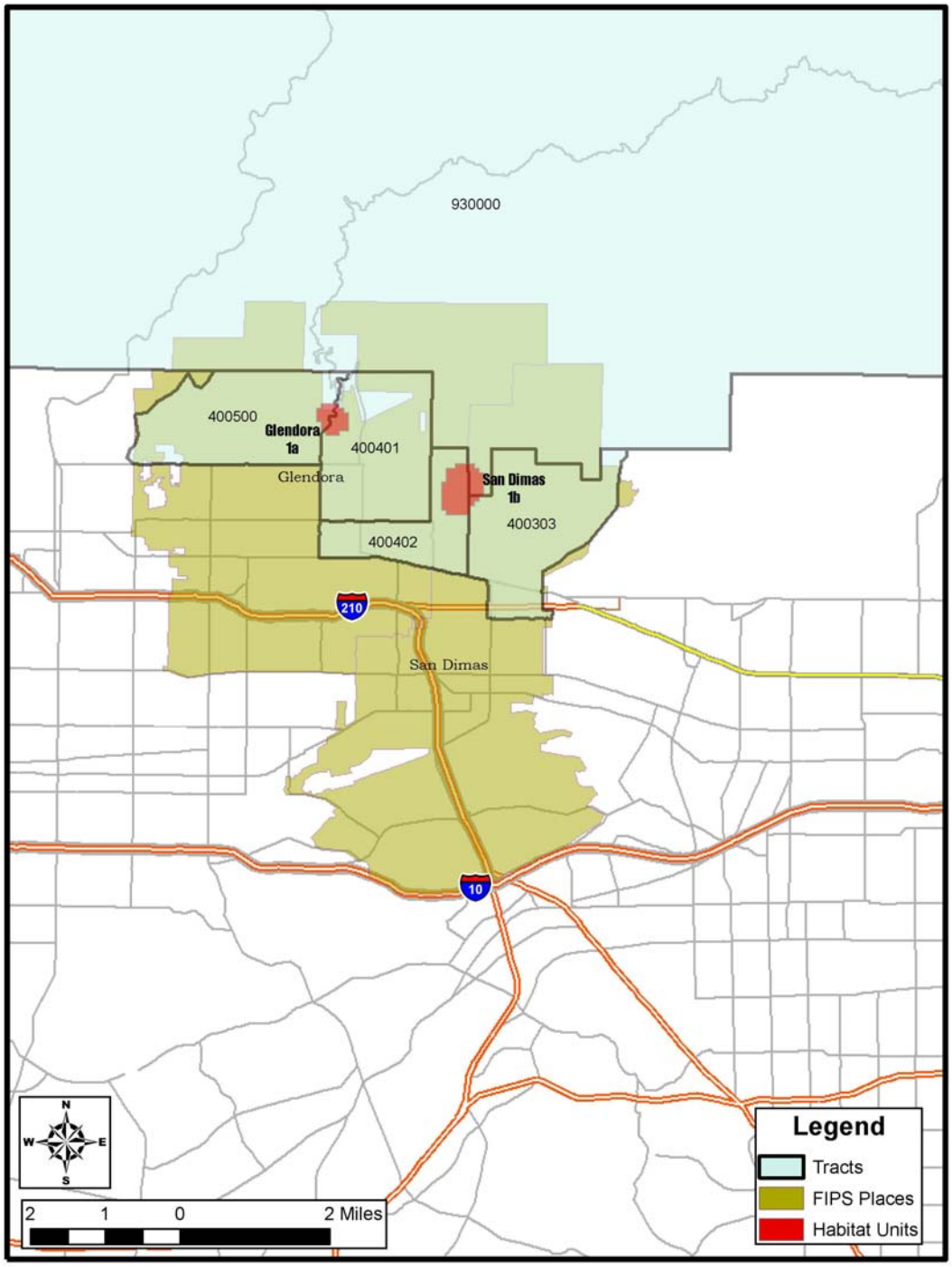


Exhibit 2-5

SAN BERNARDINO COUNTY, CALIFORNIA
(Unit 2)

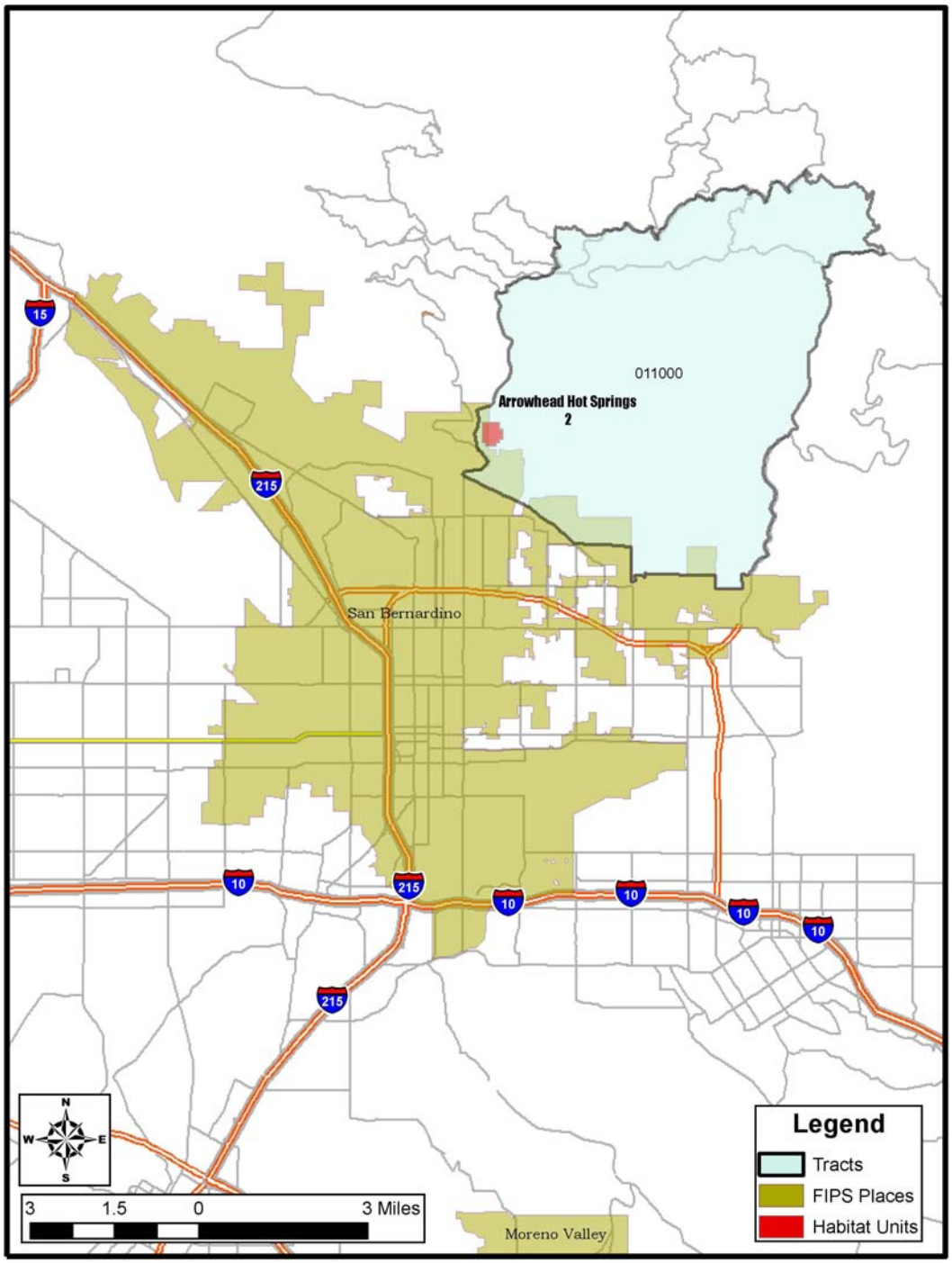


Exhibit 2-6

RIVERSIDE COUNTY, CALIFORNIA
(Units EH1-EH8)

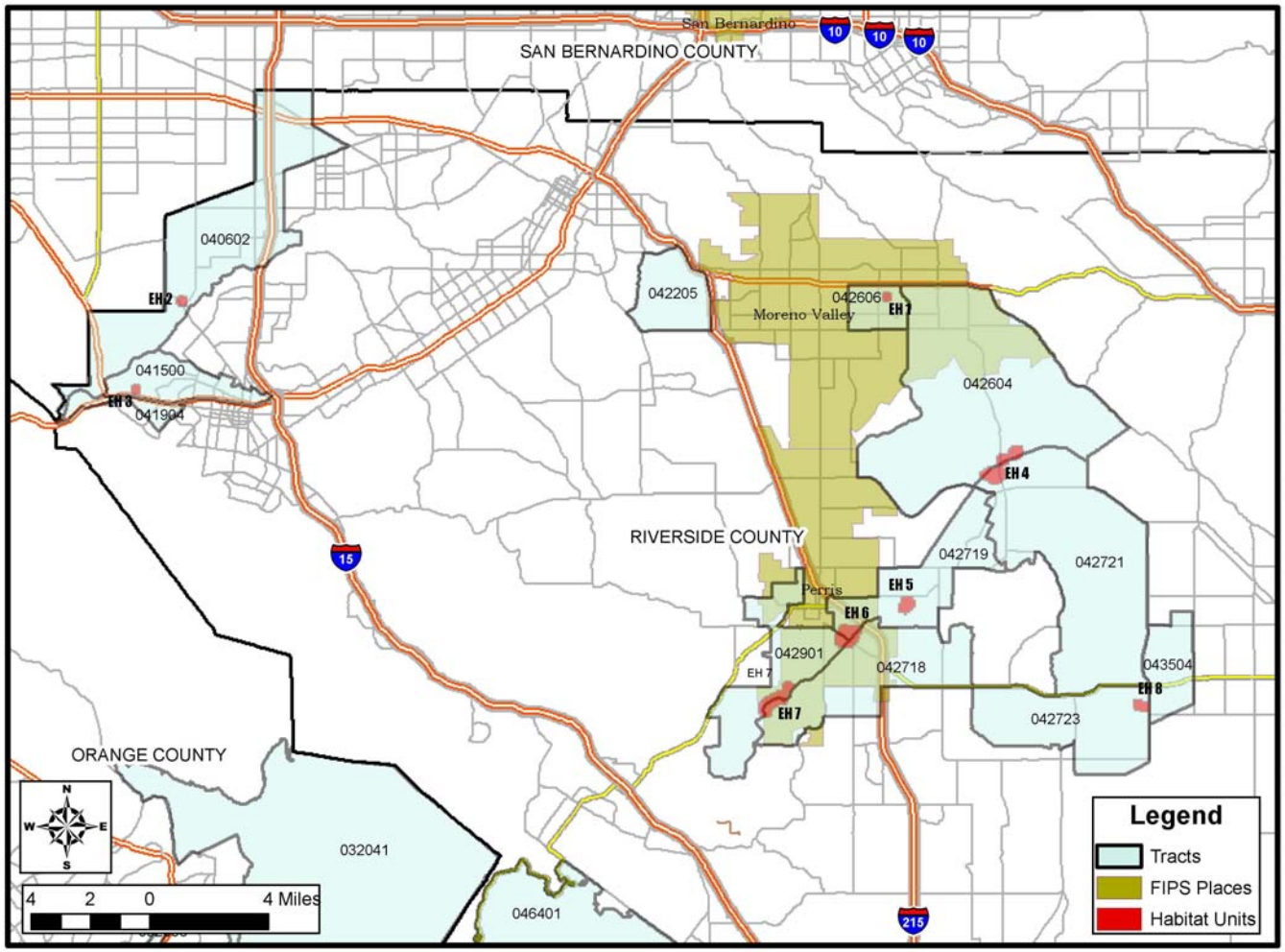


Exhibit 2-7

ORANGE, RIVERSIDE, AND SAN DIEGO COUNTIES, CALIFORNIA
(Units 3, 4a-4i, 5a-5b, and EH9-EH19)

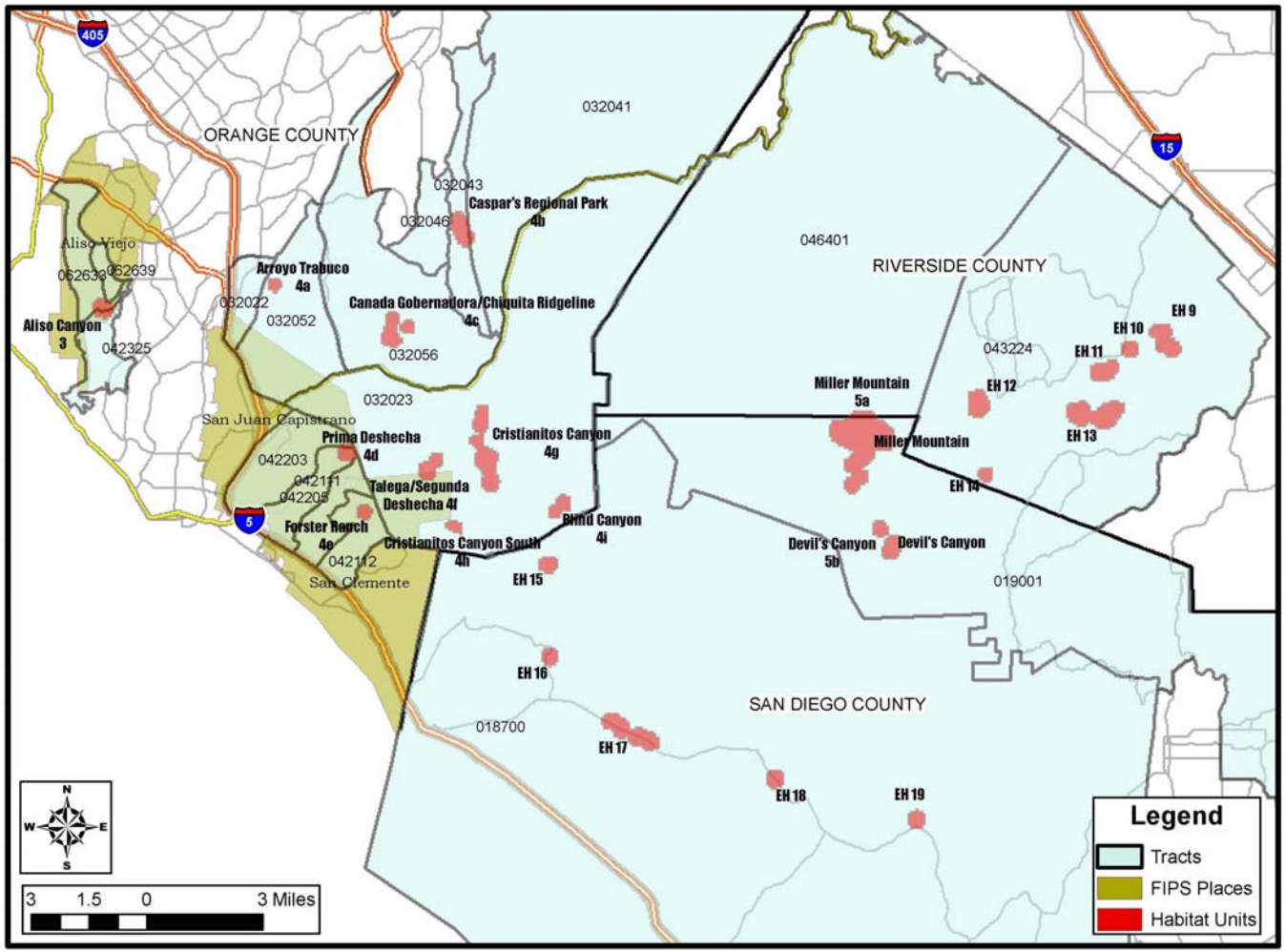


Exhibit 2-8

SAN DIEGO COUNTY, CALIFORNIA
(Units 6a-6d, 7a-7b, 8a-8e, 9, and EH20-EH24)

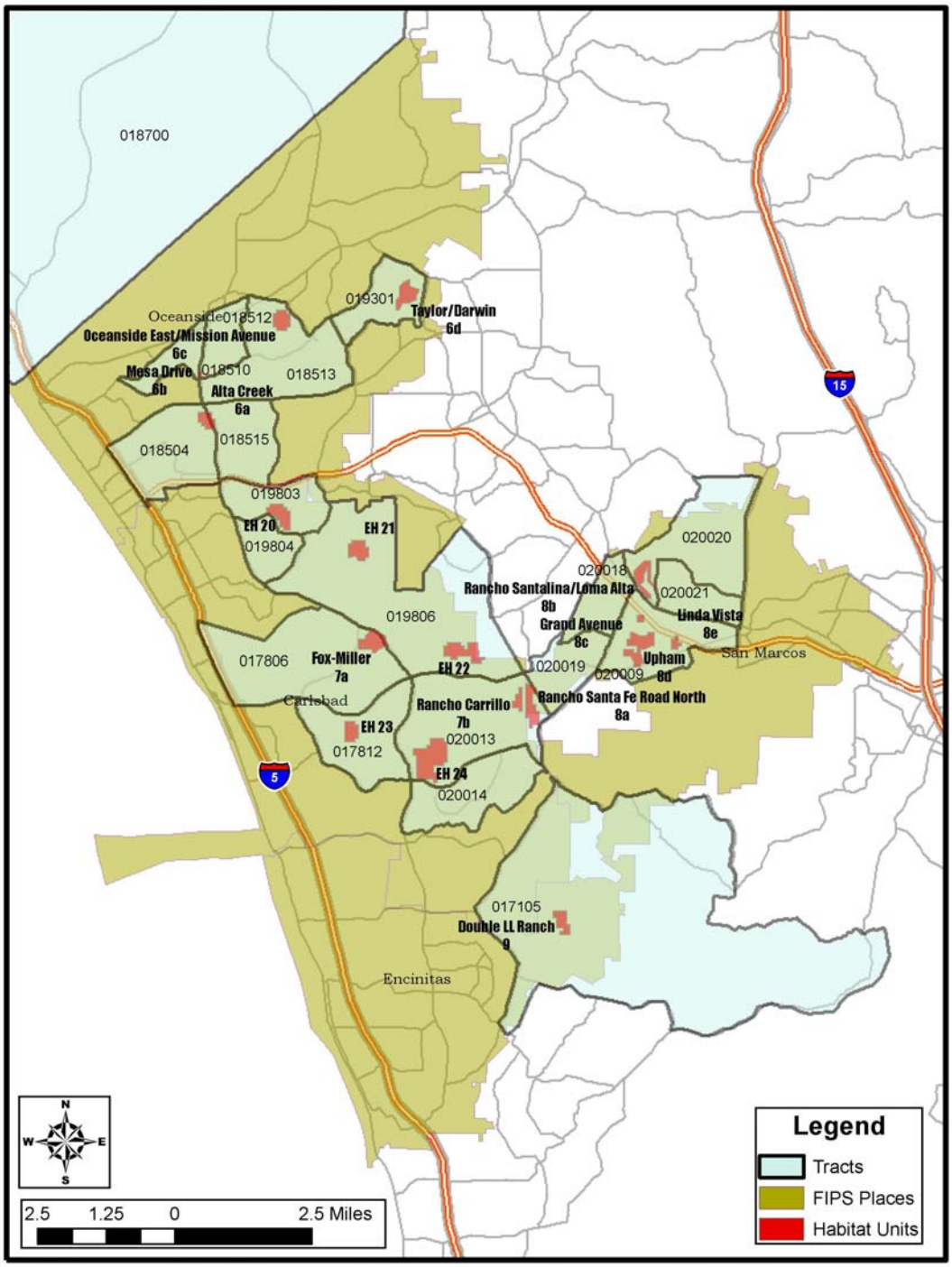
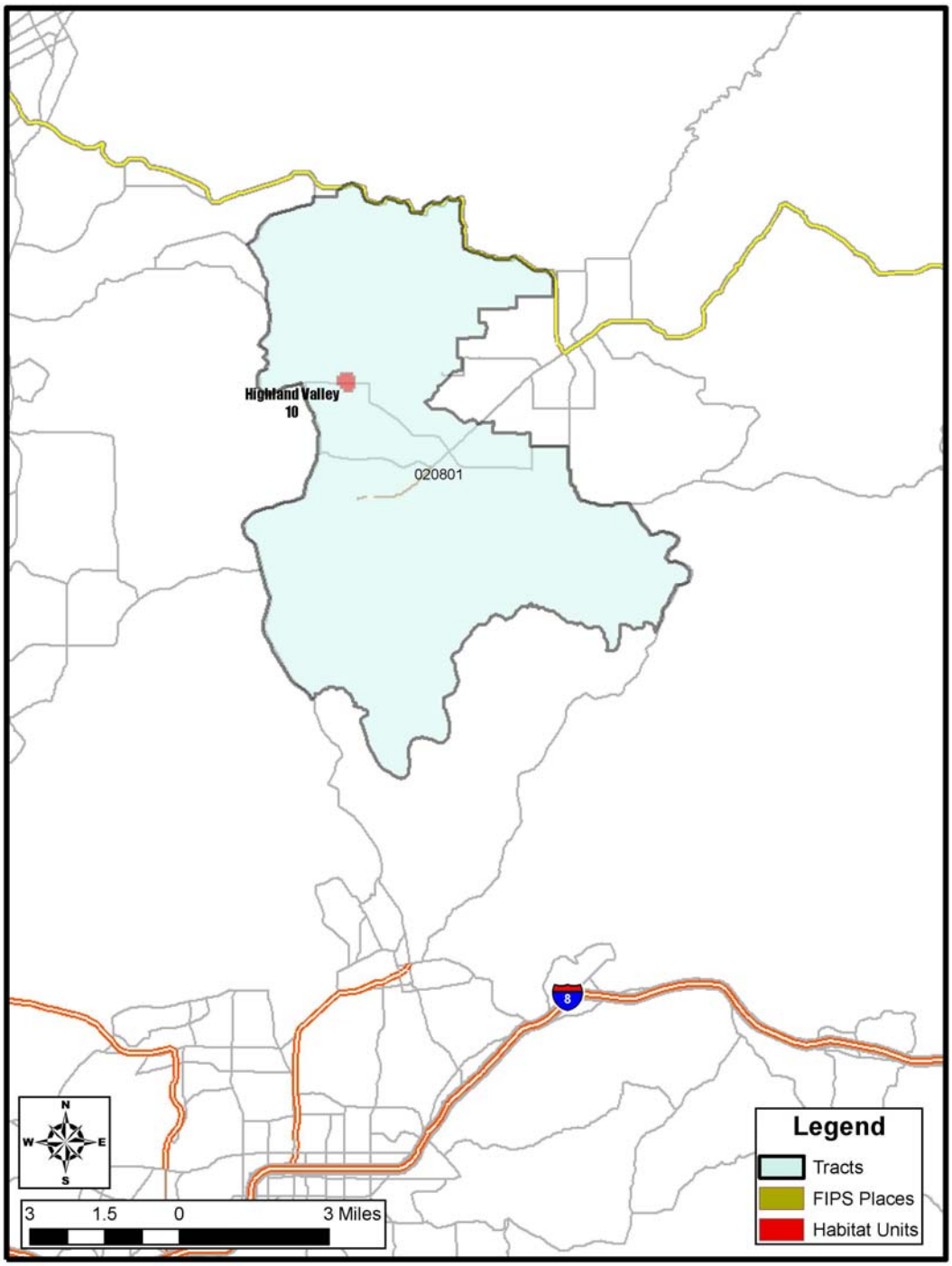


Exhibit 2-9

SAN DIEGO COUNTY, CALIFORNIA
(Unit 10)



2.3 Description of the Species and Habitat[33]

60. Brodiaea is a perennial herb in the lily family. For a detailed description of the plant, its growing season, and reproduction, see the proposed rule.[34]

61. Brodiaea's historic range extends from the foothills of the San Gabriel Mountains in Los Angeles County (Glendora and San Dimas) east to the western foothills of the San Bernardino Mountains in San Bernardino County (Arrowhead Hot Springs) south through eastern Orange and western Riverside Counties to northern San Diego County (Highland Valley). Brodiaea is usually found in herbaceous plant communities that occur in open areas on clay soils, soils with a clay subsurface, or clay lenses within loamy, silty loam, or alkaline soils, and elevations of 100 to 2,500 feet (30 to 765 meters). Brodiaea grows in association with coastal sage scrub vegetation in certain areas, such as Los Angeles and San Bernardino Counties, and are found in vernal pools and other wetlands or on clay soils and moist grasslands.

62. Considering the species' habitat requirements and population biology, the Service has identified several primary constituent elements for brodiaea relating to appropriate soil series and surface/subsurface structural conditions. Readers interested in the details of the primary constituent elements are encouraged to consult the proposed rule.[35]

63. Many of the known occurrences of brodiaea face the following common threats: direct and indirect effects from habitat fragmentation and loss resulting from urban development (and associated infrastructure projects) and agricultural activities; repeated mowing and disking associated with fire suppression activities and weed control; military training; alteration of existing hydrologic conditions (particularly in western Riverside County); off-road vehicle and other recreational activities; over-grazing; and competition from non-native plant species.[36] Exhibit 2-10 provides information about the threats within specific habitat subunits.

[33] Information on the brodiaea and its habitat included in this section are obtained from 69 CFR 71284.
[34] 69 CFR 71285 - 71286.
[35] 69 CFR 71288.
[36] 69 FR 71289.

Exhibit 2-10

SUMMARY OF THREATS TO BRODIAEA

County	Critical Habitat Unit	Critical Habitat Subunit	Acres	Land Ownership	Primary Threats to Species
Los Angeles	**1: Los Angeles County**				
		1a: Glendora	96	Private; managed by Glendora Community Conservancy	Invasive species; lack of management plan for brodiaea
		1b: San Dimas	198	Private and Federal (Angeles National Forest)	Urban development
San Bernardino	**2: Arrowhead Hot Springs**		89	Private	Invasive species
Orange	**3: Aliso Canyon**		151	Public (Aliso-Wood Canyon Regional Park)	Lack of management plan for brodiaea; fuel management (annual mowing); recreation
	4: Orange County				
		4a: Arroyo Trabuco	74	Private	Agriculture
		4b: Casper's Regional Park	259	Private and public (Casper's Regional Park)	Lack of management plan for brodiaea; recreation
		4c: Canada Gobernadora/Chiquita Ridgeline	311	Private (Rancho Mission Viejo)	Urban development
		4d: Prima Deschecha	119	Private	Urban development
		4e: Forster Ranch	96	Private	Urban development
		4f: Telega/Segunda Deschecha	190	Private	Urban development
		4g: Cristianitos Canyon	588	Private (Rancho Mission Viejo)	Development of the Foothill Transportation Corridor
		4h: Cristianitos Canyon South	72	Private (Rancho Mission Viejo)	Urban development
		4i: Blind Canyon	151	Private (Rancho Mission Viejo)	Urban development
San Diego	**5: Northern San Diego County**				
		5a: Miller Mountain	1,263	Federal (Cleveland National Forest)	Lack of management plan for brodiaea; cattle grazing
		5b: Devil's Canyon	264	Private and Federal (Cleveland National Forest)	Lack of management plan for brodiaea; cattle grazing
	6: Oceanside				
		6a: Alta Creek	49	Private	Urban Development
		6b: Mesa Drive	5	Private	Urban Development
		6c: Oceanside East/Mission Avenue	64	Private	Urban development

Exhibit 2-10

SUMMARY OF THREATS TO BRODIAEA

County	Critical Habitat Unit	Critical Habitat Subunit	Acres	Land Ownership	Primary Threats to Species
		6d: Taylor/Darwin	80	Private	Urban development
	7: Carlsbad				
		7a: Fox-Miller	93	Private	Urban development
		7b: Rancho Carillo	32	Private	Urban development and road realignment
	8: San Marcos				
		8a: Rancho Santa Fe Road North	86	Private	Urban development and road realignment
		8b: Rancho Santalina/Loma Alta	82	Private	Off-road vehicle (OHV) use; invasive species; and disking
		8c: Grand Avenue	10	Private	Urban development
		8d: Upham	117	Private	Urban development
		8e: Linda Vista	20	Private	OHV use; urban development; and trash dumping
	9: Double LL Ranch		57	Private	Urban development and road activities that bisect the unit
	10: Highland Valley		74	Private	Urban development and agriculture

Source: 69 FR 71291 - 71295.

2.4 Socioeconomic Profile of the Essential Brodiaea Habitat Area

64. This section summarizes key economic and demographic information for the counties containing proposed habitat for brodiaea, including population and housing characteristics, as well as general economic activity. County-level data are presented to provide context for the discussion of potential economic impacts, and to illuminate trends that may influence these impacts. Although county-level data may not precisely reflect the socioeconomic characteristics of the areas immediately surrounding the proposed habitat for the brodiaea, these data provide context for the broader analysis.

Population and Housing Characteristics

65. Exhibit 2-11 presents population size, change in population from 1990 to 2000, per capita income, and poverty rates for the five affected counties, and for the state of California as a whole.

66. As shown in Exhibit 2-11, the counties containing essential brodiaea habitat in California account for over 50 percent of the State population. The poverty rate and per capita income of each of these counties are both close to the State averages of 14.2 percent and $22,711, respectively. However, these counties have disparate population densities and population growth rates. For example, the population densities of Orange and Los Angeles counties exceed the state average by over 1,000 percent, San Diego County exceeds the average by 300 percent, but San Bernardino has a population density that is 40 percent below the State average. With population changes of 20.5 percent, 18.1 percent and 32 percent, San Bernardino, Orange, and Riverside counties have all experienced significantly higher population growth over the last ten years compared to the State average of 13.6 percent.

Exhibit 2-11

SOCIOECONOMIC PROFILE OF COUNTIES CONTAINING ESSENTIAL HABITAT FOR BRODIAEA

County	Population Density (persons/ sq mi)	Population (2000)	% of Statewide Population	% change (1990-2000)	Per Capita Income (2000)	Poverty Rate (2000)
Los Angeles	2,344	9,519,338	28.1%	7.4%	$20,683	17.9%
San Bernardino	85	1,709,434	5.0%	20.5%	$16,856	15.8%
Orange	3,606	2,846,289	8.4%	18.1%	$25,826	10.3%
Riverside	214	1,545,387	4.6%	32.0%	$18,689	14.2%
San Diego	670	2,813,833	8.3%	12.6%	$22,926	12.4%
State Total	**217**	**33,871,648**		**13.6%**	**$22,711**	**14.2%**

Source: U.S. Census Bureau, Census 2000 and State County Quickfacts, accessed at http://quickfacts.census.gov on June 1, 2005.

67. Counties that contain essential brodiaea habitat are projected to account for over 50 percent of California's 2000-2020 population growth.[37] As shown in Exhibit 2-12, Los Angeles county alone is expected to account for almost 20 percent of the population increase by adding more than two million people and one million households by 2020. Currently, 141,000 housing units are produced per year in California, but to accommodate the projected population expansion, 220,000 housing units will have to be constructed every year for the next twenty-three years.[38] In a report prepared for the California Department of Housing and Community Development, John Landis of the University of California-Berkeley presents data that suggest that the State's most populous counties, Los Angeles and Orange, do not have the land resources necessary to address the expected increase in housing demand by 2020.[39] His data also suggest that in all five counties containing essential habitat for the brodiaea, the amount of raw land above the amount necessary to accommodate future housing needs is not adequate.[40]

Exhibit 2-12

POPULATION AND HOUSEHOLD FORECASTS FOR COUNTIES CONTAINING ESSENTIAL HABITAT FOR BRODIAEA

	Population			Households		
County	**2000**	**2010**	**2020**	**1997**	**2010**	**2020**
Los Angeles	9,519,338	10,604,452	11,575,693	3,067,181	3,719,358	4,135,121
San Bernardino	1,709,434	2,187,807	2,747,213	506,155	721,550	910,476
Orange	2,846,289	3,163,776	3,431,869	883,229	1,103,557	1,202,094
Riverside	1,545,387	2,125,537	2,773,431	458,021	702,610	908,372
San Diego	2,813,833	3,441,438	3,917,001	944,044	1,208,981	1,374,137
State Total	**33,871,648**	**39,957,616**	**45,448,627**	**11,043,566**	**14,112,180**	**16,174,519**

Source: California Department of Finance, accessed at http://www.dof.ca.gov/html/demograp/PRV_Publications/Projections/Pl.htm on June 1, 2005.

Economic Activity

68. Exhibit 2-13 highlights the annual payroll for various industries in the five counties containing essential brodiaea habitat. The affected regional economy is large, diverse, and generally reflective of urbanized economies throughout the U.S. The principal industries in terms of annual payroll, include services, manufacturing, wholesale trade, and finance. The manufacturing and services sectors make up 40 percent of the total annual payroll in Los Angeles County, 53 percent in Orange, and 56 percent in San Diego. Southern California is expected to continue to experience growth

[37] California Department of Finance, *County Population Projections with Racial/Ethnic Detail*, December 1998.

[38] Landis, John, "Raising the Roof, California's Housing Development Projections and Constraints, 1997-2020," *California Department of Housing and Community Development*, May 2000, accessed at http://www.hcd.ca.gov/hpd/hrc/rtr/ on June 1, 2005.

[39] Ibid, accessed at http://www.hcd.ca.gov/hpd/hrc/rtr/chp3r.htm (as viewed on June 1, 2005), Exhibit 16.

[40] Ibid, accessed at http://www.hcd.ca.gov/hpd/hrc/rtr/chp3r.htm (as viewed on June 1, 2005).

in the services sector which will increase employment in healthcare, professional, technical, and business services.[41]

Exhibit 2-13

ECONOMIC ACTIVITY WITHIN COUNTIES CONTAINING ESSENTIAL HABITAT FOR BRODIAEA ANNUAL PAYROLL BY INDUSTRY (2002)

Industry	Annual Payroll ($1,000)				
	Los Angeles	**San Bernardino**	**Orange**	**Riverside**	**San Diego**
Total	**145,737,639**	**14,353,226**	**54,686,128**	**12,262,450**	**40,519,148**
Forestry, fishing, hunting, and agriculture support	39,865	8,395	9,088	23,282	27,569
Mining	110,271	52,044	35,945	24,509	19,389
Utilities	621,071	136,926	345,299	46,381	270,825
Construction	5,082,964	1,334,897	3,986,500	1,870,972	3,035,877
Manufacturing	21,110,513	2,166,573	7,516,681	1,802,875	5,142,264
Wholesale trade	12,463,868	1,127,095	5,238,191	731,177	3,411,830
Retail trade	9,869,535	1,639,987	3,928,591	1,727,787	3,492,497
Transportation and warehousing	5,854,430	983,665	1,048,344	310,670	566,051
Information[a]	11,882,409	362,651	2,130,200	339,658	2,021,582
Finance and insurance	12,443,239	641,313	6,049,250	491,733	2,940,253
Real estate	3,107,989	243,168	1,718,027	217,610	1,021,593
Services and other industries[b]	36,531,771	5,278,138	21,267,270	4,201,661	17,449,821
Arts, entertainment and recreation	5,383,436	128,078	768,974	419,557	841,247
Unclassified establishments[c]	50,454	4,495	18,064	4,410	11,996

Notes:
(a) Information sector includes media services, such as newspaper and book publishers, cable, networks, and telecommunication services.
(b) Services sector includes professional, scientific, and technical services; management of companies and enterprises; administration, support, waste management, remediation services; educational services; health care and social assistance; accommodation and food services, and other services (excluding public administration).
(c) Unclassified establishments are unclassified by NAICS codes.
Source: U.S. Census Bureau, 2002 County Business Patterns, accessed at http://censtats.census.gov/cbpnaic/cbpnaic.shtml on June 1, 2005.

69. Exhibit 2-14 provides industry and employment data for all counties that contain essential habitat for brodiaea. The largest employment sectors are services and manufacturing which contribute to approximately half of total employment in each of the counties. The "Number of Establishments" column displays the total number of physical locations at which business activities were conducted with one or more paid employees in the year 2002. Approximately 442,600 business establishments operate and employ 7.17 million individuals in the counties containing essential habitat for the brodiaea. These figures provide a measure of the average density of commercial and industrial establishments in the region.

[41] California Department of Transportation, *Long-Term Socio Economic Forecasts by County 2003-2020*, May 2000, accessed at http://www.dot.ca.gov/hq/tpp/offices/ote/socio-economic.htm on June 1, 2005.

Exhibit 2-14

ECONOMIC ACTIVITY WITHIN COUNTIES CONTAINING ESSENTIAL HABITAT FOR BRODIAEA
NUMBER OF ESTABLISHMENTS AND EMPLOYEES BY INDUSTRY (2002)

Industry	Los Angeles		San Bernardino		Orange		Riverside		San Diego	
	Employees	**Establishments**	**Employees**	**Establishments**	**Employees**	**Establishments**	**Employees**	**Establishments**	**Employees**	**Establishments**
Total	**3,791,362**	**231,948**	**487,257**	**28,696**	**1,383,303**	**81,674**	**427,580**	**28,954**	**1,083,047**	**71,330**
Forestry, fishing, hunting, and agriculture support	1,557	154	429	33	370	55	1,294	94	774	151
Mining	2,132	116	912	34	691	53	477	24	384	39
Utilities	9,022	225	2,551	85	4,813	62	796	40	3,694	83
Construction	130,365	12,027	38,589	3,009	93,263	6,215	52,756	3,718	77,704	6,155
Manufacturing	523,293	16,839	66,352	2,138	187,142	5,528	52,885	1,602	112,959	3,409
Wholesale trade	294,219	22,422	30,752	2,052	102,297	7,246	20,058	1,521	58,867	4,363
Retail trade	380,817	29,094	68,556	4,529	145,114	9,787	67,948	4,527	137,962	9,556
Transportation and warehousing	145,009	5,314	31,956	1,007	31,864	1,138	10,858	785	19,316	1,344
Information	174,757	8,783	8,698	371	39,537	1,622	9,118	408	35,094	1,420
Finance and insurance	180,827	11,510	16,103	1,481	93,322	5,723	11,042	1,393	50,117	4,336
Real estate	86,264	11,699	8,715	1,250	37,545	4,353	7,676	1,523	29,901	4,672
Services and other industries	1,771,887	103,274	198,995	12,142	604,178	38,533	174,019	12,701	520,698	34,459
Arts, entertainment and recreation	70,621	8,816	7,932	279	32,127	835	17,080	414	30,846	898
Unclassified establishments	1,146	1,299	143	170	325	387	93	166	282	330

Source: U.S. Census Bureau, 2002 County Business Patterns, accessed at http://censtats.census.gov/cbpnaic/cbpnaic.shtml on June 1, 2005.

2.5 Regulatory Environment

70. Brodiaea is listed as state endangered by the California Fish and Game Code under Section 2050-2116 of the Fish and Game Code. In addition, several other state regulations provide context for the designation of critical habitat.

California Environmental Quality Act

71. 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. 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 degrade the quality of the human environment or wildlife habitat.[42]

72. State law instructs the lead agency (typically a county, or a city or community development or planning department in the case of land development projects) to examine impacts from a broad perspective, taking into account the value of animal and plant habitat 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. Projects without a mandatory finding of significance and in which the applicant finds no significant impact may be approved by a lead agency in what as known as a *negative declaration*. Alternatively, an applicant may request that a lead agency issue a permit or some other discretionary approval for a project that is redesigned to either avoid or mitigate all impacts to the environment.

Natural Community Conservation Planning

73. The Natural Community Conservation Planning (NCCP) program is run by the California Department of Fish and Game and represents "…an unprecedented effort by the State of California, and numerous private and public partners, that takes a broad-based ecosystem approach to planning for the protection and perpetuation of biological diversity. The program identifies and provides for the regional or area-wide protection of plants, animals, and their habitats, while allowing compatible and appropriate economic activity."[43] Under the NCCP program, applicants develop Natural Community Conservation Plans and HCPs that provide approved development and other activities coverage for incidental take of multiple endangered and threatened species under the Act pursuant to implementation of pre-determined mitigation requirements for impacted species and/or habitat.

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[42] Minor projects that fit one of eleven classifications (as defined by CEQA) may be found to have no significant effect on the environment. Many of these types of projects are eligible for *categorical exemption* from the provisions of CEQA.

[43] California Department of Fish and Game, accessed at http://www.dfg.ca.gov/nccp/index.html on June 28, 2005.

Integrated Natural Resource Management Plans

74. Land in Camp Pendleton in San Diego County is excluded from proposed critical habitat due to its "mission-essential" status. Camp Pendleton land is managed consistent with an Integrated Natural Resource Management Plan (INRMP). Since 1960, the Sikes Act has required military installations to provide for the conservation and rehabilitation of natural resources on its lands. In 1997, an amendment to the Act required the military to prepare and implement INRMPs for each military installation with significant natural resources, and to do so in cooperation with the Service and the appropriate state agencies. The new INRMPs focus on the preservation and maintenance of healthy and fully functional ecosystems.

2.6 Presence of Other Listed Species

75. Numerous other federally or State-listed species may exist within or near essential brodiaea habitat. To the extent that these other species require the same protective measures as brodiaea, costs incurred that protect brodiaea habitat may not be solely attributable to the presence of brodiaea. This analysis does not attempt to allocate costs among different species. Instead, all costs of conservation within brodiaea habitat are assumed to be attributable to the presence of brodiaea. Drawing from queries of numerous databases in California, Exhibit 2-15 summarizes species that may occur in or within two hundred meters of essential brodiaea habitat.

Exhibit 2-15

OTHER FEDERALLY OR STATE-LISTED SPECIES IN OR NEAR ESSENTIAL BRODIAEA HABITAT

California Orcutt grass	Stephen's kangaroo rat
California red-legged frog	Arroyo toad
Del Mar manzanita	Coastal California gnatcatcher
San Diego button-celery	Least Bell's vireo
San Diego fairy shrimp	Southern steelhead
San Diego thorn-mint	Southwestern willow flycatcher
San Jacinto Valley crownscale	Spreading navarretia

POTENTIAL ECONOMIC IMPACTS TO PRIVATE DEVELOPMENT ACTIVITIES — SECTION 3

76. This section considers how brodiaea conservation activities may impact residential real estate development activities in areas that contain essential brodiaea habitat. The analysis employs an economic model to estimate future costs in terms of reductions in existing land values and impacts on the housing market.

77. Exhibit 3-1 summarizes future costs estimated under two different scenarios.[44] As shown, if adequate supplies of substitute land are available to replace land that cannot be developed as a result of brodiaea conservation activities, then development impacts are borne by the current landowners of affected properties. These land value losses are estimated to be $11.8 million for units proposed for critical habitat designation and the loss occurs in 2005. If adequate supplies of substitute land are not available, then fewer homes may be built. Under this scenario, impacts are estimated to be $15.6 million in undiscounted dollars. In present value terms, impacts are $14.7 million and $13.9 million, assuming discount rates of three and seven percent, respectively.

78. The section first reviews past costs of consultations and the development of HCPs in areas with essential brodiaea habitat. Then, the analysis provides an overview of the general methodology and approach used for estimating future economic impacts of conservation activities on private development. Finally, the analysis presents the detailed analysis and total estimated economic costs.

[44] Past costs of development activities estimated in this analysis are small relative to future costs. For a summary of past costs, see Section 3.1.

Exhibit 3-1

SUMMARY OF FUTURE DEVELOPMENT IMPACTS[a]

County	Unit[b]	Scenario One - Adequate Supply of Substitute Land[c]	Scenario Two: Reduced Supply of New Housing[d]		
			Total Impact (Undiscounted Dollars)	Total Impact Present Value (3%)	Total Impact Present Value (7%)
Proposed for Inclusion					
Los Angeles	1b	$115,000	$2,251,000	$1,732,000	$1,289,000
San Bernardino	2	$1,219,000	$1,449,000	$1,391,000	$1,341,000
Orange	4a	$1,891,000	$1,999,000	$1,970,000	$1,946,000
	4b	$11,000	$20,000	$18,000	$16,000
	4c	$205,000	$368,000	$327,000	$292,000
	4d	$1,231,000	$1,291,000	$1,275,000	$1,262,000
	4e	$755,000	$1,040,000	$966,000	$903,000
	4f	$162,000	$223,000	$207,000	$193,000
	4g	$456,000	$628,000	$583,000	$546,000
	4h	$61,000	$84,000	$78,000	$73,000
	4i	$128,000	$177,000	$164,000	$154,000
San Diego	5a	$856,000	$1,082,000	$1,023,000	$974,000
	5b	$151,000	$191,000	$181,000	$172,000
	6a	$30,000	$31,000	$31,000	$30,000
	6b	$0	$0	$0	$0
	6c	$447,000	$465,000	$460,000	$456,000
	6d	$409,000	$426,000	$421,000	$418,000
	7a	$58,000	$63,000	$62,000	$61,000
	7b	$98,000	$106,000	$104,000	$102,000
	8a	$712,000	$791,000	$770,000	$752,000
	8b	$368,000	$376,000	$374,000	$372,000
	8c	$46,000	$47,000	$47,000	$47,000
	8d	$710,000	$725,000	$721,000	$718,000
	8e	$185,000	$189,000	$188,000	$187,000
	9	$430,000	$464,000	$455,000	$447,000
	10	$1,115,000	$1,139,000	$1,133,000	$1,127,000
Subtotal CHD		**$11,849,000**	**$15,624,000**	**$14,679,000**	**$13,878,000**
Excluded from Proposed Critical Habitat					
San Diego	EH20	$132,000	$142,000	$139,000	$137,000
	EH21	$0	$0	$0	$0
	EH22	$203,000	$219,000	$215,000	$211,000
	EH23	$196,000	$211,000	$207,000	$204,000
	EH24	$1,558,000	$1,679,000	$1,647,000	$1,620,000
Riverside	EH1	$377,000	$2,853,000	$2,247,000	$1,730,000
	EH2	$0	$0	$0	$0
	EH5	$2,056,000	$2,555,000	$2,434,000	$2,331,000
	EH6	$712,000	$885,000	$843,000	$807,000
	EH7	$4,622,000	$5,744,000	$5,472,000	$5,239,000
	EH8	$596,000	$9,528,000	$7,413,000	$5,597,000
	EH12	$702,000	$1,021,000	$938,000	$868,000
	EH13	$451,000	$483,000	$475,000	$467,000
	EH14	$280,000	$300,000	$295,000	$290,000
Subtotal EH		**$11,886,000**	**$25,621,000**	**$22,324,000**	**$19,501,000**

Notes:
(a) Future administrative costs related to consultations and development of HCPs are less than two percent of total development-related costs and are not included in this table.
(b) Units that are completely contained within public and/or conservancy lands are excluded from the analysis.
(c) Scenario One costs are assumed to occur in 2005; therefore, the present value of these costs is equal to the undiscounted dollar amount.
(d) Scenario Two assumes a consumer surplus loss occurs in addition to land value losses estimated under Scenario One; therefore, these numbers represent the sum of land value losses estimated under Scenario One and consumer surplus losses estimated under Scenario Two.

3.1 Past Costs

79. The Service has consulted on development projects with potential impacts to brodiaea four times in areas that contain essential brodiaea habitat (one formal and three informal consultations) since the listing of the species in 1998. Exhibit 3-2 summarizes these development-related consultations for brodiaea. In addition, the Service has consulted on three HCPs since the listing of the species.[45] Exhibit 3-3 presents the estimated administrative and project modification costs of past development projects and the administrative costs of developing the HCPs. Administrative cost estimates are derived from the consultation unit cost estimates described in Appendix B.

[45] These HCPs are the County of San Diego Subarea Plan under the MSCP in March 1998, the Western Riverside MSHCP in June 2004, and the City of Carlsbad Subarea Plan under the MHCP in November 2004. Conservation requirements for the brodiaea included in these plans are discussed in detail in Section 3.2.1. The impacts of these plans on development in essential habitat are estimated in Section 3.2.

Exhibit 3-2

SUMMARY OF CONSULTATIONS FOR DEVELOPMENT PROJECTS IN ESSENTIAL BRODIAEA HABITAT

Date	Agency	Units	Project Summary	Project Modification Summary	Modification Costs
Formal Consultation					
25-Aug-03	U.S. Army Corps of Engineers (the Corps)	8b	**Rancho Santalina Project, City of San Marcos, San Diego**. The Rancho Santalina LP sought authorization from the Corps to impact 0.06 acres of an unvegetated, ephemeral drainage in connection with development of 69.7 acres of two parcels. The consultation also considered the California gnatcatcher.	The project will preserve 78 percent of the population within a 6.5 acre portion of the preserve and salvage the remaining population (432 individuals on 1.29 acres) to appropriate locations.[a]	$129,000 in undiscounted 2004 dollars for salvage of 1.29 acres of brodiaea.[b]
Informal Consultations					
29-Nov-01	City of Carlsbad[c]	7a	**Comments on the Mitigated Negative Declaration for the Fox-Miller Property, City of Carlsbad**. The proposed project is to develop 36 acres of a 53.65 acre property within the City of Carlsbad.	The applicant proposes to preserve brodiaea on-site and translocate corms located in the area of the site proposed for grading. The Service recommends using the "soil transfer" translocation technique.	(1)$140,000 for brodiaea salvaging, maintenance and monitoring. (2) $1,000,000 in project delay (3) $1,000,000 to construct a soil nail wall.[d]
25-Feb-02	City of Carlsbad[c]	7a	**Mitigated Negative Declaration for the Fox-Miller Property, City of Carlsbad**. The proposed Fox/Miller Property project includes the subdivision of a 52.33-acre site located in the City of Carlsbad into four industrial lots and one open space lot. The Service notes that 10.67 acres of brodiaea are located within 44.62 acres of annual grassland on the project site.	Mitigation for this population requires the project applicant to salvage 2.17 acres of annual grassland containing brodiaea to grassland within the open space area of the project. All brodiaea on-site will be preserved.	
12-Sep-02	California/ Nevada Operations Office	6c	**Mission View Estates Project and Mission Gate Drive Extension, City of Oceanside**. The project applicant, Fieldstone River Ranch South, LLC applied to the Service for an incidental take permit of the coastal California Gnatcatcher and coverage for brodiaea under an HCP for the proposed construction of a 65-unit single-family residential project on a 28.9-acre site and off-site grading for extension of Mission Gate Drive. The gnatcatcher is the only species located on-site, but a population of brodiaea is located 125 feet from the edge of the proposed grading area for extension of Mission Gate Drive.	The proposed HCP specifies that impacts to this population will be avoided through staking and temporarily fencing the population prior to grading. The brodiaea are not located on-site.	Minimal.

Notes:
(a) Mitigation information from Dudek & Associates, Draft Rancho Santalina and Las Posas Road/SR78 Interchange Thread-Leaved Brodiaea Preserve Long-Term Management Plan, October 9, 2003.
(b) Mitigation costs are calculated assuming $100,000 per acre for salvaging and transplanting of impacted brodiaea, and maintenance and monitoring for five years. Data from personal communication with Robert MacAller, RECON Environmental, Inc. on June 24, 2005.
(c) The Service's communication with the City of Carlsbad may not strictly be considered a consultation under section 7. However, this analysis assumes that the administrative costs associated with this communication are likely to be similar in effort to that of an informal consultation.
(d) Cost information from personal communication with Alan Jones, HG Fenton and Company, on June 2, 2005.

Exhibit 3-3

PAST COSTS OF DEVELOPMENT-RELATED CONSULTATIONS[a]

	Undiscounted Dollars (2005$)		Present Value (7%)		Present Value (3%)	
Unit Number	**Low**	**High**	**Low**	**High**	**Low**	**High**
Proposed for Inclusion						
5a	$1,000	$1,000	$1,000	$2,000	$1,000	$2,000
5b	$1,000	$1,000	$1,000	$2,000	$1,000	$2,000
6a	$1,000	$1,000	$1,000	$2,000	$1,000	$2,000
6b	$1,000	$1,000	$1,000	$2,000	$1,000	$2,000
6c	$4,000	$15,000	$6,000	$19,000	$5,000	$17,000
6d	$1,000	$1,000	$1,000	$2,000	$1,000	$2,000
7a	$2,150,000	$2,172,000	$2,634,000	$2,663,000	$2,349,000	$2,374,000
7b	$3,000	$5,000	$4,000	$6,000	$3,000	$5,000
8a	$1,000	$1,000	$1,000	$2,000	$1,000	$2,000
8b	$144,000	$153,000	$165,000	$176,000	$153,000	$162,000
8c	$1,000	$1,000	$1,000	$2,000	$1,000	$2,000
8d	$1,000	$1,000	$1,000	$2,000	$1,000	$2,000
8e	$1,000	$1,000	$1,000	$2,000	$1,000	$2,000
9	$1,000	$1,000	$1,000	$2,000	$1,000	$2,000
10	$1,000	$1,000	$1,000	$2,000	$1,000	$2,000
Subtotal CHD	**$2,311,000**	**$2,362,000**	**$2,825,000**	**$2,890,000**	**$2,523,000**	**$2,579,000**
Excluded from Proposed Critical Habitat						
EH1	$1,000	$2,000	$1,000	$2,000	$1,000	$2,000
EH2	$1,000	$2,000	$1,000	$2,000	$1,000	$2,000
EH3	$1,000	$2,000	$1,000	$2,000	$1,000	$2,000
EH4	$1,000	$2,000	$1,000	$2,000	$1,000	$2,000
EH5	$1,000	$2,000	$1,000	$2,000	$1,000	$2,000
EH6	$1,000	$2,000	$1,000	$2,000	$1,000	$2,000
EH7	$1,000	$2,000	$1,000	$2,000	$1,000	$2,000
EH8	$1,000	$2,000	$1,000	$2,000	$1,000	$2,000
EH9	$1,000	$2,000	$1,000	$2,000	$1,000	$2,000
EH10	$1,000	$2,000	$1,000	$2,000	$1,000	$2,000
EH11	$1,000	$2,000	$1,000	$2,000	$1,000	$2,000
EH12	$1,000	$2,000	$1,000	$2,000	$1,000	$2,000
EH13	$1,000	$2,000	$1,000	$2,000	$1,000	$2,000
EH14	$1,000	$2,000	$1,000	$2,000	$1,000	$2,000
EH20	$2,000	$3,000	$2,000	$3,000	$2,000	$3,000
EH21	$2,000	$3,000	$2,000	$3,000	$2,000	$3,000
EH22	$2,000	$3,000	$2,000	$3,000	$2,000	$3,000
EH23	$2,000	$3,000	$2,000	$3,000	$2,000	$3,000
EH24	$2,000	$3,000	$2,000	$3,000	$2,000	$3,000
Subtotal EH	**$24,000**	**$38,000**	**$25,000**	**$41,000**	**$25,000**	**$39,000**

Note:
(a) Includes administrative and project modification costs of section 7 consultations and administrative costs for the development of HCPs. The HCPs each cover multiple species. This analysis assumes that the effort involved in adding the brodiaea to these plans is similar to that of a formal section 7 consultation with the Service, including preparation of a biological assessment, attendance at meetings, and preparation of associated reports and paperwork. In addition, these HCP costs are distributed evenly over the units covered by the plans. Subunits without past consultation costs are not included in this table.

3.2 Future Costs

80. Under the Natural Community Conservation Planning (NCCP) program in southern California, brodiaea are categorized as narrow endemic plant species. As a result, conservation requirements for the plant are relatively stringent. Under the City of Carlsbad's HMP, narrow endemic species are defined as "[n]ative species with restricted geographic distributions, soil affinities and/or habitats, and for purposes of the HMP, species that in addition have important populations within the Plan area, such that substantial loss of these populations or their habitat within the HMP area might jeopardize the continued existence or recovery of that species."[46]

81. As a result, brodiaea conservation activities may impact development in areas that contain essential habitat in two ways: 1) lands otherwise available for development may be restricted from future development (a potential reduction in the supply of developable land); and 2) development may proceed subject to salvaging of impacted brodiaea. The degree to which land is restricted from development, and the corresponding percentage of land requiring brodiaea salvaging, is dependent on the distribution of brodiaea across the project area. Take, for example, a project that is subject to on-site conservation of 95 percent of brodiaea. If the plants are evenly distributed across a project area, 95 percent conservation of the population will equate to 95 percent of the land restricted from development. If, however, brodiaea are concentrated within the project area, 95 percent conservation of the population may occur on a small portion of the site, allowing for development on the majority of project land.

82. The implications of restricting land from development depend on several factors, such as the demand for land, the availability of substitute sites, and pre-existing development restrictions. Where empirical evidence is lacking, economists make assumptions about the characteristics of existing land and housing markets. This analysis builds on prior analyses of development impacts associated with species protection. Earlier efforts include analysis of critical habitat designation (CHD) for the vernal pool species, the arroyo toad, the Riverside fairy shrimp, a theoretical paper developed by Dr. John Quigley and Aaron Swoboda of the University of California-Berkeley, and empirical research to be published in a forthcoming issue of the *Journal of Regional Science* conducted by Dr. Jeffrey Zabel of Tufts University and Robert Paterson of Industrial Economics, Incorporated (IEc).[47]

83. The analysis employs two scenarios to estimate potential impacts of brodiaea conservation activities on real estate development within essential brodiaea habitat.

[46] Habitat Management Plan for Natural Communities in the City of Carlsbad, December 1999, page B-4.

[47] Charles River Associates (CRA), "Economic Impacts of Critical Habitat Designation for Vernal Pool Species," June 20, 2005; Economic and Planning Systems, Incorporated (EPS), "Final Report - Economic Analysis of Critical Habitat Designation for the Arroyo Toad," March 2005; EPS, "Final Report - Economic Analysis of Critical Habitat Designation for the Riverside Fairy Shrimp," March 25, 2005; Quigely, John M. and Aaron Swoboda, "The Economic Impacts of Critical Habitat Designation: A General Equilibrium Analysis," July 2004; and Zabel, Jeffrey E. and Robert W. Paterson, "The Effects of Critical Habitat Designation on Housing Supply: An Analysis of California Housing Construction Activity," *Journal of Regional Science (forthcoming)*, July 5, 2005.

These two scenarios differ based on assumptions regarding impacts to the regional housing market. Both scenarios estimate a decrease in existing land values. Consistent with the approach used in the vernal pool analysis, in the second scenario, the analysis also assumes that the regional housing market is affected and estimates resulting changes in consumer surplus.[48]

84. The first scenario assumes that within regional housing markets, substitute land exists for development that would otherwise occur within essential brodiaea habitat. In this scenario, projected development shifts to less preferred sites (e.g., areas that were previously farther out in time on the development horizon or that were not anticipated to be developed within the next twenty years). This assumption may be reasonable for this proposed designation, because the potentially affected acres represent a small percentage of the total developable land in the municipalities where they are located. Costs associated with brodiaea conservation activities, such as on-site conservation or salvaging requirements, are passed on from the developer to the existing landowner in the form of reduced prices paid for raw land. Accordingly, the cost of brodiaea conservation activities is estimated as the reduced value of lands projected for development over the twenty-year period of analysis. This impact is assumed to occur immediately in 2005.

85. The second scenario, by contrast, assumes that adequate substitute developable land is not available to offset restrictions on development within essential habitat areas. As a result, in addition to losses in land value to existing landowners, the regional housing market is affected and the supply of housing is reduced (i.e., fewer new homes are built). The total economic impact of reduced production of new housing stock is measured as a change in consumer surplus in the housing market.[49,50] This surplus loss is added to the reduction in land value for an estimate of total impacts under this scenario.

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[48] Administrative costs associated with section 7 consultations and the development of HCPs are also calculated. As described in Section 3.1, since the listing of brodiaea in 1998, the Service has conducted one formal and three informal development-related consultations that considered the species. In order to estimate future administrative costs, the analysis assumes that the average rate of informal consultations since 1998 (0.5 informal consultations per year) will continue in the future period of analysis. These consultations are spread evenly across all essential brodiaea habitat units. In addition, the analysis estimates the costs of future formal consultations based on pending HCPs that contain essential brodiaea habitat and spreads the costs evenly across units that are included in each respective HCP's jurisdictional area. These pending HCPs include subarea plans of the cities of Oceanside, Escondido, San Marcos, Vista, Encinitas, and Solano Beach under the subregional Multiple Habitat Conservation Plan in northwestern San Diego; the Southern Subregional NCCP/HCP in Orange County; and the North County Subarea of the MSCP. Total future administrative costs are less than two percent of land value losses and housing impacts and are not presented separately in this Section. These costs are included in the Exhibit ES-4 in the Executive Summary.

[49] One of the peer reviewers of this report stated that to justify analysis of changes in consumer surplus in Scenario Two, "a case must be made that consumers are not completely mobile" (i.e., a closed city model). He states, "[a] policy that reduces housing supply does not necessarily reduce consumer surplus if consumers can move elsewhere" (i.e., an open city model). Lacking empirical evidence as to whether essential habitat is located in areas more closely fitting an open or closed city model, this analysis presents estimates of both models in Scenario One and Scenario Two, respectively.

[50] Consumer surplus is the difference between the total value consumers receive from a particular good and the total amount they pay for that good. When the price of a good increases, consumer surplus declines (assuming no shift in demand), because a portion of the consumers exit the market, and the remaining consumers pay a higher price.

86. Whether impacts to the broader housing market occur or not, it is important to note that both scenarios are more likely to overstate than understate associated economic losses. Specifically, the loss in land value experienced by landowners will depend on how much of their parcels are inhabited by brodiaea, the extent to which development activities can be planned around sensitive areas, and the existence of alternative uses of the properties that do not threaten the plant or its habitat. However, absent specific information on the location of brodiaea, complete loss of value represents a conservative assumption. In addition, the manner in which market impacts are estimated under the second scenario, as in previous analyses, is partial equilibrium in nature. That is, potential substitution of housing displaced in one municipality by brodiaea conservation activities to other nearby municipalities is not considered. While consistent with the best currently available empirical evidence, this approach is more likely to overstate total housing market impacts.

3.2.1 Scenario One: Potential Land Value Losses Assuming An Adequate Supply of Substitute Land

87. In order to estimate potential impacts of brodiaea conservation activities on real estate development under Scenario One, the analysis employs a series of methodological tasks as described below:

- **Step One**: First, the analysis determines overlap (in acres) between essential brodiaea habitat and projected land development. This step has two parts: 1) first, public acres of essential habitat and acres of essential habitat located on private conservancy lands are removed from the development analysis under the assumption that these areas are not likely to be developed in the time period of analysis; and 2) the remaining private acres of essential habitat are analyzed to determine the location of developable land. The analysis identifies land use within each unit and isolates the private acreage of land that could be feasibly developed (i.e., non-developable areas such as bodies of water, urbanized areas, and designated open spaces are excluded). Geographically-based development projections are then used to estimate the acreage of future growth projected to occur on developable acreage within essential habitat over the twenty-year period of analysis.

- **Step Two**: The second step of the analysis is to identify restrictions associated with brodiaea conservation activities on lands identified in the first step as likely to be developed within twenty years. As stated, these restrictions are determined by the plant's designation as a narrow endemic species.

- **Step Three**: The final step of the analysis is to use the information estimated in Steps One and Two to calculate potential economic costs associated with brodiaea conservation activities on private developable land within each essential habitat unit. These potential costs are estimated as the sum of the loss in land value associated with development restrictions within essential brodiaea habitat and the cost of requirements to salvage allowable impacted brodiaea located on development project areas.

Step One: Estimate Projected Development Within Essential Brodiaea Habitat

88. An estimate of projected development within essential brodiaea habitat first requires an estimate of developable land within the habitat. The analysis assumes that developable land within essential brodiaea habitat exhibits two fundamental characteristics: 1) the land is currently under private ownership and is not located within a conservancy; and 2) the acres are not already developed (residential, commercial, or industrial) or undevelopable due to other features (e.g., under water, designated open space).

89. To isolate acres of essential brodiaea habitat that exhibit these characteristics, the analysis overlays spatial data locating essential brodiaea habitat units provided by the Service's Carlsbad Field Office, spatial data locating areas of public and private land ownership provided by the State of California, and spatial land use data provided by the San Diego Association of Governments (SANDAG) for San Diego County and the Southern California Association of Governments (SCAG) for Los Angeles, San Bernardino, Orange, and Riverside Counties. These land use data locate, among other uses, publicly and privately owned parcels of land, areas of existing developed land (residential, commercial, and industrial), designated open space (such as parks), and vacant land available for potential development. Exhibit 3-4 summarizes the units and portions of units removed from the analysis because they are either located in part or full on publicly owned lands, or because they are located within private conservancies.

Exhibit 3-4

ACREAGES OF PUBLIC LAND REMOVED FROM THE DEVELOPMENT ANALYSIS

Unit Number	Acres Removed	Ownership
1a	All	Glendora Community Conservancy
1b	20	Angeles National Forest
3	All	Aliso-Wood Canyon Regional Park
4b	248	Casper's Regional Park and Private Conservancy Land
5a	1,037	Cleveland National Forest
5b	249	
EH3	All	Department of Defense
EH4	All	San Jacinto Wildlife Reserve
EH7	52	Bureau of Land Management
EH9	All	Santa Rosa Plateau Ecological Reserve
EH10	All	
EH11	All	
EH13	376	
EH15-EH19	917	Marine Corps Base Camp Pendleton
EH21	45	Carlsbad Highlands Ecological Reserve

90. To estimate the proportion of developable land that is likely to be developed within each essential brodiaea habitat unit over the next twenty years, the analysis relies on development projections at the census tract level provided by SANDAG and SCAG.

To translate census tract-level development projections into projections within essential habitat, the analysis uses Geographic Information Systems (GIS) to identify census tracts that intersect each unit. The analysis demonstrated that not all essential habitat units are entirely contained within an individual census tract. For essential habitat units that overlap more than one census tract, the percentage of overlap is calculated. Then, under the assumption that projected development is evenly distributed throughout all land available for development within each census tract, the amount of growth projected within each essential habitat unit is estimated by applying the percentage overlap between the unit and census tracts to projected development within those tracts. Exhibit 3-5 summarizes the estimates of projected development (in acres) within each essential brodiaea habitat unit.

Exhibit 3-5

PROJECTED ACRES OF DEVELOPMENT WITHIN ESSENTIAL BRODIAEA HABITAT UNITS (2005-2024)

County	Unit[a]	Total Unit Acreage	Acres of Developable Land on Private Land in Unit[b]	Projected Acres of Development on Private Land in Unit (2005-2024)[c]	% of Developable Private Land Projected for Development (2005-2024)
Proposed for Inclusion					
Los Angeles	1b	198	197	3.37	1.71%
San Bernardino	2	89	89	55.26	62.09%
Orange	4a	74	71	71.00	100.00%
	4b	259	11	0.42	0.16%
	4c	311	187	7.69	4.11%
	4d	119	118	46.23	39.18%
	4e	96	96	28.36	29.54%
	4f	190	190	6.07	3.19%
	4g	588	536	17.12	3.19%
	4h	72	72	2.30	3.19%
	4i	151	151	4.82	3.19%
San Diego	5a	1255	65	22.49	34.60%
	5b	264	29	3.97	13.68%
	6a	49	0	0.78	0.00%
	6b	5	0	0.00	0.00%
	6c	64	41	11.74	28.64%
	6d	80	29	10.75	37.06%
	7a	93	4	1.54	38.41%
	7b	32	7	2.58	36.87%
	8a	86	49	18.70	38.16%
	8b	82	35	9.67	27.64%
	8c	10	3	1.22	40.53%
	8d	117	46	18.64	40.53%
	8e	20	12	4.86	40.53%
	9	57	19	11.30	59.47%
	10	74	71	29.28	41.25%
Subtotal CHD		**4435**	**2375**	**390**	
Excluded from Proposed Critical Habitat					
San Diego	EH20	84	5	3.46	69.11%
	EH21	71	1	0.00	0.00%
	EH22	113	18	5.34	29.67%
	EH23	54	13	5.15	39.58%
	EH24	208	111	40.93	36.87%
Riverside	EH1	64	52	17.06	32.81%
	EH2	74	0	0.00	0.00%
	EH5	168	103	92.99	90.28%
	EH6	373	98	32.21	32.87%
	EH7	432	422	209.04	49.54%
	EH8	131	129	26.96	20.90%
	EH12	217	193	31.75	16.45%
	EH13	519	145	20.40	14.07%
	EH14	77	77	12.67	16.45%
Subtotal EH		**2585**	**1367**	**498**	

Notes:
(a) Units under public ownership or contained within private conservancies are not included in the development analysis.
(b) Estimated using GIS data provided by SANDAG and SCAG. Acres of developable land within San Diego County represent the sum of vacant and existing agricultural land available for development as determined by SANDAG. For the remaining counties (Los Angeles, Orange, San Bernardino, and Riverside), the analysis estimates areas of developable land from estimates of vacant land provided by SCAG.
(c) Estimated using development projects provided by SANDAG and SCAG.

Step Two: Determine Off-Setting Compensation for Impacts to Brodiaea

91. In order to determine how development activities on private land may be affected by critical habitat designation for brodiaea, the analysis relies on mitigation requirements contained within subregional and subarea plans that together serve as multiple species Habitat Conservation Plans (HCPs) under Section 10(a)(1)(B) of the Endangered Species Act (ESA) and are prepared pursuant to the Natural Community Conservation Planning Act in California.[51]

92. The NCCP program is run by the California Department of Fish and Game and represents "… an unprecedented effort by the State of California, and numerous private and public partners, that takes a broad-based ecosystem approach to planning for the protection and perpetuation of biological diversity. An NCCP identifies and provides for the regional or areawide protection of plants, animals, and their habitats, while allowing compatible and appropriate economic activity."[52] Under the NCCP program, applicants develop NCCPs and HCPs that provide approved development and other activities with coverage for incidental take of endangered and threatened species pursuant to implementation of pre-determined mitigation requirements for impacted species and/or habitat.

93. Essential brodiaea habitat as identified in the proposed rule falls within the boundaries of a number of NCCP HCPs and related subarea plans in Southern California. Essential brodiaea habitat excluded from proposed critical habitat in the proposed rule is located in areas covered by the approved Western Riverside Multiple Species HCP, the approved Villages of La Costa HCP, and the City of Carlsbad HCP. In the proposed rule, the Service notes that a number of additional HCPs are under way in Southern California and may provide conservation benefits to brodiaea when approved. While lands potentially covered by these plans are proposed for inclusion in the final rule, the Service notes that "…management plans and/or habitat conservation plans that provide for conservation to the species in areas being proposed as critical habitat submitted to and approved by the Service prior to the end of the public comment period for this proposed rule will be evaluated for exclusion from the final designation." HCPs identified by the Service that are underway (and contain proposed critical habitat areas for brodiaea) include:

- Subarea plans of the cities of Oceanside, Escondido, San Marcos, Vista, Encinitas, and Solana Beach under the subregional Multiple Habitat Conservation Plan (MHCP) in northwestern San Diego County. The City of Carlsbad has already completed its subarea plan under the subregional MHCP.

- The Southern Subregional NCCP/HCP in Orange County covering approximately 128,000 acres in the cities of Rancho Santa Margarita, Mission Viejo, San Juan

[51] All subarea plans must provide mitigation measures for covered species that are at least as stringent as the mitigation measures included within the subregional plan to which they belong.

[52] California Department of Fish and Game, accessed at http://www.dfg.ca.gov/nccp/index.html on June 28, 2005.

Capistrano, San Clemente, and Rancho Mission Viejo. The Service notes that the preliminary plan document "…conveys the importance of conservation of at least 75 percent of all known *B. filifolia* occurrences."[53]

- The North County Subarea of the MSCP covering approximately 14,045 acres within unincorporated areas of San Diego County. This area includes only one known occurrence of brodiaea, which has been proposed as critical habitat.

94. In order to estimate potential impacts to development activities on private lands that are covered by existing or pending NCCP/HCPs, the analysis conservatively assumes that the highest level of conservation for brodiaea provided across the approved plans listed above are required for development impacts within all essential brodiaea habitat. Exhibit 3-6 summarizes conservation requirements contained within these plans. The highest level of conservation is contained within the City of Carlsbad HCP.[54] The analysis applies the City's conservation and mitigation requirements to all essential brodiaea habitat units. In other words, the analysis assumes that all populations are "critical" and require 95 percent conservation with salvaging and transplantation of the impacted remaining five percent of plants.

[53] 69 CFR 71298.

[54] The analysis assumes that land forecast for development is not part of a brodiaea preserve. As a result, the requirement in the City of Carlsbad HCP to conserve 100 percent of brodiaea within preserves is not applied.

Exhibit 3-6

BRODIAEA CONSERVATION REQUIREMENTS IN APPROVED/PENDING NCCP JURISDICTIONS THAT CONTAIN ESSENTIAL HABITAT

NCCP HCP	NCCP Level	Brodiaea Status	Brodiaea Conservation Requirements	Units Covered	Source
Western Riverside MSHCP	Subregional	Forest-Sensitive Species, Additional Survey Needs and Procedures Species	For locations with positive survey results, 90 percent of those portions of the property that provide for long-term conservation value for the identified species will be avoided until it is demonstrated that species-specific conservation objectives for the particular species are met. Findings of equivalency shall be made demonstrating that the 90 percent standard has been met. If it is determined that the 90 percent threshold cannot be met, the Permittee(s) must make a determination of biologically equivalent or superior preservation.	EH1 - EH14	Western Riverside County Multiple Species HCP, June 17, 2003.
Multiple Habitat Conservation Plan (MHCP), North San Diego County	Subregional	Narrow Endemic Species	Within hard-line reserve area, brodiaea populations must be 100 percent conserved; within soft-line preserve areas, brodiaea must be 95 percent conserved; outside of the reserve area, brodiaea must be 80 percent conserved. Soft-line reserve boundaries have not been pre-determined.	EH 20 -EH 24	Personal communication with Janet Fairbanks, San Diego County, on June 3, 2005.
City of Carlsbad HMP	Subarea under MHCP	Narrow Endemic Species	In areas that contain "critical" brodiaea populations, developers can impact five percent of the brodiaea population. In areas that do not contain "critical" populations of brodiaea, developers can impact 20 percent of the brodiaea population. In both cases, impacted brodiaea must be salvaged and transplanted. Narrow Endemic Species must be 100 percent conserved inside preserve areas and 80 percent preserved outside of conserve areas.	EH 20 - EH 23	(1) Personal communication with Dan Rideout, City of Carlsbad, on June 2, 2005. (2) Habitat Management Plan for Natural Communities in the City of Carlsbad, December 1999.
Villages of La Costa HCP	Subarea under MHCP	Narrow Endemic Species	83 percent conservation of the entire brodiaea population on the project site.	EH 24	Fieldstone/La Costa Associates HCP, June 1995

95. As stated, the analysis proceeds under the assumption that 95 percent of brodiaea populations will require conservation with the remaining five percent requiring salvage and a variety of maintenance and monitoring activities. The acreage occupied by brodiaea populations within each essential habitat unit determines the total acreage subject to land set-asides and/or mitigation requirements; however, data locating brodiaea within each unit are unavailable. For this reason, the analysis also makes the conservative assumption that brodiaea are evenly distributed across all essential habitat units. Therefore, for example, if an essential brodiaea habitat unit is ten acres and brodiaea are distributed evenly, 9.5 of these acres will be restricted from development.

The remaining five percent will be developed, but will require the developer to salvage and transplant the plants found in the 0.5 acre area.[55]

Step Three: Calculate Potential Land Value Losses

96. In order to estimate economic costs of brodiaea conservation on private development activities, the analysis applies the costs of the development restrictions and mitigation determined in Step Two to the acres of projected development within essential brodiaea habitat units determined in Step One. Costs consist of two parts: 1) the loss in land value associated with acres projected for development over the twenty-year period of analysis that, under brodiaea conservation requirements, cannot be developed (i.e., 95 percent of the projected development in essential habitat); and 2) the costs of mitigation to salvage and transplant brodiaea from the remaining five percent of the land.

97. In order to estimate the loss in land value associated with development restrictions, the analysis relies on estimates of the market value of raw land within parcels that are either contained by or intersect essential brodiaea habitat. Spatial analysis determined which parcels intersect the habitat, and associated raw land values for these parcels were collected from local assessors. Data from San Diego County contain sufficient information on recent transactions for relevant parcels to develop a per-acre average market value for raw land. To account for variation across counties, the analysis applies ratios estimated from a previous critical habitat economic analysis.[56] The resultant average per-acre estimates range from approximately $18,000 in San Bernardino County to $35,000 in San Diego County.[57] Exhibit 3-7 presents the per-acre raw land values for each county used in the analysis. The per-acre raw land value is multiplied by the acres lost to development. The result represents the value of land within essential habitat that would have been developed in the next 20 years, but for brodiaea. It likely overstates costs, as the entire value of the land may not be lost; alternative uses for the parcel that are compatible with the brodiaea may exist.[58]

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[55] The analysis notes that data obtained from two locations on brodiaea distribution within essential habitat units demonstrate a large range of potential impacts. At the low-end of potential impacts in terms of occupied acreage, data from Rancho Mission Viejo (RMV) (units 4c, 4g, 4h, and 4i) indicate that although brodiaea occur within each unit, only 0.6 percent (or 6.4 acres out of a total of 1,038 acres proposed on RMV) are actually occupied by the species. At the high-end of potential impacts, data from HG Fenton and Company, developers of the Fox-Miller site (unit 7a), indicate that the presence of brodiaea on the Fox-Miller project area led to permissible impacts to brodiaea on only five percent of the entire 53-acre property. (Data on Rancho Mission Viejo from personal communication with Laura Coley Eisenberg, Director, Planning and Entitlement, Rancho Mission Viejo, on June 30, 2005. Data on Fox-Miller property from personal communication with Alan Jones, HG Fenton and Company, on June 2, 2005.)

[56] Economic and Planning Systems, "Final Report: Economic Analysis of Critical Habitat Designation for the Arroyo Toad," March 2005.

[57] It is important to note that these values represent the estimated market value of raw land within brodiaea habitat that is projected to be developed within the next 20 years (and is not simply an estimate of the average price of an acre of land in these counties).

[58] One peer reviewer agreed with this comment and noted that if, for example, agricultural use is compatible with essential brodiaea habitat, then the difference between the values of farmland and developed land would be the appropriate measure of the cost of protecting brodiaea. However, agriculture is identified as a significant threat to this species, therefore it is unlikely to be an alternative use of habitat for this rulemaking.

Exhibit 3-7

PER-ACRE RAW LAND VALUES IN COUNTIES THAT CONTAIN ESSENTIAL BRODIAEA HABITAT

County	Per-Acre Values ($2005)
San Diego	$34,798
Orange	$22,765
Los Angeles	$30,779
Riverside	$18,013
San Bernardino	$17,958

98. In order to estimate costs of salvaging the plant, the analysis relies on data provided by RECON Environmental, Inc. According to a staff member at RECON with experience in relocating brodiaea, salvaging bulbs from an area, growing replacement plants on-site from collected seed, and five years of maintenance and monitoring cost approximately $100,000 an acre.[59] The analysis adopts these practices as representative of the costs that will be incurred by developers who must salvage five percent of brodiaea within their project area.

99. Exhibit 3-8 presents the results of the analysis. Assuming substitute land is available to developers, existing landowners bear the full burden of the cost of brodiaea restrictions and mitigation in the form of lower land values. This reduction in land value occurs immediately at the time of completion of a habitat conservation plan or designation of critical habitat, therefore, this analysis assumes the loss occurs in 2005. Accordingly, the total land value loss and associated mitigation costs in areas proposed for designation are estimated to be $11.8 million.

[59] Personal communication with Robert MacAller, RECON Environmental, Inc. on June 24, 2005.

Exhibit 3-8

LAND VALUE LOSSES IN ESSENTIAL BRODIAEA HABITAT
(Undiscounted Dollar & Present Value Losses)

County	Unit [1]	Projected Acres of Development In Unit (2005-2024)	Acres Conserved for Brodiaea (assuming 95% not developed)	Loss of Land Value on Projected Acres of Conservation in Unit in Tract [2]	Acres Developed w/Mitigation Requirement	Mitigation Costs [3]	Total Loss to Current Landowners
Proposed for Inclusion							
Los Angeles	1b	3.37	3.20	$99,000	0.17	$17,000	$115,000
San Bernardino	2	55.26	52.50	$943,000	2.76	$276,000	$1,219,000
Orange	4a	71.00	67.45	$1,536,000	3.55	$355,000	$1,891,000
	4b	0.42	0.40	$9,000	0.02	$2,000	$11,000
	4c	7.69	7.30	$166,000	0.38	$38,000	$205,000
	4d	46.23	43.92	$1,000,000	2.31	$231,000	$1,231,000
	4e	28.36	26.94	$613,000	1.42	$142,000	$755,000
	4f	6.07	5.77	$131,000	0.30	$30,000	$162,000
	4g	17.12	16.27	$370,000	0.86	$86,000	$456,000
	4h	2.30	2.19	$50,000	0.12	$12,000	$61,000
	4i	4.82	4.58	$104,000	0.24	$24,000	$128,000
San Diego	5a	22.49	21.36	$743,000	1.12	$112,000	$856,000
	5b	3.97	3.77	$131,000	0.20	$20,000	$151,000
	6a	0.78	0.74	$26,000	0.04	$4,000	$30,000
	6b	0.00	0.00	$0	0.00	$0	$0
	6c	11.74	11.16	$388,000	0.59	$59,000	$447,000
	6d	10.75	10.21	$355,000	0.54	$54,000	$409,000
	7a	1.54	1.46	$51,000	0.08	$8,000	$58,000
	7b	2.58	2.45	$85,000	0.13	$13,000	$98,000
	8a	18.70	17.76	$618,000	0.93	$93,000	$712,000
	8b	9.67	9.19	$320,000	0.48	$48,000	$368,000
	8c	1.22	1.16	$40,000	0.06	$6,000	$46,000
	8d	18.64	17.71	$616,000	0.93	$93,000	$710,000
	8e	4.86	4.62	$161,000	0.24	$24,000	$185,000
	9	11.30	10.73	$374,000	0.56	$56,000	$430,000
	10	29.28	27.82	$968,000	1.46	$146,000	$1,115,000
Subtotal CHD		**390.18**	**370.67**	**$9,898,000**	**19.51**	**$1,951,000**	**$11,849,000**
Excluded from Proposed Critical Habitat							
San Diego	EH20	3.46	3.28	$114,000	0.17	$17,000	$132,000
	EH21	0.00	0.00	$0	0.00	$0	$0
	EH22	5.34	5.07	$177,000	0.27	$27,000	$203,000
	EH23	5.15	4.89	$170,000	0.26	$26,000	$196,000
	EH24	40.93	38.88	$1,353,000	2.05	$205,000	$1,558,000
Riverside	EH1	17.06	16.21	$292,000	0.85	$85,000	$377,000
	EH2	0.00	0.00	$0	0.00	$0	$0
	EH5	92.99	88.34	$1,591,000	4.65	$465,000	$2,056,000
	EH6	32.21	30.60	$551,000	1.61	$161,000	$712,000
	EH7	209.04	198.59	$3,577,000	10.45	$1,045,000	$4,622,000
	EH8	26.96	25.61	$461,000	1.35	$135,000	$596,000
	EH12	31.75	30.17	$543,000	1.59	$159,000	$702,000
	EH13	20.40	19.38	$349,000	1.02	$102,000	$451,000
	EH14	12.67	12.03	$217,000	0.63	$63,000	$280,000
Subtotal EH		**497.95**	**473.06**	**$9,396,000**	**24.90**	**$2,490,000**	**$11,886,000**

Notes:
[1] Units that are completely contained within public and/or conservancy lands are excluded from the analysis.
[2] Per-acre land values used for each county are summarized in Exhibit 3-7.
[3] The analysis assumes mitigation costs are equal to $100,000 per acre as discussed in paragraph 98.

3.2.2 Scenario Two: Potential Impacts Assuming Adequate Substitute Land is Not Available

100. Depending upon the relative size of designated units and prevailing housing market conditions, economic impacts associated with brodiaea conservation activities may not be confined to those lands designated as critical habitat. For example, Quigley and Swoboda (2004) utilize a general equilibrium urban housing model to simulate resultant changes in the housing market and social welfare for designations that are sufficiently "large."[60]

101. In this section, the analysis estimates potential welfare losses associated with a reduction in housing supply attributable to brodiaea conservation activities in designated critical habitat. To do so, the analysis adapts results from Zabel and Paterson (*Journal of Regional Science,* forthcoming), provided in Appendix D.[61] This empirical analysis follows from an established model of housing supply, comparing development activity across approximately 400 California municipalities with and without critical habitat designations over a 13-year period. The results of Zabel and Paterson's analysis indicate a statistically significant difference in the number of single-family home permits issued in areas with critical habitat compared to those without. The analysis uses this information to estimate the reduction in the number of new housing units for each year 2005 to 2024 attributable to brodiaea habitat designation. Note that this analysis is partial equilibrium in nature (e.g., does not consider substitution of displaced development to other nearby areas), which is consistent the best currently available empirical information. It provides a reasonable and conservative (i.e., more likely to overstate than understate), approximation of total welfare losses.

102. Following Zabel and Paterson, the analysis estimates impacts at the Federal Information Processing Standard (FIPS) "place" level, a proxy for a single housing market. FIPS places generally follow the legal boundaries of incorporated cities. To provide additional information, the analysis allocates place or market-level impacts to the constituent units of brodiaea habitat within or adjacent to each FIPS place.

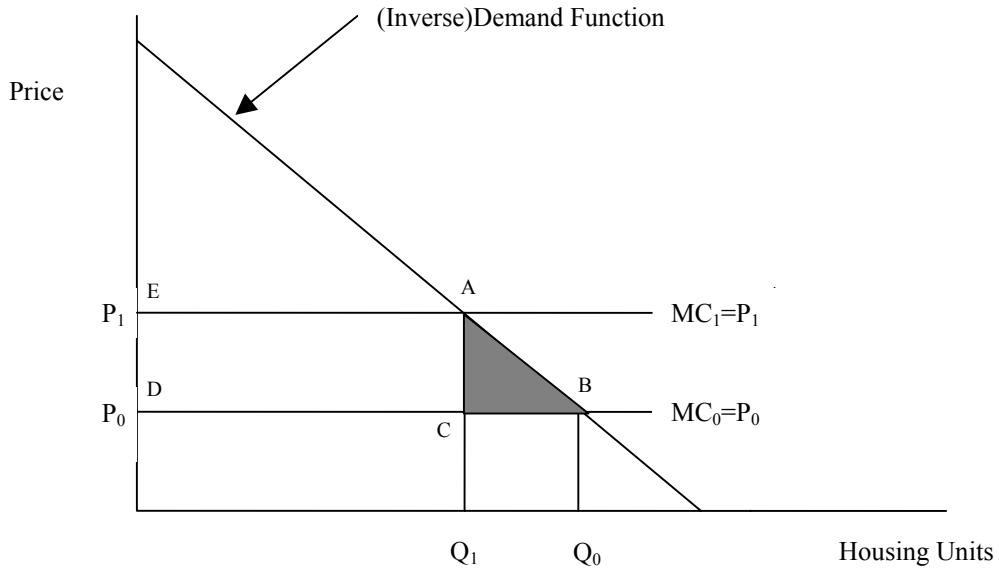
103. Measurement of welfare loss in the housing market associated with a change in housing supply is depicted in Exhibit 3-9. The figure represents the market for all housing (e.g., existing and new homes) in a given FIPS place. The analysis assumes that the supply of housing is flat (marginal cost (MC) of housing is constant) and designation of habitat shifts supply from $MC_0=P_0$ to $MC_1=P_1$ (P stands for price of a unit of

[60] Quigley, John M. and Aaron Swoboda, "The Economic Impacts of Critical Habitat Designation: A General Equilibrium Analysis," July 2004.

[61] Zabel, Jeffrey E. and Robert W. Paterson, "The Effects of Critical Habitat Designation on Housing Supply: An Analysis of California Housing Construction Activity," *Journal of Regional Science (forthcoming)*, July 5, 2005.

housing).[62] Zabel and Paterson's results estimate the change $Q_0 \rightarrow Q_1$ associated with critical habitat designation. To motivate measurement of welfare loss, this analysis interprets the observed change in housing quantity to imply a shift in supply, because development in areas with critical habitat will be more costly. An alternative interpretation would view critical habitat designation as imposing a supply constraint at Q_1. In either case, the resultant loss in social welfare is the shaded area of triangle ABC. The area ACDE represents scarcity rent and is a transfer of income from consumers to producers (and owners) of housing.

Exhibit 3-9
Loss of Surplus due to CHD



104. The analysis follows the procedures below to parameterize the model:

- **Step One:** Identify the baseline quantity (Q_0) and price (P_0) of housing in each of the 15 markets included in this analysis.

[62] This assumption is reasonable if quantity (Q) is viewed as units of housing structure. One peer reviewer noted that existing estimates of housing supply elasticity could be used to consider the case of upward-sloping supply. The analysis is restricted to the constant marginal cost case for purposes of simplification. Moreover, empirical estimates suggest that housing supply is quite elastic (e.g., see Green, R.K., S. Malpezzi, and S. Mayo, "Metropolitan-Specific Estimates of the Price Elasticity of Supply of Housing, and their Sources," Working Paper, Session on Regulation and High Cost of Housing, December, 2004; and Green, R.K., and S. Malpezzi, "A Primer on U.S. Housing Markets and Housing Policy," AREUEA Monograph Series No. 3, The Urban Institute Press, 2003).

- **Step Two:** Estimate the change in the quantity of housing (Q_1) that results from the designation of critical habitat using the empirical evidence in Zabel and Paterson's paper.

- **Step Three:** Assuming a given elasticity of demand for housing, estimate the new price of housing (P_1) resulting from a shift in the quantity of housing supplied.

- **Step Four:** Calculate the loss in consumer surplus (the area of triangle ABC). The surplus loss is added to the land value losses calculated in Scenario One (see Section 3.2.1) to estimate the total social welfare losses.

Step One: Estimate Initial Conditions

105. Brodiaea habitat occurs in 13 different FIPS places. To establish P_0 and Q_0 in each of these markets, the analysis utilizes the SANDAG and SCAG data described in Step One of Section 3.2.1. Specifically, the analysis calculates the annual rate of growth in single-family housing units for the each FIPS place and uses this to forecast total units for each year 2005 to 2024 (Q_0). To estimate P_0 in a given year, the analysis utilizes the 2000 Census median home value and applies a forecast based on the Office of Federal Housing Enterprise Oversight Home Price Index (HPI) for 1990 to 2004.[63] The analysis utilizes the HPI for either the Los Angeles or San Diego MSA, depending on which area the FIPS place is closer to.

Step Two: Calculation of Housing Supply Change ($Q_0 \rightarrow Q_1$)

106. Zabel and Paterson consider both the presence of designated critical habitat and the relative size of the designation in a FIPS place. Their results suggest that the presence of critical habitat results in a consistent reduction in the number of housing permits issued annually (approximately 20 percent). This effect increases slightly with increases in the size of the designation (approximately 0.6 percent for each additional percent of FIPS place area that is designated). The authors interpret this as evidence of a "signaling" effect, where designation acts as a sign that all development within a market may now be more costly. In keeping with their results, the analysis assumes a 20-percent annual reduction in housing permits/starts each year following habitat designation and assumes that this effect remains in place for the full period of the analysis (through 2024).[64] This assumption is consistent with evidence presented by the authors suggesting

[63] These census data represent owner-reported estimates of the unit's market value. Actual transactions are preferable to these reported values; however, we do not believe this introduces significant bias to the analysis. For example, comparisons of owner-reported to appraised or sale values indicate that owners both over and understate value. On average, owners tend to overstate value, though typically by only about five percent (see Kiel, Katherine A. and Jeffrey E. Zabel, "The Accuracy of Owner-Provided House Values: The 1978-1991 American Housing Survey," *Real Estate Economics,* 27(2), 263-98 (1999). (HPI data obtained at http://www.ofheo.gov/HPI.asp, as viewed on 6 July, 2005)

[64] Note that this applies to new housing only; it does not imply a 20-percent reduction in total housing units.

that such an impact persists for several years following designation.[65] The analysis further assumes that the marginal impact of designation acreage applies for five years (through 2010) and attenuates over this period, reflecting incorporation of and adjustment to this information in the housing market. Note that the impact of this assumption on overall results is minor, both because of the small relative impact of unit acreage on housing supply and because of the rapid attenuation of this effect predicted by Zabel and Paterson's model.[66] Exhibit 3-10 provides a summary of the total predicted number of housing units that would be built with, and in the absence of, brodiaea conservation activities over the 20-year period for each FIPS place.

Exhibit 3-10

TOTAL PREDICTED HOUSING UNITS WITH AND WITHOUT BRODIAEA CONSERVATION ACTIVITIES OVER 20-YEAR STUDY PERIOD

FIPS Place	Number of Units Predicted in the Absence of Brodiaea Conservation Activities	Number of Units Predicted With Brodiaea Conservation Activities
Carlsbad	483,554	483,057
Encinitas	338,793	338,641
Glendora	287,266	286,866
Moreno Valley	977,222	972,945
Oceanside	765,567	765,072
Perris	280,545	278,569
San Bernardino	841,249	839,919
San Clemente	312,414	311,575
San Dimas	293,019	291,517
San Juan Capistrano	172,684	172,437
San Marcos	213,154	212,925
Coto de Caza	96,519	96,348
Hemet	729,192	722,241

[65] Note that Zabel and Paterson's model incorporates the likely delay between permit issuance and construction. Critical habitat designation in 2005 is assumed to affect the housing stock in 2006 (and subsequent years).

[66] As in Scenario One, publicly owned lands (e.g., Cleveland National Forest) are excluded from this analysis.

Step Three: Calculation of Market Price Change ($P_0 \rightarrow P_1$)

107. The analysis uses an estimate of the price elasticity of housing demand to calculate the change in price implied by the reduction in housing units described in the previous step. The estimate of price elasticity, -1, is a reasonable approximation derived from literature on housing demand.[67] Exhibit 3-11 shows that the price of a single-family home is estimated to increase by 0.1 percent to 1.7 percent in the first year following designation. Note that because of the unitary elasticity estimate, these are equivalent to the predicted percentage change in total housing units in the market (e.g., including new and existing housing) in that year.

Exhibit 3-11

PREDICTED CHANGE IN PRICE OF A SINGLE-FAMILY HOME FOR FIRST YEAR FOLLOWING DESIGNATION

FIPS Place	Implied Percent Change in Price of a Single-family Home
Carlsbad	0.1%
Encinitas	0.1%
Glendora	0.2%
Moreno Valley	0.5%
Oceanside	0.1%
Perris	1.1%
San Bernardino	0.2%
San Clemente	0.3%
San Dimas	0.7%
San Juan Capistrano	0.2%
San Marcos	0.1%
Coto de Caza	0.2%
Hemet	1.7%

Step Four: Calculation of Welfare Loss

108. The steps above identify the vertices of triangle ABC and allow for calculation of the area: $[.5*(Q_1-Q_0)*(P_1-P_0)]$. The analysis calculates welfare losses for each year from 2005 to 2024 and presents these in total undiscounted dollars, total present value at a seven percent rate of discount, and total present value at a three percent rate of discount. Finally, the analysis allocates these market-level impacts to the various constituent units of brodiaea habitat. The majority of units are contained in one of the 13 FIPS places. The analysis associates the remaining units with the closest FIPS place. The market level impact is apportioned based on the extent of projected developed acreage in each unit.

[67] e.g., refer to Zabel, Jeffrey E., "The Demand for Housing Services," *Housing Economics*, 13, 16-35 (2004); Dennis, Glennon, "Estimating the Income, Price and Interest Elasticities of Housing Demand," *Journal of Urban Economics,* 25, 219-29 (1989); Harmon, Oskar R. and Michael J. Potepan, "Housing Adjustment Costs: Their Impact on Mobility and Housing Demand Elasticities," *AREUEA Journal,* 16(4), 459-78 (1988); Hanushek, Eric A. and John M. Quigley, "What is the Price Elasticity of Housing Demand," *The Review of Economics and Statistics,* 62(3), 449-54 (1980).

109. Consumer surplus losses are presented in Exhibit 3-12. In undiscounted dollars, total surplus losses are estimated to be approximately $18 million. The present value of these losses is approximately $13 million assuming a discount rate of three percent, and $10 million assuming a discount rate of seven percent. These losses are added to the land value losses calculated in Scenario One and are reported in Exhibit 3-1 at the beginning of this Section.

Exhibit 3-12

TOTAL ESTIMATED WELFARE LOSSES ASSOCIATED WITH A CHANGE IN HOUSING SUPPLY

FIPS Place	Unit Overlap (Unit #)	Welfare Loss (Undiscounted Dollars)	Present Value Welfare Loss (3%)	Present Value Welfare Loss (7%)
Carlsbad	EH20	$10,000	$8,000	$5,000
	EH21	$0	$0	$0
	EH22	$16,000	$12,000	$8,000
	EH23	$15,000	$11,000	$8,000
	EH24	$121,000	$89,000	$62,000
	7a	$5,000	$3,000	$2,000
	7b	$8,000	$6,000	$4,000
	8a	$61,000	$45,000	$32,000
Encinitas	9	$34,000	$25,000	$17,000
Glendora	1b	$139,000	$104,000	$74,000
Moreno Valley	EH1	$2,476,000	$1,870,000	$1,352,000
Oceanside	6a	$1,000	$1,000	$1,000
	6b	$0	$0	$0
	6c	$18,000	$13,000	$9,000
	6d	$17,000	$12,000	$9,000
	EH13	$32,000	$23,000	$16,000
	EH14	$20,000	$15,000	$10,000
Perris	EH6	$173,000	$131,000	$95,000
	EH7	$1,122,000	$849,000	$617,000
	EH5	$499,000	$378,000	$274,000
San Bernardino	2	$230,000	$172,000	$122,000
San Clemente	4e	$285,000	$211,000	$148,000
	4f	$61,000	$45,000	$32,000
	4g	$172,000	$127,000	$90,000
	4h	$23,000	$17,000	$12,000
	4i	$48,000	$36,000	$25,000
	5a	$226,000	$167,000	$118,000
	5b	$40,000	$29,000	$21,000
	EH12	$319,000	$236,000	$166,000
San Dimas	EH2	$0	$0	$0
	1b	$1,996,000	$1,513,000	$1,099,000
San Juan Capistrano	4d	$60,000	$44,000	$31,000
	4a	$108,000	$79,000	$55,000
San Marcos	8a	$18,000	$13,000	$9,000
	8b	$8,000	$6,000	$4,000
	8c	$1,000	$1,000	$1,000
	8d	$16,000	$12,000	$8,000
	8e	$4,000	$3,000	$2,000
	10	$25,000	$18,000	$13,000
Coto de Caza	4b	$9,000	$7,000	$5,000
	4c	$163,000	$122,000	$87,000
Hemet	EH8	$8,932,000	$6,817,000	$5,001,000

POTENTIAL ECONOMIC IMPACTS TO MILITARY ACTIVITIES SECTION 4

110. This section considers how brodiaea conservation may impact military activities at Marine Corps Base Camp Pendleton (Camp Pendleton) in San Diego County. The section first provides background information on natural resources and natural resource management at Camp Pendleton. Next, the analysis estimates past costs of brodiaea conservation activities undertaken by Camp Pendleton as part of its section 7 consultation requirements. Finally, the analysis forecasts potential future costs at the base associated with brodiaea conservation. The brodiaea habitat within Camp Pendleton is currently excluded from proposed critical habitat. *Note that this analysis does not attempt to quantify the impact to military readiness that may result from brodiaea conservation activities.*

4.1 Background

111. Camp Pendleton is located on 125,000 acres in the northwest corner of San Diego County and is surrounded primarily by urban development, rural residential development, and agriculture. The majority of Camp Pendleton (115,000 acres) is undeveloped and used for training; the remaining 10,000 acres include 5,000 buildings and structures, 500 miles of road, and 1,000 miles of utility lines across the base. In addition to operating military training activities and managing developed areas, Camp Pendleton also provides and manages a number of recreational activities within undeveloped areas. Finally, roughly 28,500 acres of the base exist under agricultural lease agreements for row crops and grazing, San Onofre State Park, public utilities, and transportation corridors.[68]

112. Camp Pendleton supports a wide variety of military training activities that "…range from relatively small, isolated activities involving a few personnel to large, integrated operations of several thousand personnel engaging in multiple actions simultaneously."[69] Infrastructure for training activities includes "…31 training areas, impact areas for receipt of dud- and non-dud producing ordnance, more than 100 live-fire facilities, 4 amphibious assault landing beaches, and Special Use Airspace. In addition, Camp Pendleton supports ground based training exercises with two Combat Training

[68] Marine Corps Base Camp Pendleton, Integrated Natural Resources Management Plan, October 2001.
[69] Ibid, page ES-3.

Towns, one Military Operations in Urban Terrain facility, 19 obstacle courses, a Crucible course, rappel towers, aircraft mock-ups, two heavy equipment training sites, etc."[70]

113. Camp Pendleton currently operates under an Integrated Natural Resource Management Plan (INRMP) that provides guidelines for natural resource management, including endangered or threatened species management, from 2002 to 2007 on the base. Eighteen federally listed threatened or endangered species are located on the base; two are plants (spreading navarretia and San Diego button celery), while the remaining 16 are wildlife. While brodiaea-specific mitigation measures are not included in the INRMP, general management provision for federally-listed species are provided and include avoidance and/or minimization and awareness efforts, surveys and monitoring, compensation and mitigation, and research. In addition, the INRMP notes the development of a Listed Upland Species Management Program by Camp Pendleton that will address management provisions for brodiaea populations. Camp Pendleton is currently consulting with the Service on this plan; however, the Biological Opinion has not been completed.[71]

4.2 Costs

4.2.1 Past Costs

114. The Service has completed six formal consultations with the U.S. Marine Corps since 1996 (five of which occurred after the listing of brodiaea in 1998). Consultations have primarily involved infrastructure construction projects on Camp Pendleton lands (two since the listing of the species), and impacts associated with military training activities (three since the listing of the species).

115. Exhibit 4-1 summarizes the past administrative costs of brodiaea consultations. As shown, the costs are $70,000 to $112,000 in undiscounted 2004 dollars, $86,000 to $138,000 assuming a seven percent discount rate, or $76,000 to $122,000 assuming a three percent discount rate. Appendix B describes the unit costs of consultation.

116. The Service has required the Marine Corps to avoid vehicular traffic around known brodiaea populations, fencing, salvaging and relocation of corms, and surveying and monitoring of existing and transplanted brodiaea populations. Costs associated with these past project modifications are unknown.

[70] Ibid, page ES-3.

[71] Personal communication with Biologist, Carlsbad Field Office, U.S. Fish and Wildlife Service, on June 29, 2005.

Exhibit 4-1

ADMINISTRATIVE COSTS AT CAMP PENDLETON

	Total (Undiscounted Dollars)		Present Value (7%)		Present Value (3%)	
	Low	**High**	**Low**	**High**	**Low**	**High**
Past	$70,000	$112,000	$86,000	$138,000	$76,000	$122,000
Future	$278,000	$446,000	$158,000	$253,000	$213,000	$342,000
Annualized Future[a]	N/A		$15,000	$24,000	$14,000	$23,000

Note:
(a) Annualized costs are calculated using Microsoft Excel's payment function, which assumes an end of year payment. The total present value cost upon which the annualized estimate is based assumes no discounting in year 2005.

4.2.2 Future Costs

117. To estimate potential future administrative costs of brodiaea conservation activities at Camp Pendleton, the analysis assumes that the rate of consultation for infrastructure and military training activities will remain constant over the twenty-year period of analysis. Under this assumption, the analysis forecasts one infrastructure-related and two training-related consultations every three years for brodiaea. Exhibit 4-1 summarizes the results of the analysis. As shown, projected future administrative consultation costs range from $278,000 to $446,000 in undiscounted 2004 dollars. This range is equivalent to $158,000 to $253,000 in present value terms and $15,000 to $24,000 in annualized terms (assuming a seven percent discount rate), or $213,000 to $342,000 in present value terms and $14,000 to $23,000 in annualized terms (assuming a three percent discount rate).

118. The costs associated with future project modifications are unknown. Additional information is required about the type and extent of potential project modifications. This analysis does not attempt to quantify the impact to military readiness that may result from brodiaea conservation activities.

POTENTIAL ECONOMIC IMPACTS TO TRANSPORTATION, UTILITY, AND FLOOD CONTROL ACTIVITIES SECTION 5

119. This section considers how brodiaea conservation activities may impact transportation, utility, and flood control activities within counties that contain essential brodiaea habitat. These activities have not impacted brodiaea significantly since the listing of the species in 1998, however, future projects may require project modification related to brodiaea conservation. Exhibit 5-1 summarizes future costs estimated in this section. As shown, total future costs of transportation and utility projects in units proposed for inclusion are estimated at $966,000 in undiscounted 2004 dollars. In present value terms, costs are $557,000 assuming a seven percent discount rate, or $746,000 assuming a three percent discount rate.

Exhibit 5-1

SUMMARY OF BRODIAEA-RELATED TRANSPORTATION AND UTILITY COSTS[a]
(High-end Estimates)

Cost Category	Undiscounted Dollars (2004$)	Present Value (7%)	Present Value (3%)	Annualized[b] (7%)	Annualized (3%)
Units Proposed for Inclusion					
Transportation	$883,000	$510,000	$682,000	$48,000	$46,000
Utility	$83,000	$47,000	$64,000	$4,000	$4,000
Total	**$966,000**	**$557,000**	**$746,000**	**$53,000**	**$50,000**
Units Excluded from Proposed Critical Habitat					
Transportation	$725,000	$411,000	$555,000	$39,000	$37,000
Utility	$17,000	$9,000	$13,000	$1,000	$1,000
Total	**$741,000**	**$420,000**	**$568,000**	**$40,000**	**$38,000**

Notes:
(a) While impacts to flood control projects are anticipated in areas excluded from proposed critical habitat, costs are not currently available.
(b) Annualized costs are calculated using Microsoft Excel's payment function, which assumes an end of year payment. The total present value cost upon which the annualized estimate is based assumes no discounting in year 2005.

5.1 Impacts to Transportation Activities

5.1.1 Past Costs

120. Since the listing of the brodiaea in 1998, the Service has completed two formal consultations and responded to one request for technical assistance, all for projects located in the City of San Marcos. In 2003, the U.S. Federal Highway Administration (FHWA) consulted on the State Route 78 Las Posas Interchange Project, which intersects Unit 8e. Project modifications resulting from the consultation included compensation for direct effects to brodiaea, translocation of individual plants to a reserve, monitoring the plants in the reserve, and compensation for removal of occupied habitat outside the project footprint. Costs of transplanting and monitoring the brodiaea are $100,000 per acre, and 0.3 acres of plants were moved, for a total cost of $30,000. FHWA followed up the consultation with a request for technical assistance on the project that same year; no project modifications resulted. [72]

121. Past costs are summarized in Exhibit 5-2. Administrative costs are estimated using the cost model described in Appendix B. Total costs were as high as $54,000 in undiscounted dollars. The present value of past costs is as high as $62,000 assuming a seven percent discount rate, or $58,000 assuming a three percent discount rate.

Exhibit 5-2

PAST TRANSPORTATION COSTS FOR BRODIAEA IN THE CITY OF SAN MARCOS, SAN DIEGO COUNTY (UNIT 8e)

	Total (Undiscounted Dollars)		Present Value (7%)		Present Value (3%)	
Cost Category	**Low**	**High**	**Low**	**High**	**Low**	**High**
Administrative	$15,000	$24,000	$17,000	$28,000	$16,000	$26,000
Mitigation	$30,000	$30,000	$34,000	$34,000	$32,000	$32,000
Total	**$45,000**	**$54,000**	**$51,000**	**$62,000**	**$48,000**	**$58,000**

5.1.2 Future Costs

122. Future transportation-related costs include development of the Foothill Transportation Corridor (FTC) with potential impacts to Unit 4g (Christianitos Canyon), and various potential impacts to transportation projects across the four CALTRANS districts that contain essential brodiaea habitat.

[72] The formal consultation and technical assistance request associated with State Route 78 are located within essential habitat identified in the proposed rule. The second formal consultation, Paloma/Las Posas Road Extension Project, is located outside of essential habitat and, therefore, not quantified as part of past costs. However, the project modification costs, which are estimated to equal $256,000 (2.56 acres x $100,000 per acre) provide information for the calculation of future costs.

Foothill Transportation Corridor

123. The FTC is part of the Master Plan of Arterial Highways (MPAH) initiated by Orange County in the 1970s. The MPAH includes roads, highways, and streets to alleviate congestion in the County. In 1982, Orange County completed an Environmental Impact Report (EIR) for the MPAH "which included a highway alternative to the I-5 to run east of Lake Forest and Mission Viejo and south of the foothills, connecting to the I-5 near the Orange/San Diego border. The highway was named the Foothill Transportation Corridor, or State Route 141."[73]

124. The Foothill-South project is expected to be constructed between 2005 and 2008. The Draft Environmental Impact Statement analyzes the potential environmental impacts of extending the existing road SR 241 south to I-5 in Orange County. The alternative routes evaluated in the report include six corridor alternatives that would extend SR 241 from Oso Parkway to I-5 near the Orange/San Diego County boundary, one alternative to improve existing arterial highways, and one alternative to widen I-5 from the Orange County boundary north to the interchange with Interstate 405 (I-405).[74]

125. Surveying completed in 2001 by the South Orange County Transportation Infrastructure Improvement Project (SOCTIIP) Collaborative located thirty-four populations of brodiaea consisting of over 4,400 individuals. The Collaborative determined that brodiaea would be directly impacted by four of the project alternatives. However, the Service is currently consulting on the FTC's preferred alternative, which avoids impacts to brodiaea.[75] For this reason, the analysis estimates administrative costs of formal consultation with the Service, but does not anticipate brodiaea-specific project modification costs for the FTC. Administrative costs of consultation for the FTC project are assigned to Unit 4g and, as the consultation is currently ongoing, are assumed to occur in 2005.

California Department of Transportation (CALTRANS) Districts

126. Essential brodiaea habitat identified by the Service is contained within five counties managed by four CALTRANS districts: District 7 (Los Angeles County), District 8 (San Bernardino and Riverside counties), District 11 (San Diego County), and District 12 (Orange County). The analysis was able to acquire information from Districts 8 and 11, but was unable to acquire information from Districts 7 and 12.

[73] Foothill-South: An Overview of the Draft EIS/SEIR for the South Orange County Transportation Infrastructure Improvement Project, accessed at http://www.thetollroads.com/home/OverviewBrochureFINAL.pdf on July 8, 2005.

[74] A detailed map of the proposed routes is available at http://www.thetollroads.com/home/pdf/AlternativesMap&Description.pdf.

[75] Personal communication with Biologist, Carlsbad Field Office, U.S. Fish and Wildlife Service, on June 7, 2005.

127. The San Diego office (District 11) of CALTRANS has indicated that there are several freeways that may pass through critical habitat; however, potential costs of mitigating for brodiaea along these highways are variable and currently unknown.[76]

128. The San Bernardino office (District 8) of CALTRANS has indicated that it has not dealt with brodiaea in past projects within District 8, and the probability of locating the plant within their transportation corridor is low. Moreover, the southwestern portion of District 8 in which brodiaea habitat is located is external to the main highway system in the district. As a result, CALTRANS District 8 does not anticipate impacts of brodiaea habitat on its projects.[77]

129. Due to the lack of site-specific information on future brodiaea conservation activities, this analysis uses the past rate of formal and technical assistance consultation (approximately two formal consultations and one technical assistance request over six years) to forecast future consultations needs. Total future transportation administrative and mitigation costs are spread evenly over all essential brodiaea habitat units and are summarized in Exhibit 5-3. In addition, Exhibit 5-3 also includes the cost of formal consultation for the FTC project for Unit 4g. Mitigation costs are assumed to equal $100,000 per acre and include costs of salvaging brodiaea and five years of monitoring of the transplanted population.[78] Mitigation costs are estimated based on the range of impacted brodiaea acres in past formal consultations (0.3 to 2.56 acres).

130. The analysis estimates that total administrative and project modification costs in units proposed for inclusion may range from $151,000 to $883,000 in undiscounted 2004 dollars. In present value terms, this range is $92,000 to $510,000 assuming a seven percent discount rate, or $119,000 to $682,000 assuming a three percent discount rate. In annualized terms, this range is equivalent to $9,000 to $48,000 assuming a seven percent discount rate, or $8,000 to $46,000 assuming a three percent discount rate.

[76] Personal communication with Susan Scatolini, CALTRACTS District Biologist, San Diego District, on June 22, 2005.

[77] Personal communication with Quyen Tang, CALTRANS, San Bernardino, CA, on July 7, 2005.

[78] Mitigation cost estimate provided by Robert MacAller, RECON Environmental, on June 26, 2005.

EXHIBIT 5-3

FUTURE TRANSPORTATION COSTS[a]

Unit Number	Unit Name	Administrative Costs						Project Modification Costs						Total Costs					
		Total (Constant Dollars)		Present Value (7%)		Present Value (3%)		Total (Constant Dollars)		Present Value (7%)		Present Value (3%)		Total (Constant Dollars)		Present Value (7%)		Present Value (3%)	
		Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
1a	Glendora	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
1b	San Dimas	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
2	Arrowhead Hot Springs	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
3	Aliso Canyon	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
4a	Arroyo Trabuco	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
4b	Casper's Regional Park	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
4c	Canada Gobernadora/Chiquita Ridgeline	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
4d	Prima Deschecha	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
4e	Forster Ranch	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
4f	Telega/Segunda Deschecha	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
4g	Cristianitos Canyon	$15,000	$25,000	$15,000	$24,000	$15,000	$24,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$19,000	$53,000	$17,000	$40,000	$18,000	$46,000
4h	Cristianitos Canyon South	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
4i	Blind Canyon	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
5a	Miller Mountain	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
5b	Devil's Canyon	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
6a	Alta Creek	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
6b	Mesa Drive	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
6c	Oceanside East/Mission Avenue	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
6d	Taylor/Darwin	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
7a	Fox-Miller	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
7b	Rancho Carillo	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
8a	Rancho Santa Fe Road North	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
8b	Rancho Santalina/Loma Alta	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
8c	Grand Avenue	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
8d	Upham	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
8e	Linda Vista	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
9	Double LL Ranch	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
10	Highland Valley	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
	Subtotal	**$59,000**	**$95,000**	**$39,000**	**$64,000**	**$48,000**	**$78,000**	**$92,000**	**$788,000**	**$52,000**	**$446,000**	**$71,000**	**$604,000**	**$151,000**	**$883,000**	**$92,000**	**$510,000**	**$119,000**	**$682,000**
	Annualized[b]			**$4,000**	**$6,000**	**$3,000**	**$5,000**			**$5,000**	**$42,000**	**$5,000**	**$41,000**			**$9,000**	**$48,000**	**$8,000**	**$46,000**
EH1	Moreno Valley	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
EH2	West of Norco	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
EH3	West of Corona	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000

EXHIBIT 5-3

FUTURE TRANSPORTATION COSTS[a]

Unit Number	Unit Name	Administrative Costs						Project Modification Costs						Total Costs					
		Total (Constant Dollars)		Present Value (7%)		Present Value (3%)		Total (Constant Dollars)		Present Value (7%)		Present Value (3%)		Total (Constant Dollars)		Present Value (7%)		Present Value (3%)	
		Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
EH4	San Jacinto Wildlife Area	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
EH5	San Jacinto River Floodplain	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
EH6	Case Road Area	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
EH7	Railroad Canyon	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
EH8	Upper Salt Creek	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
EH9	Santa Rosa Plateau (SRP)/Tenaja Road	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
EH10	SRP North of Tenaja Road	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
EH11	SRP South of Tenaja Road	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
EH12	East of Tenaja Guard Station	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
EH13	Mesa de Colorado	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
EH14	North End Redonda Mesa	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
EH20	Calavera Heights	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
EH21	Carlsbad Highlands	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
EH22	Carlsbad Oaks	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
EH23	Poinsettia	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
EH24	Rancho Carrillo	$2,000	$3,000	$1,000	$1,000	$1,000	$2,000	$3,000	$28,000	$2,000	$16,000	$3,000	$22,000	$5,000	$31,000	$3,000	$17,000	$4,000	$24,000
Subtotal		**$38,000**	**$63,000**	**$22,000**	**$35,000**	**$29,000**	**$48,000**	**$79,000**	**$675,000**	**$45,000**	**$383,000**	**$61,000**	**$517,000**	**$117,000**	**$738,000**	**$67,000**	**$418,000**	**$90,000**	**$565,000**
Annualized[b]				**$2,000**	**$3,000**	**$2,000**	**$3,000**			**$4,000**	**$36,000**	**$4,000**	**$35,000**			**$6,000**	**$39,000**	**$6,000**	**$38,000**

Notes:
(a) Units EH 15 to EH 19 are not included in the analysis of transportation impacts because these units are located on Camp Pendleton.
(b) Annualized costs are calculated using Microsoft Excel's payment function, which assumes an end of year payment. The total present value cost upon which the annualized estimate is based assumes no discounting in year 2005.

5.2 Impacts to Utility Activities

131. San Diego Gas and Electric (SDG&E) is a regulated public utility that provides energy services to 3.3 million consumers through 1.3 million electric meters and over 880,000 natural gas meters across 4,100 square miles in San Diego and southern Orange counties.[79]

132. SDG&E completed an NCCP plan in 1995 to govern impacts to threatened and endangered species within its area of activity. SDG&E conducts thousands of operations and maintenance activities each year, but only approximately 600 to 800 are within natural habitat, and of these, only a few have occurred in which potential impacts to brodiaea have been a concern. SDG&E has avoided all known impacts to brodiaea since the NCCP was finalized in 1995.[80]

133. SDG&E has suggested that critical habitat designation (CHD) could minimally adversely affect routine operation and maintenance activities associated with the company's electric and natural gas transmission and distribution systems. The company estimates that the cost to address potential impacts to brodiaea would not exceed $5,000 annually. Larger impacts are possible for new facility construction not covered in SDG&E's NCCP. In these cases, brodiaea conservation may require a change in the siting or routing of the project. The potential costs associated with redirecting or preventing the routing of a transmission line are unavailable.[81] However, SDG&E can generally avoid impacts more easily than other companies due to their ability to string over or under brodiaea populations. In the case of unavoidable impacts, SDG&E could translocate brodiaea corms.[82]

134. A rapid assessment conducted by SDG&E on three essential brodiaea habitat units identified by the Service indicates that six SDG&E transmission lines and a number of distribution poles may be impacted by brodiaea conservation activities. Specifically, unit 6a is traversed by TL23001, TL23003, TL23004, and TL23011; unit 6b is traversed by TL680 and TL134802; and unit 6c contains SDG&E distribution poles.[83] To estimate potential future costs, the analysis assumes that SDG&E incurs the upper-bound estimate of potential costs ($5,000 annually) and divides this cost evenly across all units and subunits in San Diego and Orange County for the twenty-year period of analysis.

135. Exhibit 5-4 summarizes the results of the analysis. As shown, costs associated with SDG&E activities in San Diego and Orange County in units proposed for inclusion are projected to reach $83,000 in undiscounted 2004 dollars. In present value terms, this potential cost is equivalent to $47,000 assuming a seven percent discount rate, or $64,000

[79] San Diego Gas and Electric Website, accessed at http://www.sdge.com/community on July 5, 2005.

[80] Personal communication with Donald E. Haines, Manager, Land Planning and Natural Resources, SDG&E, on June 6, 2005.

[81] Ibid.

[82] Ibid.

[83] Ibid.

assuming a three percent discount rate. In annualized terms, potential costs are $4,000 assuming either discount rate.

Exhibit 5-4

FUTURE UTILITY COSTS IN ESSENTIAL BRODIAEA HABITAT

County	Unit Number	Undiscounted Dollars	Present Value (7%)	Present Value (3%)
Proposed for Inclusion				
Orange	3	$3,000	$2,000	$3,000
	4a	$3,000	$2,000	$3,000
	4b	$3,000	$2,000	$3,000
	4c	$3,000	$2,000	$3,000
	4d	$3,000	$2,000	$3,000
	4e	$3,000	$2,000	$3,000
	4f	$3,000	$2,000	$3,000
	4g	$3,000	$2,000	$3,000
	4h	$3,000	$2,000	$3,000
	4i	$3,000	$2,000	$3,000
San Diego	5a	$3,000	$2,000	$3,000
	5b	$3,000	$2,000	$3,000
	6a	$3,000	$2,000	$3,000
	6b	$3,000	$2,000	$3,000
	6c	$3,000	$2,000	$3,000
	6d	$3,000	$2,000	$3,000
	7a	$3,000	$2,000	$3,000
	7b	$3,000	$2,000	$3,000
	8a	$3,000	$2,000	$3,000
	8b	$3,000	$2,000	$3,000
	8c	$3,000	$2,000	$3,000
	8d	$3,000	$2,000	$3,000
	8e	$3,000	$2,000	$3,000
	9	$3,000	$2,000	$3,000
	10	$3,000	$2,000	$3,000
Subtotal		**$83,000**	**$47,000**	**$64,000**
Annualized[a]			**$4,000**	**$4,000**
Excluded from Proposed Critical Habitat				
San Diego	EH20	$3,000	$2,000	$3,000
	EH21	$3,000	$2,000	$3,000
	EH22	$3,000	$2,000	$3,000
	EH23	$3,000	$2,000	$3,000
	EH24	$3,000	$2,000	$3,000
Subtotal		**$17,000**	**$9,000**	**$13,000**
Annualized[a]			**$1,000**	**$1,000**

Note:
(a) Annualized costs are calculated using Microsoft Excel's payment function, which assumes an end of year payment. The total present value cost upon which the annualized estimate is based assumes no discounting in year 2005.

5.3 Impacts to Flood Control Activities

136. A number of essential brodiaea habitat units are located within the floodplain of the San Jacinto River.[84] Three units are excluded from proposed critical habitat in the floodplain, EH 5, EH 6, and EH 7. Potential impacts to these units include activities associated with flood control on the river.

137. According to the Western Riverside MSHCP, "The Riverside County Flood Control and Water Conservation District (County Flood Control) intends to implement flood control measures (including channelization or some other form or forms of engineered flood control) on the San Jacinto River between the Ramona Expressway and the mouth of Railroad Canyon (San Jacinto River Project). Other covered activities within the vicinity of the San Jacinto River include Ramona Expressway bridge and culvert, Nuevo Road bridge, San Jacinto Avenue crossing, I-215 bridge and levee, Case Road bridge, Burlington Northern Santa Fe Railroad bridge, Ethanac Road bridge, Perris Valley Storm Drain Channel and Romoland Channel."[85]

138. Criteria that apply to the San Jacinto River Project under the Western Riverside MSHCP are:

- Conservation of mitigation lands that provide hydrology for the continued survival of covered species, including brodiaea;

- Conservation of two brodiaea populations located downstream of I-215 at Case Road and Railroad Canyon. The MSHCP states that "One of these populations may be transplanted to a suitable receiver site, in accordance with mitigation and monitoring program that includes success criteria and requirements to ensure the population has been established;" and

- Establishment of a minimum 1,000-foot wide multi-species Linkage between the Ramona Expressway and the Railroad Canyon.[86]

139. County Flood Control recently completed a 2.5 year surveying effort for federally-listed species within their jurisdiction as part of complying with threatened and endangered species requirements. Due to survey requirements, maintenance on the San Jacinto River has been limited.[87] Information about survey costs or costs associated with the criteria provided in the MSHCP are not available at this time.

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[84] Personal communication with Teresa Tung, Senior Civil Engineer, Riverside County Flood Control & Water Conservation, on June 23, 2005.

[85] Western Riverside MSHCP, June 17, 2003, pages 7-59 to 7-60.

[86] Ibid, page 7-60.

[87] Personal communication with Teresa Tung, Senior Civil Engineer, Riverside County Flood Control and Water Conservation District, on July 5, 2005.

POTENTIAL ECONOMIC IMPACTS TO PUBLIC AND CONSERVANCY LANDS — SECTION 6

140. This section considers how brodiaea conservation may impact management activities on public reserve and private conservancy lands. In sum, five units proposed as critical habitat for brodiaea are located on lands managed for their natural resources. Four units are on public lands while one is located within a private conservancy. These units are proposed as critical habitat, because they do not already operate under specific management guidelines that could reduce threats to brodiaea.[88] Exhibit 6-1 reproduces information on each unit analyzed in this section, as originally presented in Section 2.

Exhibit 6-1

CRITICAL HABITAT UNITS LOCATED ON PUBLIC AND CONSERVANCY LANDS

County	Unit	Subunit	Acres	Ownership[a]	Primary Threats to Brodiaea
Los Angeles	1	1a: Glendora	96	Private (Glendora Community Conservancy)	Lack of management plan for brodiaea; invasive species
Orange	3	N/A	151	Public (Aliso-Wood Canyon Regional Park)	Lack of management plan for brodiaea; fuel management (annual mowing); recreation
Orange	4	4b: Casper's Regional Park	259	Private and Public (Casper's Regional Park)	Lack of management plan for brodiaea
San Diego	5	5a: Miller Mountain	1,263	Private and Federal (Cleveland National Forest)	Lack of management plan for brodiaea; cattle grazing
San Diego	5	5b: Devil's Canyon	264	Private and Federal (Cleveland National Forest)	Lack of management plan for brodiaea; cattle grazing

Note:
(a) A portion of these units is made up of private lands. Impacts to non-conservancy, private lands are addressed in Section 3 of this report.

141. Exhibit 6-2 summarizes costs of future management and conservation activities within affected units. As shown, total costs (administrative and conservation) within these critical habitat units are expected to range from $78,000 to $123,000 in

[88] 69 CFR 71291 - 71295 and personal communication with Biologist, Carlsbad Field Office, the Service, on May 15, 2005.

undiscounted 2004 dollars. Present value figures are only slightly lower because most costs are assumed to occur in 2005, the year of designation.

Exhibit 6-2

FUTURE COSTS OF PUBLIC AND CONSERVANCY LAND MANAGEMENT FOR BRODIAEA

	Future (Undiscounted Dollars)		Future Present Value (3%)		Future Present Value (7%)	
Unit	Low	High	Low	High	Low	High
1a	$34,000	$54,000	$33,000	$52,000	$31,000	$50,000
3	$14,000	$22,000	$14,000	$22,000	$14,000	$22,000
4b	$14,000	$22,000	$14,000	$22,000	$14,000	$22,000
5a	$10,000	$14,000	$9,000	$13,000	$9,000	$13,000
5b	$7,000	$11,000	$7,000	$11,000	$7,000	$11,000
Total	$78,000	$123,000	$76,000	$121,000	$75,000	$118,000
Annualized[a]	$0	$0	$5,000	$8,000	$7,000	$11,000

Note:
(a) Annualized costs are calculated using Microsoft Excel's payment function, which assumes an end of year payment. The total present value cost upon which the annualized estimate is based assumes no discounting in year 2005.

6.1 Unit 1a: Glendora

142. The Glendora Community Conservancy was founded in July 1991 to "promote the preservation of land and/or buildings for historic, educational, ecological, recreational, scenic, or open space opportunities."[89] The Conservancy covers approximately 600 acres and contains a specific Brodiaea conservation area of six acres.[90] During the first week of May each year, the City of Glendora celebrates "Brodiaea Week" by city proclamation.[91] According to the Conservancy, the Brodiaea Reserve in Glendora is "second in size only to the Nature Conservancy's Santa Rosa Plateau in protection of this rare species."[92]

143. Human impacts to brodiaea populations within the Conservancy result from recreational use. The Colby Trail, a regional trail originally constructed in 1906 as a fire road, runs through the property and is used by several thousand people per year (free of

[89] Glendora Community Conservancy website, accessed at www.glendoraconservancy.org on June 2, 2005.

[90] The Conservancy has managed these six acres since 1993 when the site was originally purchased using County of Los Angeles Proposition A Bond Measure funds. It is important to note that this six-acre site exists with three additional, newly discovered brodiaea sites on a 150-acre parcel of land. Each of these brodiaea sites has unique requirements based on the characteristics of the specific population. Personal communication with Dr. Ann Croissant, Member of Board of Directors, Glendora Community Conservancy, on March 18, 2005, June 22, 2005, and June 27, 2005.

[91] Personal communication with Dr. Ann Croissant, Member of Board of Directors, Glendora Community Conservancy, on June 27, 2005.

[92] Glendora Community Conservancy FAQs, accessed at www.conservancies.com/Glendora on June 27, 2005.

charge), primarily hikers, bikers, and equestrians. According to the Conservancy, only one area of the trail affects an independent population of dwarf brodiaea; however, the Conservancy does not undertake special management provisions to protect this population.[93] The primary human impact to the species is renegade trails created by recreators. In order to prevent renegade trails, the county previously spent $3,000 to $4,000 to berm the Colby Trail for brodiaea and other rare and endangered plant species.

144. While the Service notes that invasive species are a potential threat to brodiaea within the Conservancy, the Conservancy contends that the succession of invasive species is slow within the property, and recently discovered habitat has exhibited brodiaea and sage brush (an invasive species) co-existing.[94]

6.1.1 Past Costs

145. Past costs associated with conserving brodiaea populations at the Conservancy have included general management costs and costs related to brodiaea-specific projects that occur periodically. To estimate general management costs attributable to brodiaea management, the analysis applies the percentage of land area within the Conservancy designated as brodiaea-specific land (six acres/600 acres, or one percent) to the overall annual budget of the Conservancy (approximately $15,000 to $30,000 a year).[95] Accordingly, general management costs attributable to brodiaea management are $150 to $300 annually.

146. The Conservancy also benefits from Eagle Scout projects that discourage human impacts to brodiaea populations. The Conservancy estimates that three such projects have occurred since 1996 at a cost of $400 to $500 per project. The analysis utilizes the average of this range ($450) and conservatively assumes that all three projects occurred after the listing of brodiaea in 1998 to estimate total pre-designation costs associated with Eagle Scout projects of $1,350.

147. Exhibit 6-3 summarizes the results of the analysis. Unit administrative costs of consultation are provided in Appendix B.

[93] Ibid. The Conservancy has indicated that the categorization of this population of brodiaea as "dwarf" is not a scientific name but a descriptive term given to this population, because they are roughly one-third smaller than the other populations in the area. (Personal communication with Dr. Ann Croissant, Member of Board of Directors, Glendora Community Conservancy, on September 2, 2005.)

[94] Ibid.

[95] The annual budget for the Conservancy includes such elements as insurance, discounted land taxes, weed abatement, and trail maintenance. Personal communication with Dr. Ann Croissant, Member of Board of Directors, Glendora Community Conservancy, on June 22, 2005.

Exhibit 6-3

COSTS OF BRODIAEA CONSERVATION ACTIVITIES WITHIN UNIT 1A

	Undiscounted Dollars		Present Value (7%)		Present Value (3%)	
	Low	**High**	**Low**	**High**	**Low**	**High**
Past	$2,400	$3,450	$3,175	$4,564	$2,706	$3,890
Future	$20,050	$31,450	$17,386	$27,486	$18,612	$29,311
Annualized Future[a]	N/A		$1,641	$2,594	$1,251	$1,970

Note:
(a) Annualized costs are calculated using Microsoft Excel's payment function, which assumes an end of year payment. The total present value cost upon which the annualized estimate is based assumes no discounting in year 2005.

6.1.2 Future Costs

148. The cost analysis assumes that in 2005 the Conservancy will develop a plan to manage brodiaea. The effort involved in developing the plan is assumed to be similar to that of a formal section 7 consultation and biological assessment. The cost will range from $13,900 to $22,300 in undiscounted 2004 dollars.

149. To estimate post-designation costs of brodiaea conservation within the Conservancy, the analysis assumes that the portion of general management funds estimated for brodiaea over the pre-designation period ($150 to $300 annually) will continue over the twenty-year period of analysis. In addition, based on the distribution of Eagle Scout projects since 1996, the analysis assumes that one Eagle Scout project ($450 per project) will occur every three years.

150. Using the methodology outlined above, Exhibit 6-3 summarizes post-designation management costs within Unit 1a.

6.2 Unit 3: Aliso Canyon

151. The Aliso-Wood Canyon Regional Park is managed by the Resources and Development Management Department/Harbors, Beaches, and Parks of Orange County and offers hiking, biking, and equestrian recreational use.[96] Brodiaea within this unit are surrounded by *Cynara cardunculus* (cardoon, artichoke thistle) on the upper and lower slope of the trail on which the species is located. In addition, other non-native grasses and forbs are present in the area; however, the spring survey indicated that brodiaea were growing among these non-native plants. The trail is heavily used and a paved road is located in close proximity to the brodiaea population. The population is not marked.[97]

[96] County of Orange, Harbors, Beaches, and Parks, Aliso and Wood Canyons Wilderness Park, accessed at www.ocparks.com/alisoandwoodcanyons/ on June 2, 2005.

[97] Personal communication with Joy Polston Barnes, Aliso and Wood Canyons Wilderness Park, on June 28, 2005.

152. Conversations with park staff indicate that active brodiaea management does not occur within the park. As a result, no past costs exist.

153. The analysis assumes that in 2005 Aliso-Wood Canyon Regional Park will prepare a management plan that addresses brodiaea. The effort involved in completing the plan is assumed to be similar to costs of a formal section 7 consultation and biological assessment. The cost will range from $13,900 to $22,300 in undiscounted 2004 dollars.

154. Development of brodiaea-specific management provisions may affect recreation and fuel management activities. However, the analysis cannot quantify potential recreation reductions and additional costs to fuel management activities associated with these management provisions within Unit 3.

6.3 Unit 4b: Casper's Park

155. Casper's Regional Park covers 8,000 acres in the Santa Ana Mountains and supports a variety of recreational activity, including camping, hiking, equestrian use, and biking. Annual attendance to the Park ranges from 65,000 to 70,000. The Park charges a day-use fee of $3 from Monday through Friday and $5 on Saturday and Sunday.[98]

156. The portion of Unit 4b that falls within Casper's Regional Park is located in a remote area of Bell Canyon roughly 100 yards from the Bell Canyon Trail. The Park conducts seasonal monitoring of the area to evaluate trespass activities, and during the last few years has noted none. Costs of managing this portion of Unit 4b are negligible due to the remote and undisturbed nature of the area and limited threat to the species. The specific area containing the species is not fenced or identified.[99]

157. The analysis assumes that in 2005 Casper's Regional Park will develop a plan to manage brodiaea. The effort involved in preparing the plan is assumed to be similar to a formal section 7 consultation and biological assessment. The cost will range from $13,900 to $22,300 in undiscounted 2004 dollars.

6.4 Unit 5a: Miller Mountain

158. Unit 5a is located on a grazing allotment within Cleveland National Forest. In total, the forest contains 23 grazing allotments and livestock areas, grazing approximately 362 head months in 2004.[100,101] In 2001, the Forest completed a formal consultation with

[98] Personal communication with John Gannaway, Supervising Park Ranger, Ronald W. Caspers Wilderness Park, on June 7, 2005.

[99] Ibid.

[100] According to the USDA, a head month is a month's use and occupancy of range for one animal (excluding sheep and goats). Information from http://www.nass.usda.gov.

[101] Ibid.

the Service for their grazing program. The consultation covered ten federally-listed species, six of which had designated critical habitat at the time, and 26 grazing allotments and livestock areas within the forest. The associated Biological Opinion stated that "[t]he Miller Mountain brodiaea population is almost entirely within the San Mateo Canyon Wilderness Area, so there are few other [aside from grazing] land use activities affecting it."[102]

159. The Biological Opinion issued on Cleveland National Forest's proposed grazing schedule indicated that the grazing season at Miller Mountain would run from August 15 to January 1 of each year, supporting 31 head (and an equivalent of 217 animal unit months (AUMs)).[103,104] The Service stated that "[t]he August 15 to January 1 grazing season in the Miller Mountain allotment largely avoids the growing season of thread-leaved brodiaea."[105] However, the Service also stated that "[a] potentially more frequent impact associated with the proposed grazing regime is soil compaction" and "…in years when heavy rains come early, the brodiaea population could be adversely affected by cattle compacting the soils they occupy."[106] Despite concerns over soil compaction, the Service did not include additional requirements for brodiaea coverage, and stated that the grazing schedule would be sufficient to avoid impairing the continued survival of the species.

160. The Forest Service has indicated that the Miller Mountain grazing allotment is combined with the Teneja Allotment and totals 1,035 acres. Of this total, 515 acres are suitable for grazing.[107] The Forest Service does not allow grazing within the allotment until after brodiaea seeds have set and dispersed. As a result, one rancher utilizes the combined allotments under a lease agreement and grazes (on average) 35 head of cattle from October or November to December of each year.[108] However, due to recent drought in the area, the leasee has not utilized the allotment over the last few years.[109]

6.4.1 Past Costs

161. As stated, one formal consultation was completed for Unit 5a since the listing of brodiaea in 1998. Costs associated with this consultation are included for 1998 in Exhibit 6-4 below.

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[102] U.S. Fish and Wildlife Service, Reinitiated Biological Opinion on the Cleveland National Forest's Livestock Grazing Program, Orange, Riverside, and San Diego Counties, California, April 27, 2001, page 8.

[103] Ibid, Table 2.

[104] An AUM is the equivalent of forage for one cow and one calf for one month.

[105] Ibid, page 33.

[106] Ibid, page 33.

[107] Personal communication with Kirsten Winter, Forest Biologist, Cleveland National Forest, on June 6, 2005.

[108] The leasee pays a standard grazing fee annually determined jointly by the Bureau of Land Management and the U.S. Forest Service. Personal communication with Mary Thomas, Cleveland National Forest, on June 30, 2005.

[109] Personal communication with Mary Thomas, Cleveland National Forest, on June 30, 2005.

162. Project modification costs associated with brodiaea conservation activities include surveying for brodiaea locations and grazing reductions resulting from avoidance of brodiaea flowering months. Cleveland National Forest has surveyed for brodiaea at a cost of approximately $5,000 to $10,000.[110] The analysis utilizes the average of this range ($7,500) to assign past costs of surveying for brodiaea and divides the cost evenly between Units 5a and 5b.

163. Grazing restrictions during brodiaea flowering months result in a reduction in grazing effort available within the Miller Mountain and Teneja allotment. Personnel at Cleveland National Forest have indicated that absent the presence of brodiaea, the leasee may graze the area for four to five months annually, or one to two months more than currently.[111] Therefore, the analysis estimates the costs of a reduction in grazing on the allotment for two months annually for each year since brodiaea was listed and the formal consultation on grazing was completed in 1998. Specifically, the analysis assumes that the Miller Mountain/Teneja Allotment can accommodate 48 AUMs per month, resulting in a reduction of approximately 96 AUMs for the two months of brodiaea-specific grazing restriction.[112] This reduction in grazing effort is multiplied by the grazing permit fee at Cleveland National Forest ($1.43 per AUM in 2004) to estimate the total value of grazing reductions within the allotment.[113]

164. Exhibit 6-4 presents the results of the analysis for Unit 5a. Past costs include administrative costs (incurred in 1998), survey costs, and costs associated with grazing reductions.

Exhibit 6-4

COSTS OF BRODIAEA CONSERVATION ACTIVITIES WITHIN UNIT 5A

	Undiscounted Dollars		Present Value (7%)		Present Value (3%)	
	Low	**High**	**Low**	**High**	**Low**	**High**
Past	$18,611	$27,011	$28,552	$42,041	$22,407	$32,738
Future	$9,696	$13,896	$9,054	$13,254	$9,054	$13,254

6.4.2 Future Costs

165. The analysis forecasts one formal consultation in the year of critical habitat designation (2005) between Cleveland National Forest and the Service to develop a plan that will manage brodiaea according to Service requirements. The analysis assumes that

[110] Personal communication with Kirsten Winter, Forest Biologist, Cleveland National Forest, on June 6, 2005.

[111] Personal communication with Mary Thomas, Cleveland National Forest, on June 30, 2005.

[112] The analysis estimates that the Miller Mountain/Teneja Allotment can accommodate 48 AUMs per month by dividing the allocated number of AUMs (217) by the number of allocated grazing months (August 15 to January 1, or 4.5 months).

[113] Grazing fee per AUM accessed from the Bureau of Land Management at http://www.blm.gov/nhp/news/releases/pages/2004/pr040220_grazing.htm on July 7, 2005. Personal communication with Virgil Mink, Cleveland National Forest, on July 7, 2004.

the consultation will address Units 5a and 5b within Cleveland National Forest, and therefore divides the administrative cost of consultation evenly between these two units. The analysis assumes that the effort involved in completing a formal consultation and biological assessment will be sufficient to address the threats to brodiaea. The cost of completing the formal consultation and biological opinion will range from $13,900 to $22,300 in undiscounted 2004 dollars.

166. The analysis assumes that grazing restrictions during brodiaea flowering months will continue over the twenty-year period of analysis. Exhibit 6-4 summarizes the results of the analysis, including administrative costs incurred in 2005.

6.5 Unit 5b: Devil's Canyon

167. While the proposed rule notes that grazing is a potential threat to brodiaea within this unit, Cleveland National Forest notes that the unit is not located within a grazing allotment. Forest Service personnel also noted that because the Devil's Canyon brodiaea population is located along a forest road, the Forest Service is not actively managing the population.[114]

6.5.1 Past Costs

168. Pre-designation costs for Unit 5b are limited to surveying conducted by the Cleveland National Forest. As stated, the cost of surveying ($7,500) is divided evenly between units 5a and 5b. Therefore, past costs of surveying at unit 5b are estimated at $3,750. Exhibit 6-5 summarizes the resulting past costs.

Exhibit 6-5

COSTS OF BRODIAEA CONSERVATION ACTIVITIES WITHIN UNIT 5B

	Undiscounted Dollars		Present Value (7%)		Present Value (3%)	
	Low	**High**	**Low**	**High**	**Low**	**High**
Past	$3,750	$3,750	$4,961	$4,961	$4,228	$4,228
Future	$6,950	$11,150	$6,950	$11,150	$6,950	$11,150

6.5.2 Future Costs

169. As stated, the analysis forecasts one formal consultation in the year of critical habitat designation (2005) between Cleveland National Forest and the Service to develop a brodiaea management plan, and divides the administrative cost of consultation evenly between Units 5a and 5b. The analysis assumes that the effort involved in completing a formal consultation and biological assessment will be sufficient to address the threats to brodiaea within this unit. Costs of this consultation attributable to Unit 5b are $6,950 to

[114] Personal communication with Kirsten Winter, Forest Biologist, Cleveland National Forest, on June 6, 2005.

$11,150 in undiscounted 2004 dollars. Because these costs are expected to be incurred in 2005, the present value of this range is roughly equivalent to the undiscounted dollar amount.

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APPENDIX A: RFA/SBREFA AND ENERGY IMPACTS SCREENING ANALYSES

170. This Appendix considers the extent to which the analytic results presented in the previous sections reflect potential future impacts to small entities in units of essential brodiaea habitat.[115] The screening analysis presented in this Appendix is conducted pursuant to the Regulatory Flexibility Act (RFA) as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA) in 1996. The Appendix also contains an analysis of the effects of the rulemaking on energy markets, as required by Executive Order 13211.

A.1 SBREFA Screening Analysis

171. In accordance with RFA/SBREFA, when a Federal agency publishes a notice of rulemaking for any proposed or final rule, it must make available for public comment a regulatory flexibility analysis that describes the effect of the rule on small entities (i.e., small businesses, small organizations, and small government jurisdictions).[116] No regulatory flexibility analysis is required, however, if the head of an agency certifies that the rule will not have a significant economic impact on a substantial number of small entities.[117] SBREFA amended the RFA to require Federal agencies to provide a statement of the factual basis for certifying that a rule will not have significant economic impact on a substantial number of small entities.

172. To assist in this process, the following represents a screening level analysis of the potential for brodiaea conservation activities to affect small entities. This analysis is based on the estimated impacts associated with the proposed rulemaking as described in Sections 3, 4, 5, and 6 of this report.

173. This appendix first describes the industries, organizations, and governments that may experience impacts due to brodiaea conservation activities within essential habitat. It then provides more detail on the specific type of impacts potentially affecting small

[115] To the extent possible, impacts to small entities associated with essential habitat proposed for designation and habitat excluded from proposed critical habitat are presented separately in this Appendix.

[116] 5 U.S.C. 601 et seq.

[117] Thus, for a regulatory flexibility analysis to be required, impacts must exceed a threshold for "significant impact" and a threshold for a "substantial number of small entities." (5 U.S.C. 605(b))

entities. The bullets below summarize the results of the screening analysis. Details are provided in the following discussion.

- This analysis assumes that project modification costs (i.e., on-site conservation and salvaging) associated with development projects are passed on from the developer to the existing landowner in the form of lower prices paid for raw land. As a result, existing landowners experience an immediate decrease in the value of their property. Affected landowners may be developers, farmers, ranchers, or simply individuals or families that are not small entities as defined by the Small Business Administration (SBA). This screening analysis estimates that between zero and seven landowners in a given subunit proposed for designation could experience a decrease in the value of their property. The loss in land value experienced by an individual will depend on how much of a parcel is inhabited by brodiaea, the extent to which development activities can be planned around sensitive areas, and the existence of alternative uses of the property that do not threaten the plant or its habitat.

- In one of two alternative scenarios, the analysis assumes that the number of new homes constructed in the future decreases as a result of brodiaea conservation activities. If this scenario occurs, small construction firms could be affected. This screening analysis estimates that between 1 and 18 small construction firms in a given municipality with habitat proposed for designation may experience a loss of between one-third and all of their annual revenues. Note that to the extent that homes not built in these municipalities are constructed in neighboring communities, the impact to small firms reported in this analysis is likely overstated.

- The Glendora Community Conservancy will experience costs associated with brodiaea conservation activities equal to approximately 11 percent to 17 percent of annual expenditures assuming the low-end estimate of its annual budget ($15,000) and 5 percent to 9 percent assuming the high-end estimate ($30,000).

A.1.1 Identification of Activities that May Involve Small Entities

174. The analysis estimates potential costs of brodiaea conservation activities to residential development; the management of military lands; transportation, utilities, and flood control; and the management of public and conservation lands. Of these potentially affected activities, impacts to small entities are not anticipated for the following reasons:

- *Military lands management:* The analysis predicts that the Department of Defense (DoD), which manages Marine Corps Base Camp Pendleton (EH units 15 to 19), will experience administrative and project modification costs associated with brodiaea conservation activities. DoD does not meet SBA's definition of a small government.

- *Transportation, utilities, and flood control:* The analysis estimates that additional project modification costs associated with brodiaea conservation activities are likely for CALTRANS transportation projects, utility projects undertaken by San Diego Gas & Electric, and the San Jacinto River Flood Control Project of the Riverside County

Flood Control and Water Conservation District. None of these three entities are small businesses or governments as defined by SBA and, therefore, are not considered further in this screening analysis.

- *Public and conservancy lands management:* The United States Forest Service manages Cleveland National Forest (units 5a and 5b); Orange County's Department of Harbors, Beaches and Parks manages Aliso-Wood Canyon Regional Park (unit 3) and Casper's Regional Park (unit 4); and the Glendora Community Conservancy manages the Conservancy (unit 1a) of the same name. With the exception of the Glendora Community Conservancy, these entities exceed the threshold established for small governments (service population of 50,000 or less). Therefore, the Glendora Community Conservancy is the only land manager considered in this screening analysis.

Accordingly, this screening analysis focuses on economic impacts related to residential development and the management of Glendora Community Conservancy.

A.1.2 Potential Impacts to Real Estate Development Activities

Effects On Existing Landowners

175. Section 3 of the analysis considers the impacts of brodiaea conservation activities to real estate development under two scenarios. Both scenarios assume that project modification costs associated with brodiaea conservation activities (i.e., on-site conservation and salvaging) are passed on from the developer to the existing landowner in the form of reduced prices paid for raw land. In other words, the costs of brodiaea conservation activities are estimated as the reduced value of lands projected for development over the twenty-year period of analysis, and the cost is assumed to be incurred by the present landowner. These landowners may be developers, farmers, ranchers, or simply individuals or families that are not registered businesses. No North American Industry Classification System (NAICS) code exists for landowners, and SBA does not provide a definition of a small landowner. However, recognizing that it is possible that some of the existing landowners may also be small entities, this analysis provides information about the number of landowners potentially affected and the size of the impact.

176. Section 3.2.1 estimates that 390 acres within proposed critical habitat are projected to be developed over the next 20 years. The analysis assumes that as a result of brodiaea conservation activities, 95 percent of the acres are conserved, and the plant is salvaged from the remaining five percent. As a result, landowners of 100 percent of these acres bear costs of brodiaea conservation activities.

177. To estimate the number of landowners potentially impacted by brodiaea conservation activities, the analysis estimates the average parcel size within essential habitat units in each county that contains essential habitat and compares it to the estimate of affected acres in these areas. Exhibit A-1 presents the results of the analysis by

subunit. In areas proposed for designation, between zero and seven individuals may be impacted in a given subunit. Note that this estimate may be understated if habitat partially overlaps several parcels or overstated if one person owns more than one parcel with brodiaea.

Exhibit A

ESTIMATED LANDOWNER IMPACTS IN ESSENTIAL BRODIAEA HABITAT

County	Unit[a]	Unit Acreage	Projected Acres of Development In Unit on Private Land	Total Loss to Current Landowners	Average Parcel Size in County[b]	Number of Impacted Individuals in Unit
Proposed for Inclusion						
Los Angeles	1b	198	3.37	$115,437	9.85	1
San Bernardino	2	89	55.26	$1,219,116	312	1
Orange	4a	74	71.00	$1,890,504	10.36	7
	4b	259	0.42	$11,230	10.36	1
	4c	311	7.69	$204,717	10.36	1
	4d	119	46.23	$1,231,070	10.36	5
	4e	96	28.36	$755,037	10.36	3
	4f	190	6.07	$161,628	10.36	1
	4g	588	17.12	$455,960	10.36	2
	4h	72	2.30	$61,248	10.36	1
	4i	151	4.82	$128,451	10.36	1
San Diego	5a	1255	22.49	$855,879	7.92	3
	5b	264	3.97	$151,037	7.92	1
	6a	49	0.78	$29,812	7.92	1
	6b	5	0.00	$0	7.92	0
	6c	64	11.74	$446,962	7.92	2
	6d	80	10.75	$409,054	7.92	2
	7a	93	1.54	$58,472	7.92	1
	7b	32	2.58	$98,224	7.92	1
	8a	86	18.70	$711,596	7.92	3
	8b	82	9.67	$368,117	7.92	2
	8c	10	1.22	$46,272	7.92	1
	8d	117	18.64	$709,503	7.92	3
	8e	20	4.86	$185,088	7.92	1
	9	57	11.30	$430,054	7.92	2
	10	74	29.28	$1,114,515	7.92	4
Proposed for Exclusion						
San Diego	EH20	84	3.46	$131,510	7.92	1
	EH21	71	0.00	$0	7.92	0
	EH22	113	5.34	$203,265	7.92	1
	EH23	54	5.15	$195,813	7.92	1
	EH24	208	40.93	$1,557,556	7.92	6
Riverside	EH1	64	17.06	$377,235	33.14	1
	EH2	74	0.00	$0	33.14	0
	EH5	168	92.99	$2,056,228	33.14	3
	EH6	373	32.21	$712,212	33.14	1
	EH7	432	209.04	$4,622,331	33.14	7
	EH8	131	26.96	$596,189	33.14	1
	EH12	217	31.75	$702,122	33.14	1
	EH13	519	20.40	$451,104	33.14	1
	EH14	77	12.67	$280,121	33.14	1

Notes:
(a) Units that are completely contained within public and/or conservancy lands are excluded from the analysis.
(b) Average parcel size in the county is calculated using parcel acreages of parcels that intersect private acres of essential brodiaea habitat only.

178. The loss in land value experienced by an individual landowner will depend on how much of a parcel is inhabited by brodiaea, the extent to which development activities

can be planned around sensitive areas, and the existence of alternative uses of the property that do not threaten the plant or its habitat. For example, if brodiaea exist on only a small portion of the parcel that can be incorporated into existing open space requirements, then a small percentage of the land value is lost. However, if the brodiaea are found throughout the parcel, most or all of development value of that parcel may be lost. In such a circumstance, the parcel may continue to derive value from other, non-development oriented uses.

Effects on Homebuyers and Small Construction Firms

179. Section 3.2.2 estimates a potential shift in the supply of housing resulting from increased land scarcity. Scenario Two assumes that as a result of on-site conservation requirements, less land is available for development, and therefore fewer new homes are built. Under this scenario, small construction firms may be indirectly affected. This analysis uses a methodology used by Charles River Associates (CRA) to estimate the potential impact to small construction firms.[118] The analysis uses the following steps to estimate the number of firms potentially affected:

- **Step One.** The analysis estimates the number of new homes typically built by a small construction firm in one year. Average annual revenues for a small construction firms are $694,000.[119] Using the average construction costs for a single family home of $236,000 obtained from CRA's vernal pool analysis, a small firm is assumed to build on average three houses a year ($694,000/$236,000 = 2.9).[120]

- **Step Two.** Next, the analysis estimates the number of homes that would have been built by small businesses in the absence of brodiaea conservation activities. As described in Section 3.2.2, the analysis predicts 316 homes will not be built in cities with habitat proposed for designation, and 714 homes will not be built in cities with habitat excluded from proposed critical habitat (summarized in Exhibit A-2).[121] In an analysis of building permits in Sacramento County conducted by CRA, researchers determined that 22 percent of permits for single family dwellings were requested by small businesses.[122] This analysis assumes that a similar proportion of new home construction activity is conducted by small construction firms in the five Southern California counties included in this analysis. As shown in Exhibit A-2, multiplying

[118] CRA, "Economic Impacts of Critical Habitat Designation for Vernal Pool Species," June 20, 2005.

[119] Average annual revenues for small firms classified under NAICS code 236115 "New Single-Family Housing Construction (except Operative Builders)." Note that RMA reports annual sales for size classes zero to $1 million, $1 to $3 million, $3 to $5 million, $5 to $10 million, and $25 million and over. Entities classified under this NAICS code are small if they have annual revenues under $28 million annually. This analysis estimates average annual sales for small businesses using data for size classes up to $25 million in sales. As a result, it understates actual average annual revenues. (The Risk Management Association (RMA), *Annual Statement Studies: Financial Ratio Benchmarks*, 2004-2005, p. 177.)

[120] CRA, "Economic Impacts of Critical Habitat Designation for Vernal Pool Species," June 20, 2005, p. 110.

[121] The methodology used to estimate the reduction in the number of new houses does not allow for the separation of effects by areas proposed for inclusion and exclusion in Los Angeles and San Diego Counties.

[122] CRA, "Economic Impacts of Critical Habitat Designation for Vernal Pool Species," June 20, 2005, p. 105.

22 percent by the number of homes not built in each municipality provides an estimate of lost home construction for small firms.

- **Step Three.** Next, using the number of homes not built by small firms, the analysis estimates the number of small businesses affected. Results of this calculation are presented in Exhibit A-2. At the high-end, assuming that each lost house would have been built by a separate firm, the number of firms potentially affected is equal to the number of lost homes. For a low-end estimate, the number of houses not built is divided by the average number of houses built per year by small firms (three houses). In summary, in a given municipality containing proposed critical habitat, between one and 18 small construction firms may be affected annually by brodiaea conservation activities.[123] In Hemet, Moreno Valley, and Perris, where habitat is excluded from proposed critical habitat, approximately nine to 82 small firms could be affected if habitat were designated.

[123] As discussed, part of essential habitat in Los Angeles and San Diego Counties is excluded from proposed critical habitat. This analysis is not able to separate the impacts to small entities associated with these acres from other essential habitat in the counties.

Exhibit A-2

NUMBER OF SMALL CONSTRUCTION FIRMS POTENTIALLY AFFECTED ANNUALLY

FIPS Place*	Number of New Houses Not Built (a)	Number of Houses Not Built by Small Firms (b) = a * 22%	Minimum Number of Small Businesses Affected = b/3	Maximum Number of Small Businesses Affected = b
Units Proposed for Inclusion				
Glendora	22	5	2	5
San Dimas**	80	18	6	18
San Bernardino	70	15	5	15
San Clemente	46	10	3	10
San Juan Capistrano	13	3	1	3
Coto de Caza	9	2	1	2
Oceanside	27	6	2	6
Carlsbad**	28	6	2	6
Encinitas	8	2	1	2
San Marcos	13	3	1	3
Excluded from Proposed Critical Habitat				
Hemet	374	82	28	82
Moreno Valley	226	50	17	50
Perris	114	25	9	25

Sources:
(a) Section 3.2.2 of this report.
(b) CRA, "Economic Impacts of Critical Habitat Designation for Vernal Pool Species," June 20, 2005, p. 105.

Note:
* As described in Section 3, this analysis estimates housing impacts for each Federal Information Processing Standard (FIPS) place overlapping essential habitat. FIPS places generally follow the legal boundaries of incorporated cities and are proxies for individual housing markets.
** denotes FIPS places where part of its essential habitat is excluded from the proposed rule. The methodology used to estimate the reduction in the number of new houses does not allow for the separation of effects by areas proposed for inclusion and exclusion in these areas.

180. The impact to affected small businesses is estimated to be between one-third and all of their revenues for the year, depending on the estimate of the number of businesses affected. For the low-end estimate of firms affected, they will not build any homes in a single year and, as a result, 100 percent of their revenues are lost. If the high-end estimate of firms affected is more accurate, then each firm will build only two homes instead of three. In other words, one-third of projected annual revenues is lost.

181. Note that the impact to small construction firms may be overstated. As discussed in Section 3, the analysis of lost housing units is partial equilibrium in nature (e.g., does not consider substitution of displaced development to other nearby areas), which is consistent the best currently available empirical information. If, instead, homes not built in these municipalities are constructed in neighboring communities unaffected by

brodiaea conservation activities, the impact to small construction firms is likely to be less than presented in Exhibit A-2. As a result, impacts to these firms are more likely overstated than understated in this analysis.

A.1.3 Potential Impacts to the Glendora Community Conservancy

182. Section 6 of the analysis estimates potential costs to public and private land management entities. Of the entities analyzed, the Glendora Community Conservancy is the only small entity. This section estimates potential impacts of brodiaea conservation activities to the Conservancy.

183. The Conservancy's overall annual budget ranges from $15,000 to $30,000 and includes such elements as insurance, discounted land taxes, weed abatement, and trail maintenance. [124] The analysis estimates that potential future costs associated with brodiaea conservation activities at the Conservancy may range from $1,600 to $2,600 on an annualized basis (assuming a seven percent discount rate). These costs represent approximately 11 percent to 17 percent of annual expenditures assuming the low-end estimate of the annual budget ($15,000) and 5 percent to 9 percent assuming the high-end estimate ($30,000).

A.2 Potential Impacts to Energy Supply, Distribution, or Use

184. Pursuant to Executive Order No. 13211, "Actions Concerning Regulations that Significantly Affect Energy Supply, Distribution, or Use," issued May 18, 2001, Federal agencies must prepare and submit a "Statement of Energy Effects" for all "significant energy actions." The purpose of this requirement is to ensure that all Federal agencies "appropriately weigh and consider the effects of the Federal Government's regulations on the supply, distribution, and use of energy."[125] The Office of Management and Budget has provided guidance for implementing this Executive Order that outlines nine outcomes that may constitute "a significant adverse effect" of a regulatory action under consideration:

- 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 (thousand cubic feet) per year;

[124] Personal communication with Dr. Ann Croissant, Member of Board of Directors, Glendora Community Conservancy, on June 22, 2005.

[125] U.S. Office of Management and Budget, The Executive Office of the President, "Memorandum For Heads of Executive Department Agencies, and Independent Regulatory Agencies, Guidance For Implementing E.O. 13211, M-01-27," July 13, 2001.

- Reductions in electricity production in excess of 1 billion kilowatts-hours per year or in excess of 500 megawatts of installed capacity;
- Increases in energy use required by the regulatory action that exceed 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.[126]

185. Brodiaea conservation activities are likely to have minimal impacts to the energy industry. Utility corridors already exist in the essential habitat, and potential costs to San Diego Gas & Electric of avoiding brodiaea habitat are expected to be minimal. Therefore, the analysis does not anticipate impacts to energy markets.

[126] Ibid.

APPENDIX B: UNIT COSTS OF CONSULTATION

186. This appendix describes the section 7 consultation process and the administrative costs associated with the process. First, it describes the types of consultations typically undertaken by the Service, Action agencies, and third parties. Then, it describes the per consultation costs obtained from a 2002 survey of consultation records.

Technical Assistance

187. The Service responds to requests for technical assistance from State agencies, local municipalities, and private landowners and developers who may have questions regarding whether specific activities affect the brodiaea and its critical habitat. Technical assistance costs represent the estimated economic costs of informational conversations between these entities and the Service. Such conversations may occur between municipal or private property owners and the Service regarding lands designated as critical habitat or lands adjacent to critical habitat. The Service's technical assistance activities are voluntary and may occur with Federal, State, or local agencies, or private stakeholders.

Section 7 Consultations

188. Section 7(a)(2) of the Act requires Federal agencies (Action agencies) to consult with the Service whenever activities that they undertake, authorize, permit, or fund may affect a listed species or designated critical habitat. In some cases, consultations will involve the Service and another Federal agency only, such as the U.S. Forest Service. More often, they will also include a third party involved in projects on non-Federal lands with a Federal nexus, such as State agencies and private landowners.

189. During a consultation, the Service, the Action agency, and the landowner manager applying for Federal funding or permitting (if applicable) communicate in an effort to minimize potential adverse effects to the species and/or to the proposed critical habitat. Communication between these parties may occur via written letters, phone calls, in-person meetings, or any combination of these. The duration and complexity of these interactions depends on a number of variables, including the type of consultation, the species, the activity of concern, and the potential effects to the species and designated critical habitat associated with the proposed activity, the Federal agency, and whether there is a private applicant involved.

190. Section 7 consultations with the Service may be either informal or formal. Informal consultations consist of discussions between the Service, the Action agency, and

the applicant concerning an action that may affect a listed species or its designated critical habitat, is designed to identify and resolve potential concerns at an early stage in the planning process. By contrast, a formal consultation is required if the Action agency determines that its proposed action may or will adversely affect the listed species or designated critical habitat in ways that cannot be resolved through informal consultation. The formal consultation process results in the Service's determination in its Biological Opinion of whether the action is likely to jeopardize a species or adversely modify critical habitat, and recommendations to minimize those impacts. Regardless of the type of consultation or proposed project, section 7 consultations can require substantial administrative effort on the part of all participants.

Per Consultation Costs

191. Estimates of the cost of an individual consultation and technical assistance request were developed from a review and analysis of historical section 7 files from a number of Service field offices around the country conducted in 2002. These files addressed consultations conducted for both listings and critical habitat designations. Cost figures were based on an average level of effort of low, medium, or high complexity, multiplied by the appropriate labor rates for staff from the Service and other Federal agencies.

192. The administrative cost estimates presented in this Section take into consideration the level of effort of the Service, the Action agency, and the applicant, as well as the varying complexity of the consultation or the technical assistance request. Costs associated with these consultations include the administrative costs associated with conducting the consultation, such as the cost of time spent in meetings, preparing letters, and the development of a biological opinion. Exhibit B-1 summarizes the estimated administrative costs of consultations and technical assistance requests.

Exhibit B-1

ESTIMATED ADMINISTRATIVE COSTS OF CONSULTATION AND TECHNICAL ASSISTANCE EFFORTS (PER EFFORT)[a]

Consultation Type	Service	Action Agency	Third Party	Biological Assessment
Technical Assistance	$260 - $680	N/A	$600 - $1,500	N/A
Informal Consultation	$1,000 - $3,100	$1,300 - $3,900	$1,200 - $2,900	$0 - $4,000
Formal Consultation	$3,100 - $6,100	$3,900 - $6,500	$2,900 - $4,100	$4,000 - $5,600
Programmatic Consultation	$11,500 - $16,100	$9,200 - $13,800	$0	$5,600

Sources: IEc analysis based on data from the Federal Government General Schedule Rates, Office of Personnel Management, 2002, a review of consultation records from several Service field offices across the country. Confirmed by local Action agencies.
Note: Low and high estimates primarily reflect variations in staff wages and time involvement by staff.

APPENDIX C

Zabel and Paterson Study

The Effects of Critical Habitat Designation on Housing Supply: An Analysis of California Housing Construction Activity[*]

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Abstract

Under the Endangered Species Act, the U.S. Fish and Wildlife Service is required to designate critical habitat for listed species. Designation could result in modification to or delay of residential development projects within habitat boundaries, generating concern over potential housing market impacts. This paper draws upon a large dataset of municipal-level (FIPS) building permit issuances and critical habitat designations in California over a 13-year period to identify changes in the spatial and temporal pattern of development activity associated with critical habitat designation. We find that the proposal of the median sized critical habitat results in a 23.5% decrease in the supply of housing permits in the short-run and a 37.0% decrease in the long-run. The results indicate the proposal of critical habitat acts as a signal that all development in that FIPS will be more costly. We also find that the impact varies across the two periods in which critical habitat is designated and by the number of years relative to when critical habitat was first proposed.

[*] This work was funded by the U.S. Fish and Wildlife Service, Division of Economics. The conclusions and opinions expressed here do not necessarily reflect those of the Service. We are grateful for GIS analysis assistance from Scott Cole of Northwest Economic Associates and helpful comments from Jennifer Baxter and Robert Unsworth of Industrial Economics, Incorporated, Dean Gatzlaff, Keith Ihlanfeldt and seminar participants at the University of Connecticut.

1. Introduction

Under Section 4(b)(2) of the Endangered Species Act, the U.S. Fish and Wildlife Service (the Service) is required to designate areas viewed as essential to listed species conservation and requiring special management protections as "critical habitat." Designation identifies geographic units of habitat with distinct boundaries, within which certain public and private activities or projects may require review and/or modification as recommended by the Service. As part of this process, the Service is required to conduct an economic analysis, and may exclude areas from designation if the costs of including the areas within critical habitat are believed to outweigh the benefits, provided the exclusion will not result in extinction of the species (16 U.S.C. §1533(b)(2)).

Critical habitat for nearly 500 species has been designated throughout the U.S. Many of these designations have received a high degree of scrutiny and opposition, especially where habitat overlaps with resource-based industry or incompatible recreational uses. Potential housing and development-related impacts have also received a great deal of attention in critical habitat economic analyses. Designation may cause developers to alter project plans within habitat boundaries and/or delay construction activities pending Service consultation. In some areas where population is growing rapidly, there is concern that designation may constrain housing supply and drive up prices, with corresponding negative impacts to local economies (e.g. Sunding et al., 2003). However, little corroborating empirical evidence of such an effect exists.

In this paper, we test the hypothesis that the designation of critical habitat has had a depressive effect on development activity. We carry out this test using a large panel dataset of counts of building permits issued in California municipalities (Federal Information Processing Standards or FIPS) for 1990-2002, which we adopt as a surrogate measure for the level of

construction activity. By arraying these data spatially in a Geographic Information Systems (GIS) model and combining them with information on a number of designations over time, we test whether designation in a given municipality results in reduced permitting relative to a no-designation scenario.

In Section 2, we provide additional background information on critical habitat designation. In Section 3, we summarize the literature that is relevant to our analysis. In Section 4, we discuss our data sources. In Section 5, we carry out a three-step empirical analysis of the impact of critical habitat proposal on permit issuance. First, we conduct a simple comparison of means of FIPS with and without critical habitat designation. Second, given that these two groups might differ in ways that influence the number of permits issued, we carry out a matched pair analysis to try to minimize these potential differences. Third, to fully control for both observable and unobservable differences across the two groups of FIPS, we develop and estimate an econometric model of building permit issuances based on the analysis in Mayer and Somerville (2000a, 2000b). The model that best controls for the endogeneity of critical habitat designation is a partial adjustment model that includes FIPS-specific fixed effects and a lagged dependent variable. We find that the proposal of the median sized critical habitat results in a 23.5% decrease in the supply of housing permits in the short-run and a 37.0% decrease in the long-run. The results indicate the proposal of critical habitat acts as a signal that all development in that FIPS will be more costly. We also find that the impact varies across the two periods in which critical habitat is designated (1994-1995 versus 2000-2001) and by the number of years relative to when critical habitat was first proposed. Finally, we present concluding remarks in Section 6.

2. Critical Habitat Designation

The Endangered Species Act (the Act), enacted by Congress in 1973, is administered by the U.S. Fish and Wildlife Service (the Service) in conjunction with the National Marine Fisheries Service. The Service's role is to identify species in danger of extinction and to advance methods for their conservation and protection, in the hopes of eventually removing endangered and threatened species from the Federal endangered species list.

Listing species is the primary method by which the Act affords protection. Section 9 of the Act, and the Service's regulations, prohibit any action that results in the "take" of a listed animal species; that is, actions involving harassing, killing, capturing or otherwise harming endangered and threatened species. Furthermore, section 7 of the Act stipulates that Federal agencies must consult with the Service regarding any actions they fund, authorize, or carry out that may affect a listed species or designated critical habitat.

Critical habitat is defined in section 3 of the Act as: (i) the specific areas within the geographic area occupied by a species, at the time it is listed in accordance with the Act, on which are found those physical or biological features (I) essential to the conservation of the species and (II) that may require special management considerations or protection and; (ii) specific areas outside the geographic area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species. (16 U.S.C. § 1532(5)(A)).

Under the Act, the purpose of critical habitat is to help protect those areas that are identified as being essential for the conservation of the species. Critical habitat provides benefits to the species by informing the public and private sectors of areas that are important for species

recovery and where conservation actions would be most effective (in addition to regulatory protection under section 7, as mentioned above).

The Act contains specific provisions that preclude economic and other non-biological criteria from being a factor in listing decisions. Section 4(b)(1)(A) of the Act stipulates that listing determinations must be made solely on the basis of biological evidence. Section 4(b)(2) of the Act, which calls for the establishment of critical habitat for all listed species if it is prudent and determinable, also requires critical habitat designations to be made on the basis of the best scientific data available (16 U.S.C. § 1531(b) 1994). This section adds, however, in contrast to listing provisions, that the economic impact of the designation and any other relevant impacts should be taken into consideration before specifying any particular area as critical habitat. As a consequence, areas where the costs of designation are believed to be greater than the benefits can be excluded from critical habitat designation.

Our analysis focuses on California both because many recent listings have occurred there and because of the significant development pressure in some designated areas. As of 2003 there were 82 listed species in California and 68 critical habitat designations (note that more than one species can be included in a single designation). Figure 1 displays the geographic extent of these combined designations. As shown, while a significant portion of critical habitat exists in less-populated areas in the southeast, there is a considerable amount of designated area in urban and suburban portions of the San Francisco Bay area, Los Angeles, and San Diego. Note that we use the terms "critical habitat proposal" and "critical habitat designation" interchangeably in this paper. Technically, critical habitat is first proposed (at which point species information and maps get released to the public), and then following the economic analysis, public hearings and solicitation of comments, etc., is (possibly amended in some fashion and then) finalized. So the

proposal details where the critical habitat will be, but the actual "designation" corresponds to the final unit boundaries. From a practical standpoint, though, there is little difference between the concept of first proposal and final designation. Further, final designation usually occurs soon after proposal of critical habitat; in our data almost two-thirds of critical habitat actions were finalized in the same calendar year of critical habitat proposal.

3. Literature Review

Two literatures that are relevant to this analysis are the one on housing supply and the one on the impact of regulation on housing. As noted by DiPasquale (1999), there has been relatively little analysis of the supply of housing relative to the demand for housing. For our purposes, the key paper in this literature is Mayer and Somerville (2000a). The authors develop a model of housing supply that is based on the Capozza-Helsley urban growth model (Capozza and Helsley 1989). While housing price is determined in the market so as to equilibrate supply and demand, it is the change in price that will affect the change in supply or housing starts. Thus, Mayer and Somerville model housing starts as a function of the change in house price and housing construction costs. Since new housing development will not occur immediately, they include lags of house price and construction cost changes in their model.

Mayer and Somerville compare their model to another important model in the literature; DiPasquale and Wheaton's (1994) stock adjustment model. In this model, housing starts are proportional to this period's desired stock and last period's existing stock (net of depreciation). The current house price is used as a proxy for desired stock and lagged stock is included as a regressor. Mayer and Somerville note that the DiPasquale-Wheaton approach recognizes the

difference between housing supply as a stock and starts as a flow but the stock of housing is difficult to measure in non-census years since depreciation and removal are not observed.

Mayer and Somerville use quarterly national data from 1975-1994 to estimate their model. As they note, this requires two strong assumptions: 1) the model is applicable to national data, and 2) a single national housing market exists. The resulting model includes three lags of the price change variable though only the first two are significant. They estimate that the contemporaneous, one quarter, price elasticity of housing starts is 6.3% while the annual elasticity is 3.7%. Finally, the coefficient on the change in construction costs is not significant.

In Mayer and Somerville (2000b), the authors use quarterly data for 44 MSAs between 1985 and 1996 to estimate the model they developed in the previous paper. The focus of this paper is on the impact of land use regulation on residential construction. The main model is a regression of the natural log of permits on the growth rate of house prices and 5 lags of this growth rate, variables capturing land use regulation (months to receive subdivision approval, number of growth management techniques, and a dummy for the presence of development fees), the change in the real prime rate, and the log of MSA population in 1980. First, Mayer and Somerville estimate a version of the model that corrects for first-order serial correlation and an MSA-specific error term. The evidence indicates that regulation reduces housing permits. Increasing the number of months to receive subdivision approval by one standard deviation reduces the number of permits by 20-25% while adding a growth management technique reduces the number of permits by 7%. The coefficient for the variable indicating development fees is not significant.

Mayer and Somerville then correct for the endogeneity of regulation using a number of instruments. The result is the expected increase in standard errors and a large increase in the

estimated coefficient for one of the regulation variables. It should be noted that Mayer and Somerville do not use a fixed effects estimator. This is because the regulation variables do not change over time and hence would be excluded from the model if the fixed effects estimator was used.

Quigley and Raphael (2004) note the high house prices in California and particularly the large increases in house prices between July 2000 and July 2003. They also note that California has a high level of regulation that affects land use and residential construction because cities have relative autonomy in setting these regulations. Quigley and Raphael consider three hypotheses that are consistent with the fact that this high level of regulation is causing the high house prices in California: 1) housing is more expensive in more regulated cities, 2) growth in the city-level housing stock depends on the degree of regulation and, 3) the price elasticity of housing supply is lower in more regulated cities.

To test these hypotheses, Quigley and Raphael use data from the 1990 and 2000 Public Use Microdata Samples (PUMS) to generate house price indices for 407 cities in California for both owner-occupied and rental housing units. Data on land use and residential construction regulations come from a study by Glickfeld and Levine (1992). Quigley and Raphael generate a growth control index that is the number of 15 possible regulations that are in place in each city. Annual building permits for each city are obtained from the California Industry Research Board (CIRB). The results show: 1) that an additional regulation results in a 1% increase in prices in 1990 and 2000 but has no effect on the change in prices between these years, 2) the growth control index has a negative and significant effect on the growth rate of housing supply for single-family houses but not significant for multi-family houses, and 3) weak evidence of a positive supply elasticity in unregulated cities and a negative supply elasticity in regulated cities.

Margolis, Osgood, and List (2005) look at whether critical habitat designation (CHD) leads to preemptive habitat destruction (PHD). PHD often takes the form of premature land development or timber harvesting. The authors point out that 90% of listed species are found on private land and most have more than 80% of their habitat on private land. PHD is measured as the difference in the timing of permit applications between critical habitat (CH) and non-critical habitat land. The species studied is the Pigmy-owl near Tuscon, Arizona.

The data include approximately 25,000 land parcels from January 1997 through February 2001. Margolis, Osgood, and List use propensity score matching to pair CH land parcels with similar non-CH land parcels. The main estimation is a probit/logit model of pre-emption. The dependent variable is permit application. Dummy variables for CHD are broken down by time periods corresponding to events that affected PHD. Generally, the results show that CH parcels were more likely to be developed. Further, the results suggest that CH land parcels were developed roughly 300 days earlier than similar non-CH parcels

The authors also examine the impact of CHD on the sales price of undeveloped land. They collected sales prices for 7,000 transactions during the analysis period. They find that the proposal of critical habitat (the release of the property map) results in a 20% reduction in price per acre (though the p-value is only 0.091).

Quigley and Swoboda (2004) apply the standard general equilibrium urban housing model (Brueckner 1987) to analyze the general equilibrium implications of CHD. CHD is specified by designating land where housing production is not allowed. The interesting case is where CHD occurs within the urban boundary. They use simulation to solve their model and then compare the outcomes before and after CHD. Results show that, given large enough set-asides due to CHD (4% of land where development is prohibited), the most significant impact on

the urban area is the rise in the price of non-CHD land. A key assumption of the analysis is that the urban area is closed. This means that the population is fixed and no one is allowed to move out of the area after CHD. As Quigley and Swoboda point out, if this assumption is relaxed, then the cost of CHD is only the change in market value of the CHD land.

4. Data Description

The observation unit used in this study is a FIPS place.[127] FIPS boundaries follow either (1) the legal boundaries of incorporated areas (e.g., San Diego, Los Angeles, etc), or (2) Census Designated Place (CDP) boundaries established by the US Census (CDP boundaries are for unincorporated areas that support a sizable population). There is a fair amount of variation in the size of FIPS. The largest FIPS in this analysis is Los Angeles which is 303,000 acres with a population in 1990 of 3.5 million. The smallest FIPS is Amador City (approximately 30 miles south-east of Sacramento) which is 209 acres with a population in 1990 of 196.

The dataset includes the total number of permits granted each year for single-family detached and multi-family units (e.g., duplex, three/four, and five or more units) for approximately 400 FIPS places over the period 1990-2002, as recorded by the CIRB.[128] This represents the incorporated subset (with minor exceptions) of all California FIPS places and encompasses the majority of all land within FIPS boundaries. In this study, we focus on the number of single-family permits since they constitute the bulk of the permitting activity.

A GIS model was developed to geocode the permit data, compile critical habitat designations and other information and construct variables to support the analysis. GIS data on

[127] FIPS Codes are promulgated by the Federal government to facilitate data collection and processing and are established at a variety of geographic levels including, American Indian area, state, county, subcounty, metropolitan area, and place. For further information see the FIPS homepage http://www.itl.nist.gov/fipspubs/index.htm

FIPS places were obtained through the Census Bureau.[129] Figure 2 depicts the boundaries of FIPS included in this analysis.

GIS data were compiled from U.S. Fish and Wildlife Service offices for 39 critical habitat designations finalized in California between 1979 and 2003. Habitat has been designated for only a subset of the total number of federally listed species found in California and GIS spatial data are only available for a subset of these species. Table 1 provides an overview of the species-specific data relied upon in this analysis. In some cases, the originally designated habitat has since been vacated by court order, but remains in effect until a new designation is proposed and finalized by the Service. In these cases, we include the original designation in our analysis. In other cases, the vacated critical habitat is no longer valid and the revised GIS data are not available.

Three additional sources of data are utilized in our analysis. Housing price data were acquired from DataQuick Information Systems. These data provide information on the annual median selling price of single-family homes by city for the time period of our analysis. Data on total annual precipitation for over 200 monitoring stations throughout California were acquired from the Western Regional Climate Center. Using GIS, these stations were mapped to the nearest FIPS place. In many cases, a monitoring station existed within the boundaries of a given FIPS. Data on acres of forest, shrubland, water, and wetlands were constructed from United States Geological Service National Land Cover Data (NLCD), which in turn are derived from 1992 Landsat Thematic Mapper satellite data. The NLCD is a land cover classification scheme applied consistently across the United States. Twenty-one classes are grouped into nine categories, of which we examine four: Water, representing all areas of open water or permanent

[128] We thank John Quigley for providing us with this data.
[129] http://www.census.gov/geo/www/cob/pl1990.html.

ice/snow cover (the latter being irrelevant to our analysis); Forested Upland, representing areas characterized by tree cover generally greater than six meters in height and where tree canopy accounts for 25-100 percent of the cover; Shrubland, representing areas characterized by woody vegetation less than six meters tall as individuals or clumps; and Wetlands, representing areas where soil or substrate is periodically saturated with or covered with water.

5. Empirical Analysis

In this section, we carry out an empirical analysis of the impact of critical habitat designation on the number of permits issued. This analysis consists of three stages. In Stage 1, we carry out a simple comparison of the number of permits issued and other characteristics of FIPS where critical habitat was and was not proposed. We refer to these two groups as CHP FIPS and non-CHP FIPS. There were two distinct periods during which critical habitats were proposed: 1994-1995 and 2000-2001. Thus, we also compare the characteristics of the CHP FIPS that were proposed during these two periods.

Given that the CHP FIPS and the non-CHP FIPS might differ in ways that influence the number of permits issued, for each CHP FIPS, we generate a matched pair to try to minimize these potential differences. We choose the nearest non-CHP FIPS with the belief that the close proximity of the two FIPS will mean that they will be relatively similar in their development potential so that it is more likely that any difference in the number of permits issued (standardized by size of the FIPS) can be attributed to the designation of critical habitat. This matched pair comparison is Stage 2 of our analysis. Finally, to fully control for both observable and unobservable differences across CHP FIPS and the non-CHP FIPS, we develop and estimate an econometric model of building permits as Stage 3 of our empirical analysis.

5.1 Stage 1: Initial Data Analysis

There are approximately 400 FIPS in the initial data set. Due to missing information, the final data set consists of a total of 385 FIPS. Definitions of the variables and their summary statistics are given in Table 2. Of the 385 FIPS in the data set, 121 had critical habitat proposed within their boundaries while the remaining 264 did not. Critical habitat was first proposed in two distinct time periods. In 1994 and 1995, critical habitat was proposed in 13 and 10 FIPS, respectively. In 2000 and 2001, critical habitat was proposed in 63 and 35 FIPS, respectively. Thus, most (81%) of the critical habitat proposals occurred at the end of our data period. We will investigate if there is any difference in these two groups of FIPS.

To get an idea if the CHP FIPS differ systematically from the non-CHP FIPS, we compare the means of the observable characteristics for these two groups for the period in our data before any critical habitat designations occurred (1990-1993). This information is given in Table 3; columns 1 and 5 for all CHP FIPS and non-CHP FIPS, respectively. We see that in 1990 the CHP FIPS are larger in population, the number of housing units, and area but are actually smaller in terms of population per acre and the number of housing units per acre than the non-CHP FIPS. The median price of single-family houses was higher in the CHP FIPS compared to the non-CHP FIPS during the 1990-1993 period. The means of both the pro-growth and growth-exclusion indices (regulation count variables similar to those utilized by Quigley and Raphael, 2004) are higher in the CHP FIPS than in the non-CHP FIPS. Given the latter result, we don't necessarily expect the number of permits per acre issued to differ across the CHP FIPS and non-CHP FIPS because of existing land-use regulations.

The mean number of permits issued annually between 1990 and 1993 is 188.9 and 97.9 in CHP FIPS and non-CHP FIPS, respectively. But while this average is more than twice as high for the CHP FIPS (because they are larger on average), the standardized (by acre) mean is actually higher in the non-CHP FIPS than in the CHP FIPS (0.0178 versus 0.0132, respectively). Further, the mean number of permits issued in CHP FIPS in the 1994-2002 period was 272.8 so the difference in means in the period in which critical habitat was proposed and in the period prior to any proposals is 83.9. The mean number of permits issued in non-CHP FIPS in the 1994-2002 period was 103.1 so the difference in means between the period in which critical habitat was proposed in the prior period prior is 5.2. Thus is appears that there was a relative increase in permits issued across these two periods in CHP FIPS compared to non-CHP FIPS (this is true for standardized permits as well).

Using columns 2 and 3 in Table 3, we can compare the CHP FIPS where critical habitat was first proposed in 1994-1995 with those where critical habitat was first proposed in 2000-2001. The p-value for this comparison of means is given in column 4 of Table 3. We see that relative to the 1994-1995 group, the group of FIPS with critical habitat proposals in 2000-2001 are smaller in population, number of housing units, and area, though the differences are not statistically significant. Yet the 2000-2001 CHP FIPS had a higher average number of single family permits issued during 1990-1993 and the average per acre was twice that of the 1994-1995 CHP FIPS and this difference is statistically significant. Thus there does seem to be a difference between the CHP FIPS based on when critical habitat was proposed.

5.2 Stage 2: Neighbor Comparisons

The results from Stage 1 show that the increase in the mean number of permits from the period prior to CHD (1990-1993) to the period when critical habitat designation took place (1994-2002) was actually higher for the CHP FIPS compared to the non-CHP FIPS. Attributing this result to critical habitat designation can be erroneous since we have not controlled for other factors that might affect permits issuance. In Stage 2 of the empirical analysis, we refine the comparison of mean permits issued by matching each CHP FIPS with its nearest non-CHP FIPS neighbor. This should provide a more accurate measure of the impact of critical habitat designation on permit issuance since the nearest neighbors are more likely to be similar to the CHP FIPS in terms of development potential than the group of non-CHP FIPS as a whole.

We begin this analysis in 1994 when the first critical habitat area was proposed. For each subsequent year, we present two basic results. First, we calculate the percent of times the number of permits per acre in the non-CHP FIPS exceeds that for the CHP FIPS. Second, we test whether the differences in permit means are statistically significant by performing paired t-tests. We then combine the years in a simple regression model to get an overall assessment of the difference in permits per acre across the matched pairs.

To further isolate the impact of the proposed critical habitat designation, we consider two difference-in-difference estimators. First, we look at the mean change in permits per acre issued between the year that critical habitat is first proposed and the year prior to this event. That is, we compare the mean of $s_t - s_{t-1}$ for the CHP FIPS and the non-CHP FIPS (where s_t is the mean number of single family permits per acre in year *t*, the year of critical habitat proposal). Second, we compare the mean change in permits per acre issued between the year after critical habitat is first proposed and the year prior to this event. That is, we compare the mean of $s_{t+1} - s_{t-1}$ for the

CHP FIPS and the non-CHP FIPS. This difference-in-difference comparison controls for other factors that caused the number of permits per acre to change between years.

For the 120 CHP FIPS, the average distance to the nearest non-CHP FIPS neighbor is 1.3 miles.[130] The maximum distance is 11.5 miles. In order to make it more likely that the neighbor is similar to the FIPS with proposed critical habitat, we also restrict the maximum distance to be less than or equal to one and two miles. These restrictions reduced the number of FIPS with proposed critical habitat to 60 and 99, respectively. We present the mean values for the observable characteristics for the nearest non-CHP FIPS neighbor in column 6 of Table 3. For the most part, these means are closer to the comparable values for the CHP FIPS than are the means for all non-CHP FIPS (column 5). Column 7 in Table 3 gives the p-values for the differences in the mean values for the CHP FIPS (column 1) and their neighbors (column 6). While the standardized population and number of housing units and price are not significantly different at the 5% level, the mean standardized number of permits is significantly greater in the non-CHP FIPS. This appears to be driven, in part, by some large outliers. While the mean standardized number of permits in the non-CHP FIPS is 34% higher compared to the CHP FIPS, the median is only 16% higher. Further, when we look at CHP FIPS where the neighbor is at most one mile away, the mean and median values are only 17% and 10% higher in the non-CHP FIPS, respectively.

As discussed earlier in this section, one comparison we make is the frequency with which permits per acre in the non-CHP FIPS neighbor are greater than in the CHP FIPS. Consistently higher permits per acre in neighboring communities could suggest some effect associated with critical habitat. The results of this comparison (column 2 of Table 4) show that no consistent pattern emerges. The second comparison is for the mean permits per acre. In column 3 of Table

4, we present the percent difference between the mean permits in the CHP FIPS and their neighbors. The mean number of permits is greater in the CHP FIPS relative to the non-CHP FIPS for all but the last two years. The p-values for the differences (column 4 of Table 4) indicate that they are generally not significant though the p-values for the comparisons in 2001 and 2002 are 0.06 and 0.05, respectively.[131] When we restrict the maximum distance between FIPS to be two miles and then one mile, the differences tend to increase.

The difference-in-difference results are also given in Table 4. These comparisons are restricted to the years when the critical habitat was first proposed. Here we see that the change in permits issued in the CHP FIPS tended to be smaller than for the non-CHP FIPS. These differences are not significant but the results are influenced by the small number of FIPS in each comparison. These results do give some evidence that the proposal of critical habitat does adversely affect the issuance of building permits.

We then combine the annual comparisons in a simple regression model to get an overall assessment of the difference in permits across the two groups. We regress the number of permits per acre on year dummies and CHP_{it}, a dummy variable for FIPS where critical habitat was proposed in year t or earlier. The results are presented in Table 5. When we use all observations, the estimated coefficient for CHP_{it} is negative but insignificant (p-value is 0.077). When we confine the observations to only those years in which the critical habitat was first proposed, the coefficient is still negative but much larger in magnitude and the p-value is 0.025. An important result occurs when we divide the sample into the two periods when critical habitat

[130] One CHP FIPS was excluded from this analysis since its eight nearest neighbors were also CHP FIPS.

[131] It is important to note that the number of FIPS places in California, as designated by the Census Bureau, increased in 2000. Our current dataset contains permit data for a subset of all FIPS places present in 1990 and 2000. The addition of new FIPS could be problematic if significant portions of critical habitat designated in recent years are contained in these areas and would otherwise appear in our comparisons (i.e., in incorporated areas). A quick comparison, however, reveals that only 17 of *all* 231 newly established FIPS contain habitat for recent designations. Only 2 of those 17 are incorporated areas that would have otherwise been included in our comparisons.

was first proposed: 1994-1995 and 2000-2001. The coefficient estimate for CHP_{it} is positive but insignificant for the regression run using the 1994-1995 sub-sample and is negative and significant when the 2000-2001 sub-sample is used. Recall that the mean number of permits issued in 1990-1993 for the 2000-2001 CHP FIPS sub-sample was greater than the 1994-1995 CHP FIPS sub-sample, particularly on a per acre basis. Thus it appears that the proposal of critical habitat might have more of an impact on the FIPS that are more active in terms of development.

Overall, these results suggest that the proposal of critical habitat had a negative impact on the issuance of single-family building permits. Further, the impact is different depending on when critical habitat was proposed. This motivates the more formal structural analysis through the modeling of housing permits.

5.3 Step 3: Development and Estimation of Econometric Models

Step 3 of the empirical analysis involves the development and estimation of an econometric model of building permits. This will allow us to control for both observed and unobserved factors that affect building permits and hence provide the best estimate of the causal impact of critical habitat designation on the issuance of permits.

5.3.1 Development of Econometric Models

Housing starts occur for two reasons, 1) to replace existing stock that is demolished and 2) to meet increases in population growth (or, in general, increases in the demand for housing). Thus housing starts may occur to maintain an equilibrium stock of housing or they may arise in response to changing conditions that require an increase in the housing stock relative to last

period. Mayer and Somerville (2000a) point out that it is the change in population, i.e. growth that pushes up housing prices and changes in other factors such as construction costs that will result in a change in the housing stock. Otherwise, the equilibrium housing stock will not change. Thus, they include changes in prices and costs of construction as regressors in their model of housing starts.

Our model is most similar to that in Mayer and Somerville (2000b) since they use MSA-level data and include measures of regulation in their model of housing starts. Our analysis differs from theirs in at least three ways. First, we use a fixed effects estimator to control for unobserved factors that affect housing starts and are correlated with measures of CHD. Second, we develop a partial adjustment model of housing starts. This results in the addition of a lagged dependent variable to the model. Third, we allow the impact of CHD to vary over time.

Initially, we specify a model of housing starts where the natural log of the number of permits or starts (*S*) issued in FIPS place *i* during year *t* is modeled as:

$$\ln S_{it} = \beta_0 + \beta_1 \Delta \ln PRICE_{it} + \beta_2 CHP_{it} + \beta_3 CH\_AREA_{it} + \beta_4 CH\_AREA_{it}^2 + \beta_5 CH\_EVER_i + X_{it}\beta_6 + YEAR_t\beta_7 + u_i + \varepsilon_{it} \quad (1)$$

where $\Delta \ln PRICE_{it}$ is the percent change in the median house price[132], CHP_{it} is a binary variable that indicates whether or not critical habitat was proposed in FIPS place *i* in year *t* or earlier, CH_AREA_{it} is the percent of the FIPS area that was finalized as critical habitat (this variable is zero when CHP_{it} is zero), and CH_EVER_i indicates if critical habitat was ever proposed in FIPS i. Further, X_{it} is a vector of other factors that affect the number of permits issued, $YEAR_t$ is a

[132] While there is some concern that the median house price index is not adjusted for quality, Meese and Wallace (1997) find little difference between this index and the constant quality house price index.

vector of year-specific dummy variables, u_i is a FIPS-specific effect, ε_{ij} is an unobserved error term, and $\beta_0, \beta_1, ..., \beta_7$ are parameters to be estimated. We denote equation (1) as Model 1.

The year dummies will capture annual economic factors such as the interest rate. They will also pick up construction costs given that they are relatively constant across the FIPS in California that are included in this analysis. The FIPS-specific effect will capture unobserved time-invariant factors that make the FIPS more likely to be developed. These might include any time-invariant factors such as the distances to centers of economic activity and environmental amenities such as the Pacific Ocean or the existence of particular industries in the FIPS. The vector X_{it} includes the natural logs of population and land area of the FIPS (we do not include the number of housing units since the correlation with population is 0.98). These two variables are based on the 1990 and 2000 censuses. We set each equal to the value from the 1990 Census for years 1990-1999 and we use the value from the 2000 census for years 2000-2002. The FIPS land area actually varies across censuses because in 2000 the Census Bureau modified the spatial boundary definitions of many of the FIPS in our sample.

We also include two indices that measure the regulatory stringency of the FIPS; regulations that affect the ability to build new units in the FIPS. The first, *GROW*, is a pro-growth index while the second, *EXCLUDE*, is an index of existing growth-limiting regulations.[133] These variables are time-invariant since they are generated from data that was only collected for 1992. Interestingly, these two variables are positively correlated. Thus, it appears that FIPS are regulation "happy" or they are not.

Of primary interest are the three variables that indicate critical habitat designation. Note that the binary variable CHP_{it} remains equal to 1 for all years after critical habitat has been

proposed.[134] Initially, we assume that the impact will be constant for all these years. Later on, we will allow the coefficient on CHP_{it} to vary over time to determine if the impact differs after the initial year in which critical habitat is proposed. Also, we allow for a non-zero impact prior to proposal to pick up possible preemptive activity (as discussed in Margolis et al 2005). Recall that, in Steps 1 and 2 of the empirical analysis, we showed that there are significant differences between the CHP FIPS where critical habitat proposals occurred in 1994-1994 versus 2000-2001. Thus we will allow the impact of CHP_{it} to differ across the two groups in Model 1.

The coefficient for CHP_{it} will measure the impact of the proposal of critical habitat regardless of the amount of land it covers. Given that CH_AREA_{it} is included in the model, a significantly negative value of the coefficient for CHP_{it} will indicate that the proposal of critical habitat acts as a signal to developers of higher costs of development in general. This can occur if the proposal of critical habitat leads to greater regulatory stringency in CHP FIPS for all development.

To determine if the amount of critical habitat land affects the number of permits issued, we include the variable CH_AREA_{it} which measures the percent of the FIPS area that is proposed for critical habitat. We add the square of CH_AREA_{it} to allow for a non-linear impact. We also include CH_EVER_i in Model 1 to measure any difference in the mean number of permits issued between CHP FIPS and non-CHP FIPS conditional on all the other regressors including the other two critical habitat variables. By including this variable, the coefficients on CHP_{it} and CH_AREA_{it} will more accurately measure the impact of proposing critical habitat and not any other underlying differences across the CHP FIPS and non-CHP FIPS.

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[133] These indices were originally developed by Glickfeld and Levine (1992) and were provided to us by John Quigley.

[134] We also look at the impact of final designation but generally final designation occurred at most two years after critical habitat was initially proposed and often occurred in the same year. In practice, a variable that

An important concern with CHP_{it} and CH_AREA_{it} is that because economic costs can play a role in critical habitat designation, they are not likely to be exogenous. One might think that the critical habitat land will have less development potential, either because species tend to live in areas that are less likely to be developed or because there is a tendency not to designate areas that have high development potential as critical habitat. The former reason could occur because the most developable land, all things equal, does not provide good habitat for species. On the other hand, areas that exhibit the greatest development potential are the ones where species are most likely to be affected since their habitat is being destroyed. This is particularly true in California as new development is occurring in more remote areas with terrain more conducive to species habitat.

This discussion makes it clear that CHP_{it} and CH_AREA_{it} are likely to be correlated with u_i and hence estimating equation (1) by OLS or random effects will results in biased estimates of the parameters. One can view the addition of CH_EVER_i to equation (1) as a proxy for u_i that will mitigate the bias. This bias can also be removed by using an estimator that controls for u_i. One such estimator is the fixed effects estimator. The use of fixed effects will not completely correct the endogeneity bias if the change in permits as well as the level of permits affects CHP_{it} and CH_AREA_{it}. While this seems less likely, it is a source of bias that we must still address. One way of correcting the bias caused by the endogeneity of CHP_{it} and CH_AREA_{it} is to use instrumental variables. We use the annual rainfall and the number of acres of forest land, shrubland, water, and wetlands in each FIPS as an instrument. Thus we argue that rainfall and the number of acres of forest land, shrubland, water, and wetland are not correlated with building permits (conditional on the other regressors) but that these variables are correlated with the

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accounted for final designation was never significant when included in the regression with CHP (the correlation between the two measures is approximately 0.7).

proposal of critical habitat. Since we have more than one potential instrument, we can test for the validity of all but two of them using the over-identification test (see Wooldridge 2003)

DiPasquale and Wheaton's (1994) stock-adjustment model for housing supply motivates a second model of permit issuance. Given the prevalence of land-use regulations, it is likely that there is a lag in obtaining new building permits. We use a partial adjustment approach to model permits in terms of the optimal level of permits, S_{it}^*, rather than the actual level, S_{it}

$$\begin{aligned}\ln S_{it}^* = {} & \beta_0 + \beta_2 \Delta \ln PRICE_{it} + \beta_3 CHP_{it} + \beta_4 CH\_AREA_{it} + \beta_5 CH\_\mathrm{AREA}_{\mathrm{it}}^2 \\ & + X_{it}\beta_6 + YEAR_t\beta_7 + u_i + \varepsilon_{it}\end{aligned} \tag{2}$$

Given time lags in the permitting process, the market only partially adjusts to the desired level

$$\ln S_{it} - \ln S_{it-1} = \delta\left(\ln S_{it}^* - \ln S_{it-1}\right) \text{ where } 0 \le \delta \le 1$$

or

$$\ln S_{it} = \delta \ln S_{it}^* + (1-\delta)\ln S_{it-1} \tag{3}$$

Substituting (2) into (3) gives

$$\begin{aligned}\ln S_{it} = {} & \delta(\beta_0 + \beta_2 \Delta \ln PRICE_{it} + \beta_3 CHP_{it} + \beta_4 CH\_AREA_{it} + \beta_5 CH\_AREA_{it}^2 \\ & + X_{it}\beta_6 + YEAR_t\beta_7 + u_i + \varepsilon_{it}) + (1-\delta)\ln S_{it-1} \\ = {} & \alpha_0 + \alpha_1 \ln S_{it-1} + \alpha_2 \Delta \ln PRICE_{it} + \alpha_3 CHP_{it} + \alpha_4 CH\_AREA_{it} + \alpha_5 CH\_AREA_{it}^2 \\ & + X_{it}\alpha_6 + YEAR_t\alpha_7 + u_{1i} + \varepsilon_{1it}\end{aligned} \tag{4}$$

where

$$\alpha_1 = 1-\delta,\ u_{1it} = \delta u_{it},\ \varepsilon_{1it} = \delta\varepsilon_{it},\ \alpha_j = \delta\beta_j \quad j = 0,1,...,7$$

The result is a model with a lagged dependent variable. Call this Model 2.

In both Mayer and Somerville papers (2000a, 2000b), the authors find evidence of first-order serial correlation in a model similar to Model 1 above. Their response is to correct for this

using a Generalized Least Squares estimator. In the context of Model 2, one can also interpret the presence of first-order serial correlation in Model 1 as evidence of misspecified dynamics; the lagged dependent variable is excluded. Evidence in favor of Model 2 will be the presence of first order serial correlation in Model 1 and a significant estimate of α_1 and the absence of first-order serial correlation in Model 2.

5.3.2. Estimation of Econometric Models

In this sub-section, we estimate Models 1 and 2 that were just developed in Section 5.3.1. The dependent variable is the natural log of single-family building permits.[135] Regressors include the percent change in real median house prices, year dummies, variables that measure the potential impact of critical habitat designation, and other factors that might affect the number of permits issued. When the price data are added to the data set, we lose 24 FIPS due to missing values or reliability issues. Finally, the percent of the FIPS designated as critical habitat is missing for two FIPS. The final tally for the regression analysis is 359 FIPS and a total of 4,132 observations.

We first estimate Model 1 using FIPS-specific random effects. This allows us to include time invariant variables in the model. We view these results as mainly descriptive since we have not fully controlled for the endogeneity of the critical habitat indicators. We include the natural logs of the population and area of the FIPS in 1990, the two regulation measures, and the three critical habitat indicators; CHP_{it}, CH_AREA_{it} (and its square) and CH_EVER_i. The results are given in column 1 of Table 6. Both the percent change in price and its lag are positive and significant (the coefficient estimates are 0.017 and 0.014, respectively). The contemporaneous

[135] Given that there are some observations with 0 permits (3.44%), we add 1 to the number of permits before taking the natural log.

price elasticity is 1.7 and the elasticity next period is 1.4. Thus a 1% increase in prices will lead to a 3.1% increase in permits over two years. Mayer and Somerville (2000b) estimate an annual supply elasticity of 3.7%. The size of the FIPS and its population both significantly affect the number of building permits: a 1% increase in area (population) leads to a 0.669% (0.162%) increase in building permits issued. The pro-growth index is positive and significant. An additional pro-growth regulation raises the number of permits by 6.5%. The estimated coefficient for the exclusionary growth index is actually positive but not significant.

The coefficient for CH_EVER_i is positive but not significant, indicating there is no significant difference in permits issued between the CHP FIPS and the non-CHP FIPS after controlling for the other explanatory variables. The coefficient for CHP_{it} is negative and significant at the 1% level. Note that it does not make sense to interpret the coefficient on CHP_{it} by itself given the presence of CH_AREA_{it} in the model. That is, the proposal itself is in conjunction with the land that is designated as critical habitat. The percent of the FIPS area that is designated as critical habitat has a distribution that is skewed right; the mean is 15.4 while the median is 6.9 and approximately 10% of the values are greater than 50%. The coefficient for CH_AREA_{it} and its square are positive and negative, respectively and both are individually significant at the 5% level. Initially an increase in designated area will increase the number of permits issued and additional area does not decrease the number of permits until the critical habitat area is 41.6% of the total area in the FIPS. Thus we find that at the three quartiles (1.4%, 7% and 20% of land designated as critical habitat) the number of permits is lower by 21.8%, 15.1%, and 2.0%, respectively, relative to a comparable non-CHP FIPS. This fact that this impact decreases in magnitude as the percent of land designated as critical habitat increases is

not a tenable result and this motivates the need for a model that better controls for the endogeneity of critical habitat designation.

We next estimate Model 1 using fixed effects. We test for first-order serial correlation and find significant evidence that it exists ($\hat{\rho} = 0.37$, p-value<0.01). We then estimate Model 2 using fixed effects. Note that Model 2 includes a lagged dependent variable. The consistent estimator requires that Model 2 be first-differenced and that the differenced lagged dependent variable be instrumented (Hsiao 2003). We use the second lag of the log of permits as our instrument. The results are given in columns 2 and 3 of Table 6.[136] Note that there is no evidence of first-order serial correlation in Model 2 (the p-value is 0.333) and that the lagged dependent variable is significant at the 1% level with an estimated coefficient of 0.420 (see column 2 of Table 6). Thus, Model 2 is preferred to Model 1.

When both CH_AREA_{it} and $CH\_AREA_{it}^2$ are included in Model 2, the coefficients for CHP_{it} and CH_AREA_{it} are both negative and the one for $CH\_AREA_{it}^2$ is positive and all three are individually insignificant at the 5% level (see column 2 of Table 6). The p-value for the F-test that all three coefficients are jointly zero is 0.011. In column 3 of Table 6, we present the results when only CH_AREA_{it} is included. The p-value for the F-test that the coefficients for CHP_{it} and CH_AREA_{it} are jointly zero is 0.006. Thus we prefer the version of Model 2 that only includes CH_AREA_{it} and not it's square. Using these results (column 3) we find, in the short-run, at the three quartiles (1.4%, 7% and 20% of land designated as critical habitat) the number of permits will decrease by 21.1%, 23.5%, and 28.9%, respectively, when critical habitat is

[136] Given that we estimate Model 2 using fixed effects, all time-invariant variables will drop out. While, technically, the population in the FIPS is time varying (since we use information from both the 1990 and 2000 Censuses), it only proxies for the true values in non-census years. Thus, we do not include population as a regressor in Model 2. We do include the FIPS area variable since the areas only changed in 2000 so our variable accurately measures the actual FIPS area across all years of the sample. Plus, given that the number of building permits is

proposed[137]. As opposed to Model 1, the impact increases (in magnitude) as the percent of the FIPS area that is designated as critical habitat increases. In the long run, these impacts are 33.5%, 37.0%, and 44.4%, respectively[138]. The fact that this is a economically large impact and that the change between the first and third quartiles of CH_AREA_{it} is not large (relatively) indicates that the proposal of critical habitat acts as a signal that all development in this FIPS will be more costly.

The presence of the median house price in the model raises concerns about endogeneity. Endogeneity of the current price change variable is unlikely since the issuance of a permit will not result in a new house until some point in the future. Mayer and Somerville (2000a) point out that the actual agreement about the price of the house at the purchase and sale is made 6-12 weeks prior to the listed date of the transaction and hence "The combination of a leading measure of supply and a lagged measure of prices makes endogeneity quite unlikely." (page 654) Despite this conclusion, Mayer and Somerville take two approaches towards mitigating the possible endogeneity bias. First, they leave out the current price change and second, they instrument for the current price change with the user cost of capital and the change in an index of employment in the MSA. They find that the instruments do not work well. In both cases, there is little change in the estimated coefficients or their standard errors for the regulation variables. We try leaving out the contemporaneous price change and instrumenting for the current price change with the lagged price change but neither have much impact on the estimated coefficient or its standard error for CHP_{it} and CH_AREA_{it}.

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clearly related to the size of the FIPS, we do not want any change in building permits due to the expansion or contraction of the FIPS in 2000 to be attributed to the proposal of critical habitat.

[137] The comparable results when $CH\_AREA_{it}^2$ is included (column 2 of Table 6) are a decrease of 17.3%, 23.5%, and 34.2%, respectively.

[138] The long-run impact is the short-run impact divided by $(1-\alpha_1)$ where α_1 is the coefficient for $\ln S_{t-1}$.

While the use of fixed effects is likely to alleviate much of the endogeneity bias associated with CHP_{it} and CH_AREA_{it} there is still the possibility that ΔCHP_{it} and ΔCH_AREA_{it} are correlated with $\Delta\varepsilon_{it}$ (recall that since Model 2 includes a lagged dependent variable, the consistent fixed effects estimator requires first-differencing). We try two approaches to reducing this possible bias. Fist we include a random trend in permits that is specific to each FIPS. If this trend is correlated with critical habitat designation and is left out of the model, the coefficients for CHP_{it} and CH_AREA_{it} will be biased in both the linear and first-differenced model. The random trends are transformed into fixed effects in the first-difference model. These fixed effects are not jointly significant and their inclusion has little impact on the estimated coefficient or its standard error for CHP_{it} and CH_AREA_{it}.

Next we use the annual rainfall and land-type variables to instrument for CHP_{it} and CH_AREA_{it}. Note that because Model 2 is estimated in first-differences, we are actually instrumenting for ΔCHP_{it} and ΔCH_AREA_{it}. We use annual rainfall, the first-difference of annual rainfall and the logs of the four land-type variables as instruments.[139] The F-statistic/p-value for the test that the six instruments are jointly zero in the first stage regression is 2.72/0.012 and 1.18/0.315 for ΔCHP_{it} and ΔCH_AREA_{it}, respectively. Thus these six instruments are not particularly good instruments for ΔCHP_{it} and ΔCH_AREA_{it}. The results for the instrumental variables (IV) regression are given in column 4 of Table 6. The coefficient estimate for CHP_{it} has decreased in magnitude from -0.229 to -0.082 while the coefficient estimate for CH_AREA_{it} has increased in magnitude from -0.006 to -0.016. The two coefficients are no longer jointly significant. Given that there is little change in the coefficient estimates for the other variables, it should not be surprising that the Hausman test does not reject the null

hypothesis of the exogeneity of ΔCHP_{it} and ΔCH_AREA_{it}. Thus the results in column 3 tend to be more believable.

Note that because we have six instruments, the IV regression is over-identified. This means that we can test for the validity of four of the instruments. We choose to assume that rainfall and the first difference in rainfall are exogenous. This allows us to test for the validity of the four land-type variables. First we run the IV regression using only rainfall and the first-difference in rainfall as instruments. We then regress the residuals from this regression on the exogenous variables from the IV regression and the four land-type variables. The F-test that the coefficients for the four land-type variables are jointly zero is not rejected at the 5% level. Thus this is evidence that the four land-type variables are exogenous.

Next, we allow the coefficient for CHP_{it} to vary both by the year since critical habitat was first proposed and by whether critical habitat was first proposed in the 1994-1995 period or the 2000-2001 period. We exclude CH_AREA_{it} from this regression to minimize the number of time-varying parameters in the regression so we can focus on whether the impact of CHD varies over time relative to when it was first proposed. The variables are denoted as *CHP9495-j*, j=0,1,…,8 and *CHP0001-k*, k=0,1,2 to indicate which period and how many years ago critical habitat was proposed (*CHP9495-0* refers to the 1994-1995 period and that critical habitat was proposed in that year). Since the data go through 2002, there are eight years after critical habitat was proposed in 1994 but only two periods after it was proposed in 2000. Further, to check to see if knowledge of the proposal of critical habitat existed prior to the proposal date, we include *CHP9495-M1*, *CHP9495-M2*, *CHP0001-M1*, and *CHP0001-M2*. These variables are 1 in each

[139] Since the four land-type variables can be zero, we add 1 before taking the log.

of the two years prior to the proposal of critical habitat. A positive coefficient estimate for these variables would be indicative of preemptive activity.

As seen in column 5 of Table 6, the variation in the coefficient estimates indicates that there is a different impact during the period that critical habitat was proposed and in the ensuing years. Note that the only variable that is significant is *CHP0001-0*; the year of critical habitat proposal during the 2000-2001 period. The insignificance of the other variables is due, at least in part, to the fact that there are so few observations when these variables are 1. For example, there were only 23 FIPS in which critical habitat was proposed during the 1994-1995 period. When critical habitat was first proposed in either 2000 or 2001, there was a 28.6% decrease in the number of permits issued.[140] In the following two years, the decrease was 20.9% and 25.8%. Whereas, when critical habitat was first proposed in either 1994 or 1995, there was only a 15.2% decrease in the number of permits issued. What is somewhat surprising is that this impact increased to 42.5% and 36.7% in the two years after critical habitat was proposed. After that, the impact was similar to the year that critical habitat was first proposed.

Note that there is no impact on permit issuances in the two years prior to critical habitat proposal. This result is not entirely surprising considering the circumstances of most California designations. Species in question typically occupy the proposed habitat and developers and others may already be aware of their presence due to protections afforded under other provisions of the Act. The proposal itself, however, through the delineation of specific boundaries and interpretation of that information by developers and municipalities is a significant event.

These results for the time-varying coefficients suggest that we are correctly measuring the causal impact of CHD on permit issuance. That is, the estimated impacts are consistent with

[140] When the dependent variable Y is specified in logs, the appropriate interpretation of the coefficient for a dummy variable X is that when X = 1, there is a 100*(exp(β)-1)% change in Y on average compared to when X = 0.

the timing of this event; no effect prior to critical habitat proposal and then a large negative and sustained impact once proposal occurs.

6. Conclusion

We have conducted one of the first empirical analyses of the impact of critical habitat designation on the issuance of building permits for single family homes. Our data consist of the number of single family permits issued in close to 400 cities (FIPS) in California for the period 1990-2002. In our final dataset, critical habitat was proposed in 23 cities during the 1994-1995 period and in 98 cities during the 2000-2001 period.

Since the U.S. Fish and Wildlife Service is required to consider economic impacts when designating critical habitat there is likely to be an endogeneity problem. We conducted a three-stage empirical analysis that involved steadily increasing the controls of this endogeneity problem. First, we did a simple comparison of means of CHP FIPS and non-CHP FIPS. This showed that the change in the mean number of permits issued from the period prior to any critical habitat proposal (1990-1993) to the period during which critical habitat was proposed (1994-2002) actually increased more in the CHP FIPS. But when we next matched CHP FIPS to their nearest non-CHP FIPS neighbor in Stage 2 of our analysis, there was evidence that the proposal of critical habitat had a negative impact on the issuance of single-family building permits. This change in outcome from Stage 1 and Stage 2 highlights the need to control for observed differences between the CHP FIPS and non-CHP FIPS in order to get an accurate estimate of the impact of critical habitat proposal on permit issuances.

In Stage 3 of the analysis we take this a step further by developing an econometric model that controls for both observable and unobservable differences between the CHP FIPS and non-CHP FIPS. Our best model is a partial adjustment model that includes FIPS-specific fixed

effects and a lagged dependent variable. We find that the proposal of the median sized critical habitat results in a 23.5% decrease in the supply of housing permits in the short-run and a 37.0% decrease in the long-run. Further, the change in the magnitude of the impact on permit issuance when going from the 25th to the 75th percentile in terms of CHD area is only 7.8 percentage points. Thus the relatively large impact for even small sized designations indicates that critical habitat proposal acts as a signal that all development in that FIPS will be more costly. This is consistent with anecdotal evidence that cities where critical habitat has been designated tend to become more risk averse and hence more stringent in issuing new building permits regardless of whether or not they are for land in critical habitat designated areas.

We also find that the impact varies across the two periods in which critical habitat is designated and by the number of years relative to when critical habitat was first proposed. We do not find evidence of preemptive behavior since there is no significant change in the number of building permits in the two years prior to critical habitat proposal.

We believe that our results provide evidence that there is a statistically and economically significant causal effect of the designation of critical habitat on the issuance of permits for single-family houses in California during the 1990-2002 period. Since CHD is a relatively new phenomenon, this analysis can only be enhanced by future data. This is the first step towards determining the impact of critical habitat designation on the housing market in California. The next step is to look at the general equilibrium impact of CHD on the issuance of building permits. This will capture any potential substitution of the lost development in CHP FIPS with additional new development in the nearby non-CHP FIPS. The final step is to translate the change in the supply of new building permits into an impact on the overall stock of housing in

order to determine the full costs of critical habitat designation as the loss of welfare in the housing market. We leave these two steps for future research.

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Figure 1. Approximate Extent of Designated Critical Habitat in California

Figure 2. FIPS Places included in Empirical Analysis

Table 1 **Federally Listed Species and Critical Habitat Designations in California**	
Category	**Number**
Total number of species	82
Total number of critical habitat designations	68
Number of species for which GIS data are available for designations	39
Number of species habitat designations that intersect with FIPS places	26
Source: USFWS Website (endangered.fws.gov)	
Note: the number of critical habitat designations is not equivalent to the number of listed species. For example, several species can be included in one designation or individual species can be found in separate designations that occupy the same land.	

Table 2 - Variable Definitions and Summary Statistics						
Variable	Definition	N Obs	Mean	Std Dev	Minimum	Maximum
PERMITS (S)	Single family permits	4811	152.33	302.11	0	3227
CHP	1 if critical habitat proposed in current or prior year, 0 otherwise	4811	0.09	0.29	0	1
CH_EVER	1 if critical habitat ever proposed, 0 otherwise	4811	0.32	0.47	0	1
CH_AREA	Percent FIPS area designated as critical habitat when CHP=1, 0 otherwise	4785	1.62	8.72	0.00	91.49
PRICE	Median house price in 1,000s of 1990 dollars	4687	171.19	121.55	24.19	2520.69
AREA	Land area of FIPS in 1990 in 1,000s of acres	4811	10.22	22.03	0.21	303.34
POPULATION	Population in 1990 in 1,000s	4811	56.97	198.72	0.19	3485.40
HOUSE UNITS	Number of housing units in 1990 in 1,000s	4811	21.25	74.14	0.09	1299.96
GROW	Pro growth index	4811	2.49	2.30	0	9
EXCLUDE	Exclusionary growth index	4811	8.15	6.48	0	58
RAINFALL	Annual precipitation in inches	4811	18.42	12.58	0.00	102.49
FOREST	Acres characterized by tree cover generally greater than 6 meters in height	4811	380.07	1411.10	0.00	19673.23
SHRUBLAND	Acres of areas characterized by woody vegetation less than six meters tall	4811	1841.95	6328.05	0.00	76468.08
WATER	Acres of areas of open water	4811	82.46	525.41	0.00	8407.19
WETLAND	Acres of areas where soil or substrate is periodically saturated with or covered with water	4811	8.99	42.26	0.00	404.24

Table 3 - Comparison of Mean Characteristics of CHP FIPS and Non-CHP FIPS							
	CHP FIPS				Non-CHP FIPS		
Variable	All (1)	1994-1995 (2)	2000-2001 (3)	p-value of (2) vs (3) (4)	All (5)	Nearest Neighbor (6)	p-value of (1) vs (5) (7)
Number of FIPS	120	23	97		264	120	
POPULATION (in 1990)	103.4	112.7	63.54	0.531	32.80	35.34	0.030
HOUSE UNITS (in 1990)	38.90	42.51	23.51	0.516	12.10	13.17	0.028
AREA (in 1990)	17.60	18.94	11.89	0.389	6.397	7.057	0.002
POPULATION/AREA (in 1990)	5.292	5.340	5.086	0.735	6.207	6.601	0.050
HOUSE UNITS/AREA (in 1990)	2.018	2.057	1.849	0.470	2.258	2.371	0.112
PRICE, 1990-1993	190.3	158.8	199.0	0.000	170.8	177.2	0.067
PERMITS, 1990-1993	188.9	178.5	233.3	0.095	97.94	126.2	0.000
PERMITS/AREA, 1990-1993	0.013	0.011	0.022	0.000	0.018	0.018	0.003
GROWTH	2.736	2.847	2.261	0.259	2.261	2.067	0.014
EXCLUDE	9.579	9.724	8.957	0.646	7.170	7.463	0.009

Table 4: Matched Pair Results

Year	Number of FIPS (1)	Percent Neighbors Permits>* (2)	Pct Diff Between Mean Number of Permits** (3)	P-value (4)
1994	13	46.15	32.89	0.38
1995	23	47.83	34.70	0.28
1996	23	43.48	10.11	0.82
1997	23	39.13	31.78	0.41
1998	23	34.78	42.01	0.32
1999	23	34.78	38.78	0.40
2000	86	44.71	10.46	0.58
2001	121	51.69	-45.35	0.06
2002	120	51.69	-43.70	0.05
Distance between pairs less than or equal to 2				
1994	11	36.36	37.42	0.35
1995	20	45.00	46.62	0.14
1996	20	45.00	5.85	0.90
1997	20	35.00	43.98	0.26
1998	20	35.00	61.52	0.14
1999	20	35.00	60.76	0.18
2000	72	41.67	11.15	0.61
2001	99	48.98	-34.44	0.16
2002	98	50.00	-39.73	0.11
Distance between pairs less than or equal to 1				
1994	8	25.00	67.98	0.10
1995	15	40.00	68.12	0.04
1996	15	26.67	70.41	0.06
1997	15	26.67	60.58	0.12
1998	15	26.67	76.85	0.09
1999	15	33.33	75.29	0.13
2000	48	39.58	19.11	0.49
2001	58	48.28	-58.46	0.13
2002	58	48.28	-51.16	0.16
sf - sf(-1)				
1994	12	76.92	-136.01	0.10
1995	10	70.00	-2032.21	0.41
2000	63	54.84	-39.18	0.64
2001	35	71.43	-76.90	0.59
sf(+1)-sf(-1)				
1994	12	69.23	-86.02	0.14
1995	10	40.00	-120.75	0.31
2000	63	53.23	-212.14	0.16
2001	35	51.43	60.47	0.90

* - Column 2 gives the percentage of times the neighbor's mean number of permits is greater than the CHP FIP's mean number.

** - Column 3 gives the percentage difference between the mean number of permits in the CHP FIPS and the nearest neighbor FIPS.

Table 5 – Matched Pair Regression Results					
	Number (1)	Coefficient (2)	Std Err (3)	p-value (4)	R-square (5)
All CHP FIPS and Matched Pair					
All Observations	898	-0.002	0.002	0.077	0.014
Distance <= 1 Mile	494	0.002	0.002	0.419	0.014
Only Year Proposed	240	-0.005	0.003	0.025	0.025
Only Year Proposed and Distance <= 1 Mile	130	-0.003	0.004	0.121	0.029
CHP FIPS where proposal occurred in 1994-5 and Matched Pair					
All Observations	394	0.008	0.002	0.500	0.052
Distance <= 1 Mile	248	0.015	0.003	0.500	0.113
Only Year Proposed	46	0.005	0.005	0.414	0.119
Only Year Proposed and Distance <= 1Mile	32	0.014	0.006	0.497	0.276
CHP FIPS where proposal occurred in 2000-1 and Matched Pair					
All Observations	504	-0.009	0.003	0.000	0.026
Distance <= 1 Mile	246	-0.011	0.003	0.000	0.040
Only Year Proposed	194	-0.008	0.004	0.009	0.022
Only Year Proposed and Distance <= 1 Mile	98	-0.008	0.004	0.018	0.033

Table 6 - Regression Results for Models of Building Permits					
Variable	Model 1 – RE (1)	Model 2 – FE (2)	Model 2 – FE (3)	Model 2 – IV (4)	Model 2 – FE (5)
lnS_{-1}		0.418**	0.420**	0.421**	0.422**
		(0.076)	(0.076)	(0.096)	(0.077)
ΔlnPRICE	0.017**	0.004*	0.004*	0.004	0.004*
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
$\Delta lnPRICE_{-1}$	0.014**	-0.0005	-0.0005	-0.0006	0.000
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
lnAREA	0.669**	0.325	0.319	0.291	0.327
	(0.064)	(0.189)	(0.189)	(0.399)	(0.190)
lnPOPULATION	0.162*				
	(0.064)				
GROW	0.065*				
	(0.028)				
EXCLUDE	0.012				
	(0.010)				
CH_EVER	0.150				
	(0.131)				
CHP	-0.268**	-0.170	-0.229	-0.082	
	(0.084)	(0.148)	(0.129)	(1.873)	
CH_AREA	0.016*	-0.015	-0.006	-0.017	
	(0.007)	(0.012)	(0.005)	(0.120)	
$CH\_AREA^2/100$	-0.020*	0.013			
	(0.009)	(0.016)			
CHP9495-M2					0.05
					(0.229)
CHP9495-M1					0.004
					(0.228)
CHP9495-0					-0.165
					(0.227)
CHP9495-1					-0.553
					(0.324)
CHP9495-2					-0.458
					(0.400)
CHP9495-3					-0.192
					(0.462)
CHP9495-4					-0.166
					(0.515)
CHP9495-5					-0.108
					(0.565)
CHP9495-6					0.07
					(0.610)
CHP9495-7					-0.293
					(0.653)

Table 6 - Regression Results for Models of Building Permits					
Variable	Model 1 – RE (1)	Model 2 – FE (2)	Model 2 – FE (3)	Model 2 – IV (4)	Model 2 – FE (5)
CHP9495-8					-0.163
					(0.724)
CHP0001-M2					-0.015
					(0.119)
CHP0001-M1					0.019
					(0.119)
CHP0001-0					-0.337**
					(0.119)
CHP0001-1					-0.235
					(0.177)
CHP0001-2					-0.299
					(0.240)
p-value of AR1 Test	<0.001	0.333	0.328		
1st-Stage F-test statistics[5]				2.72/1.18	
No. of FIPS	359	359	359	359	361
Observations	4132	3773	3773	3773	3795

Notes
1. Dependent variable is the natural log of single family permits
2. Year dummies are included in all regressions
3. Standard errors are in parentheses
4. * Significant at 5%; ** Significant at 1%
5. F statistics for the tests that the coefficients for the instruments are jointly zero for the regressions of ΔCHP_{it} and ΔCH_AREA_{it} on all instruments and exogenous variables.