SECTION

III

ANNOTATIONS OF STUDIES

This section contains detailed information on specific source materials of the literature on sprawl. The information is presented according to five basic categories (and their subcategories) of sprawl's impacts. A listing of works included here by author follows the references section of this monograph.

I. *Public and Private Capital and Operating Costs*
   1. Alternative Development Analyses
   2. Fiscal Impacts, Exactions, and Impact Fees
   3. The Effects of Growth Controls on Housing Costs
   4. Urban Form and Sprawl

II. *Transportation and Travel Costs*
   1. Changes in Automobile Travel
   2. The Effects of Density on Travel Choice
   3. Unlimited Outward Extension
   4. Spatial Segregation of Uses (Land Use Mix and Urban Design)
   5. Dispersed Employment
   6. The Costs of Travel

III. *Land/Natural Habitat Preservation*
   1. Land Preservation and Community Cohesion
   2. Land/Habitat Preservation: Empirical Studies

IV. *Quality of Life*
   1. Popular Literature
   2. Indicators, Report Cards, and Benchmarks
   3. Economics Literature
   4. Sociology Literature
   5. Psychology Literature

V. *Social Issues*
   1. The Growth of Cities and Metropolitan Areas
   2. Urban Decline
   3. Urban Renewal

The citations that have been annotated here are far from an exhaustive coverage of the individual topic. Yet, within the five basic categories of sprawl's impacts, there is a representation of some of the field's most important current and historical literature. Approximately 25 percent of the references have been annotated. Each of the annotated works is reviewed in a similar manner. The first portion of the analysis places the work in an overall context. A second component involves a discussion of why the work is important to the sprawl literature. A third component discusses methodology and data sources employed, if appropriate. A final component discusses results and conclusions of the work.

The annotations have been chosen to include both positive and negative positions on sprawl as well as a balance between descriptive and empirical works.

The annotations included here contribute to the judgments on strengths and weaknesses of the literature contained in the previous chapter. Sprawl has a rich and diverse literature, as will be seen in this compilation of annotations.

CHAPTER 9

Annotations of Studies

PUBLIC/PRIVATE CAPITAL AND OPERATING COSTS

This chapter annotates studies that relate to sprawl and the alleged *public/private capital and operating costs* that it imposes. *Public* capital and operating costs are costs associated with residential and nonresidential development: roads, utilities, public buildings and the costs of providing day-to-day police, fire, general government, recreational, and educational services. *Private* capital and operating costs are the expenses incurred in occupying residential and nonresidential properties—in other words, the costs imposed on housing and commercial development related to type, location, and density of development. The chapter is divided into four parts:

Alternative Development Analyses
Fiscal Impacts, Exactions, and Impact Fees
The Effects of Growth Controls on Housing Costs
Urban Form and Sprawl

The *Alternative Development Analyses* section includes the works of Robert W. Burchell (1997b, 1992a, and others), James Frank (1989), James Duncan (1989), RERC (1974), and Paul Tischler (1994), among others. *Fiscal Impacts, Exactions, and Impact Fees* includes, in addition to the above, the works of the American Farmland Trust (1986, 1992) and DuPage County, Illinois (1989, 1991). The *Effects of Growth on Housing Costs* literature includes the works of Katz and Rosen (1987), George Parsons (1992), and Seymour Schwartz et al. (1981 and 1989). Finally, the section on *Urban Form and Sprawl* includes the articles of Helen Ladd (1991) and Richard Peiser (1989).

ALTERNATIVE DEVELOPMENT ANALYSES

Burchell, Robert W. 1997b. *South Carolina Infrastructure Study: Projection of Statewide Infrastructure Costs, 1995-2015.* New Brunswick, NJ: Center for Urban Policy Research, Rutgers University.

This study involves a 20-year projection of infrastructure need in the State of South Carolina. It encompasses all public and quasi-public infrastructure required in the state including developmental (roads, bridges, water/sewer), educational,

commercial, public safety, public health, recreational/cultural, and environmental. Twenty-eight individual categories of infrastructure are contained in the above seven groupings listed above. Findings for the state are as follows:

- $56.7 billion in required infrastructure costs from 1995-2015
- $16.7 billion in potential infrastructure savings due to technology, differing means of provision, and costs of sprawl savings. Much of the above savings to come from technology and differing means of provision, as opposed to costs of sprawl savings
- Three-quarters of the remaining $40 billion ($2 billion per year for 20 years), or an average of $1.5 billion annually, could be raised via 10 percent infrastructure set-asides in all state, county, municipal, and school district general fund budgets and intergovernmental transfer revenues
- The remaining $500 million annually must be raised from a variety of revenue sources, including property tax, sales tax, the tolling of roads, development impact fees, water/sewer charges and the like. A 2¢/gallon gasoline tax increase would raise only $56 million in revenues annually for infrastructure purposes.

Burchell, Robert W. 1992a. *Impact Assessment of the New Jersey Interim State Development and Redevelopment Plan. Report II: Research Findings.* Trenton: New Jersey Office of State Planning.

This study is an analysis of the effects of implementing a managed growth strategy in the state of New Jersey in the form of a State Plan. Two alternative futures are modeled—one with development as usual (TREND), and one with development according to the proposed State Development and Redevelopment Plan (PLAN).

The study showed that the state could save $1.4 billion in infrastructure funding over 20 years for roads, utilities, and schools, if it followed the PLAN versus the TREND scheme. This savings occurred mainly through more intensive use of existing infrastructure, as opposed to building additional infrastructure. The PLAN approach directed new growth to where excess capacity existed, rather than to virgin territories. The PLAN scheme was also more compact than the TREND scheme, therefore requiring less distance to be covered when linking developments by local and county roads. In addition, concentrating larger numbers of people in more compact areas provides for economies of scale, such as larger water and sewer treatment facilities, with lower costs per individual user. The Rutgers study, using the same increases in population (520,000 persons in 20 years), jobs, and households, for both TREND and PLAN, found that PLAN would save:

- $699 million in roads—a 24 percent savings
- $561 million in water and sewer costs—a 7.6 percent savings
- $173 million in school capital costs—a 3.3 percent savings
- $1.4 billion, overall, or just under 10 percent of all development-related (roads, water/sewer, public buildings) infrastructure expenditures.

Burchell, Robert W. et al.

1. ***The Economic Impacts of Trend versus Vision Growth in the Lexington Metropolitan Area.*** **Report Prepared for Bluegrass Tomorrow, Lexington, KY. 1995b (November).**
2. ***Impact Assessment of DELEP CCMP versus STATUS QUO on Twelve Municipalities in the DELEP Region.*** **Report Prepared for by the Government Committee of the Delaware Estuary Program. Philadelphia, PA. August 15, 1995.**
3. ***Fiscal Impacts of Alternative Land Development Patterns in Michigan: The Costs of Current Development Versus Compact Growth.*** **Southeast Michigan Regional Council of Governments. 1997a.**

These three studies extend and broaden the application of Burchell's New Jersey modeling of development alternatives (sprawl versus compact growth) to different geographic settings. A broader base enables refinement and testing of the models under different taxing structures, differing means of providing and funding infrastructure, and differing geographic levels of investigation.

Each of the studies—Lexington, Kentucky, the Delaware Estuary, and the State of Michigan—looked at the land, infrastructure, housing, and fiscal costs of sprawl versus compact development. Compact development was differently defined in each study; sprawl which was equated with historical development, varied only marginally from place to place. There was much more consistency in the definition of trend development or sprawl across these studies than there was in the specific alternatives to sprawl. Findings from the studies are included in the following table:

COMPACT GROWTH VERSUS SPRAWL DEVELOPMENT: FINDINGS OF MULTIPLE STUDIES

Area of Impact	Savings: Compact Growth Over Sprawl Development (Lexington, KY and Delaware Estuary Studies)	Savings: Compact Growth Over Sprawl Development (State of Michigan)
Developable Land	20.5–24.2%	15.5%
Agricultural Land	18-29%	17.4%
Fragile Land	20-27%	13.1%
Infrastructure		
Roads	14.8%-19.7%	12.4%
Utilities (Water/sewer)	6.7-8.2%	13.7%
Housing Costs	2.5-8.2%	13.7%
Fiscal Impacts	6.9%	3.5%

Duncan, James E. et al. 1989. *The Search for Efficient Urban Growth Patterns.* Tallahassee: Department of Community Affairs.

This analysis encompasses detailed case studies of the actual costs (and revenues) incurred by several completed residential and nonresidential projects throughout Florida. The projects chosen are representative of five different development patterns ranging from "scattered" to "compact." Although the Florida study did not intend such an analysis, it is possible to group the five development patterns into two aggregate development profiles, "trend" and "managed/planned" growth. The term "trend" includes the Florida development patterns labeled "scattered," "linear," and "satellite"; the term "managed/planned" refers to the Florida patterns of "contiguous" and "compact" growth. With this grouping, the relative capital costs for trend versus managed or planned growth can be determined from the base Florida case study information. The data show that the total public capital costs for a detached unit built under trend conditions in Florida approached

$16,000; under planned development the capital cost was about $11,000 per unit, or roughly 70 percent of the cost of "trend" (see table below).

CAPITAL FACILITY COSTS UNDER TREND VERSUS PLANNED DEVELOPMENT
(PER DWELLING UNIT; 1990 DOLLARS)

Category of Capital Costs	Average of Case Studies Under Trend Development	Average of Case Studies Under Planned Development	Trend Versus Planned Development Difference	#/%
Roads	$7,014	$2,784	(+) $4,230	60.3
Schools	6,079	5,625	(+) 545	7 4
Utilities	2,187	1,320	(+) 867	39.6
Other	661	672	(-) 11	1.7
Total	15,941	$10,401	(+) 5,4540	36.7

ECONorthwest. 1994. *Evaluation of No Growth and Slow Growth Policies for the Portland Region.* Portland, OR: Metropolitan Portland Government.

As part of its *Region 2040* planning program, Metro (Portland, Oregon's metropolitan area's regional government) evaluated alternative futures for the region and the policies available to achieve those futures. This report examined whether the region could or should adopt policies to reduce and slow the anticipated growth in the region.

The study identifies both reactive and proactive policies which would slow growth. Reactive policies would discourage growth through a municipality's economic development activities, its investment in infrastructure and public facilities, and its programs for environmental amenities and social services. Proactive government policies would discourage growth by limiting the supply and use of buildable land (via zoning and planning regulations), charging more for public facilities, and imposing increased environmental and design standards on existing and new developments.

The authors concluded that while municipally initiated reactive or proactive policies would slow growth in the short run at the local level, a viable strategy for the Portland metropolitan area must be implemented at a regional scale, so that aggregate growth is decreased and not simply redistributed within the metropolitan area.

Finally, the study pointed out that although not always considered, slow growth policies could have negative effects on the local economy. These include decreased economic opportunities and income growth, and increased housing costs.

Fodor, Eben V. 1997. "The Real Cost of Growth in Oregon" *Population and Environment* 18-4.

Oregon municipalities levy *system development charges* to offset development costs. Within Oregon, for a typical three-bedroom home, these development charges can range from $1,000 to $6,500 per unit. Fodor, however, conservatively estimates that the actual public cost is closer to $24,500 per unit. He provides a breakdown as shown in the table below.

Fodor concludes that Oregon (like other states) is only recovering a fraction of the public infrastructure costs through *system development charges* and other development fees. Rather, he postulates that communities are subsidizing growth by keeping housing prices artificially low. Implementing growth management strategies, while providing these subsidies, works at cross purposes. Fodor suggests that communities should pursue alternatives, such as the public acquisition of land to prevent development, as a viable, cost-saving policy for growth management.

DEVELOPMENT COSTS (PER DWELLING UNIT)	
Public Service	Amount
School Facilities	$ 11,377
Sanitary Sewage Facilities	5,089
Transportation Facilities	4,193
Water System	2,066
Parks and Recreation	797
Stormwater Drainage	510
Fire / EMS facilities	470
Total	24,502

Frank, James E. 1989. *The Costs of Alternative Development Patterns: A Review of the Literature.* Washington, DC: Urban Land Institute.

This study reviews the national literature conducted over roughly four decades concerning development costs. Frank orders the findings of the various reports and expresses them in equivalent dollar terms (1987 dollars). He concludes from the national literature that multiple factors affect development costs including density, contiguity of development, distance to central public facilities (e.g., sewage and water plants), as well as other characteristics, such as municipal improvement standards. In brief, capital costs are highest in situations of low-density sprawl, and for development located a considerable distance from central facilities. By contrast, costs can be dramatically reduced in higher-density development that is centrally and contiguously located. As described by Frank:

> When all capital costs are totaled ... the total cost for low-density ... sprawl ... is slightly more than $35,000 per dwelling unit. Further, if that development is located 10 miles from the sewage treatment plant, the central water source, the receiving body of water, and the major concentration of employment, almost $15,000 per dwelling unit is added to the cost, for a total of $48,000 per dwelling unit ...
>
> The cost can be reduced to less than $18,000 ... by choosing a central location, using a mix of housing types in which single-family units constitute 30 percent of the total and apartments 70 percent, and by planning contiguous development instead of leapfrogging. (Frank 1989, 39)

To the extent that planned or managed growth fosters the more efficient patterns described above—centrally located, contiguous development that includes units at somewhat higher density—it can achieve infrastructure savings relative to traditional development.

Peiser, Richard B. 1984. "Does It Pay to Plan Suburban Growth?" *Journal of the American Planning Association* 50: 419-433.

The aim of this study is to provide a comprehensive method for comparing one development pattern to another. To achieve this aim, Peiser conducts a quasi-controlled experiment comparing the planned development of a 7500-acre tract in southwest Houston with the hypothetical "unplanned" development of the same tract. Peiser patterns unplanned development after development that occurred to the north of Houston in an area called Champions. The author evaluates the capital costs associated with land development and transportation for each of the two development alternatives. Other social costs are also examined in a qualitative analysis. Unlike previous studies, Peiser includes non-residential land uses in his analysis.

Peiser makes four assumptions in his comparison. First, total density and total acreage of each case is assumed to be equal. Second, he assumes that each community derives the same level of total benefits. The relative advantage of one community over the other is determined by the differences in costs associated with each type of development. Third, the study focuses upon the differences in costs of the overall community design, not the costs associated with differences in housing, building types, interior streets or utilities for residential subdivisions. Finally, travel costs are accounted for to and from the edge of the development site.

Peiser finds that planned development produces higher net benefits than unplanned development for the three cost components investigated: land development, transportation, and social issues. Overall, transportation costs provide the greatest net benefit. However, the magnitude of the difference is small, only accounting for one to three percent of total costs. Further, Peiser acknowledges the obstacles to planning large-scale developments. He highlights several constraints associated with such development including the cost and availability of financing, the labyrinthine permitting process, and the difficulties of managing large-scale projects.

Real Estate Research Corporation (RERC). 1974. *The Costs of Sprawl: Environmental and Economic Costs of Alternative Residential Development Patterns at the Urban Fringe: (Volume I: Detailed Cost Analysis; Volume II: Literature Review and Bibliography).* Washington, DC: U.S. Government Printing Office.

Among the most often cited studies in the history of planning literature, this three-volume series is the final report of an early effort to isolate the variable of density from those of structural age, obsolescent layout, and low-income population, in order to measure some of the most important and costly consequences of urban form. Sponsored jointly by the U.S. Council on Environmental Quality, the Department of Housing and Urban Development, and the Environmental Protection Agency, the project was carried out by the Real Estate Research Corporation. Its central conclusion, that low density development is extremely costly on energy, environment, and fiscal grounds, has been generally accepted as both intuitively correct and accurately determined.

The basic study method was to make detailed estimates of the costs associated with six hypothetical new communities—each containing 10,000 dwelling units, each housing an "average" urban fringe population mix, and each constructed in a "typical" environmental setting.

The report's basic conclusions are:

1) The high-density planned community would be optimal with reference to all four key indicators examined: energy cost, environmental impact, capital cost, and operating cost. The low-density sprawl community would be least desirable with reference to all four.

2) The high-density planned community would require 44 percent less energy than the low-density sprawl community.

3) The high-density planned community would generate 45 percent less air pollution.

4) The high-density planned community would require a capital investment 44

percent less than the low-density sprawl community; the largest proportionate savings would be in road and utility construction, but the largest absolute saving would be in the cost of residential construction itself.

5) The operating cost of community services would be about 11 percent lower in the high-density planned community than in the low-density sprawl community

A classic in its field, *The Costs of Sprawl* has not failed to attract criticism. Perhaps the most glaring limitation is that its energy, pollution, and capital cost comparisons all require correction. The authors assumed different space standards for the different types of dwelling units. The savings in capital and operating costs calculated in the report are mainly a function of the difference in size, not where these units are located or the density of their development. Furthermore, the energy savings attributed in the report to high-density development appear significantly overstated; and since the estimates of air pollution reduction was made a direct function of energy savings, these estimates must be deflated to a similar degree.

Despite these qualifications, *The Costs of Sprawl* merits the close attention of those interested in an analysis of urban form. Although it is important to recognize the fragility of the main conclusions of *The Costs of Sprawl,* it is equally appropriate to recognize this report as a landmark from which most research on the consequences of urban form has branched.

Souza, Paul. 1995. *New Capital Costs of Sprawl, Martin County, Florida.* Gainesville, Fl: University of Florida.

This is a study of the capital requirements of growth in a developing county in South Florida. Souza assumes that Martin County's population will grow at a similar rate as the rest of South Florida. He then calculates the density- and distance-related costs of providing certain public infrastructure. Costs associated with providing roads, a potable water supply, and sanitary sewers within three different housing densities (3, 5, and 10 units per acre) are assessed using Martin County-specific unit costs and development assumptions. Souza then computes costs associated with connecting three sites at varying distances from the urban service area.

Souza finds that the provision of infrastructure within the *lowest density* development is over 100 percent more costly than the provision of infrastructure within the *highest density* development. He also finds that distance costs can not be separated from density costs. As distance from the center increases, density decreases.

The provision of infrastructure to the *lowest density* housing pattern situated on the site *farthest* from the urban service area is 181 percent more costly than the provision of infrastructure to the *highest density* housing pattern situated on a site *within* the urban service area. Low-density sprawl is significantly more costly than high-density non-sprawl. Roads comprise the largest proportion of both density- and distance- related costs.

Tischler & Associates. 1994. *Marginal Cost Analysis of Growth Alternatives—King County, Washington.* Bethesda, MD: Tischler & Associates, Inc.

This paper was prepared for the King County, Washington Growth Management Planning Council (GMPC) to evaluate options for future development. The analysis consists of three basic land-use scenarios, with and without high capacity transit between planned urban centers, yielding five alternatives for study.

The study identifies the costs of new development for each alternative over a twenty-year projection period, estimating costs and revenues associated with growth for roads, transit, water and sewer utilities, and government administration.

The study draws the following conclusions:

- The alternatives with more development in the urban centers and cities are more fiscally beneficial when roads, utilities, and general fund activities are considered.
- The scenarios using eight centers generate higher net revenues for the general fund and utility districts than those with fourteen centers, because the eight-center scenarios assume fewer new households in the unincorporated counties inside the urban growth area (UGA) than do the fourteen-center scenarios.
- The fourteen-center scenarios indicate net road costs which are 11 percent below those of the eight-center scenarios. Road costs (especially rights-of-ways) are higher for the eight-center scenarios because these alternatives include major increases in new households and jobs, which entail both the construction of new roads and purchases of rights-of-ways in the maturing urban centers.

Windsor, Duane. 1979. *"A Critique of The Costs of Sprawl." Journal of the American Planning Association* 45, 2: (July) 279-292.

This article is a critical review of the RERC study, *The Costs of Sprawl.* The first part summarizes the findings from the RERC study. The author then criticizes RERC for not disentangling density from other factors. Windsor criticizes RERC for using different size units for different densities, i.e., smaller units for higher densities. Because smaller units have lower floor areas, they are less costly to build. This is a major reason why larger low-density, single-family units are considered more costly to build and to publicly service than higher-density units. Total floor area is 44 percent lower in high-rise developments than single-family neighborhoods. Differences in housing costs and public capital costs largely parallel these floor area differences.

Windsor recomputes the RERC analysis assuming all housing units are 1,200 square feet. This computation greatly reduces the housing and capital cost advantages of high density, though the advantages still exist. However, this approach is equally unrealistic. In reality, higher-density units are indeed smaller, on average, so RERC is not entirely wrong. Windsor concludes that the only way to avoid the problem is to calculate results for both methods on a per square foot basis and compare them.

Another criticism Windsor levels at the RERC study is that it assumes structure costs are highest for single-family homes,

lower for high-rise construction, and lowest for walk-up units. Windsor, in contrast, believes that high-rise units should have the highest costs per square foot. He also takes issue with RERC's assumption that developers have to contribute more land to the public sector under single-family development than under high-rise development.

RERC assumes that clustering in higher-density patterns results in savings of vacant land. But, Windsor argues that if the model assumed that a given amount of land is developed at different densities, the total population accommodated on the land could vary. Some ability to account for saved land when residents have more land immediately around them than permitted by existing zoning should have been developed.

The author also criticizes RERC for: "the underlying assumption that cost minimization is an appropriate principle for planning and development ... Cost minimization is not a planning principle unless benefits are constant." Since RERC ignores the benefit side, its conclusions of reduced costs ignore the reduced benefits. However, the author thinks it is not necessary to measure benefits. He claims the prevalence of low-density settlements reflects the benefits to consumers: "Consumers choose to live at high densities only where land costs are very high, as in central cities." Where land costs are lower, as in suburbs, they prefer low density environments.

The author claims that suburbs resist high density on several grounds, not just costs. "Voters are opposed to rapid population growth, the possible characteristics of new residents, the fiscal implications, and the loss of suburban amenities like open space, semi-rural ambiance, etc. Exclusionary land-use controls are intended, in part, to force low-density development; they function as a form of growth management." (291)

By ignoring these nuances, says Windsor, RERC "does not properly evaluate the relative economic efficiency of alternative development patterns." (291)

York, Marie L. 1989. *Encouraging Compact Development in Florida.* Fort Lauderdale, FL: Florida Atlantic University–Florida International University Joint Center for Environmental and Urban Problems.

York analyzes three areas: growth management programs from around the country (Maine, Massachusetts, New Jersey, Oregon, Vermont); innovative development strategies by region; and problems with redevelopment. The analysis of the statewide programs consists of descriptive summaries of state policies designed to address increasing growth management problems, as well as summaries of the situations that prompted the development of these policies. Each state's section concludes with a discussion of how well the policies and legislation have worked in achieving the state's goals. Some of the difficulties, noted by York, revolve around definitions of rural versus urban uses; areas that are exempted from the legislation for one reason or another; property taxes as a disincentive to compact growth; opposition from developers and municipalities; and the methods of determining urban growth boundaries.

The innovative development strategies section of this document examines the use of urban growth boundaries (UGBs)—a proactive growth management tool to contain, control, direct, or phase growth

close to existing urban development. Basic to this strategy is the delineation of perimeters around urban development areas, within which urban densities are normally encouraged, and outside which urban uses and densities are discouraged. Also discussed are transfers of development rights, point systems, and revenue sharing as means of growth management. All four of the subsections conclude with the experiences of communities in several states that have implemented these strategies.

The section on problems of in-fill and development provides overviews of issues and approaches, followed by discussions of programs and projects in Florida and other states.

A secondary analysis of several state studies is undertaken to quantify the impact of UGBs on land prices. However, York admits that the data are neither complete nor consistent enough to draw firm conclusions concerning the land price impacts of urban growth boundaries.

The report concludes with separate sets of recommendations for encouraging compact development, redevelopment, and in-fill development. The recommendations address land use, fiscal, and infrastructure issues.

FISCAL IMPACTS, EXACTIONS, AND IMPACT FEES

Altshuler, Alan. 1977. "Review of The Costs of Sprawl," *Journal of the American Planning Association* 43, 2: 207-209.

This short article reviews the RERC report and was published about two years after the report. The review is so clear and so well done that it changed forever the way the *Costs of Sprawl* report was viewed. For purposes of simplicity, Altshuler focuses on the two extreme cases analyzed by RERC—high-density multifamily housing and low-density single-family housing. He begins by summarizing the major findings of the RERC study. He then asks three questions: (1) Have the results of the theoretical analysis been calibrated against actual community experiences? (2) Does the report itself fully support the conclusions stated in its summary? and (3) Are the reported advantages of high-density over low-density development clearly differentiated as to reason? His answer to all three questions is "No"!

One key issue Altshuler raises is whether density per se affects the demand for community services. RERC explicitly assumes that it does not, but Altshuler challenges that assumption. Low-density areas often have no sidewalks; they have above-ground utility lines, and infrequent street lights, when measured against high-density areas. The demand for public safety services is also likely to be lower in low-density development. Further, RERC does not include any estimates of mass transit spending in its study, though such spending would surely be higher in high-density communities that rely more on mass transit. Therefore, Altshuler maintains high-density settlements are likely to have higher community service costs than low-density ones, which would offset many of the savings projected for the latter types of settlements.

According to RERC, the savings for high-density living versus low-density living are only $238 per year in operating costs, for a density rise from 3.5 to 19.0 units per acre plus more intensive planning. Four-fifths of the savings are attributed to density alone. Altshuler believes, given the omissions mentioned

above, that this small amount would vanish if the analysis were done correctly.

He also makes the point, which Windsor later picks up on, that dwelling units in the high-density settlement are 34 percent smaller than those in the low-density settlement, and this accounts for a large part of their differences in capital and energy costs. Five-sixths of the heating and air conditioning savings in high-density development is attributable to smaller housing unit sizes.

RERC further assumes that average annual travel per household in high-density developments is about 9,891 miles versus 19,673 miles per household in low-density developments. Generally, only local trips vary by density, but RERC fallaciously attributes cost savings to the entire travel mileage. According to Altshuler, correcting this error eliminates four-fifths of the claimed savings in auto energy consumption. With proper analysis, the total energy savings of high-density versus low-density development is about 3 percent, of which only 1 percent is attributable to density alone.

Another issue Altshuler addresses is whether higher residential density leads to higher density in other types of land uses. He thinks not: "The case that low-density living is a highly expensive luxury remains to be made" (209).

Nonetheless, the author commends RERC for having putting forth a systematic analysis that can serve as a starting point for other studies.

Altshuler, Alan A., and Jose A. Gomez-Ibanez. 1993. *Regulation for Revenue: The Political Economy of Land Use Exactions.* Washington, DC: Brookings Institution.

The central issues and themes of this text relate to government-mandated exactions paid by real estate developers. Exactions may be in-kind or involve monetary outlays. The legal theory underlying development exactions is that governments, having reasonably determined that certain public needs are "attributable" to new development, may require that their costs be "internalized" as part of the development process. A key premise of the argument for exactions is that land development is a major cause of escalating local infrastructure demands and costs.

This study looks at the costs of growth in built-up communities. Alternative estimates of revenues and expenditures for the city of San Francisco are discussed, as are approaches for allocating public expenditures for growth among county businesses and residents in Montgomery County, Maryland.

This text also critiques the Real Estate Research Corporation's *The Costs of Sprawl* study. As Altshuler found in his 1977 study, the principal problem with the RERC study is the meaning associated with the cost differences. Altshuler and Gomez-Ibanez argue that the degree of variation between the quality of housing units from one community to another does not allow costs to be fairly compared. If conditions can not be replicated in future studies, community cost impacts will continue to be difficult to compare.

Overall, the chapter on fiscal impact analysis reflects at least one of the authors' inexperience with this technique.

The authors rely too heavily on secondary analyses and critiques. Furthermore, the book does not give enough recognition to the role (both constructive and destructive) of fiscal impact analysis to either counter or abet development (sprawl) during subdivision or site plan review.

American Farmland Trust. 1986. *Density-Related Public Costs.* Washington, DC: AFT.

This study tests the hypothesis that, in rural areas, public costs for new residential development exceed the public revenues associated with this type of development. Using Loudoun County, Virginia data, the study attempts to develop a methodology to estimate: (1) the net public costs (public costs minus public revenues) of new residential development; and (2) how these costs vary with different development densities.

The study's methodology entails a four-step process. First, major categories of public expenditures (education, health and welfare, and safety) and public revenues (property taxes, state funds, and other local taxes) are identified, based on the county's annual budget. Second, the demographic profile of a 1,000-household new development is determined, based on surrounding demographics, to consist of 3,260 residents (including 940 school-age children). Third, four development scenarios are projected at different density levels, varying from 0.2 dwelling units (d.u.) per acre (rural, low-density) to 4.5 d.u. per acre (suburban, high-density), while retaining the demographic profile of the development. Finally, fiscal impact analysis models are run to determine public costs and revenues associated with each density scenario.

The results reveal a public revenue shortfall for residential development at all densities. However, the lowest-density development results in a shortfall three times larger than the highest density development ($2,200 per d.u. versus $700 per d.u.). To cover the shortfall, the county would have to apply some combination of reduced public services, higher taxes, or increased commercial zoning. In addition to imposing higher public costs, the lower-density developments also remove larger amounts of agricultural land—a result counter to Loudoun County's goal to preserve its agricultural economy.

American Farmland Trust. 1992a. *Does Farmland Protection Pay? The Cost of Community Services in Three Massachusetts Towns.* Washington, DC: AFT.

This report summarizes the American Farmland Trust's findings from studies of three Pioneer Valley, Connecticut towns (Agawan, Deerfield, and Gill). The report addresses the five basic steps undertaken by the studies: 1) discussions with local sponsors to define land-use categories (residential, industrial, commercial, and farm/forest/open land); 2) the collection of data for each town; 3) the review of public revenues, allocated by land use; 4) the review of public expenditures, allocated by land use; 5) data analysis and calculation of revenue-to-cost ratios.

This study is part of a series of studies on the costs and benefits of unimproved land as it relates to a community's fiscal well-being. The bulk of support for these analyses comes mostly from groups desiring to preserve agricultural lands in perpetuity as opposed to general academic inquiry into this area.

It is important to summarize the results of these studies before talking about methodologies. In general, they conclude that:

- Residential development does not pay its own way.
- Nonresidential development does pay its own way but is a magnet for residential development.
- Open space or agricultural lands have higher revenue-to-cost ratios than both residential and non-residential development.

Several aspects of the American Farmland Trust studies cause concern. For instance, these studies are not termed "fiscal impact" but rather *Cost of Community Service* (COCS) studies. They are not approached in a standard cost/revenue framework, yet they proffer standard fiscal impact conclusions.

Further, no one is viewed as being at home "tending" the farm. The farm contains no residents or workers. The costs/revenues for residents are deflected to other land uses—predominantly residential. No costs are assigned to agricultural workers, and no highway costs, garbage costs, traffic costs, or health/social service costs are assigned to the farm. Nor are municipal legal or election costs factored in.

- If a reasonable cost-assignment method could not be found, a "default" procedure was used, which assigned costs by the distribution of revenues or by the value of property. Given the low agricultural assessments, predictably large shares of local costs were assigned to residential and nonresidential uses; very small amounts were assigned to agricultural uses. The study's conclusions were blunt: The results of the study show that the residential category is being supported by the agricultural and commercial/industrial categories. The residential sector is demanding more in services than it is contributing in revenues.
- This study provides a fiscal argument for the protection of farmland and open space.

Despite the lopsided findings of the study, the fact remains that fiscal impact relationships between agricultural and other land uses are not well-documented. Most of the cost and revenue calculation procedures developed since *The Fiscal Impact Handbook* (Burchell and Listokin 1978), ignore open space and agriculture as either a significant cost or revenue. All costs are assigned to the residential and nonresidential sectors, and all forthcoming revenues come exclusively from developed properties whether or not they have inclusive open space. Most studies assume that open space or unimproved lands have neither a significant negative nor positive cost/revenue impact, which is probably an accurate assumption. Neither agricultural nor open space lands cost very much or provide much in local revenue.

Buchanan, Shepard C. and Bruce A. Weber. 1982. "Growth and Residential Property Taxes: A Model for Estimating Direct and Indirect Population Impacts." *Land Economics* 58, 3 (August): 325-337.

Buchanan and Weber's analysis is an attempt to determine the extent to which population growth affects single-family residential property taxes, and how these effects are transmitted. To answer these questions, the authors examine both tax rates and assessed values of properties in Oregon, and the possible influence of increased population on each of these variables. Among other procedures, they

study intermediate variables, such as age of housing stock, personal income, and population density.

The authors find that up until 1979, increases in new single-family homes apparently both directly increased average homeowner assessments and indirectly increased tax rates on *all* properties. In 1979, however, the Oregon legislature enacted a tax relief program under which the average rates of increase in assessed valuation of both residential property and all other property on a statewide basis were limited to a maximum 5 percent per year. After this change was enacted, assessments and tax rates slowed in their rate of increase. The costs of servicing new properties could no longer be "exported" to old properties beyond a fixed percentage per year.

The authors suggest that similar legislation be enacted in other states where there is a quest for homeowner property tax relief. They assert that the model they developed for local governments in Oregon is generalizable to other states with similar tax systems. In addition, they believe that the model could be adapted for use in analyzing the impact of population growth on the tax bills of owners of all types of property.

Dougharty, Laurence, Sandra Tapella, and Gerald Sumner. 1975. *Municipal Service Pricing Impacts on Fiscal Position.* Santa Monica, CA.: RAND.

This report analyzes the impact of alternative municipal service pricing policies on urban structure and on a community's financial position. A pricing policy is a method of allocating the cost of a service to one sector or another of the community (e.g., new residents, existing residents, the entire community). In this report, primary attention is paid to pricing policies for the capital infrastructure required to service new development.

The pricing structures estimated in the report are developed using actual data from San Jose and Gilroy, California. San Jose is a fairly large city that has already experienced fairly rapid growth; Gilroy is a city that could potentially undergo explosive growth. Both are believed by the authors to be prototypical of a number of American cities.

This analysis finds that pricing policies allocated to the largest base of payees has the least overall negative effect on the economy of the community.

Downing, Paul, ed. 1977. *Local Services Pricing and Their Effects on Urban Spatial Structure.* Vancouver: University of British Columbia Press.

The central claim of this book is that local governments are increasingly turning to alternative sources to raise revenues. Many now impose user charges.

A user charge is an explicit price on the consumption of a public service. In addition to being a source of revenue, user charges are also a direct measure of taxpayers' willingness to pay for the services provided by local government. A user charge makes the payment explicit and directly associated with the public service that is being delivered. It gives the taxpayer a better understanding of what the choices are, enabling a more intelligent decision regarding the array of goods provided by local government. In addition, the user charge performs the function of price. It rations demand, according to who values the service most highly.

The first section of this book presents the rationale for developing new sources of

revenue for local government. It identifies the possible scope of user charges as a means of filling this demand, and presents a detailed examination of how a user charge is designed and calculated. The second section presents an analysis of spatial variation in the costs of providing public services. The third section is concerned with institutional systems and their effects on the financing and supply of services. The fourth section argues that while location may not affect costs, political bodies are willing to account for cost differences in the way they assign user charges. The final section presents the author's conclusions about the findings and relates their implications for future policy.

DuPage County Development Department. 1989, 1991. *Impacts of Development on DuPage County Property Taxes.* DuPage County, IL: DuPage County Regional Planning Commission.

Five years ago, a brouhaha emerged in the Chicago area involving the cost of nonresidential uses. Debate in DuPage County centered on whether or not commercial uses paid for themselves. A number of experts subsequently gathered to evaluate the findings of the DuPage County Planning Commission's study, *Impacts of Development on DuPage County Property Taxes.*

A regression analysis by DuPage County inferred *a strong relationship between nonresidential development and property tax increases.* Although preservationists leaped to defend these findings, others pointed to the weaknesses of the study. The most convincing of the critiques took a position in the middle—pointing out that some evidence backed up the findings of DuPage County, but the evidence was not nearly as strong as had been presented in the report.

The DuPage County report is not a classic fiscal impact analysis, but rather a regression equation in logarithmic form. The dependent variable is total property taxes levied; independent variables include change in nonresidential firms, change in ratio of nonresidential-to-residential equalized valuation, median residential property tax levy, and the ratio of taxes to the total municipal equalized assessed valuation.

Some critics of the analysis believed both sides of the regression equation formed an identity, whose intercorrelation prevented solution. Some thought the research design should undergo significant alteration; others thought both dependent and independent variables should be recast. DuPage County, however, continued to defend both the analysis and its results.

In reality, the analysis must be put into a fiscal impact frame wherein *all* costs can be compared to *all* revenues. In addition, the quality and quantity of services, the relative levels of tax and nontax revenue, the presence of deficient or excess service capacities, and the effects of other land uses in similar situations should be viewed. A number of studies with similar conclusions about nonresidential growth's impact on property taxes have been documented. Most results can be traced to the nonaccountability of elected/appointed officials, which in turn led to significant service increases for primarily nonresidential properties.

The DuPage study points out that nonresidential development and its associated surplus fiscal revenues could improve service quality and quantity in a community. However, it may also increase local expenditures. Without knowing the type and quantity of public services produced before and after the nonresidential development is put in

place, no judgment can be made about nonresidential development and future tax rates.

Logan, John, and Mark Schneider. 1981. "Suburban Municipal Expenditures: The Effects of Business Activity, Functional Responsibility, and Regional Context." *Policy Studies Journal* 9: 1039-50.

The authors set out to explain the variations in the level of suburban government spending. They first summarize existing explanatory models, which stress either local stratification and discrimination, the structure of local decision making, ecological position, or public choice. These models suggest varying hypotheses about which suburbs spend more and which less. Logan and Schneider then evaluate each of the alternative models and propose major directions for further research.

The authors conclude that each model has its strengths and certain hypotheses from each is supported by the data. Certain variables stand out, however, as having particularly strong explanatory power in all models. The strongest, in terms of determining suburban expenditures, is economic function. Regardless of any other differences among communities, suburbs with strong employment bases spend more than those with weak employment bases.

Of nearly equal importance is the set of service responsibilities that a suburban municipality assumes. This finding may take historical inquiry to fully explain.

Finally, differences in SMSA structure are shown to explain part of the expenditure variation, although no simple reason is given for this influence. Instead, the authors call for additional research to be directed towards explaining what kinds of economic, historical, political, or social situations cause the differences in suburban expenditures detected in this study.

THE EFFECTS OF GROWTH CONTROLS ON HOUSING COSTS

Katz, Lawrence, and Kenneth Rosen. 1987. "Interjurisdictional Effects of Growth Controls on Housing Prices." *Journal of Law and Economics 30* (April): 149-160.

In this article, Katz and Rosen argue that the widespread proliferation of land use and environmental regulations, primarily imposed by local governments, forces the home-building industry to work within a much more complex and often more costly regulatory framework.

Local governments have used a wide variety of procedures to control residential development, and these controls have become increasingly complex and innovative over time. In many municipalities, traditional land-use controls have been augmented by environmental and fiscal impact procedures, urban growth management systems, utility connection moratoria, multiple permit systems, overall growth limitations, or a combination of these measures.

Katz and Rosen examine the effects of local land use regulations on house prices in the San Francisco Bay Area. They find that land use regulations appear to have had a substantial effect on housing prices. The authors conclude that the widespread use of controls in communities limits available housing supply. The spread of these regulatory techniques to metropolitan areas outside California could have substantial negative effects on

the affordability of housing in these locations.

Parsons, George. 1992. "The Effects of Coastal Land Use Restrictions on Housing Prices." ***Journal of Environmental Economics and Management*** **(February): 25-27.**

In this paper, the author estimates the effect on housing prices of land-use restrictions for property abutting the Chesapeake Bay. He examines the change in housing prices before and after the introduction of restrictions in Anne Arundel County, the most populated of the 16 counties that were affected. The price changes are compared to the change in housing prices in several inland locations, not affected by the restrictions, over the same monitoring period.

Parsons finds that the coastal land-use restrictions appear to have caused a considerable increase in housing prices. To make this assertion, he assumes that, absent the controls, the change in housing prices in coastal areas would have been the same as it was for inland locations. Except for land use restrictions, the author believes, both locations share the same general market conditions. This is a significant assumption, considering the effect of "water frontage" on housing price.

Parsons also believes that the land use restrictions create winners and losers in the local housing market. The winners are the current owners of housing in the community. The losers include current owners of undeveloped and restricted land, renters, and future purchasers of housing in the coastal community.

Parsons closes with an admonition that the large transfer of wealth from future residents to current residents through housing price increases, and the absence of future residents in the political process in which the restrictions were established raise suspicion about the fairness and efficacy of these regulations.

Propst, Luther, and Mary Schmid. 1993. ***The Fiscal and Economic Impacts of Local Conservation and Community Development Measures: A Review of Literature.*** **Tucson, AZ: Sonoran Institute.**

The authors undertook an effort to review about 200 articles and other publications, with a special emphasis on those dealing with actual experiences in real communities. This literature review includes economic studies of the impacts of zoning and other land use regulation, and the economic impacts of a community's appearance, architecture, and natural environment.

Both a subject-related analysis and annotations of the more important studies appear in this review.

The author's general conclusion is that environmentally sensitive land use planning need not have a detrimental effect on real estate values, economic vitality, or the local tax base. Rather, the opposite is often true.

The authors close on the optimistic note that the lessons contained in the studies may help Greater Yellowstone (near Bozeman, Montana) communities successfully manage rapid growth and change as they choose their own futures.

Schwartz, Seymour I., David E. Hansen, and Richard Green. 1981. "Suburban Growth Controls and the Price of New Housing." *Journal of Environmental Economics and Management* 8 (December): 303-320.

In this paper, the authors study the effects of suburban growth control programs upon the price of new housing. The programs that limit growth employ a variety of devices, including phased zoning, reduced development densities, and increased development charges. Some programs take an even more direct approach, by setting restrictions on the number of housing units permitted, or by imposing population or housing unit caps. The authors then analyze the effects of perhaps the most direct form of control: the housing quota of Petaluma, California.

To estimate price effects, the authors compare price changes of new single-family housing in Petaluma between 1969 and 1977 (after the quota was enacted) to the price changes in two nearby communities. The authors limit the analysis to new housing because it provides a relatively consistent basis for evaluation.

The study's results suggest that Petaluma's growth control program was responsible for an increase in housing prices. Because of the complexity of the issue, however, a totally unambiguous finding is not possible.

The authors are more confident when describing the effect of growth controls on the quality of construction. Here, they find evidence that higher construction quality and prices are attributable to growth controls. The authors close by calling for additional research to analyze the effects of growth controls on housing price.

Schwartz, Seymour I., Peter M. Zorn, and David E. Hansen. 1989. "Research Design Issues and Pitfalls in Growth Control Studies." *Land Economics,* 62, (August): 223-233.

In this article, the authors analyze the experiences of Davis, California, a community that attempted to mitigate the effects of growth controls on the price of housing. The authors seek to determine whether Davis was successful in reducing the expected increase in the per-unit price of housing services due to growth control, and also to determine the extent to which Davis was successful in limiting the exclusionary impact of growth controls on lower income households.

The authors discover that growth controls increased per-unit housing prices due to the reduction in supply, but that price-mitigating programs are also effective. Furthermore, the incentives created by price-mitigation lead developers to build smaller, lower quality units.

Surprisingly, the study's results also show that growth controls increase the sales price of older housing, but the per-unit price declines, implying an increase in the quality of old houses sold. This is explained by the fact that the decrease in the quality of new housing may have encouraged households desiring higher quality (larger) housing to turn to the older housing market, resulting in an increase in the demand for higher quality older homes.

The authors conclude that price-mitigating measures are only partially successful in reducing the price effects of growth controls, since they mostly shift the impacts of growth controls from the new to the old housing market.

URBAN FORM AND SPRAWL

Black, Thomas J. 1996. "The Economics of Sprawl," *Urban Land* 55, 3.

For most businesses, the decentralization of activity and improvements in communications and transportation create a choice of location options. In addition, globalization trends (particularly in the production of some goods) are placing many U.S. businesses under increasing competitive pressure. According to Black, low-density, dispersed urban settlement patterns result from these powerful economic forces that continue to be driven primarily by changing transportation costs and production requirements.

The major benefit to businesses and residents in metropolitan areas of the dispersed settlements is reduced land rents, writes Black. Increased location options and lower transportation costs mean highly competitive land markets and, consequently, lower land prices, giving U.S. firms a significant advantage over their foreign competition. This translates into more competitive pricing by U.S. firms, a lower cost of living for workers, and higher returns on financial capital and labor.

It is obvious that high-density urban areas make sense only for economic activities that can justify hefty rents. As an alternative, extended transportation systems and lower-cost truck transportation also have enabled industrial and warehouse facilities to spread out to less dense locations to save money on building and land costs.

Black points out that another major issue surrounding current development patterns is the extent to which general taxpayers, especially those in built-out communities, subsidize new incremental, low-density development. Examples include subsidies in the form of income tax mortgage, interest, and property tax deductions; federal highway expenditures in excess of user taxes and fees; and state and local government subsidies for infrastructure expansion to support new development.

Views on these issues differ, and Black ends this article by calling for a realistic analysis of the forces at work to avoid faulty conclusions about the economics of sprawl.

Ladd, Helen, and William Wheaton. 1991. "Causes and Consequences of the Changing Urban Form." *Regional Science and Urban Economics* (21): 157-162.

The papers compiled in this work were initially presented at a conference on the *Causes and Consequences of the Changing Urban Form*, October 1990, run under the auspices of the Lincoln Institute of Land Policy. The goal of the conference was to bring together empirical, theoretical, and policy-oriented economists to improve the understanding of the nature, causes, and implications of polycentrism in metropolitan areas.

Recently, older, traditionally monocentric cities, such as Boston and Chicago, have developed significant suburban subcenters. Other newer cities, such as Phoenix, Dallas, and Los Angeles are perceived as lacking in any sense of "centrality."

Two of the papers in this collection provide insights on the nature and function of employment subcenters and decentralization; two develop and test empirical models that specifically include elements of polycentrism. One paper provides a new theory of subcenter formation in the context of a dynamic

model; and two more examine various implications of changing urban form for labor markets.

McKee, David L. and Gerald H. Smith. 1972. "Environmental Diseconomies in Suburban Expansion." *The American Journal of Economics and Sociology* 31, 2: 181-88.

In this paper, the authors set out to isolate and analyze the components of suburban sprawl. Causes of sprawl are discussed, and an attempt is made to specify the economic effects sprawl has on urban areas, people, and the economy. The authors intention is to develop suitable policy recommendations for dealing with sprawl.

The authors conclude that sprawl appears to be the result of strong market forces, and that solutions to the problem may be beyond the abilities of public policy makers to solve. They call for more government intervention, especially at the local level, and for action on the part of regional planning agencies. To date, these institutions have not been able to deal adequately with the problem, because of overlapping jurisdictions and other political considerations. The authors further call for greater cooperation and sharing of resources at all levels of government to find solutions to suburban sprawl.

Mills, David E. 1981. "Growth Speculation and Sprawl in a Monocentric City." *Journal of Urban Economics* 10: 201-226.

Mills presents an economic theory of sprawl in a growing, monocentric city. He posits that where decision makers have perfect knowledge, leapfrog development and discontinuous land-rent functions may occur and be efficient in both an ex-post and ex-ante sense. Where the extent of future growth is uncertain, decision makers become speculators, and the spatial pattern of development is more complicated. Ex-post inefficiency generally occurs.

In the context of Mill's formal monocentric-city model, three land-use patterns qualify as examples of sprawl. *Leapfrog development* occurs when a von Thunen ring of undeveloped land separates rings of developed land. This form of sprawl involves radical discontinuity. *Scattered development,* the second form of sprawl, occurs when there are annuli with both developed (homogeneously) and undeveloped land in them. *Mixed development* occurs when there are annuli with more than one developed use. Scattered development and mixed development forms of sprawl involve circumferential discontinuity.

Mills provides theoretical explanations for each form of sprawl. Leapfrog development can be explained by intertemporal planning on the part of decision makers who anticipate future growth with certainty. The essential idea here is similar to the notion put forth by Ohls and Pines (1975), that is, that land inside of the urban fringe is sometimes withheld from early development and preserved for more remunerative future options. Theoretical explanations for scattered and mixed development forms indicate that decision makers are uncertain about future growth and make speculative decisions.

Several criticisms of sprawl are cited and addressed with evidence generated from the monocentric city model constructed for this analysis.

Ohls, James C., and David Pines. 1975. "Discontinuous Urban Development and Economic Efficiency." *Land Economics* 3 (August): 224-234.

Many observers argue that discontinuous development (wherein land that is closer to urban centers is skipped over in favor of land further away) is inefficient for several reasons. First, this development pattern fails to make use of the most accessible land. Second, the expense of providing public services, such as roads and sewage systems, to new development is high. In contradiction, Ohls and Pines argue that discontinuous development may be desirable and efficient in certain cases. For instance, the development of retail and commercial services near the urban fringe must often wait for the maturation of critical scale. In rapidly expanding urban areas, contexts arise in which it may be efficient to skip over land for a period of time in order to reserve it for commercial uses after market scale increases.

This strategy has been implemented in some planned communities. In Columbia, Maryland, for example, the planners of this "new town" explicitly reserved vacant land in residential areas for the development of shopping clusters in the future—after increased residential densities make such shopping enterprises economically feasible.

Peiser, Richard B. 1989. "Density and Urban Sprawl." *Land Economics* 65, 3 (August): 193-204.

In this article, Peiser argues that, contrary to accepted thinking, if a free urban land market were allowed to function it would inherently promote higher-density development. He offers theoretical arguments and empirical evidence to support this thesis.

Peiser argues that *uniformly* low-density urban development is inefficient, because it increases transportation costs, consumes excessive amounts of land, and adds to the cost of providing and operating public utilities and public services. Furthermore, he claims that the data show that over time discontinuous development patterns actually promote *higher* density. So public policies aimed at preventing discontinuous development may be misguided. They may lead to development patterns in which densities might be lower than they ordinarily would be without such a policy.

Three case studies (Dallas, TX; Montgomery County, MD; and Fairfax County, VA) are presented in which lot sizes are examined over time along major arterial roadways. Higher densities (i.e. smaller lot sizes) are found in later in-fill development.

Peiser concludes that polices that encourage sequential development should be avoided. Instead, he argues that a competitive land market will achieve higher density through discontinuous development followed by later in-fill development.

CHAPTER 10

Annotations of Studies

TRANSPORTATION AND TRAVEL COSTS

Transportation and travel costs as they relate to sprawl involve mode of travel, pattern of residential development and development access, density of residential development, and location/type of non-residential development. The specific topics that group the annotations of this section reflect the above topical concerns. They are:

Changes in Automobile Travel
The Effects of Density on Travel Choices
Unlimited Outward Extension
Spatial Segregation of Uses
Dispersed Employment
The Costs of Travel

Changes in Automobile Travel includes the works of Gordon and Richardson (1989, 1991) and Alan Pisarski (1992). *The Effects of Density on Travel Choices* includes the works of Anthony Downs (1992), Robert Cervero (1991b, 1996), Frank and Pivo (1994), John Holtzclaw (1990, 1994), and Newman and Kenworthy (1989). *Unlimited Outward Extension* includes the works of Judy Davis (1993) and Parsons Brinckerhoff (1997). *Spatial Segregation of Uses* includes the works of Robert Cervero (1989, 1995, 1996), Reid Ewing (1994), S. Handy (1992, 1995), Robert Kitamura et al. (1994), and Parsons Brinckerhoff (1996c). *Dispersed Employment* includes the works of Robert Cervero et al. (1996, 1997). *The Costs of Travel* includes the works of Apogee Research (1994), M. E. Hanson (1992), J. J. MacKenzie et al. (1992), Parsons Brinckerhoff (1996a), and Michael Voorhees (1992).

CHANGES IN AUTOMOBILE TRAVEL

Gordon, Peter, Harry W. Richardson, and Myung-Jin Jun. 1991. "The Commuting Paradox: Evidence from the Top Twenty." *Journal of the American Planning Association* 57, 4: 416-20.

This comparison of mean commuting times of residents of core counties in the 20 largest U.S. metropolitan areas shows that average trips times declined or remained the same between 1980 and 1985, even as population increased in most areas. The authors hypothesize that constant or declining trip times were the result of commuters changing residences or jobs so that their origins and

destinations were closer to each other or so they could travel faster on less congested routes. However, the *American Housing Survey* database they use does not contain the information needed to confirm or disprove this hypothesis.

Levinson, D. M., and A. Kumar. 1994. "The Rational Locator: Why Travel Times Have Remained Stable." *Journal of the American Planning Association* 60: 319-332.

The authors compare travel diary data from the Washington, DC metropolitan area for the years 1968 through 1988. They conclude that greater dispersion of activities has helped keep travel times constant. During this 20-year period, the metropolitan area became more dispersed; population grew by 30 percent, employment grew by 85 percent, and the number of daily motorized trips per person increased from 2.3 to 2.8. Yet, differences of means test show that for most modes and purposes, average times for home-to-work and work-to-home were the same at the beginning and end of the period. The authors conclude that the "locators"—households and firms—acted rationally and relocated to keep travel times constant.

Pisarski, Alan E. 1992. *New Perspectives in Commuting.* Washington, DC: U.S. Department of Transportation. July.

Pisarski identifies trends in commuting using data from the *1990 Census* and the *1990 Nationwide Personal Transportation Study*. He shows that the proportion of all trips that were for work purposes declined slightly, from 20.4 percent in 1983 to 20.1 percent in 1990. Although the miles of travel for work increased, average travel times for work trips increased by only 40 seconds. This result is partly due to a 35 percent increase in the number of work trips made in single-occupant vehicles, usually the fastest mode of travel. The additional 22 million people who drove alone exceeded the number of workers added to the labor force. Meanwhile, the absolute number of people using transit remained at about 6 million, but the share of users declined due to population growth.

Richardson, Harry W., and Peter Gordon. 1989. "Counting Nonwork Trips: The Missing Link in Transportation, Land Use, and Urban Policy." *Urban Land* (September): 6-12.

One recent transportation phenomenon in the United States has been the growth in non-work travel, both during peak and off-peak hours. Using data from the *Nationwide Personal Transportation Studies for 1977 and 1983*, the authors find that the number of non-work trips increased three to four times faster than work trips during that time frame in all sizes of SMSAs. Non-work travel even increased faster than work travel during the peak periods. Richardson and Gordon contend that suburbanization, especially in the largest metropolitan areas, was a principal cause of the increase in non-work travel, although they acknowledge that demographic and workforce changes were probably also involved. Suburbanization of businesses means that suburbanites have more close-by shopping and recreational opportunities and, therefore, may make more trips to satisfy immediate needs rather than wait until they have a list of needs. The study, however, does not demonstrate either that shopping and recreational opportunities have increased in suburbia or that households take more trips because of such an increase. Nor does the study rule out the effects of other factors such as

rising incomes, greater participation of women in the workforce, and changes in leisure activities on non-work travel choices.

Rossetti, M. A., and B. S. Eversole. 1993. *Journey to Work Trends in the United States and Its Major Metropolitan Areas, 1960-1990.* Washington, DC: U.S. Department of Transportation.

The authors compare mean commuting times in 1980 and 1990 for the 39 metropolitan areas with populations in excess of one million in 1990. They find that commuting times increased in 35 of the metropolitan areas, and that the increases ranged from 0.47 percent in Philadelphia to 13.69 percent in San Diego. All four of the metropolitan areas with commuting time increases of more than 10 percent are Sunbelt cities: Los Angeles, San Diego, Sacramento, and Orlando. The only cities where commuting time declined are New York (-7.70 percent), Pittsburgh (-1.05 percent), New Orleans (-0.57 percent), and Salt Lake City (-1.92 percent).

THE EFFECTS OF DENSITY ON TRAVEL CHOICES

Simulations

Downs, Anthony. 1992. *Stuck in Traffic: Coping with Peak Hour Congestion.* Washington, DC: Brookings Institution; and Cambridge, MA: Lincoln Institute of Land Policy.

Downs develops a hypothetical urban area model to test the extent to which changes in the location and density of development would change average commuting distances. The basic model uses values for the proportion of jobs in the CBD, central city, suburbs, and exurbs, and commuting distances similar to the averages for large metropolitan areas. Different densities are created by varying the size of the suburbs and exurbs (and adjusting the proportion of population and jobs in each area as needed to match the size). The study shows that the density of growth at the urban fringe has a significant impact on commuting distances; a move from very low to medium densities has the greatest impact. Increasing exurban densities from 886 persons per square mile to 2,800 reduces commuting distances by 8 percent. An increase from 886 persons to 4,363 persons per square mile decreases commuting trip lengths by 14 percent. Beyond that, large increases in density shorten trips by only a small amount.

Ewing, Reid. 1997b. *Transportation and Land Use Innovations.* Chicago, IL: Planners Press, American Planning Association.

The author's goal in this book is to provide suggestions for improving mobility by reducing congestion and automobile dependence. He defines mobility as "the ability [of individuals] to engage in desired activities at moderate costs to themselves and to society."

Ewing cites two key implementation strategies for solving mobility problems. First, according to the author, the length, mode, and frequency of trips of household travel is affected by residential accessibility—the accessibility from a person's home to their destination; and by destination accessibility—the accessibility from one destination location to another. Better accessibility can be achieved, according to Ewing, through better land-use planning at the regional and community levels.

The second strategy espoused by the author is travel demand management

(TDM). TDM attempts to reduce the number of automobiles on the roads at peak travel times. This strategy promotes such techniques as carpooling, staggered work hours, compressed work weeks, and telecommuting. The success of TDM programs hinges on employers' willingness to implement them and to provide incentives to their employees to utilize them.

The author also examines how cities can create conditions favorable to transit, pedestrian, and bicycle use. He notes that to accomplish this goal, these modes must become more flexible and feasible. Again, Ewing concludes that land use development patterns must become more supportive of transit and alternative modes of travel.

In conclusion, Ewing calls for a paradigm shift in land use and transportation planning. He believes there "should be less emphasis on how fast vehicles move and more emphasis on how well people's travel needs are met."

Metro. 1994. *Region 2040 Recommended Alternative Decision Kit.* Portland, OR.

This analysis of alternative urban forms of growth for the Portland, Oregon metropolitan area shows that more concentrated development, in conjunction with expansion of transit service, reduces vehicle miles of travel and use of the automobile. This study uses one of the most advanced travel demand models in the United States to simulate transportation outcomes. It determines that under continued current development patterns, the urban area would have to expand by more than half of its current size over the next 50 years.

The study also tests three different scenarios that concentrate various amounts of growth in transit corridors, centers, and in neighboring cities. In the "Growing Out" scenario, a larger share of single-family housing is built than the region has at present, with more than one-fourth of future growth placed outside the current urban growth boundary. The "Growing Up" scenario keeps all future growth inside the urban growth boundary by increasing densities and building a larger share of multifamily housing. The "Neighboring Cities" scenario moves about one-third of the expected growth to other cities within commuting distance of the urban area. Not surprisingly, the highly concentrated development of the "Growing Up" scenario produces the highest transit use (6 percent of all trips) and the greatest reduction in VMT over base case levels (16.7 percent). The more dispersed patterns, while consuming more land, have lower levels of congestion.

Despite the results of this study, the ability to change travel behavior is limited, because much of the capital infrastructure that will serve the built environment for the next 50 years is already in place. Some of the study's other proposed changes in the way the regions develop may also not be feasible to undertake for political and economic reasons.

Mobility for the 21st Century Task Force. 1996b. *Strategic Goals for the 21st Century.* Washington, DC: American Public Transit Association.

In 1995, the American Public Transit Association formed the Task Force on Mobility for the 21st Century (M21). The M21 Task Force believes that the problems caused by urban sprawl are rapidly worsening. The Task Force

concluded that over the next fifty years, with continued existing development patterns, the nation will "slip into a downward spiral of economic, environmental, and social decline."

In response, the M21 Task Force engaged in a year-long strategic planning process to develop a plan for an alternative future. As a result, the Task Force devised four plausible scenarios for the future, developed a preferred vision for the year 2050, and adopted six goals and recommendations to make the vision a reality.

The four scenarios of how the Task Force believes urban development patterns may evolve over the next fifty years follow.

Boundless Sprawl—Continued growth and unchecked urban sprawl; U.S. maintains economic growth, but central cities decline and urban problems worsen.

Dying Cities—Continued growth and unchecked urban sprawl feed economic and social decline, causing a downward spiral. Central cities are faced with increased poverty, crime, and other problems.

Community-oriented Growth—Growth continues, but in the form of infill and mixed-use, pedestrian-scale communities centered around transit stations.

Reinventing the City—A new urban pattern emerges following the tenets of sustainable development. All development occurs within an urban growth boundary (surrounded by greenbelts), and every location can be reached easily by transit.

Based on the analysis of these plausible scenarios, the M21 Task Force developed a vision of their preferred future. This future, based on sustainable community development, benefits the economy, environment, social equity, community life, and individual quality of life.

In this vision, both central cities and suburbs thrive. Although people continue to live in suburbs, transit-oriented developments (TODs) have replaced low-density suburbs as the preferred neighborhood design. In addition, these neighborhoods allow easy pedestrian and bicycle movement. Also, TODs offer a wide choice of housing type, densities, and costs.

TODs offer numerous additional benefits. They require less new infrastructure and utilize existing infrastructure and maximum capacity, ease traffic congestion, save commuting time, and reduce pollution.

The Task Force acknowledges that the vision is a long stretch but believes that it is achievable if the following six strategic goals and recommendations are adopted.

1. Build on the principles of ISTEA.
2. Invest in innovative sustainable technologies.
3. Create desirable land-use and development patterns.
4. Strengthen regional and metropolitan planning and decision making.
5. Shift toward true cost pricing.
6. Provide creative leadership initiatives.

Empirical Studies

Cervero, Robert. 1991b. "Land Use and Travel at Suburban Activity Centers." *Transportation Quarterly* 45, 4: 479–491.

This article analyzes the effects of density, land-use mix, and parking characteristics on commuting behavior in suburban activity centers. The study uses data from

83 randomly selected buildings in six suburban activity centers, collected as part of a project called *Travel Characteristics of Large-Scale Suburban Activity Centers*, for the National Cooperative Highway Research Program.

The strongest relationship evidenced in the study was between density (measured as the height of each building) and transit use. Having retail operations in the building had only modest effects on mode choice; primarily it increased transit and walking mode shares. Parking supply had less effect on mode choice, probably because most of the office buildings had generous supplies of parking spaces.

Using buildings as the unit of analysis in this study poses some problems. For example, the study fails to consider other center characteristics that may play important roles in determining commuting behavior, such as distances between buildings and opportunities to shop and conduct personal business at other locations within the center.

Cervero, Robert, and Kara Kockelman. 1996. "Travel Demand and the 3Ds: Density, Diversity, and Design." ***Transportation Research Digest*** **2, 3:199-219.**

The authors claim that a host of urban design philosophies—new urbanism, transit-oriented development, traditional town planning—have gained popularity in recent years as ways of shaping travel demand. All share three common transportation objectives: (1) reduce the number of motorized trips; (2) of trips that are produced, increase the share that are non-motorized; and (3) of the motorized trips that are produced, reduce travel distances and increase vehicle occupancy levels. An expected outcome of weaning people from their cars, proponents hope, will be a lessening of the negative consequences of an automobile-oriented society—namely, air pollution, fossil fuel consumption, and class and social segregation.

Cervero and Kockelman describe how new urbanists, neo-traditionalists, and other reform-minded designers argue for changing three dimensions, or the 3Ds, of the built environment—*density, diversity, and design*—to achieve these objectives. While the effects of density on travel demand have been acknowledged, the effects of diversity and design have just as long been ignored. This paper examines the connection between the 3Ds of the built environment and travel demand. It tries to sort through the relative influences of these three dimensions after controlling for other variables, such as travelers' demographic characteristics. It does this by applying the technique of factor analysis to gauge the relative influence of each dimension as well as their collective impacts.

The research findings of this paper lend some degree of credibility to the claims of new urbanists and others that compact, mixed-use, pedestrian-friendly designs can reduce vehicle trips, vehicle miles traveled (VMT) per capita, and motorized travel. The research suggests that the effects of the Bay Area's built environment on travel demand were modest to moderate at best. Densities exerted the strongest influence on personal business trips. Additionally, residential neighborhoods that were spatially accessible to commercial activities, reflected by an accessibility index variable, tended to average appreciably less VMT per household. Diversity also had a modest impact on travel demand, although where it was significant, its influences was somewhat stronger than that of density. Having retail activities within neighborhoods was

most closely associated with mode choice for work trips. Further, the dimension of walking quality was generally moderately associated with travel demand. Finally, several specific design elements of the built environment seemed to be particularly relevant to non-work trip-making. Notably, neighborhoods with high shares of four-way intersections, as a proxy for grid-iron street patterns, and limited on-street parking abutting commercial establishments, tended to average less single-occupant vehicular travel for non-work purposes.

The researchers believe that higher densities, diverse land uses, and pedestrian-friendly designs must co-exist to a certain degree if meaningful transportation benefits are to accrue. Having nice sidewalks, attractive landscaping, and other pedestrian amenities in a low-density, residential-only neighborhood is unlikely to prompt many residents to walk to shops and stores. However, the synergy of the 3Ds in combination is likely to yield more appreciable impacts.

Dunphy, R. T., and K. M. Fisher. 1994. *Transportation, Congestion and Density: New Insights.* Paper presented at the 73rd Annual Meeting of the Transportation Research Board, Washington, DC: January.

Using data on urbanized areas from *Highway Statistics, 1990*, the authors investigate the relationships (using graphs) between density and vehicle miles of travel and travel use. They find some correlation between urbanized area population density and transit use (26 percent), but little correlation between vehicle miles of travel and density (8 percent). However, using data from the *1990 Nationwide Personal Transportation Survey*, the authors find that people in denser areas make nearly the same number of daily trips as people at lower densities, but they drive less. At most densities the average number of person trips per day is just below 4.0; only at 30,000 persons/square mile or more do trip numbers dip to 3.4 trips per day. However, the average number of trips by car drops from about 3.5 at densities below 30,000 persons/square mile to 1.9 at 30,000 persons/square mile. People living at higher densities drive less because both transit and walking/biking are more viable options. The authors, however, find a strong correlation between density and life cycle stage. They contend that demographics may be more of a contributing factor to differences in travel behavior than density.

This study is descriptive, suggesting relationships that need further analysis with multivariate techniques to sort out the relative effects of household characteristics versus land-use density. The data analyzed in this study are also aggregate, comparing whole regions rather than specific places within regions where people live and work.

Dzurik, Andrew. 1993. "Transportation Costs of Urban Sprawl: A Review of the Literature." *State Transportation Policy Initiative.* Center for Urban Transportation Research. November.

This article cites nine studies that deal with transportation costs and sprawl, including the classic RERC *The Costs of Sprawl* study (1974a), reviews by Altshuler (1977) and Windsor (1979), and several others. The first part of the article cites a 1965 study—"The Nature and Economics of Urban Sprawl" by Harvey and Clark—that defined three characteristics of sprawl, low-density, ribbon, and leapfrog development.

Automobile use was also viewed as the catalyst for urban sprawl. John Kain (1967) argued, however, that any savings from developing high-density areas may be offset by higher construction costs per unit.

RERC's report is cited extensively. It estimated that a low-density sprawl community would require more than six times the amount of minor streets than a planned high-density community. Only road length costs were considered as direct costs in the analysis of transportation variations among these communities. However, two indirect costs were also considered: travel time and air pollution. The RERC report assumed twice as much VMT in a low-density community, which accounted for a large difference in such costs.

Dzurik's article then cites Altshuler's criticisms of the RERC report. Altshuler's book *The Urban Transportation System* (1979) argues that the American public has strong preferences for auto transportation and low-density settlements. Therefore, Americans will refuse to live in densities high enough to bring about any changes in the problems associated with sprawl, which he believes have been exaggerated anyway. Bowler completed a study in 1977 that showed that "user-operated transportation" accounted for about one-seventh of consumer spending, a proportion that stayed roughly constant from 1950 through 1973. He argues that suburban living results in higher use of energy and land resources for transportation than higher-density living.

When the urban environment is modeled as polycentric, however, the percentage of suburban dwellers who increase their travel distances for journeys to work no longer continues to rise, since work places also become decentralized. Yet many models assume that rising commuting costs are a major transportation cost of suburbanization.

Gordon also argues that because work trips are declining as a percentage of all trips, the relative importance of accessibility to workplaces as a motive for choosing places to work and places to live is falling. Gordon and Richardson argue that decentralization is an antidote to traffic congestion because it scatters both origin and destination points and makes suburb-to-suburb trips shorter than any other types.

BART failed to replace the auto as the preferred means of commuting in the Bay Area, in spite of its enormous cost. Where light rail systems have been created, cities have experienced small gains in public transit ridership over pure bus systems, but they have also incurred major cost increases. Light rail tends to replace bus travel more than auto travel.

Dzurik reviews the argument over compact development. One advantage compact development is supposed to have over sprawl is that it uses the excess capacity in existing infrastructures, rather than create a need to build new infrastructures. This was a major source of the economies found in the New Jersey sprawl studies. But such savings do not always materialize.

Dzurik discusses how much subsidy from local governments goes into highways and mass transit. In Milwaukee, Wisconsin, for example, he points out, the local burden of highway costs equals 59 percent of the local property tax levy. Because user fees do not pay the entire cost of auto travel, more sprawl occurs than would otherwise take place.

Dzurik's study claims that the transportation costs associated with urban sprawl have not been studied in the appropriate quantitative terms. Therefore, most questions about this issue are still unanswered. His article cites unfavorable views of sprawl's transportation costs in 12 articles and studies, with one-sentence summaries of their major complaints.

Dzurik's article contains almost no original quantitative analysis. Numerous cited studies offer contradictory evidence, and the author does not critically analyze why these differences exist. Further, he offers few better approaches to research the areas of transportation and urban sprawl.

Frank, L. D., and Gary Pivo. 1994. *The Relationship Between Land Use and Travel Behavior in the Puget Sound Region.* WARD 351.1. Olympia, WA: Washington State Department of Transportation.

The authors use data from the *1989 Transportation Panel Survey* for the central Puget Sound region, along with household characteristics from the *1990 Census*, employment data from the state employment agency, and land-use data from the county assessor to identify the factors that affect travel behavior. They find that density, mix, and jobs/housing balance are all related to travel behavior, with employment density and jobs/housing balance having the strongest relationships. At higher densities, trips are shorter but take more time. More trips are made using alternatives to the single-occupant vehicle. As land-use mix increases, trip distances, times, and auto-mode shares decrease. As jobs and housing become more balanced, trip distances and travel times go down. The relationships between density and mode split are not linear. The authors identify thresholds at which there is a substantial increase in transit use. These thresholds are 50-75 employees and 9-13 persons per gross acre for work trips, and 75 employees and 18 persons per gross acre for shopping trips. The use of carpooling, however, seems unrelated to urban densities or other land-use attributes. The study controls for household characteristics, such as income and vehicle availability.

Gordon, Peter, A. Kumar, and Harry W. Richardson. 1989. "The Influence of Metropolitan Spatial Structure on Commuting Time." *Journal of Urban Economics*, 26: 138-151.

The authors combine data on residential and employment densities (residents or workers per acre of land zoned for that purpose) for 82 SMSAs from twelve states (from the U.S. Geological Survey LANDSAT file) with census data to identify factors that influence commuting times by auto and transit. Their research finds that lower residential densities are associated with shorter commuting times both by car and by transit. For auto trips, concentration of industrial employment leads to shorter travel times, whereas concentration of commercial employment increases trip times. The clustering of manufacturing produces economies in driving, but the clustering of commercial activities (such as in the CBD) produces congestion that reduces times. Other variables (land area, income, economic structure) have the expected positive or negative influences, and the equations are fairly robust, explaining 61 to 87 percent of the variability in mean travel times. As a result, the authors conclude that polycentric or dispersed spatial structures reduce commuting times.

The authors' use of SMSAs as the unit of analysis, however, raises questions about what density means. No SMSA has

uniform density throughout. Perhaps lower regional density is a proxy for age of development, city size, or some other factor that influences transit use.

Holtzclaw, J. 1990. *Explaining Urban Density and Transit Impacts on Auto Use.* Paper presented to the State of California Energy Resources Conservation and Development Commission by Natural Resources Defense Council and the Sierra Club. April 19.

Holtzclaw compares the annual vehicle miles of travel in five communities with various densities in the San Francisco Bay Area to test whether higher residential densities combined with better transit service and neighborhood shopping result in less driving. The study finds that doubling residential density reduces annual vehicle miles by 20 to 30 percent. Better transit access also reduces vehicle travel.

Holtzclaw's study, however, is a cross-sectional one, that only demonstrates correlation between density and vehicle miles of travel. It does not show, for example, that increasing density in a particular neighborhood would reduce vehicle miles of travel. Neither does the study control for income levels or other characteristics of households that influence vehicle miles of travel.

Holtzclaw, J. 1994. *Using Residential Patterns and Transit to Decrease Auto Dependence and Costs.* San Francisco, CA: Natural Resources Defense Council.

Holtzclaw uses smog check odometer readings for 28 communities in San Francisco, Los Angeles, San Diego, and Sacramento—all with at least 20,000 residents—to evaluate the relationship between density and land use. The study finds that neighborhood density is negatively related to both automobile ownership rates and vehicle miles of travel, controlling for household income and size. When household densities double, vehicle miles of travel decline by 16 percent, controlling for such factors as transit service intensities and vehicle ownership. Better access to transit also reduces vehicle miles of travel. Shopping opportunities and the pedestrian environment, on the other hand, are not statistically significant in explaining travel behavior.

Although, income is controlled in this study, residents could still vary by number of children, number of workers, or other characteristics that influence travel behavior.

While, this cross-sectional analysis shows a relationship between density and automotive use in existing communities, it does not demonstrate that if low-density communities became denser fewer trips would be made by automobile.

Newman, Peter W. G., and Jeffrey R. Kenworthy. 1989a. *Cities and Automobile Dependence: An International Sourcebook.* Brookfield, VT: Gower Publishing.

Newman and Kenworthy assemble a set of data on the transportation and land-use characteristics of ten large U.S. cities, five Australian, twelve Western Europe, three Asian, one Canadian, and one Russian city for the period 1950 to 1980. Using gasoline consumption per capita as the primary measure of automobile dependence (other measures such as transit mode share are highly correlated with this measure), they identify the relationship between automobile dependence and urban density. Low densities are associated with high

automobile dependence, and high densities with less dependence on the automobile. This relationship holds for regions as a whole, for inner areas (pre-World War II parts of the cities), and for outer areas. As a result, the authors conclude that more compact cities would reduce automobile use.

Reviewers, however, have questioned the validity of using gasoline consumption as the measure of automobile dependence, noting that many factors, such as gas prices and fleet characteristics, influence gasoline consumption. Newman and Kenworthy's analysis of automobile dependence also fails to make full use of the data collected, employing only a single variable—urban density—to explain automobile use, when other factors are clearly involved. As a result, the role of density may be overstated.

Parsons Brinckerhoff Quade and Douglas. 1996b. "Commuter and Light Rail Corridors: The Land Use Connection." In *Transit and Urban Form, Vol. 1.* Washington, DC: Transit Cooperative Research Program, Transportation Research Board. October.

This study updates the work of Pushkarev and Zupan (1982) by analyzing the effects of residential densities and CBD employment levels and densities on light rail and commuter rail boardings. The data are from eleven cities in the United States with a total of nineteen light rail lines and six cities with a total of fortyseven commuter rail lines. Boardings and transit service characteristic data were provided by transit agencies. Employment and population characteristics are from the *1990 Census.* The data are used to develop models of light rail and commuter rail boardings and costs. The empirical results are then used to estimate boardings and costs for hypothetical light rail and commuter rail corridors.

The study finds that residential densities have a significant influence on light rail boardings. A 10 percent increase in residential density within two miles of stations increases station area boardings by 5.9 percent, holding constant other factors affecting ridership, such as income. Residential densities matter less for commuter rail boardings. Commuter rail is a high fare mode of travel, and many of the high-income riders come from low-density suburban areas some distance from the city center.

Both the size and density of the CBD influence light rail ridership. A 10 percent increase in CBD employment density raises light rail boardings per station by about 4.0 percent, holding constant the number of CBD employees, the residential density of stations, and other factors affecting ridership. For commuter rail, a 10 percent increase in CBD employment densities increases station boardings outside the CBD by 7.1 percent.

The study concludes that light rail is most cost-effective and efficient in the cities with larger CBDs and denser corridors. Commuter rail works best with dense CBDs. Other factors within the control of transit agencies, such as the availability of feeder bus service and park-and-ride lots, also influence ridership and costs.

Pushkarev, B., and J. M. Zupan. 1977. *Public Transportation and Land Use Policy.* Bloomington, IN: Indiana University Press.

The authors estimate the effects of population density on transit use by employing areawide population densities and transit use data from 105 urbanized

areas. They show that population density explained 55 percent of the variation in transit use in 1960, and 66 percent in 1970.

The authors also estimate the effects of residential density, downtown floor space, and the presence or absence of rail transit for 27 urbanized areas. Using these factors increases the explanatory power of the equations, but the new variables are still less significant than residential density in explaining transit use. Pushkarev and Zupan attribute this result to greater variability in office floor space than in residential densities among the areas studied.

UNLIMITED OUTWARD EXTENSION

Davis, Judy. 1993. "The Commuting of Exurban Residents." *Urban Geography*, 14, 1: 7-29.

A comparison of the commuting times of workers who bought homes in the suburbs and those who bought homes in the exurbs of Portland, Oregon, shows that the average exurban home buyer has a commuting trip six to seven minutes longer than his counterpart in suburbia, controlling for occupation, income, and other household and job characteristics. The data is from a survey conducted by the author of about 750 households that bought and occupied homes in 1987.

Although some exurban households have commutes similar to those of suburban households, the average exurbanite appears to trade off longer travel times for more space, a rural environment, lower housing prices, a better place to raise children, or some combination of these factors. However, exurban residents seem to sort themselves out so that those who live close to the urban area have central city and suburban jobs, whereas those who live farthest out most likely work in exurban towns.

Parsons Brinckerhoff Quade & Douglas. 1997. "TCRP Project H-13A—Draft Report: Consequences of the Interstate Highway System for Transit." Washington, DC: Transit Cooperative Research Program, Transportation Research Board.

This report describes the intended and unintended consequences of the development of urban interstate highways for transit by examining four metropolitan areas in the United States, four selected cities in Germany, and one city in Canada. The report includes profiles of these communities, their transportation systems, and the positive and negative impacts of their transportation choices.

The authors gathered information from published articles, official plans, and interviews with officials and other knowledgeable people in each community. They also visited each site. Their goal was to understand the history of the development of the interstate highway system within the urbanized area and the interactions between high-speed limited-access roads and changes in the transit system and land-use patterns.

The case studies were selected to test two major hypotheses identified from the literature review: that the interstate highway program biased transportation investments in favor of high-speed limited-access highways that made automobile travel much more attractive than transit use; and that interstate highways facilitated the suburbanization of households and firms, producing a pattern of development that is difficult for public transit to serve.

The authors present evidence from these case studies that confirms that the development of the interstate highway system adversely affected public transit. The data show declines in transit ridership, increasing difficulty in maintaining transit service levels, and the decentralization and dispersion of households and jobs in case study regions with the highest use of interstate highways. Yet the authors correctly point out that transit was in decline well before the interstate system was operational, and other factors supported development in outlying areas, such as low property tax rates, inexpensive land, and the growth of competing local governments.

The authors couch their main findings within other significant influences in the decline of transit:

1) The magnitude and certainty of public funding has influenced modal investment choices. These choices, in turn, have affected regional travel.

2) Those cities whose citizens have shown a continuous commitment to, and investment in, high-quality transit service have strong urban centers and high transit use.

3) Strong, well-respected institutions build and operate transit systems in the regions where the impacts of highways on transit are low.

4) Active, well-organized citizen groups mitigated the impacts of highways by successfully opposing certain highway designs as well as highway construction itself.

5) The integration of transportation and land-use policies, plans, and projects has mitigated the impacts of automobile infrastructure.

6) In cities where highways' adverse impacts are fewest, public policies support the use of alternative modes of transportation.

7) In general, city centers with fewer freeways have experienced less adverse impacts from automobile travel.

SPATIAL SEGREGATION OF USES (LAND-USE MIX AND URBAN DESIGN)

Suburbs (Employment and Residential Areas)

1000 Friends of Oregon. 1996. *Making the Land Use, Transportation, Air Quality Connection (LUTRAQ): Analysis of Alternatives. Vol. 5.* Portland, OR. May.

This study compares auto-oriented versus transit-oriented alternatives of land use and transportation patterns in suburban Washington County, in the Portland, Oregon metropolitan area. Each alternative utilizes the same land area and has the same overall density.

In the auto-oriented alternatives, most new multifamily housing and jobs are at the urban fringe. The "no build" variation includes few transportation improvements, whereas the "highways" variation includes a bypass freeway and other highway improvements. With the transit-oriented alternatives, most new multifamily housing and jobs locate on vacant lands near transit routes. This alternative also takes into account transit investments, retrofitting of pedestrian improvements, selected highway improvements, and a demand management program that includes parking charges for work trips. The region's travel demand model, which was enhanced to increase its sensitivity to density and design, is

used to simulate the transportation outcomes in 2010 of each of the alternatives.

The study finds that the package of transit-oriented development and transportation improvements that focus on non-automotive modes generates the following effects within the study area:

- Reduces auto ownership rates by 5 percent from auto-oriented levels
- Reduces single-occupant auto use for work trips to 58 percent compared to 76 percent in auto-oriented alternatives
- More than doubles the share of work trips made by transit over auto-oriented alternatives (18.2 percent versus 8.8 percent)
- Reduces daily vehicle trips per household from 7.5 to 7.2 trips
- Reduces the delay over "no build" levels by more vehicle hours than highway building alternative (53 percent reduction versus 43 percent reduction)
- Reduces peak period vehicle hours of travel at three times the rate that the "highway" building alternative does (15.7 percent reduction versus 5.6 percent)
- Reduces daily vehicle miles of travel by 6.4 percent, whereas the "highway" building alternative increases them by 1.6 percent.

One caveat, however, is important to note. The study area encompasses the fastest growing part of the Portland metropolitan area. The impacts would likely be less if transit-oriented land uses and transportation improvements were built throughout the metropolitan area, since the remainder of the region has less growth to focus toward transit-oriented developments.

Activity Centers

Cambridge Systematics. 1994. *The Effects of Land Use and Travel Demand Strategies on Commuting Behavior.* Washington, DC: U.S. Department of Transportation, Federal Highway Administration.

This study tests the influence of employment site design characteristics on commuting mode choice at suburban work sites in the Los Angeles area. The research involved on-site data collection of specific urban design and land-use attributes to ensure a careful calibration of the independent variables. The results indicate that the presence of land-use mix and certain urban design features, such as shade trees and sidewalks, in coordination with demand management programs, are responsible for increasing the percentage of work trips made by transit by three to four percentage points. An attractive urban environment proved to be the only factor that influenced mode choice in the absence of a travel demand program. In other words, mixed uses and access to services within the employment center were not strong enough incentives, by themselves, to generate more commuting by transit. This study did not control for factors such as the level of transit service to the site, however.

Cervero, Robert. 1989. *America's Suburban Activity Centers: The Land Use–Transportation Link.* Boston: Unwin-Hyman.

Cervero compares the commuting characteristics of workers in 57 suburban employment centers. These centers all have at least one million square feet of office space, 2,000 or more workers, and are at least five miles distant from the CBD. He uses cluster analysis to identify six types of centers—office park, office

center, large mixed-use center, moderate mixed-use center, sub-city, and large corridor. Cervero then uses analysis of variance techniques to determine whether the center types differ in commuting characteristics. He concludes that locations of higher densities and greater land use mix do result in more commuting by transit, ridesharing, and walking. Ridesharing is greatest in the centers with higher densities, whereas walking is greatest in centers with significant retail activity and nearby multifamily housing. These denser, more mixed centers also have slower speeds of travel because of greater congestion within the centers. This study did not control for transit availability and the quality of the pedestrian environment, however.

Cervero, Robert. 1996. "Jobs-Housing Balance Revisited." *Journal of the American Planning Association* 62, 4: 492-511.

Using data from the 1980 and 1990 Censuses, Cervero compares the jobs-housing balance of the 23 largest cities in the San Francisco Bay Area. His evidence shows that the jobs-housing balance generally improved during the decade, particularly as jobs increased in formerly housing-rich areas. However, housing did not grow significantly in job-rich areas, largely because zoning and growth controls prevented housing growth. Fifteen of the communities studied showed small increases in the ratio of internal commuting to external commuting. Nonetheless, about twice as many people commuted in and out of the average community as commuted within it. Thus, he concludes that despite less segregation of uses (measured at a gross city-wide scale), many people continue to commute considerable distances in part because of mismatches between the jobs available in their community and the type of housing found there.

Among other things, this descriptive study demonstrates that the transportation consequences of spatial segregation of uses need more careful consideration than just a look at the numbers of residences and jobs. The mismatches between the incomes of employees and housing prices and between new jobs and housing availability also must be considered.

Neighborhoods

Cervero, Robert, and R. Gorham. 1995. "Commuting in Transit Versus Automobile Neighborhoods." *Journal of the American Planning Association* 61 2: 210-225.

This study compares work trip mode shares and trip generation rates between matched pairs of transit-oriented and auto-oriented neighborhoods. Seven of the pairs are located in the San Francisco Bay Area, and six in the Los Angeles area. Transit-oriented neighborhoods are defined as those built around streetcars or rail stations prior to 1945, which have a grid street pattern. Auto-oriented neighborhoods are those built after 1945, with little orientation to transit, and with more curving streets and cul-de-sacs.

The neighborhood pairs in the study had similar incomes and, as far as possible, similar levels of transit service. Six of the seven San Francisco pairs showed the expected results of lower auto ownership and more use of transit and walking for work trips. (In one pair with a large university in the transit neighborhood, the transit neighborhood had less incidence of driving alone but walking often substituted for transit.) The difference in the share of drive-alone rates between neighborhood pairs ranged from 2.0 to

17.5 percent of trips. The results were more mixed in Los Angeles than in San Francisco, however.

The authors conclude that neighborhood design matters little in the Los Angeles area because of the overwhelming dominance of the automobile in this region. The results may also be muddled because transit service levels were less closely matched in the Los Angeles pairs than they were in the San Francisco pairs.

Ewing, Reid, P. Haliyur, and G. W. Page. 1994. "Getting Around a Traditional City, a Suburban PUD, and Everything In-Between." *Transportation Research Record* 1466: 53-62.

In this study, the authors compare six communities in Palm Beach County, Florida, on the basis of work accessibility, neighborhood shopping opportunities, and pedestrian accessibility. They find little evidence that accessibility to retail affects mode choice or vehicle hours of travel per person. The shortest shopping and recreational trips occurred in a classic 1970s planned-unit development (i.e., a suburban auto-oriented community) because ample stores and recreational facilities could be found within the community. This result suggests that the mix of uses is as important as the layout of streets and other design features in determining travel behavior.

Handy, S. 1992. "Regional Versus Local Accessibility: Neo-Traditional Development and Its Implications for Non-Work Travel." *Built Environment* 18, 4: 253-267.

Handy compares the shopping trip travel modes of residents of traditional and suburban neighborhoods in the San Francisco Bay Area. She finds that residents of traditional neighborhoods, where shopping opportunities are located nearby, make 2.75 to 5.5 times as many shopping trips by walking as residents of more auto-oriented neighborhoods. Residents of both types of neighborhoods make about the same number of auto trips to regional shopping malls, suggesting that neighborhood shopping trips may supplement rather than replace longer trips.

Handy, S. 1995. *Understanding the Link Between Urban Form and Travel Behavior.* Paper presented at the 74th Annual Meeting of the Transportation Research Board, Washington, DC. January.

In this study, Handy makes detailed comparisons of non-work trips in four suburban neighborhoods in the San Francisco Bay Area. A "traditional" and a "typical" suburban neighborhood are identified in Silicon Valley, where there are good transit connections to the rest of the region. Another pair is selected in Santa Rosa, on the fringe of the metropolitan area. The data used stem from original surveys. An analysis of variance shows that differences in travel behavior do occur because of urban form, controlling for household type (i.e., number of adults and number of workers). People make more shopping trips on foot in the "traditional" neighborhoods where the downtowns are connected to residential neighborhoods and offer services to those residents. It is not clear whether these trips replace auto trips, or merely supplement them, however. What is clear, is that people value choices and on average visit more than one grocery store and more than one regional mall in a month, if the choices are available. Having choice adds to

travel since trips are made to places more distant from home.

Kitamura, R., P. L. Mokhtarian, and L. Laidet. 1994. *A Micro-Analysis of Land Use and Travel in Five Neighborhoods in the San Francisco Bay Area.* Institute of Transportation Studies, University of California, Davis. November.

The authors studied the travel behavior of several hundred families in five San Francisco Bay Area neighborhoods. The areas were selected because they had similar median incomes. But some had high density, some low, and they varied in mix of use and access to rail transit. Three-day travel diaries were collected, and site surveys were made to identify urban design characteristics. Models estimated individual travel behavior and, therefore, controlled for individual characteristics such as income, occupation, education, and vehicle ownership. Differences in travel were explained both by individual characteristics and by land-use measures, especially residential density, public transit accessibility, and the presence of sidewalks. Density was most important in explaining the share of non-motorized trips. Access to transit influenced the number of non-motorized trips and the share of transit trips. The mix of uses was not a very powerful indicator of travel behavior, but a dummy variable for place (combining all the land use attributes) was significant.

Overall, however, the models developed in this study had limited explanatory power; they were able to explain only about 15 percent of the variability in the number or share of trips by various modes.

Parsons Brinckerhoff Quade and Douglas. 1996c. "Influence of Land Use Mix and Neighborhood Design on Transit Demand." Unpublished report for TCRP H-1 Project. Washington, DC: Transit Cooperative Research Program, Transportation Research Board. March.

In this report, separate studies examine the effects of neighborhood land-use mix and urban design on the demand for transit and other alternatives to the automobile.

The first study uses *Annual Housing Survey* data for 1985 for 11 large metropolitan areas to compare mode choices for work trips of residents in areas with and without easy access to a "corner store" or other commercial activities. A second study of the greater Chicago area uses transit and land-use data to identify the factors that influence individual transit trips. The third study compares the mode choices for work and non-work trips in "traditional" and "suburban" neighborhoods in the San Francisco Bay Area, using original survey data. All of the studies use multi-linear regression techniques to control for income and other household characteristics.

Overall, the studies show that the types and mix of land uses do influence the demand for transit, as well as the use of non-motorized modes. People who live in mixed-used neighborhoods have a lower probability of commuting by car (3 to 4 percentage points), a slightly higher probability of using transit (1 to 2 percentage points), and a much higher probability of walking or bicycling (10 to 15 percentage points) for work trips. In the Chicago area, a 10 percent increase in residential density is associated with an 11 percent increase in the number of trips by transit. Residents of "traditional" neighborhoods in San Francisco are more

likely to use non-automotive modes for non-work trips than residents of "suburban" neighborhoods. The neighborhood comparison study, however, did not find statistically significant differences in mode choice for work trips between the two types of neighborhoods.

Moreover, all these studies found it difficult to sort out the effects of land-use mix and urban design, because these characteristics are so strongly correlated with density. When density is included in an equation, mix and design variables generally explain little about mode choice. Each of the studies controlled for residential characteristics such as income and auto ownership. Because the studies are cross-sectional, however, they show only correlation between land-use characteristics and mode choice, not causality.

DISPERSED EMPLOYMENT

Cervero, Robert; Timothy Rood; and Bruce Appleyard. 1997. "Job Accessibility as a Performance Indicator: An Analysis of Trends and their Social Policy Implications in the San Francisco Bay Area." Institute for Urban Regional Development, University of California at Berkeley.

The authors claim that "accessibility," as an indicator of opportunities to reach destinations efficiently, has gained increasing attention as a complement to transportation planning's more traditional mobility-based measures of performance, like "average delays" and "levels of service." They maintain that evaluating transportation performance in terms of accessibility allows a more balanced approach to transportation analysis and problem-solving.

Increasing accessibility by bringing urban activities closer together through more compact development and the inter-mix of land uses, as well as by promoting teletravel, can substitute for physical movements. Although not a replacement for mobility-based planning, accessibility measures help gauge progress toward meeting other regional objectives like sustainability and social equality.

The authors use census transportation planning data to study trends in job accessibility between 1980 and 1990, with the San Francisco Bay Area serving as a case context. The objectives of the analysis are multifold: 1) The work seeks to advance the use of accessibility indicators as inputs to long-range transportation planning and monitoring; 2) The work aims to enrich how job accessibility is measured by introducing an "occupational match" refinement; 3) The authors employ empirical measures of job accessibility to address the spatial mismatch question; and 4) The work calls for more formally institutionalizing and expanding the use of accessibility indicators for evaluating and monitoring long-term transportation system performance as well as progress toward achieving broader social welfare objectives.

The research showed that the Bay Area's largely market-driven patterns of regional employment growth failed to improve job accessibility among residents of the region's poorest inner-city neighborhoods. Minority neighborhoods in the inner East Bay and parts of downtown San Francisco averaged the worst occupational mismatches in terms of proximity to available jobs throughout the 1980s. Controlling for occupationally matched accessibility, educational levels, and vehicle availability, Bay Area neighborhoods with high shares of African Americans still had

disproportionately high unemployment rates in 1990.

Cervero, Robert and Kang-Li Wu. 1996. "Subcentering and Commuting: Evidence from the San Francisco Bay Area, 1980-1990." Paper presented at the 1996 TRED Conference on Transportation and Land Use. Cambridge, MA: Lincoln Institute. October.

This paper examines the growth of dispersed subcenters in the San Francisco Bay Area and the effects of this growth on commuting. Cervero identifies 22 employment centers with 7 or more workers per gross acre and 9,500 or more employees in 1990. Downtown San Francisco is the largest and most densely populated subcenter. Other centers are in Silicon Valley and the East Bay core area (Oakland, Berkeley, and Emeryville); 16 more are located further out in suburbs. Two of the subcenters did not exist in 1980. Employment in these subcenters grew on average by 23.6 percent annually in the 1990s, increasing the regional share of employment in centers from 47.5 percent to 48.2 percent.

The growth of these subcenters has produced an increase in vehicle miles of travel (VMT) for commuting trips. On average, one-way VMT increased from 7.1 to 8.7 miles during the 1980s—a 23 percent increase, with the largest increases to be found in suburban centers. This increase in vehicle miles of travel is linked to both longer distances and to greater use of single-occupant vehicles. Of these, longer distances between home and work had more influence on VMT, since outside of downtown San Francisco and the eastern Bay Area, the vast majority of commuters used cars in both 1980 and 1990. Cervero estimates that more than four-fifths of the growth in VMT is due to longer distances between home and work. Longer distances were especially important in increasing VMT in the more peripheral centers.

While at least one of their previous studies suggested that job decentralization shortened commutes, this result has been explained mainly in terms of recorded travel times, and typically measured at the aggregate, metropolitan-wide level. This study sought to refine the analysis of spatial implications on commuting by disaggregating data among employment centers, measuring highway and transit network distances, and examining commuting behavior during the 1980-1990 window of rapid suburban employment growth. When combining refined commute distance measures with data on shifts in modal distributions and occupancy levels, the finding is that employment decentralization is associated with substantial *increases* in commute VMT per employee. Cervero attributes these longer distances both to regional growth and to mismatches in the job and housing markets that necessitate long commutes.

THE COSTS OF TRAVEL

Apogee Research, Inc. 1994. *The Costs of Transportation: Final Report.* Conservation Law Foundation. March.

This report reviews the literature on the costs of transportation and estimates the per-mile costs of several modes for Boston, Massachusetts, and Portland, Maine. The study divides costs into three types: user costs, governmental costs, and societal costs. Extensive data were collected for the case study regions, in an effort to accurately reflect the cost of travel in these specific places. Some costs—land loss, water pollution, solid and hazardous waste pollution, and social

isolation—could not be quantified and are not included in the analysis.

The report estimates costs for various modes, in different kinds of environments. For example, it estimates that a peak-period trip in a dense part of Boston using a single-occupant vehicle (SOV) on an expressway costs $1.05 per mile. Of the $1.05, $0.88 are user costs (including $0.24 for travel time), $0.05 are governmental costs not paid by the user, and $0.12 can be regarded as societal costs. In the off-peak period, the same trip costs $0.89 per mile, with $0.73 attributable to user costs ($0.10 for travel time), $0.05 to governmental costs, and $0.11 to societal costs. In a low-density setting the peak and off-peak SOV trips both cost $0.71. For the SOV mode, user costs, including travel time, vary the most among different settings.

By contrast, a high-occupancy vehicle (HOV) expressway trip in high-density Boston at peak hours costs $0.58 per mile, a commuter rail trip $0.58, a rail transit trip $1.04, a bus trip $1.09, a bicycle trip $0.73, and a walking trip $2.56. The relatively higher cost of rail transit, bus, and walking trips is primarily attributable to the added travel time. Costs in the smaller city of Portland are generally lower for all modes and densities.

The authors believe that transportation does influence sprawl, and this impact should be considered a societal cost of the transportation system. They do not, however, measure this cost, since studies have neither identified the full range of the costs of sprawl nor the proportion of these costs that are due to the transportation system.

This report documents the ways that travel costs differ with the physical environment and the modes available. As far as possible, costs are based on actual data for the locations studied, although measures of societal costs are generally taken from national studies.

DeCorla-Souza, Patrick; Rathi, Ajay K.; and Caldwell. 1992. "Nationwide Investment Requirements for New Urban Highway Capacity Under Alternative Scenarios," *Transportation Research Record 1359*: 57-67.

The paper provides cost estimates for maintaining the nation's urban highway capacity at 1985 levels of service through the year 2005. Besides providing the capital costs as a function of various levels of travel growth projections, the authors add a policy dimension to their estimates. Both land-use and transportation systems management policy constraints are included. While significant costs will be required despite policy levels, the paper demonstrates that appropriate policies could contain the capital investments required.

The cost models were run under the condition of no additional management imposed, then under moderate and high management conditions. The policy constraints incorporated were complex, containing several thrusts each in the land-use and traffic management areas.

Land use policies involved restricting development to where existing capacity was available, incentives for high density developments at commute trip terminus areas, mixed-use developments in the suburbs, and traditional neighborhood developments. On the transportation management side, policies included encouraging alternative commuting modes, work rescheduling programs, discouraging solo commuting, and increasing traffic control provisions.

The paper describes the process used in the analysis. There are two phases to the procedure: first to calculate the additional lane-miles required, then to calculate the equivalent dollars needed. The analysis yielded lane-mile increases ranging from 33 percent (low growth) to 49 percent (high growth) under baseline policy conditions. For the high management condition, the range was from 22 percent to 34 percent. At the low-growth condition which the authors thought was the more likely, policy management cut the required increase by a third. It should further be noted that with the elevated policy management, the high-growth condition almost equaled that of low growth and policy status quo condition. The capital investment needs varied from 1.2 trillion dollars under the high-growth, baseline management conditions down to 375 billion dollars under the low-growth, high management scenario.

The authors conclude that significant increases in highway funding (up to a possible 1.2 trillion dollars) will be required to maintain the 1985 levels of services. With the imposition of only a moderate increase in management policy and under the assumption of a low underlying travel growth rate, the required investment can be halved.

Delucchi, M. A. 1996. *The Annualized Social Cost of Motor-Vehicle Use in the U.S., 1990-1991: Summary of Theory, Data, Methods, and Results.* Davis, CA: Institute of Transportation Studies. August.

In this 20-volume study, Delucchi and his colleagues estimate the total social cost of automobile use in the United States for 1991. The study shows that many cost functions are non-linear and dependent upon location. Therefore, the study's estimates cannot be divided by total automobile mileage or some other measure of use to produce an accurate average price to use in other studies or analyses, although the methods may be applied in other studies.

Delucchi divides costs into six categories:

1) personal non-monetary costs, such as travel time;
2) motor vehicle goods and services priced in the private sector, such as vehicle ownership, maintenance, and use costs;
3) motor vehicle goods and services bundled with other goods and services in the private sector, such as employer- or business-provided parking;
4) publicly provided motor vehicle goods and services, such as roads;
5) monetary externalities of motorvehicle use, such as accident costs not paid by the responsible party; and
6) nonmonetary externalities of motor vehicle use, such as air pollution and global warming.

This report estimates that the total social cost of motor vehicle use is between $1.88 trillion and $2.839 trillion per year. Of these costs, 38 to 50 percent of the costs are for private-sector goods and services; 21 to 22 percent of the costs are for personal non-monetary purposes; 13 to 21 percent are for non-monetary externalities; 4 to 5 percent are for monetary externalities; 4 to 8 percent are for bundled private-sector costs; and about 7 percent are for public infrastructure and services. Delucchi also estimates that payments by motor vehicle users total $109 billion to $173 billion dollars a year, which is less than the $125 to $207 billion estimate of the amount spent on public infrastructure and services. He argues, however, that it is not necessary for user payments to match government expenditures for efficient

provision of resources. The difference between taxes paid by users and the provision of public goods and services related to motor-vehicle use must be judged on other grounds.

Delucchi does not include urban sprawl as a cost of automobile use. He argues that sprawl is a result of locational decisions, not motor vehicle use. Although transportation systems and costs may influence location decisions, he contends that the costs of different patterns of development are not directly a result of the use of motor vehicles. Furthermore, he claims the proper corrective action is to charge correctly for infrastructure provisions and other aspects of urban form, not to change automobile prices.

Ewing, Reid. 1997. "Is Los Angeles-Style Sprawl Desirable?" *and* Gordon, Peter and Harry W. Richardson. 1997a. "Are Compact Cities a Desirable Planning Goal?" *Journal of the American Planning Association* 63, 1 (winter): 107-126.

These two articles published in the *American Planning Association Journal* debate the sprawl issue. The first article by Reid Ewing paints sprawl as undesirable. It defines sprawl not as suburbanization per se but rather as a wasteful form of outward development. Sprawl is characterized by: 1) leapfrog or scattered development; 2) commercial strip development; or 3) large expanses of low-density or single-use development. Ewing points out two indicators that typify sprawl—suburban environments that are *difficult to access* and those that *lack functional open space.* Locations that are difficult to access are those far from the core and from each other; locations that lack functional open space are defined as those where open space is totally private and cannot be used to link neighborhoods, buffer incompatible uses, or provide space for social interaction, recreation or civic functions.

According to Ewing, sprawl is reinforced by consumer preference, technological innovation, public transportation subsidies, and the "more than shelter" concept of the housing market.

Costs of sprawl include increased: 1) vehicle miles traveled; 2) energy consumed; 3) public/private infrastructure; 4) depletion of developable and fragile lands; and 5) psychic and social stress. The cures for sprawl include more government oversight in the form of state and regional planning and more compact, mixed-use cluster development.

The second article by Peter Gordon and Harry W. Richardson attempts to attack "compact cities" as an alternative to spread-out metropolitan development—or sprawl. Gordon and Richardson define compact cities as those with 1) high densities at a macro or metropolitan level; 2) even higher densities at a micro or neighborhood/community level; or 3) even higher densities at a downtown or central city level. Gordon and Richardson reject compact cities because: 1) people like low, rather than high-density living; 2) there is no real chance that at either a national or global level there will be a shortage of land; 3) there is currently an energy glut, and therefore no need to alter residential preferences to conserve fuel; 4) the automobile is the most efficient and preferred way to access residential neighborhoods, and ideally suited to spread development; 5) suburbs are not congested and by their location have contributed to less inner-city and inner-suburb congestion; 6) inner city (compact) and suburban (spread) work and shopping trips are compatible; 7)

agglomeration economies, once the province of cities, have now moved to suburbs; and 8) central locations have no market and continue to decline, and their rescue is a wasteful misallocation of public funds. Given these reasons, no case can be made for compactness as a description of desired urban form.

Which article is right? The answer is probably both. People appear to 1) prefer the accroutrements of suburban living but dislike strip commercial development; 2) want to distance themselves from urban problems, but worry about energy and land consumption; 3) like their automobiles but see merit in transit; 4) see a growing sophistication in suburbs but acknowledge a need for safe and functioning cities; and 5) travel and function in an environment that is less than efficient and less than beautiful, but very, very comfortable.

Hanson, M. E. 1992. "Automobile Subsidies and Land Use: Estimates and Policy Responses." *Journal of the American Planning Association* 58, 1: 60-71.

This paper estimates the subsidies of automobile use in Madison, Wisconsin, a medium-sized city, in 1983. Hanson uses data on highway costs and taxes in the city and determines that direct subsidies for highway infrastructure, maintenance, and policing were equivalent to $0.024 per passenger-mile or $105 per person in 1983. Indirect subsidies for air and water pollution, petroleum prices, land-use opportunity costs, and personal injury were estimated from national data, and are, therefore, less precise than the highway data. Nonetheless, he calculates that indirect subsidies were equal to $0.034 per passenger-mile or $257 per person. In this estimation of costs, the largest subsidies were for personal injury (36 percent), highways (23 percent), and air pollution (15 percent).

Hanson contends that subsidization of the automobile produces more dispersed patterns of development than would occur otherwise. Furthermore, he claims that sprawled development limits transportation options by making the automobile the only viable source of travel.

Litman, Todd. 1995. *Transportation Cost Analysis: Techniques, Estimates and Implications.* Victoria, BC: Victoria Transport Policy Institute. February.

Based on a review of existing studies, Litman estimates the cost per mile for a number of different modes of transportation: average car, fuel-efficient car, electric car, van, rideshare passenger, diesel bus, electric bus/trolley, motorcycle, bicycle, walking, and telecommuting. The report includes cost estimates for 20 different factors that affect travel choice, ranging from the costs of operating a vehicle to the cost of lack of transportation options.

Litman estimates that for urban travel during peak periods, a mile of travel by automobile costs $1.33. Of this amount, $0.16 is attributable to variable vehicle costs, $0.25 to fixed vehicle costs, $0.31 to user time and risk, and $0.61 to external or societal costs, such as pollution and land use impacts. The same mile of travel in an urban area during the off-peak hours costs $1.06, with $0.14 attributable to various vehicle costs, $0.25 to fixed vehicle costs, $0.33 to user time and risk, and $0.34 to external or social costs.

Litman does not separate out governmental costs of travel. Those costs paid by users, such as roads built with gasoline

taxes, are considered user costs; those paid through general taxes, such as policing, are lumped in external costs. The largest external costs in Litman's scheme are for air pollution, accident costs not paid by the user, the opportunity costs of land currently used for roads, and external costs of energy consumption such as tax subsidies, energy security, and environmental damage.

Litman contends that land-use costs are a legitimate cost of automobile use because auto use encourages sprawl. It requires large amounts of land for transportation facilities and makes development of the urban fringe much easier. The effects include loss of prime farmland and wetlands, aesthetic degradation, loss of community, and higher transportation costs. Indeed, Litman estimates that landuse effects cost about 7 cents per mile, compared to 33 to 35 cents per mile for owning and operating the vehicle and 17 to 23 cents for travel time.

This study provides relative measures of the various costs of using the automobile versus other modes of travel; the calculations are based on estimates made by others. The data used rarely cover the full range of modes for which the author estimates costs. Thus, the figures in his tables are often simplified. The author attempts to monetize all costs despite the lack of hard data on many costs. The numbers are average estimates and do not consider location-specific factors such as differences in costs for urban and rural road building or congestion. The types of outcomes that the author counts as land-use impacts of transportation are generally counted elsewhere in an analysis of the costs of the sprawl and should not be counted again.

MacKenzie, J. J., R. C. Dower, and D. D. T. Chen. 1992. *The Going Rate: What It Really Costs to Drive.* Washington, DC: World Resources Institute.

This report estimates the amount spent on automobile subsidization in the United States; it defines subsidies as costs not paid directly by the user. According to the study, road users pay only about 60 percent of the $53.3 billion annual governmental costs of building and maintaining roads. They pay only 25 percent of the $91.0 billion police, fire, and other municipal costs associated with automobile use. Free employer-provided parking accounts for the largest portion of the subsidy. The authors estimate that 85 percent of the $100 billion cost of employee parking is not paid by the user. The report also estimates that users pay virtually none of the air pollution costs (estimated to be $37 billion), security costs for maintaining a reliable supply of oil ($25 billion), petroleum subsidy ($0.3 billion), or noise pollution costs ($9 billion). About 15 percent of accident costs, or $55 billion worth, are also estimated to be paid by someone other than the responsible party. The authors were unable to estimate some costs, however, such as the opportunity costs of land devoted to roads.

Estimates are based on data from previous studies. Estimates of externality costs are more speculative than other costs.

Parsons Brinckerhoff Quade and Douglas. 1996a. *Cost of Travel in Boulder.* City of Boulder, CO. July 15.

This study employs the methods of the Apogee study; local data for governmental costs; and national data for societal costs; and local and national data for user costs to estimate the total cost of typical

trips by various modes within the built environment of Boulder. The study is based on actual travel times to and from specific locations.

The authors estimate that the cost of commuting to Denver (25.5 miles) is $24.61 by single-occupancy vehicle (SOV) and $15.79 by transit. The SOV trips breaks down as follow: $19.40 for user costs (mostly travel time); $1.16 for governmental costs; and $4.04 for societal costs. The transit trip includes $10.68 for user costs; $4.70 for governmental costs (mostly for transit provision), and $0.41 for societal costs. Although, in this case, transit is a cheaper trip, for a multi-purpose shopping trip of 9.75 miles within the city of Boulder, an SOV trip costs much less than a transit trip, $11.66 versus $29.17. Transit is more expensive because of the time involved and because of the relatively high governmental expenses for off-peak transit travel. For a short 2-mile trip to downtown Boulder, more options are considered. An SOV trip costs $4.02, a transit trip $3.43, a bike trip $1.74, and a pedestrian trip $5.59. The relatively high costs of pedestrian travel is due to the longer time needed to complete the trip.

This study shows that travel costs vary with the environment and by type of travel. Transit costs less for long commutes; walking and bicycling are viable alternatives for short trips in a compact city; the car is best for linked trips.

Voorhees, M. T. 1992. *The True Costs of the Automobile to Society.* City of Boulder, CO. January.

This study estimates the total annual cost of automobile use in the United States in 1990. The author divides costs into two main categories: 1) the direct expenses of automobile ownership and use, including the cost of highways; and 2) external costs, including direct monetary costs, for emergency medical care; lost economic gain due to air pollution and other externalities; and the opportunity costs of using land for roads and parking. Relying on data from other studies, he estimates that in 1990, the total cost of automobile use in the U.S. was $1.152 trillion. The largest costs were direct expenditures for automobile ownership and use ($440 billion, or 38 percent); land-use opportunity costs ($246 billion, or 21 percent); congestion costs ($146 billion, or 13 percent); air pollution costs ($100 billion, or 9 percent); and highway costs ($80 billion, or 7 percent). Voorhees also argues that the automobile has two major land-use impacts; it consumes large amounts of land for roads and parking and it encourages sprawl. He does not try to estimate the costs of sprawl, however, because he lacks data and because these costs are already calculated in the amount of fuel consumed and other costs of using the automobile that result from a more dispersed pattern of development.

His external cost estimates are quite subjective and would easily be changed by making different assumptions. The cost estimate for land opportunity costs is relatively large compared to estimates in other studies.

CHAPTER 11

Annotations of Studies

LAND/NATURAL HABITAT PRESERVATION

Land/natural habitat preservation seeks to protect unique lands and environments from development. Because it is assumed that this is the most logical and fertile area of potential improvement by anti-sprawl measures, this is often the component of the literature that receives the least empirical and analytical attention. The literature collected here for annotation contains discussions of the importance of natural environments to communities and the potential losses of natural environments to the development process. The annotated literature in this chapter is organized as follows:

Land Preservation and Community Cohesion
Land Preservation and Sprawl: Empirical Studies

The first category, *Land Preservation and Community Cohesion,* includes the works of Randall Arendt (1994b, 1996), Constance Beaumont (1994, 1996b, 1997), Reid Ewing (1995a), Moe and Wilkie (1997), and Arthur Nelson (1992b). The second category, *Land Preservation and Sprawl: Empirical Studies*, includes the works of Robert W. Burchell (1995a) and John D. Landis (1995).

LAND PRESERVATION AND COMMUNITY COHESION

Arendt, Randall et al. 1994b. *Rural by Design.* Washington, DC: American Planning Association.

In this volume, Arendt and his fellow authors supply the reader with a great deal of material on a broad range of land design subjects, selected for their relevance to residents and local officials in rural and suburbanizing areas. The author's objective is to present pertinent information both to people working and living in small towns and to rural planners. The book's emphasis is on design issues, and it provides material that is not readily available outside of technical publications.

The authors work to provide answers to commonly asked questions, and supply readers with numerous examples of rural residential and commercial projects that have used creative design techniques.

Photographs and schematic site plans are used to show how these viable alternatives to conventional design approaches work.

One section of the book contains extensive information devoted to the "traditional town," in the belief that these rural communities will be able to conserve much of their remaining character and sense of place only if residents and local officials gain a fuller understanding of some of the basic principals underlying the form and the functioning of traditional towns. The authors see it as their role to encourage new development that complements, enhances, and builds upon historic town patterns.

Arendt, Randall. 1996. ***Conservation Design for Subdivisions: A Practical Guide to Creating Open Space Networks.*** **Washington, DC: Island Press.**

Arendt published this book in response to numerous inquiries concerning two earlier books on rural design principles. Readers wanted to know more about the techniques available to landowners, developers, local officials, and conservation organizations who were interested in conserving land in the development process. They were all looking for ways that land could be assembled and positioned so that communities could enjoy open space for years to come.

In this book, Arendt sets out principles that are far from novel, but presents them in a way that is easily understood by lay people. He addresses residential development around a central organizing principle—land conservation. He describes a way that open space can be arranged so that it will create an interconnected network of protected lands. Arendt views the "conservation subdivision" as the key component of this community-wide system of open space.

Arendt's vision is for land-use planners to work much more closely with conservation professionals, and with developers and landscape architects, to help strengthen the "Greenspace Alliance." The author believes that this can be accomplished in a way that respects both the rights of landowners and the equity of developers. According to his view, developers can build at full density only when their design includes meadows, fields, and woodlands that would otherwise have been graded, and converted into house lots and overly wide streets.

Beaumont, Constance. 1996b. ***Smart States, Better Communities: How State Governments Can Help Citizens Preserve Their Communities.*** **Washington, DC: National Trust for Historic Preservation.**

In this book about restoring American communities, Beaumont examines the role of state governments in growth management, especially the way they deal with several primary aims of the historic preservation movement, such as protecting the economic viability of historic downtowns and neighborhoods; preserving the countryside and character of local communities; and maintaining a sense of community. These are often exactly the objectives that are thwarted by sprawl-type development, which results in older community disinvestment, a radical transformation of the countryside, and the creation of "centerless, featureless settlement patterns."

Beaumont begins her effort by first defining sprawl, and then she explains why sprawl creates problems for community livability and historic

preservation. She also examines the economic assumptions underlying sprawl-type development, and looks at various state policies that aim to manage this type of growth.

Beaumont, Constance. 1994. *How Superstore Sprawl Can Harm Communities—And What Citizens Can Do About It.* and 1997. *Better Models for Superstores: Alternatives to Big-Box Sprawl.* Washington, DC: National Trust for Historic Preservation.

In *How Superstore Sprawl Can Harm Communities*, Constance Beaumont launches an attack on the increasing presence of big-box, generic superstore warehouses (such as those of Wal-Mart, Kmart, etc.), which locate at major interchanges at the outskirts of communities.

The author acknowledges that superstores have positive impacts. These include creating jobs, generating tax revenues, and providing affordable consumer goods. However, she believes that the hidden costs of these establishments are often overlooked. These hidden costs include:

- shifting retail activity out of downtowns and main streets to peripheral areas;
- taking retail spending money away from existing local businesses;
- increasing taxes by requiring infrastructure and services, such as new roads, water/sewer lines, and police protection, in formerly vacant areas;
- causing abandonment of previously developed areas;
- homogenizing America by building standardized structures that have no relation to their surroundings;
- increasing automobile dependence and its associated energy consumption and pollution effects.

In the second part of this work, Beaumont highlights several case studies in which local activists were successful in fending off superstore-type developments. From these experiences, Beaumont is able to provide a series of strategies and recommendations for other grassroots organizations. These include a review of relevant local, state, and federal laws that can be used against developers; tips for utilizing the media; a review of regulatory takings and property rights issues; and an action plan for concerned citizens.

In a companion piece, *Better Models for Superstores*, Beaumont reviews cases in which traditional big-box retailers chose nontraditional development in structures located in downtown.

According to Beaumont, retailers such as Target (Pasadena, CA), Toys R Us (Santa Monica, CA and Chicago, IL), Wal-Mart (Rutland, VT), Kmart (Manhattan, NY), and others are discovering that stores in downtowns can be profitable. Also, in some cases, the big-box stores are moving into historic structures that may have been abandoned for decades.

Beaumont concludes that to effectively prevent superstore sprawl, communities must have strong leadership, good design review mechanisms, defined land-use plans, and aggressive zoning policies. With these elements, communities can negotiate with retail chains and create alternative development patterns to revitalize the downtown, protect the environment, *and* generate profits for these national retailers.

Clearly, these writings advocate controlling the spread of these types of retail land uses. Notwithstanding the obvious point of view of the author, the two monographs present a significant amount of information on the land-use implications of superstore development.

Dahl, Thomas E. 1990. *Wetlands Losses in the United States: 1780s-1980s.* Washington, DC: U.S. Department of the Interior, Fish, and Wildlife Service.

Dahl points out that in colonial America, about 400 million acres of wetlands existed; by the 1980s, the wetlands inventory had dropped to 250 million acres.

Wetlands occur in every state in the nation in varying size, shape, and type. Variation occurs because of differences in climate, vegetation, soils, and hydrologic conditions.

Until recently, wetlands were generally considered a hindrance. Swamps, bogs, sloughs, and other wetland areas were regarded as wastelands, to be drained, filled, or manipulated to "produce" services and commodities. Recently, however, wetlands have come to be seen as vital areas that constitute a productive and invaluable public resource.

According to Dahl, in order to prevent continued wetlands losses, development must proceed in an environmentally responsible way. Development must respect the natural habitats of wetlands and other sensitive lands or these lands will be lost for all generations.

Ewing, Reid. 1995a. *Best Development Practices: Doing the Right Thing and Making Money at The Same Time.* Chicago: American Planning Association.

Ewing addresses the need for change in development policy and practice given Florida's expected rapid growth rates (approximately 5 million people during the next 20 years) and given Florida's dominant development pattern of urban sprawl. Ewing argues that increasing social and economic costs will occur due to the continuation of sprawl. In an attempt to minimize sprawl's costs, the author advocates a community development process in which public purposes are weighed against market considerations. He lists such public purposes as affordable housing, energy efficiency, and the preservation of natural land masses and resources.

Discouraging urban sprawl by creating vibrant more compact communities means placing an emphasis on population diversity (age and class), establishing street life, creating a sense of place, and establishing other features that contribute to "livability." Recommendations to realize these goals are presented in the form of "best development" practices, which are meant to be used as a basis for developing comprehensive plans for new communities and redevelopment projects, for structuring land development regulations, or for evaluating specific development proposals. Seven new communities (planned communities within the 300-500 acre range) are discussed in reference to his best development practices.

Lewis, Peirce F. 1995. "The Galactic Metropolis." In *The Changing American Countryside: Rural People and Places,* Emory N. Castle, ed. Lawrence, KS: University of Kansas Press.

The author believes the term "suburban sprawl" is a misnomer. Instead, he endorses a concept he terms "metropolitan dispersion." He utilizes this term to describe the disappearance of the boundary between the city and the country. Lewis provides two meanings for his use of "metropolitan." The first refers to the buildings, skyscrapers, parks, and other tangible aspects of the city. The second refers to intangible aspects, such as the people, institutions, ideas, and their interactions within the city's culture.

In the past, according to Lewis, the tangible and intangible aspects of a metropolitan city were intertwined. Lewis points to major old-world European cities which were centers of civil authority, military might, and religious focus. The architecture of these institutions was dominant and imposing on the city's landscape, including high defense walls, large palaces, and grandiose cathedrals. While these cities were also centers of commerce, this function played a secondary role to the others. Thus, markets flourished inside city walls for safety and security and in cathedral squares to attract customers.

In contrast, major American cities were exclusively centers of commerce. The central square was a market square, and the largest buildings were office buildings. Also in contrast to European cities, military, educational, and political institutions were dispersed into smaller communities outside the urban area instead of concentrated in the central city. As a result, Lewis believes, major American cities were deprived of traditional metropolitan functions. Their single-minded economic focus alienated much of the regional population and generated anti-urban prejudices. Conversely, however, this dispersion of central metropolitan functions enriched non-urban and rural areas of America.

Over time, through the process of metropolitan dispersion, these urban and rural areas of America have begun to meld. The physical metropolis has followed the cultural metropolis into the countryside. Lewis names this new urban form the *galactic metropolis.*

How did this galactic metropolis arise? The primary factor, according to Lewis, was the widespread use of the automobile. The automobile allowed people to live outside the crowded cities. And although suburbs had previously existed, these new suburbanites discovered that they could also work and shop outside the city center. The interstate highway program further sealed the fate of central cities. High-speed highways made interchanges more accessible, more attractive, and less expensive than the downtown. In addition, the urban renewal programs of the 1950s and 1960s destroyed the infrastructure and architecture of many central cities. This combination of flexible transportation, rapid accessibility, and cheap land lured commercial and industrial enterprises out of the central city.

In conclusion, Lewis does not devise a plan to reform the new urban structure, realizing that it is not going away. Rather, he counsels that "we must *learn* to live with it." In particular, we must learn three things about the new metropolis: how it is arranged, why it is arranged that way, and how it works.

Michigan Society of Planning Officials (MSPO). 1995. *Patterns on the Land: Our Choices, Our Future.* Rochester, MI: Michigan Society of Planning Officials.

This report by the Michigan Society of Planning Officials (MSPO) reveals that, over the past three decades, Michigan has experienced a major population shift to suburban and rural areas. Sprawl is most apparent in Southeast Michigan, the Grand Rapids area, and Traverse City, but is also occurring in most of the lower half of the lower peninsula, and in a number of northern counties.

The study's authors claim that there is a growing sense of community degeneration, manifested by citizens at public hearings on land use. The authors warn that if this pattern of development continues, certain costs and problems will be created, including significant public capital and maintenance expenditures channeled to water, sewer, roads, and other infrastructure; the continued decline of urban areas; the loss of jobs in key resource-based industries such as agriculture, timber harvesting, and mining once open land is converted to residential and commercial uses; the loss of the aesthetic appeal of natural open spaces; and the loss of a distinct edge between city and country in the developing landscape.

The authors warn that, although the current pattern can be sustained for several decades, the impact on renewable resources and mineral deposits will be irreversible. On a more positive note, the study concludes that an informed public can achieve a different future through coordinated and integrated land use planning, creative use of new technology, and better information.

Moe, Richard, and Carter Wilkie. 1997. *Changing Places: Rebuilding Community in the Age of Sprawl.* New York: Henry Holt.

The authors begin with the premise that most of America's communities (new as well as old; suburban and rural as well as inner city) are not functioning as they should. There are a number of reasons for this, but Moe and Wilkie stress the fact that the leaders and residents of these communities have either made bad choices, allowed bad choices to be made for them, or made no choices at all. They claim that communities can be "shaped by choice" or they can be "shaped by chance." In other words, we can continue to accept the communities we get, or we can insist on getting the kind of communities we want.

Moe and Wilkie assert that the design of most contemporary American communities is largely determined by highway engineers and superstore developers. They have stepped into the void left by public officials (who are either resigned to, or eager for, this kind of development) and by citizens—who are either complacent or feel powerless. Communities are built in a series of steps, each one so apparently logical or innocuous that it goes unchallenged. The result, as the authors point out, is rampant sprawl, a phenomenon that has reduced the social and economic vitality of traditional communities and filled millions of acres of farmland and open space with "formless, soulless, structures unconnected to one another except by their inevitable dependence on the automobile."

Moe and Wilkie put forth two alternatives to sprawl: (1) better planning of how we use our land; and (2) the use (or reuse) of the capacity of older neighborhoods, towns, and downtowns to a greater extent

than they are used currently. Both alternatives, claim the authors, are essential if we are to successfully manage growth and contain sprawl before it bankrupts society and local economies.

Nelson, Arthur C. 1992b. "Preserving Prime Farmland in the Face of Urbanization: Lessons from Oregon" *Journal of the American Planning Association* 58: 471-488.

This article first reviews Oregon's effective combination of policies to preserve prime farmland despite intense urbanization pressures. It then proceeds to propose a scheme for comprehensive farmland preservation, building on Oregon's successes and mistakes.

Prime farmland near urban areas is required for three important reasons: the production of truck and specialty crops; the provision of key environmental functions such as flood water absorption, air cleansing, and water filtration; and for open space protection and the provision of spatial definition to urban areas.

Communities in every state have implemented farmland preservation techniques, with varying degrees of success. According to the author, for a policy to be successful, it must influence the land market in the several different ways. It must increase the productive value of farmland; it must stabilize, reduce, or eliminate the value of the farmland tract as a single-family homesite (the consumptive value); it must remove the speculative value of farmland; and it must eliminate the impermanence syndrome.

According to Nelson, *property tax relief* programs reduce the property tax farmers pay for urban and educational services which mostly benefit urban residents. As a result, this policy subsidizes housing costs and turns farmers into speculators. *Right-to-farm laws* protect farmers from nuisance complaints from urban residents. However, although farmers usually win their legal battles, they often lose because of the heavy financial expense of the process. *Transfer of development rights (TDR)* and *purchase of development rights (PDR)* programs preserve farmland by compensating farm owners for maintaining their farmland. However, these programs often fail because the programs are randomly applied and usually result in isolated farmland tracts being surrounded by urban development. A final common strategy, *agricultural zoning*, restricts land uses to farming and other open space activities. *Non-exclusionary agricultural zoning* also restricts lot sizes to certain minimums. Smaller minimum lot sizes (higher densities) usually result in a form of development called rural sprawl. As a result, nonexclusive agricultural zoning is generally effective only when large lot size requirements (160-acre-minimum) are coupled with strict development review.

Exclusive agricultural zones, on the other hand, restrict all non-farm activities and require that farmland be used for commercial activities. This strategy can be effective only when all prime farmland is zoned for exclusive agricultural use and urban development pressures are diverted to other areas.

Oregon has implemented a statewide program to preserve farmland in the Willamette Valley. This 4,000-square-mile valley contains one-third of the state's prime farmland; produces 40 percent of the state's agricultural products; and houses more than two-thirds of the state's population.

Oregon's farmland preservation plan does not rely on a single strategy. Rather, it

employs a multifaceted approach consisting of exclusive agricultural districts, urban growth boundaries, development restrictions in exurban areas, farm use tax deferrals, and right-to-farm provisions. Data from the 1987 Census of Agriculture suggest that Oregon's policies are working. They are preserving a viable agricultural economy while accommodating a craze for hobby farms.

The effectiveness of Oregon's efforts can be further analyzed by comparing developments in Oregon with those in nearby Washington, a state without a statewide farmland preservation plan. Oregon has lost more small farms than Washington, but it has gained more larger farms (over 500 acres), more commercial farms (over $10,000 in earnings), and more total farm acreage.

According to the author, a successful farmland preservation plan relies on multiple techniques and strategies that work together and reinforce each other.

LAND PRESERVATION AND SPRAWL: EMPIRICAL STUDIES

Burchell, Robert W., and David Listokin. 1995a. *Land, Infrastructure, Housing Costs, and Fiscal Impacts Associated with Growth: The Literature on the Impacts of Sprawl versus Managed Growth.* Paper prepared for "Alternatives to Sprawl" Conference, Brookings Institution, Washington, DC. March.

This short summary paper reviews the major studies on sprawl through 1995. It draws heavily upon the research done by the same authors for the State of New Jersey, as well as the work of James Duncan and James Frank in Florida. This paper, however, was prepared before Burchell's studies of Lexington (Kentucky), the Delaware Estuary, Michigan, and South Carolina were released. The paper examines the implications of planned development versus more traditional decentralized development in the areas of land consumption, infrastructure costs, housing costs, and fiscal impacts.

Most of the studies reviewed in the paper contrast sprawl with at least one other development pattern. Sprawl is described as development that typically includes subdivision-style residential development and strip nonresidential development consisting of skipped-over, noncontiguous land development, including low-density residential and low floor-area ratio nonresidential developments. In contrast, planned development is described as seeking to contain new growth around existing centers and limiting development in rural and sensitive environmental areas, usually accomplished by increasing the share and density of development close in to existing development.

The growth analyzed in this paper is assumed to consist of household growth that in turn leads to job growth, which requires additional land. Ideally, this growth and the provision of facilities to accommodate it are handled in a timely, harmonious manner.

Traditional growth is shown to depart from the most harmonious possible path by locating residential and other development in "a new outer ring of the metropolitan area with access from this new outer ring oriented increasingly to a beltway or interstate [highway] rather than central core job locations." Increasing under-utilization of core land and infrastructures result. This process is associated with the development of "edge cities," which, in turn, generate a new farther-out ring of bedroom residential

subdivisions. "The core of the metropolitan area, absent redevelopment, becomes relatively abandoned by a variety of necessary and blue-chip economic activities and a home by default for poor residents who cannot follow ... or are not allowed to follow upper-income residents to the suburbs (because of zoning). Even with redevelopment, the central core is a struggling entity with no soft-goods retail anchors, no quality supermarkets or movie theaters, a declining upwardly mobile population, public school systems being replaced by private, and increasingly higher property taxes to pay for rising public service costs" (3).

Traditional growth is costly because new infrastructure must be provided for those households and businesses located far out, and the old infrastructure must be maintained for those left behind. Yet in the short run, traditional growth is not bad for a region. It distributes firms and households to localities that minimize individual out-of-pocket costs. No consideration is given to the larger societal costs or impacts of these individual choices.

The alternative development pattern of planned growth channels the growth to more efficient locations over the long run. Most of the far-out growth which arises in traditional development is contained closer to existing infrastructure and built-up areas. Thus, "in the final equation ... there is a more orderly and less wasteful relationship between old and new development" (5).

Another goal of planned development is the conservation of open space (i.e., agricultural land, forests, and environmentally sensitive areas). The New Jersey analysis compares the impacts of development in New Jersey for the period 1990 to 2010 under two development scenarios—TREND versus PLAN. The authors developed a series of models to examine the relative effects of each scenario.

They found that more than enough land existed statewide to accommodate the projected twenty-year development (1990-2010) of persons, households, and employees under both traditional (TREND) and managed (PLAN) growth. The authors estimated that development under TREND would consume 292,100 acres, whereas PLAN could accommodate the same level of growth but would consume only 117,600 acres—175,000 fewer acres than the alternative (Burchell et al. 1992b). PLAN's overall land drawdown was 60 percent less than TREND.

Managed growth would also offer the environmental advantage of preserving greater levels of frail and agricultural lands. If historical rates of loss are projected into the future, under TREND 36,500 acres of frail lands would be consumed for development during the 20-year period. By contrast, under PLAN, frail and agricultural consumption drops to 7,150 acres, only 20 percent of the TREND scenario. In other words, managed growth in New Jersey could accommodate future development and at the same time, save more than 30,000 acres of frail environmental lands. In a similar vein, although development under TREND would consume 108,000 agricultural acres between 1990 and 2010, under PLAN, only 66,000 agricultural acres would be drawn down, representing a savings of 42,000 acres, or 40 percent of prime agricultural land.

Diamond, Henry L., and Noonan, Patrick F. 1996. *Land Use in America.* Washington, DC: Island Press.

In this compilation of papers, essays, and vignettes, the authors and a dozen contributors argue that better land use is essential to the health and well-being of Americans and their communities. Using the nation's land well yields many benefits including cleaner air and water, and better towns and neighborhoods in which to live. The management of land, however, has been largely neglected in this country due to its highly politicized character and the confused nature of its regulatory structure. In an effort to rectify this wanting situation, the authors advocate a new political agenda:

1. Local communities must define a vision for the future by enlisting all sectors in devising land-use plans, and then executing those plans with greater efficiency and flexibility.
2. States must establish greater rules for land-use planning and provide leadership to encourage communities to deal with complex regional problems.
3. Rules governing the use of land must become more adaptable while ensuring predictability to developers.
4. The rights of landowners must be taken seriously.
5. Cooperation among agencies and coordination among policies are essential to achieving better land-use practices.
6. A federal trust fund for assisting acquisition is needed to provide states and local jurisdictions with funds and predictability so they can plan ahead.
7. To redevelop vacant and deteriorating areas, a clearing of the regulatory thicket is needed, especially those rules that unnecessarily encumber the reuse of land with a history of hazardous wastes.
8. Private initiatives for conservation and quality development require incentives; relief from regulations should be exchanged for efforts to enhance natural habitats.
9. Land trusts are an effective means of focusing upon geographic features of a landscape and must be encouraged as a means for citizen collaboration in the next century.
10. Land disputes should be resolved through negotiation or mediation, perhaps in conjunction with geographic information system tools.

This book is a self-described call for action. The authors intend it to be a rallying cry for land stewardship, quality development, and environmental progress. They call for the American public and its leaders to make a commitment to good land-use practices and to pursue an agenda for the next century that would improve land use, much as the environmental agenda of the past quarter century has largely accomplished its goals.

Landis, John D. 1995. "Imagining Land Use Futures: Applying the California Urban Futures Model." *Journal of the American Planning Association* 61, 4 (Autumn): 438-457.

This article explains how the California Urban Futures (CUF) Model, a second generation metropolitan planning model, works to help planners and other individuals create and compare alternative land use policies. Landis demonstrates how the model simulates the impacts of regional and subregional growth policy and planning alternatives.

He expends much effort explaining the design principles and logic of the CUF model, and in presenting CUF model simulation results of three alternatives for

growth policy and land-use planning for the San Francisco Bay and Sacramento areas. The three alternatives offered are a) "business-as-usual"; b) "maximum environmental protection"; and c) a "compact cities" scenario. Each alternative is evaluated for its impact on overall land consumption and the consumption of environmentally sensitive lands in particular, at the county level.

Alternatives (b) and (c) show considerable overall land savings and considerable savings in environmentally sensitive lands relative to the business-as-usual scenario. Total land saved in scenarios (b) and (c) were 15,000 and 46,000 acres, respectively. Redirected growth in scenario (b) saved nearly 60,000 acres of prime agricultural land, 10,500 acres of wetlands, and 3,000 acres of steep sloped land; scenario (c) saved 29,000 acres of prime agricultural land, 10,500 acres of wetlands, and 8,000 acres of steep sloped lands.

Landis believes that the CUF model breaks new ground in that it incorporates GIS software to assemble, manage, display, and make available millions of pieces of information about land development potential. The CUF model also recognizes the role of land developers and home builders in determining the pattern, location, and density of new development. Finally, the CUF model is adept at incorporating realistic local development policies and options into the growth forecasting process. It serves a similar purpose as the Rutgers Land Consumption Model in that it specifies growth alternatives as a beginning point for all subsequent infrastructure analyses.

CHAPTER 12

Annotations of Studies

QUALITY OF LIFE

Quality of life reflects how we feel about our environments. Those who are concerned about living environments object to sprawl's loss of a sense of place and mourn the loss of unique environments. In this atmosphere, cities of scale are no longer viable, and replacement suburbs have no sense of identity. As "place" has become increasingly important to businesses and individuals, ratings of places have grown in the literature. Some of these are empirically based, whereas others merely reflect the opinions of raters. Place ratings and their limitations are a focus of this chapter.

Quality of life as a subject also has significant contributions from the fields of economics, sociology, and psychology. Attempting to catalog these contributions would dominate any compilation of annotations. These contributions are just briefly touched upon here.

The presentation of information in this chapter is as follows:

Popular Literature
Indicators, Reports Cards, and Benchmarks
Economics Literature
Sociology Literature
Psychology Literature

In the *Popular Literature* section, *Money Magazine's* "Best Places to Live in America," *Fortune Magazine's* "Best Cities: Where the Living is Easy," and the *Places Rated Almanac* are commented upon.

In the *Indicators, Report Cards, and Benchmarks* section, works by Dowell Myers (1987) and the Oregon Progress Board (1994) are included. In the *Economics Literature* section, works by N. E. Duffy (1994), Stuart Gabriel (1996), and Priscilla Salant et al. (1996) are included. In the *Sociology* and *Psychology* sections, works by David Popenoe (1979) and Oleg Zinam (1989) are found.

POPULAR LITERATURE

Fried, Carla, Leslie M. Marable, and Sheryl Nance-Nash. 1996. "Best Places to Live In America." *Money* (July): 66-95.

Money magazine publishes an annual ranking of "the Best Places to Live in America" that includes the country's 300 largest metropolitan areas. To determine

the rankings, *Money* first surveys its subscribers and asks them to rate 41 quality-of-life factors. The magazine then collects data on specific measures for the 300 cities and assigns the data to nine broad categories: crime, economy, health, housing, education, weather, leisure, arts and culture, and transportation. The data are then weighted according to readers' preferences to produce the final ranking.

The top 10 quality-of-life characteristics, as rated by *Money* subscribers, are low crime rate, clean water, clear air, plentiful doctors, many hospitals, housing appreciation, good schools, low property taxes, low income taxes, and strong state government. *Money* points out, however, that the rating of quality-of-life characteristics differs by gender and by type of household.

Although informative, the *Money* ranking does have some drawbacks. Since the survey results are based on a poll of readers, the results are probably not representative of the U.S. population in general. Furthermore, *Money* does not reveal enough about its specific measures or scoring method to assess whether its rankings accurately reflect the survey results. In addition, because the survey asks *Money* subscribers to rate only 41 quality-of-life characteristics, it may not include every characteristic that readers think are important. Overall, however, this article provides insight into how the topic of quality of life is typically treated in the popular literature.

Hall, Bob, and Mary Lee Kerr. 1991. *1991-1992 Green Index: A State-By-State Guide to the Nation's Environmental Health.* Washington, DC: Island Press.

Drawing from a variety of private and public data sources, the *Green Index* uses 256 indicators to measure and rank each state's environmental health. The indicators encompass a broad range of environmental conditions and are grouped into eight major categories: air sickness; water pollution; energy use and auto abuse; toxic, hazardous, and solid waste; community and workplace health; farms, forests, fish and fun; congressional leadership; and state policy initiatives. Based on these indicators, the authors identify the best and worst states overall.

Landis, John D. and David S. Sawicki. 1988. "A Planner's Guide to the *Places Rated Almanac.*" *Journal of the American Planning Association* (Summer): 336-346.

In this 1988 critique of the *Places Rated Almanac* (1985 edition), the authors point out that the essential problem with the component measures used to rank places is that they have not been tested against the stated opinions of migrants or against observed migration behavior. The authors also cite an article that compared overall metropolitan scores (not rankings) in the *Places Rated Almanac* with a nonrandom sample of households and finds that only four of the nine categories included in the *Almanac* are actually statistically significant to migration decisions. These four categories are: housing costs, crime, education, and recreation. The authors also compare category rankings for 51 metropolitan areas in *Places Rated Almanac* with migration patterns between 1975 and 1980. This comparison finds that the rankings of housing cost and economic opportunity are significantly correlated with rates of in-migration.

Landis and Sawicki point out, however, that the *Places Rated Almanac* assumes that a person's quality of life is critically related to the qualities of the place where he or she lives or works. Research, however, indicates that most individuals rank personal causes of satisfaction and

dissatisfaction as much more important determinants of their quality of life than geographical factors.

Precourt, Geoffrey and Anne Faircloth. 1996. "Best Cities: Where the Living is Easy." *Fortune* (November 11): 126-136.

This article identifies the 15 best U.S. cities and the five best international cities for work and family. Much of the article is devoted to qualitative descriptions of the best cities, with little explanation of the methods used for the rankings. Among the variables considered are the crime rate, quality of schools, availability of culture, traffic congestion, number of doctors, tax rates, price of real estate, and costs of a martini and a first-run movie. The article contains a table showing the attributes of the cities in the following six categories:

Demographics: Measured by 1996 population, projected percentage change in population 1996-2001, median household income, and percentage of population with bachelor's degree

Cost of living: Measured by the cost of living index, high-end housing price, low-end housing rent, and the cost of a loaf of French bread and a martini

Business: Measured by percentage employed in managerial positions, Class A office rental rate, best business hotel, recommended restaurant, and average commute time

Leisure: Measured by the number of art museums, public libraries, and 18-hole golf courses, as well as the most-visited attraction

Climate: Measured by the number of days below 32 degrees, above 90 degrees, and incidence of poor air quality

Quality of Life: Measured by violent crime rate and doctors per capita

Savageau, David, and Richard Boyer. 1993. *Places Rated Almanac.* New York: Macmillan Travel.

The authors use an extensive set of criteria to rank 343 U.S. and Canadian metropolitan areas by ten categories. These categories, with their specific component measures are:

Costs of Living: average house price, the cost of utilities, property taxes, college tuition, the cost of food at home, the cost of health care, and the cost of transportation, all indexed relative to the U.S. average

Jobs: the number and percent increase in new jobs

Housing: annual payment for average-priced home

Transportation: commute time, and the cost of mass transit, national highways, airline service, and passenger rail service

Education: number of students enrolled in community or two-year colleges and private and public four-year or graduate-level institutions

Health Care: number of general/family practitioners, specialists, short-term hospital beds, and hospitals

Crime: violent crime and property crime rates

The Arts: number of concert or classical-format radio stations, touring artists bookings (classical music, dance, professional theatre), resident arts companies (classical music, ballet, professional theatre), nonprofit art museums/galleries, and public library collections

Recreation: number of public golf courses, good restaurants, movie theatre screens, zoos, aquariums, and family theme parks; incidence of parimutual betting, professional and college sporting events, ocean or Great

Lakes coastlines, national forests, national parks, national wildlife refuges, and state parks

Climate: number of very hot and cold months, seasonal temperature variation, heating- and cooling-degree days, freezing days, zero-degree days, 90-degree days

Each of the measures is converted into a score. The scores are then summed to rank metropolitan areas in each category. The scoring method implicitly weighs the specific measures and describes the relationship between the measure and quality of life.

The ranks in each category are then summed for an overall score that is used to rank the metropolitan areas. Each category has equal weight in the overall ranking, however, the authors discuss how the reader can use his or her personal preferences to weight the categories to get a personalized overall ranking of metropolitan areas.

Although this book puts forth a common sense and anecdotal notion of quality of life, it provides no theoretical underpinning or review of relevant literature. The authors' scoring system implicitly weights the various measures with no apparent basis other than their own opinion. The book clearly acknowledges that individuals will have different preferences and unsuccessfully attempts to provide a method of weighting categories to reflect individual preferences.

INDICATORS, REPORT CARDS, AND BENCHMARKS

Andrews, James H. 1996. "Going by the Numbers." *Planning* (September) 14-18.

Many states, cities, and hamlets use indicators to measure their own economic and social health, and to set future goals. This article takes a look at these indicators which are often referred to as "benchmarks" or "vital signs." Local governments often create these measures, but they are sometimes developed by community groups. All indicator projects discussed in this article used some public process to identify specific measures. Certain indicator projects have a specific focus, such as government performance or the environment; others are more comprehensive. Three examples are listed below.

Jacksonville, Florida developed a Quality of Life index in 1985 and updates the index annually. A 1991 community review of the index revealed education as the community's top priority. The other categories in the index include the economy, public safety, natural environment, health, social environment, government and politics, culture and recreation, and mobility. Specific measures used in the index include the number of outdoor sign permits issued, the cost of 1,000 kwh of electricity, student fitness test scores in 50th percentile or better, and reports of commute times of less than 25 minutes. Jacksonville has recently developed an equity index that provides a neighbor-hood-level looks at measures from the Quality of Life index related to delivery of public services, such as police response times.

- "Sustainable Seattle" is an indicator project focused on the region's longterm cultural, economic,

environmental, and social health and vitality. The project has developed a set of indicators with the headings "environment," "population and resources," "economy," "youth and education," and "health and community." Specific measures used to determine quality of life include the incidence of wild salmon, VMT and fuel consumption, amount of work required to pay for basic needs, ethnic diversity of teachers, and asthma hospitalization rate for children.

- The Upper Valley 2001 project in the upper Connecticut River valley has developed a list of indicators with 15 categories, including citizenship, community, communications, education, recreation, health care, personal and public safety, human services, the arts, transportation, businesses, farms and forests, resource use, and the natural environment.

The goal of all these indicators is to change policy and to move the measures in positive directions. Change, the author points out, does happen, but often on an ad hoc basis.

Myers, Dowell. 1987. "Internal Monitoring of Quality of Life for Economic Development." ***Economic Development Quarterly*** **1: 238-278.**

Quality of life is recognized as an important factor in economic development, but its exact role and the methods for measuring it are poorly understood. The author identifies four major limitations to developing quality of life measures to compare cities or regions: poor availability of comparable objective data; lack of subjective data necessary for addressing this inherently subjective topic; inability to address unique local features; and the difficulties in choosing commonly valued weights for combining different components in overall indexes. This article argues for the monitoring of quality of life within a city or region as an important complement to external comparisons. Internal monitoring can measure changes in local quality of life over time to guard against deterioration of competitive advantages in the future.

Myers cites Austin, Texas as an example of a place where quality of life characteristics have played an important role in the city's development. Austin has relied on its quality of life to attract high-technology firms. Locals are now concerned that rapid development, particularly suburban "silicon strips," will cause the city's quality of life to decline, and with it, the city's attractiveness to those high-tech firms.

Austin's quality of life was a major factor in the location decision of one high-tech firm and an explicit element in the formal offer to the firm to locate in the city. Ten quality-of-life advantages were itemized: excellent schools, parks and playgrounds; ease of mobility around the city; close-by lakes for water recreation; other opportunities for hunting, fishing, and camping; access within two-hours flying to Colorado skiing and Mexican vacations; abundant cultural and entertainment possibilities; general cleanliness of the city; attractive topography and mild year-round climate; and an "open, receptive social structure, a population long noted for friendliness, and a reputation as a desirable place to live and raise children."

Accelerated growth triggered by the high-tech firm's move to Austin produced negative consequences for quality of life, including decreased housing affordability, traffic congestion, threats to the area's water quality and natural

environment, and the perception that downtown office development threatened the city's music scene. These consequences were perceived locally to be caused by unmanaged development.

In reaction, the Austin Chamber of Commerce began a research program to measure trends in the area's quality of life. Leaders of interest groups were interviewed to identify significant aspects of Austin's quality of life; measures for these aspects were developed, and residents surveyed about the importance of these measures in their perceived quality of life. It was determined that residents placed more importance on concerns such as crime, cost of living, schools, traffic, and jobs, than they did on amenities such as shopping, restaurants, and entertainment. Sixty-two percent of recent migrants identified quality of life as an important factor in attracting them to Austin.

Oregon Progress Board. 1994. *Oregon Benchmarks: Standards for Measuring Statewide Progress and Institutional Performance.* Report to the 1995 Legislature. Salem, OR: Oregon Progress Board. December.

The Oregon Progress Board is a part of the State of Oregon's Economic Development Department. Oregon "Benchmarks for Quality of Life" are measurable indicators used at the statewide level to assess the state's progress toward broad strategic goals. The categories and subcategories of measures used for the benchmarks include:

Unspoiled Natural Environment: air, water, land, plants/fish/wildlife, and outdoor recreation

Developed Communities that are Convenient, Affordable, Accessible, and Environmentally Sensitive: community design, transportation, housing, access for persons with disabilities, access between communities, and emergency preparedness

Communities that are Safe, Enriching, and Civic Minded, with Access to Essential Services: public safety, justice, access to cultural enrichment, sense of community, access to health care, and access to child care.

Other measure have been devised as "Benchmarks for People" and "Benchmarks for the Economy."

ECONOMICS LITERATURE

Duffy, N. E. 1994. "The Determinants of State Manufacturing Growth Rates: A Two-Digit-Level Analysis." *Journal of Regional Science* 34 (2): 137-162.

This examination of the nation's manufacturing industries illustrates the potential importance of amenities and their impact on migration patterns. Duffy observes that, "One of the most noticeable economic phenomena of this century has been the change in the regional distribution of manufacturing." Duffy examines the factors related to interstate differences in the growth of employment in 19 manufacturing industries between 1954 and 1987. He finds that for four of the 19 industries, the pattern of employment growth was directly related to amenities. In the study, amenities are represented by two variables: one that distinguishes states with a warm climate from those with a cold climate; and another that identifies the states that exhibit both a high population of retirees and high in-migration rates. Duffy also finds that 18 of the industries studied had shifted closer to their product markets and 16 had shifted closer to workers.

Gabriel, Stuart A., Joe P. Mattey, and William L. Wascher. 1996. *Compensating Differentials and Evolution of the Quality-of-Life Among U.S. States.* San Francisco: Federal Reserve Bank of San Francisco. 96-07. June.

This article examines how changes in the quality and quantity of amenities can contribute to the evolution of quality of life over time and across places; in so doing it extends the existing "static" literature on regional differences in quality of life. The article provides estimates of quality of life rankings for U.S. states over the period 1981-1990.

Results indicate that sparsely populated mountainous western states such as Montana and Wyoming, rank highly in the estimated quality of life throughout the decade, whereas densely populated midwestern and eastern states consistently rank near the bottom in terms of quality of life. Reduced state and local government spending on highways, increased traffic congestion, and air pollution are found to be the most important contributors to the deterioration of quality of life. States that ascended in the quality of life rankings did so for a variety of reasons, including improved air quality, increased highway spending, reduced commuting times, and reduced state and local taxes.

Gottlieb, Paul D. 1995. "Residential Amenities, Firm Location and Economic Development." *Urban Studies* 32, 9: 1413-1436.

In this article, Gottlieb investigates whether residential amenities can influence the locational decisions of high-tech firms in New Jersey. In order to determine whether firms evaluate amenities on behalf of potential employees, Gottlieb measures a variety of amenities at both the potential site of the firm and the residential area where potential employees are likely to live. Results of the study suggest that firms in the high-tech sector are repelled by disamenities like violent crime and high municipal expenditures at the work site. However, Gottlieb finds weak evidence to support his hypothesis that residential amenities, such as recreation, low traffic congestion, and strong public education, affect the locational decisions of high-tech firms.

Greenwood, Michael J., Gary L. Hunt, Dan S. Rickman, and George I. Treyz. 1991. "Migration, Regional Equilibrium, and the Estimation of Compensating Differentials." *American Economic Review* 81, 5: 1382-1390.

This study examines the patterns of migration across the fifty states and attempts to determine the relative strengths of two primary motives that workers and households have for moving: (1) to earn a higher wage (adjusted for differences among the states in the costs of living); and (2) to have access to the particular amenities of the individual states. Based on migration patterns for 1971-87, the authors estimate the differential in wages for each state, relative to a national average, that is related to amenities.

Roback, Jennifer. 1982. "Wages, Rents, and the Quality of Life." *Journal of Political Economy* 90, 6: 1257-1278.

Roback investigates the role of wages and rents in allocating workers to locations with varying quantities of amenities, both theoretically and empirically. Roback finds that regional differences in wages and land rents are largely explained by regional differences in amenities. The results of her empirical work indicate that

crime, pollution, and cold weather are disamenities, while clear days and low population density are amenities. Amenities will decrease wages and increase land rents; disamenities will increase wages and decrease land rents.

Rosen, Sherwin. 1979. "Wage-Based Indexes of Urban Quality of Life." In Peter Mieszkowski and Mahlon Straszheim, eds., *Current Issues in Urban Economics.* Baltimore: Johns Hopkins University Press.

Rosen examines the determinants of intercity wage differentials for 19 SMSAs. He finds that particulates, rain, crime, population growth, and unemployment are disamenities; whereas sunny days are amenities. Using regression estimates, he developed, Rosen computes an average quality-of-life ranking for the 19 SMSAs. Not surprisingly, he finds that the SMSAs with the highest average quality of life rankings in general exhibit less pollution, better climate, and lower crime rates than the SMSAs with the lowest rankings. He cautions the reader, however, that the rankings of the SMSAs may be altered depending on the weight given to the various city attributes, especially population density.

Salant, Priscilla, Lisa R. Carley, and Don A. Dillman. 1996. *Estimating the Contribution of Lone Eagles to Metro and Nonmetro In-Migration.* Pullman, WA: Social & Economic Sciences Research Center, Washington State University. 86-19. June.

The main objective of this study is to determine to what extent decisions to move to the state of Washington and subsequent employment are influenced by the availability and the use of information technology in the state. The study also investigates the push and pull factors that contribute to a migrant's decision to move.

The study estimates that 2,600 so-called lone eagles—individuals who are able to live anywhere and telecommute to work—moved to Washington in 1995 and that many of them did so for quality of life reasons. The most influential pull factors that lone eagles cited included the quality of the natural environment, outdoor recreational opportunities, a desirable climate, and a safe place to live. Influential push factors included urban congestion, undesirable climate, and fear of crime.

von Reichert, Christiane, and Gundars Rudzitis. 1992. "Multinomial Logistical Models Explaining Income Changes of Migrants to High-Amenity Counties." *Review of Regional Studies* 22, 1: 25-42.

This article uses a survey of migrants to, and residents of, 15 high-amenity wilderness counties to determine what factors can explain the migrants' willingness to accept declines in income after moving. Survey respondents were asked about their dissatisfaction/ satisfaction with their previous location (push factors) and the importance of certain attributes in their destination county in their migration decision (pull factors).

On the push side, such factors as environmental quality, pace of life, crime, scenery, and the lack of outdoor recreation in their previous locations produced higher levels of dissatisfaction than did the employment opportunities and cost of living there. In a similar manner, survey respondents placed more importance on such pull factors as environmental quality, scenery, outdoor recreation, and other natural resource amenities in their new locations than they

did on employment opportunities and cost of living.

The study finds that approximately half of the surveyed migrants received lower incomes and that quality of life and amenities were more important factors in attracting migrants to the counties than employment opportunities.

SOCIOLOGY LITERATURE

Popenoe, David. 1979. "Urban Sprawl: Some Neglected Sociological Considerations." *Sociology and Social Research* 63, 2: 255-68.

Urban sprawl is defined by the author as very low-density urban development, oriented to the automobile, with detached single-family houses on relatively large lots. For Popenoe, urban sprawl implies a scatteration of jobs, shops, and services, often in the form of strip commercial development; a scarcity of large open or green spaces; and a lack of community focus in both the physical and social sense. Despite its negative image, however, he points out that most Americans live in environments characterized by urban sprawl.

Many Americans, including some sociologists, see urban sprawl as desirable when compared to crowded, noisy, violent, and corrupt cities. Urban sprawl gives the individual more space, increased safety, more privacy, and a piece of land to call one's own. Urban sprawl, however, has been attacked as expensive and a significant user of natural resources, especially land and gasoline. This article examines the effects on residents of living in low-density, suburban residential environments. Since the positive consequences of suburban living are reasonably well known, this article is devoted instead to the negative consequences.

Four negative consequences have been fairly well-documented by sociologists:

1. Low-density suburban development has led to an intensification of residential segregation by race and social class.
2. The benefits of urban sprawl are distributed regressively with respect to wealth.
3. Of all the alternative forms of urban expansion, urban sprawl is the one that is most destructive to the center city.
4. Although not an inherent consequence of low-density development, urban sprawl, when linked up with America's small scale, semiautonomous local governments, has led to the proliferation of fragmented and overlapping governmental units.

The negative consequences of urban sprawl appear most tangible when considering the situations of five groups: women, teenagers, the poor, the elderly, and the handicapped. The author states that "it is hard to escape the conclusion that urban sprawl is an urban development form designed by and for men, especially middle-class men." Urban sprawl functions best when a resident has regular and direct access to an automobile, and middle-class men have more access to an automobile than the people in the five groups listed above. Furthermore, a major negative consequence of urban sprawl is deprivation of access. Even where community facilities and services are present and people can afford to use them, a large percentage of the population is disenfranchised from their use, due to inadequate transportation.

A closely related negative consequence is environmental deprivation from a deficiency of local elements that provide activity, stimulation, and well-being. This consequence applies particularly to teenagers. The walking environment of the low-density American suburb is virtually the sole environment for the teenage resident. Yet in this environment homes are often placed so far apart that access to local friends is difficult. Moreover, there is little diversity or variety of activities. The best amenity that usually is offered is a shopping center, or perhaps a fast-food restaurant, where teenagers are often made to feel unwelcome if they just hang out.

Popenoe mentions other potential negative consequences, including "sensory underload" and the "fall of public man." He also points out that the suburban trend of differentiation of residential areas by stages in the life cycle—with families, single adults, and the elderly inhabiting entirely separate neighborhoods—breaks up the "round of life" and may have negative consequences for young people.

PSYCHOLOGY LITERATURE

Zinam, Oleg. 1989. "Quality of Life, Quality of the Individual, Technology and Economic Development." ***American Journal of Economics and Sociology*** **48, 1: 55-68.**

This article relates Maslow's (1970) "hierarchy of needs" to components of quality of life. These needs and the corresponding components are:

1. Physical—safety of natural habitat
2. Peace—security
3. Physiological—material well-being
4. Reputation, Love, Belongingness—social harmony and justice
5. Independence—freedom, human rights, and dignity
6. Collective Self-actualization—cultural heritage and consensus on values
7. Personal Self-actualization—moral perfection

It is now generally accepted that there is a direct positive relationship between quality of life and quality of the person; that a higher quality of life improves the quality of the person in a self-reinforcing manner. But there is also ample evidence of the possibility of an inverse relationship—i.e., a higher quality of life may reduce the quality of the person (moral decay) and that a lower quality of life may increase the quality of the person ("adversity builds character").

CHAPTER 13

Annotations of Studies

SOCIAL ISSUES

Sprawl is the movement of residential and nonresidential land uses to the outer reaches of the metropolitan area. As land uses move increasingly outward, the tax bases of the areas left behind are weakened. Unless there is a way to compensate for peripheral growth, the urban center will almost always suffer. The literature of sprawl and social issues is concerned with both the aftereffects of, and curative measures for, outward growth. The literature concentrates on why outward growth takes place, alternatives to outward growth, the costs and benefits of outward growth, and ways to counter outward growth. These substantive declensions form the basis for the organization of this chapter.

The chapter is composed as follows:

The Growth of Cities and Metropolitan Areas
Urban Decline
Urban Renewal

In the section on *The Growth of Cities and Metropolitan Areas,* the works of Jonathan Barnett (1995), Robert Fishman (1987), Gordon and Richardson (1997, 1997b), Arthur Nelson et al. (1997), and David Rusk (1993) are annotated. The section on *Urban Decline* includes the works of Marcellus Andrews (1994), Katharine Bradbury (1982), Anthony Downs (1994), Keith Ihlanfeldt (1995), James Kunstler (1993), Myron Orfield (1997), and Henry Richmond (1995). The section on *Urban Renewal* examines the works of Peter Calthorpe (1993) and Peter Katz (1994).

THE GROWTH OF CITIES AND METROPOLITAN AREAS

Barnett, Jonathan. 1995. *The Fractured Metropolis: Improving the New City, Restoring the Old City, Reshaping the Region.* New York: Harper Collins.

This strictly narrative analysis of metropolitan area trends advances the thesis that U.S. metropolitan settlements are splitting apart into "old cities" and "new cities." It covers much of the same ground as Anthony Downs's *New Visions for Metropolitan America* but in a much less systematized, non-quantitative way. The author proposes redirecting a share of future growth into older cities where they have been "emptied out," and integrating new and old cities with strong public transit networks.

Barnett's analysis is heavily skewed toward physical design, since he is an

architect and urban planner. He attacks strip commercial development in suburbs and advances many of the ideas of the "new urbanism." He favors compact development over continued sprawl. He supports strong tree preservation ordinances and other environmentally sensitive regulations.

Barnett traces the historic development of older core areas and shows why the desire of the rich to live away from the poor, combined with transportation improvements, caused a withdrawal of resources from the center of our metropolitan areas.

> Attracting new investment to the bypassed areas of the older city is also the other side of the coin of policies to restrict growth at the urban fringe. One will not work without the other. (118)

He argues that some urban central business districts (CBDs) have been growing, but the remaining portions of older cities have been shrinking.

> The current market for a new suburb in derelict parts of an old city is likely to consist of people from nearby areas who have started to make a little money, plus people whose other housing choice is a small house or a mobile-home way out on the urban fringe. (146)

> The minimum requirements [of successful inner-city revival] are to foster a community [with] affordable housing, public safety, and effective schools. (163)

> The future of older cities depends ultimately on public policy initiatives that cannot be controlled directly. Older centers and neighborhoods need rapid-transit links to the new centers in formerly suburban areas so that the metropolitan area can function as one economy. Metropolitan services have to be supported by an equalized tax base; there needs to be limits to growth at the metropolitan fringe accompanied by major new investment in bypassed residential neighborhoods and derelict industrial districts. Reintegrating the metropolitan area is necessary for the survival of cities, suburbs, and the regional eco-system. (175)

The book's weakness is that Barnett does not indicate how to implement his recommendations or how to grapple with the political forces involved.

He claims there have been major changes in the environment for metropolitan development, including the following:

- The addition of design methods to the practice of planning.
- Community participation in planning.
- The rise of the conservation ethic and the concept of sustainability.
- Environmental conservatism.

He points out that we need positive planning about how to grow in the future. But, he says:

> [L]ocal governments are not accustomed to making affirmative decisions about which areas of the natural landscape ought to be preserved and which areas should be built up. (191)

> The basic components of any city design are the organization of public open space—including streets, plazas, and parks or gardens—the architectural relationships among buildings, and the composition of building mass in relation to the landscape or the skyline. (193)

> The most difficult and central problems of urban design today [are] reconciling tall buildings with lower structures, or the need to incorporate parking and highway

viaducts within a physical fabric defined by streets and buildings. (196)

Experience has led city designers to seek to reestablish the primacy of the street in urban settings and go back to a mix of uses in central areas, rather than create the separate tower zones for office buildings that characterized many urban renewal plans." (196)

His national action agenda includes the following:

- Creating urban growth boundaries around all metropolitan areas.
- Adopting state planning laws in all 50 states.
- Creating regional revenue sharing based upon state-mandated revenue equalization formulas.
- Restoring natural ecosystems in urban areas.
- Having local plans that encourage compact neighborhoods with a mix of housing types and dense commercial centers.
- Expanding public transit systems, beginning with more buses.
- Renovating public housing.
- Helping some low-income households move out of areas of concentrated poverty.
- Spending more on inner-city schools, rather than industrial subsidies.

The environmental movement could be a strong political constituency for the maintenance and restoration of the old city. (236)

Although this book contains an accurate analysis of basic trends, it lacks quantified analysis and political savvy about how its broad recommendations might be accomplished in real-world settings.

Drucker, Peter F. 1992. "People, Work, and the Future of the City." *Managing the Future.* New York: Dutton. 125-129.

In this short essay, Drucker explains how the growth of cities in the nineteenth century was due to advances in transportation that enabled people to move to centralized locations to work together. But now the author points out, it is cheaper and more convenient to move information to where the people are. Nevertheless, big corporations will still want their top people together; and many people will still want to work in groups. But, in the future, these groups will no longer need to be gathered in downtown office clusters. Work will be out-sourced to specialized firms that are not necessarily located downtown. We are probably at the end of the big boom in office construction in major city downtowns, Drucker concludes.

This essay covers no more than a fragment of the overall subject, without much depth of analysis and with very little supporting data.

Fishman, Robert. 1987. *Bourgeois Utopias: The Rise and Fall of Suburbia.* New York: Basic Books.

This book discusses the role of suburbs in the historic development of modern urban life. It looks at the two phases of suburbia—the "original" suburb, and the post-industrial "technoburb."

The original suburb, as defined by Fishman, was a retreat from the tumult of industry and commerce and high-density residences that characterized the early industrial city into an exclusively residential community. It first appeared in the London area in the late eighteenth century, and became more prominent in

the nineteenth and twentieth centuries, both in England and in America.

The original suburbs were almost exclusively residential areas, occupied almost entirely by the middle-class elite; they excluded all industry and commerce, and all lower-income households. They were a retreat from the ills of city life into a more utopian scene linked to nature through the prevalence of single-family homes with private yards. Suburban life was family-oriented and separated middle-class women from the world of work; it placed them in a world exclusively focused on the family. In Fishman's view, the suburb was a specialized bedroom community, the employed residents of which commuted into either the central city downtown or its industrial areas; the employed residents never worked in suburbs themselves. *Exclusion was at the heart of the suburbs as thus conceived.* Industry, commerce, diversity, jobs for women, and low-income households were all perceived as potential threats to the primacy of the family-centered, lot-linked single-family home.

Over time, however, the suburbs have gradually evolved into a completely different urban arrangement, structured around what Fishman calls the "technoburb." It can also be called *the urban network form.* What most people conceive of as the suburbanization of America, Fishman considers a shift to a development pattern that radically undermines the original suburbs—and the old central city. Although suburbs maintained their specialized roles as bedroom communities into the 1950s, the migration of so many other types of activities into suburban areas since then has changed the basic nature of these communities. As they acquired first shopping facilities, then warehouses, then industrial firms, and finally offices, they lost their exclusively residential character. They have been transformed into fully urban communities, but with no single center, and with very low densities. This transformation was made possible by innovations in automobiles, roadways, and communications.

Today, the metropolitan area is a noncentered amorphous growth, resembling an amoeba without a nucleus. Although regional downtowns still exist, and central cities still specialize in housing the poor and some central facilities and amenities, the vast majority of both residences and workplaces are scattered throughout the area in no particular pattern. They are linked by a huge network of roads and electronic communications. The center of each person's life is his or her own home, and the universe of each consists of the territory he or she can reach within one hour's drive from home. There is no single centralized urban form because each household essentially has its own unique network. The overall form is an undefined massive overlapping of all these individual networks. The exclusivity of the old suburb has been destroyed, although poor people still seem concentrated in older core areas. But all types of activities are now found at all distances from any one spot; there is no single center that everyone relates to. This uncentered network has replaced the monocentric city of old, and even the polycentric city of the 1960s and 1970s. What most people perceive of as suburbanization today involves the destruction of the former suburbs and their full urbanization in a totally decentralized form.

A key question concerning the future of this trend is: "Is the low density of the new city destructive to all cultural diversity?" (200) Since this new network contains very few public spaces and no

set of places in which a large fraction of the community habitually gathers or interacts physically, there is no sense of community. Television greatly aggravates this outcome because it fosters passive, home-centered separation of each household from all others, although it does provide some commonality of experience across the multitudes (which may be undermined by the multiplication of channels). Fishman believes we are still working out the cultural implications of this new form:

> The new city will probably never be able to compete culturally with the old centers. There will be for the foreseeable future a division founded on choice between those who seek out even at great cost the kind of cultural excitement that can only be found in the center, and those who choose the family-centered life of the outer city. (202)

Fishman, however, underestimates the degree to which cultural activities can take place in the outer regions of such networks, because people with common cultural interests can still gather together in outlying locations in sufficient numbers to support cultural activities like symphonies, theaters, etc.

> Seen in historical perspective, suburbia now appears as the point of transition between two decentralized eras: the preindustrial rural area and the postindustrial information society... Suburbia kept alive the ideal of a balance between man and nature in a society that seemed dedicated to destroying it. That is its legacy. (206-207)

Glaeser, Edward L. 1994. "Cities, Information, and Economic Growth." *Citiscape* 1, 1 (August): 9-47.

This article explores recent contributions to the theory of cities concerning how information flow and usage contribute to city growth or decline. Glaeser argues that simple capital and labor accumulation models fail to explain city growth. A variable relating to human capital and one relating to abstract intellectual capital should be included in any analysis to explain certain failings in simpler models.

One aspect of cities that is not often discussed is that of informational externalities. These help explain why people and firms locate in cities, and why cities grow. They also have negative impacts, they allow rioting to spread rapidly, and increases in crime to be communicated quickly.

Growth theory regards increases in the stock of human knowledge as a central aspect of economic progress over time. Because knowledge is more easily accessed by people living close together, "closeness contributes to the degree of appropriability." (11)

Growth theory based upon capital and labor accumulation had an inconsistency: it could not explain why countries and cities did not converge on a steady state. Only an exogenous technological change variable could explain that. But increasing returns to scale from intellectual knowledge also made it possible to explain continuous growth. However, increasing returns to scale are not compatible with an economy based upon perfect competition, because the former leads to monopolistic results. Also, marginal prices lie under average prices, which means firms would be losing money.

Romer solved this problem by indicating that private profits did not have increasing returns to scale, but social benefits produced by general increases in knowledge did. His argument made perfect competition among private firms possible in theory, but also allowed growth to continue over time due to the social benefits of accumulated knowledge. Lucas focused this idea on returns to human (private) capital, but the truth must be that both private capital and general social knowledge gain from innovations in the long run.

These ideas are related to cities because people living and working close together can more easily tap into the store of accumulated knowledge and exchange ideas with each other. The externalities of knowledge exchange are clearly facilitated by urban proximity, as opposed to its alternatives.

Barro regressed growth in per capita GDP against several other variables across countries, and discovered that poor governmental qualities are negatively correlated with rapid growth. His basic findings were that education and absence of regulation were positively correlated with rapid growth.

Rauch found that SMSA cities with high levels of human capital had both higher property costs and higher wages than other cities, holding individual traits constant.

Glaeser and others arrived at the following findings: (1) initial concentration in an industry does NOT seem to foster subsequent creativity, therefore scale economies in a local industry do not really create growth; (2) urban diversity is positively related to later growth; and (3) more competitive industries grow more quickly.

In general equilibrium theory, real differences in incomes among cities should be quickly eliminated by migration of workers and capital. Any remaining differences should reflect negative amenities in the higher-income cities that must be offset by higher incomes.

A strong finding from U.S. census data is that the cities that grew quickly between 1950 and 1970 also grew quickly between 1970 and 1990. Growth in the first period was established as the best single predictor of city growth in the second period. Thus, growth begets further growth in spite of congestion problems. At least, that is one interpretation of the data.

Another finding is that areas with highly educated work forces at the outset of a period tend to have higher levels of education at the end. The well-educated are either born or move to areas where other well-educated people are already located.

High—and low—unemployment rates among cities also tend to persist over time. No convergence occurs, such as what might be predicted by general equilibrium theory. This lack of convergence may reflect permanent maladies in the structure of those cities with high unemployment rates. Similarly, high crime rates are persistent over time among cities.

Rioting is a phenomenon found mainly in cities, because of contagion and other effects. Almost every city has a potential for rioting if some spark ignites a crowd.

Neighborhoods play key roles in the accumulation of human capital. Both skills and behavioral habits are learned from peers and neighbors and mentors. Stability of occupancy in neighborhoods may be important, because, according to

game theory the length of relationships influences the types of behavior one is willing to carry out. If you have a longterm relationship with other players (neighbors), for example, you are more likely to take the impacts of your actions upon them into account, because they can retaliate against you in the future, and you must live with them for a long time. Thus, residents in stable neighborhoods can more strongly reinforce good behavior than residents in unstable areas—a finding that presents an argument for subsidizing homeownership, which creates greater residential stability.

Cities also foster proximity to political power, which is concentrated there. This proximity may influence people to undertake actions to change the behavior of key authorities located in cities. Political agitation is much more likely to work in cities than in rural areas for that reason. There are also more people to get agitated per unit of effort in cities than in rural areas.

One of the most critical challenges in the future is reducing informational barriers between ghettos and downtown power centers.

Suburbanization provides many of the benefits of urban agglomeration while avoiding many of its negative impacts, such as high rates of crime, greater probability of rioting and less residential stability in local neighborhoods to inhibit negative behaviors.

Gordon, Peter, and Harry W. Richardson. 1997b. "The Destiny of Downtowns: Doom or Dazzle?" *Lusk Review* (Fall): 63-76.

The authors remark that the prospect of successful downtowns is often promised as a source of metropolitan economic strength and prestige—but offer evidence that suggests this is rhetoric at best, and profit-seeking at worst. Gordon and Richardson assert that the futility of large-scale downtown-focused projects is easy to understand—the push-pull factors of spatial decentralization constantly reinforce each other. Improved mobility has given people more and better choices at lower cost, as witnessed by continually increasing automobile use. Furthermore, the telecommunications revolution has irreversibly changed our concept of distance, making the concentrated, vertical city a transient phenomenon.

The authors explain how these transitions will continue to accelerate as new technology makes it possible for work, shopping, learning, entertainment, and socializing to be at-home activities. These anti-urban trends are further reinforced by "push" factors like crime, panhandlers, and "dysfunctional public agencies" that are found in downtown locations. People continue to leave these ills for better amenities and more pleasant shopping opportunities in America's suburbs.

It is the authors' contention that these push-and-pull forces explain more than just the continuing demise of downtowns; they also explain the outward expansion of cities into suburbs and exurbs. Although the current political debate is about the contest between cities and suburbs, it is becoming less relevant. The more important question hinges on how much future development will occur in suburbs, exurbs, and rural areas. Gordon and Richardson point out that most U.S. job growth since the late 1980s has occurred outside of large Metropolitan Statistical Areas (MSAs). This silent migration, the authors conclude, has had little impact on public policy because it does not match the conventional, but

hopelessly outdated, paradigm of how cities evolve.

Gordon, Peter; Harry W. Richardson; and Gang Yu. 1997. "Metropolitan and Non-Metropolitan Employment Trends in the U.S.: Recent Evidence and Implications." Los Angeles, CA: School of Urban Planning and Development and Department of Economics, University of Southern California.

This study looks at employment change in seven major industrial sectors over a twenty-six-year time span (1969-1994), using the Bureau of Economic Analysis Regional Economic Information System (REIS) file that reports one-digit SIC employment and income data at the county level.

The authors observe a steady decentralization, often beyond the suburbs into both exurban and rural areas. They see new and mobile firms choosing locations according to their demand for agglomeration benefits. These are now available throughout suburban and parts of exurban America, obviating the advantages of traditional centers and of central counties as a whole. Exurban and rural settings are increasingly attractive to firms because of breakthroughs in goods handling and in the transmission of information. The authors' work shows a negative and sometimes absolute decline in CBD employment over the period of study.

The study suggests that the locational decisions of households are influenced more by workplace accessibility than by the availability of amenities, recreational opportunities, and public safety. In addition, the locations of firms are less tied to place because of access to information technologies, just as core diseconomies have displaced the original agglomeration economies that pulled people and economic activities together. The authors therefore conclude that central cities are not coming back any time soon.

Nelson, Arthur C., and Thomas W. Sanchez. 1997. "Exurban and Suburban Households: A Departure From Traditional Location Theory." *Journal of Housing Research* 8, 2.

In this article, Nelson and Sanchez describe how modern social, cultural, economic, and technological changes have permitted households to settle farther from urban centers than in the past. They then test the proposition that exurbanites are different from suburbanites in household characteristics, occupation of household heads, accessibility to employment, and residence characteristics.

Nelson and Sanchez use a variety of nonparametric and cluster analysis techniques, and find that exurbanites and suburbanites are more similar than previously thought. They conclude that the rise of polycentric urban areas seems to have pushed the suburban fringe further out.

The results of this analysis suggest that the primary differences between exurbanites and suburbanites is that the former have a greater desire to locate away from urban-related problems and disamenities, especially households with middle incomes and families with small children. In contrast, smaller families or families at the early or late stages of life are more likely to choose suburban locations.

In conclusion, the authors speculate that the continued outward expansion may be attributable to the inability of urban and suburban governments to provide suitable public facilities and services at prices affordable to residents, and to suburban

policies that constrain the supply of housing relative to demand through opposition to affordable housing or innovative housing configurations, and through otherwise exclusionary zoning practices.

Rusk, David. 1993. *Cities Without Suburbs.* Washington, DC: Woodrow Wilson Center Press.

This book is a detailed and comprehensive look at sprawl and at least one of its alternatives, written by the former mayor of Albuquerque, New Mexico. Its basic thesis is that cities which have elastic boundaries—i.e., those that can annex surrounding territories—are much healthier than cities which have inelastic boundaries—i.e., those where boundaries are frozen because they are surrounded by incorporated suburban municipalities. The elastic cities can expand outward as their metropolitan areas grow, enabling them to retain access to the new taxable bases created outside the original boundaries of these cities as they grew. In contrast, inelastic cities cannot reach out to new taxable resources as growth expands beyond their borders. Both elastic and inelastic cities have disproportionate shares of poor people within their original boundaries, but the former can counteract the negative effects by expanding their boundaries. Inelastic cities are stuck with rising percentages of poor residents and falling tax bases, causing them to have falling taxable resources per capita at the very time that they need more such resources to cope with the rising percentages of poor residents.

Rusk presents a great deal of statistical information to support his claim that elastic cities are healthier economically and socially than inelastic ones. He does not use regression analysis, but rather presents paired city comparisons and compares averages of groups of cities with different degrees of elasticity.

This book is one of the most comprehensive and intelligent analyses of sprawl and other urban problems yet written. However, it has one serious flaw. The author believes that unified metropolitan government is the best solution for inelasticity, but there appears to be no political support for this arrangement whatever. Even so, Rusk's analysis is definitely one of the best studies of urban problems.

Where Rusk particularly excels is in analysis of three aspects of the urban problem. First, he fearlessly confronts the racial aspects of urban problems. Second, he offers concrete recommendations for solving the problems that he describes. His recommendations include: regional governance of land-use planning; regional tax-base sharing; a regional program of creating desegregated affordable housing for the poor; and promotion of regionwide economic development. Third, Rusk presents a cogent analysis of the "point of no return" for central cities. He identifies three benchmarks: a low ratio of per capita income in a city relative to that of its suburbs (70 percent or less); a high fraction of minority-groups (30 percent or more of the total population); and substantial and sustained population loss (20 percent or more). He claims that no city that has crossed all three of these thresholds has ever even begun to recover.

Sclar, Elliot, and Walter Hook. 1993. "The Importance of Cities to the National Economy." In Henry G. Cisneros, ed., *Interwoven Destinies: Cities and the Nation.* New York: American Assembly of Columbia University. 1-26.

This is the lead article in a volume of essays presented at the 82nd American Assembly held in Harriman, New York in April 1993. The authors argue that central cities are the vital centers of production in the American economy. They complain that most policy analysts in recent decades have viewed cities mainly as homes for the poor. They cite the following facts in support of their view on central cities:

- In most metro areas, the higher paying jobs are located in the central city. Such jobs constitute 32.2 percent of all jobs nationally, but garner 37.7 percent of nationwide earnings (no source for this data is cited). Wages of central city jobs are 20 percent higher on average than those of suburban jobs, and this gap has been widening.
- Many suburban residents have jobs in central cities. A survey by Arthur Goldberg of the suburban areas of the nation's 100 largest cities showed that half of suburban families had at least one worker in the central city.
- The same survey showed heavy suburban dependence on central city services. Approximately 67 percent of suburban residents depend on the city for major medical care; 43 percent have family members attending or planning to attend an institution of higher learning in the city; 46 percent believe their property values would be hurt by a serious decline in their central city.
- The top 24 counties accounted for 39 percent of all jobs in information-intensive industries but had only 27 percent of total jobs. Wages for jobs in downtown Boston were 3.55 times higher than wages for jobs in the same categories in the suburbs, and 2.37 times higher in New York City than in its suburbs.
- The production advantages of central cities include: (1) minimized transportation and communications costs for both workers and customers; (2) easy face-to-face contact among experts, which facilitates analysis; (3) superior telecommunications infrastructures which facilitates international transactions; and (4) more specialized producer services, which tend to be located where the size of the market is greatest.

One reason suburban locations continue to grow faster than central cities is that the costs of moving are not fully borne by the businesses that move. Some of the cost is borne by their employees and public taxpayers. If suburbanization were so efficient, one would see more of it in international competitor nations. Instead, the growth of the suburbs in the United States indicates that U.S. urban policy is more concerned with stimulating demands for consumer products—such as housing and autos—than it is with productive efficiency.

Suburbanization has also been encouraged by biased public policies, such as home tax deductions and federal highway finance—a subsidy that was not reflected in public transit aid until very recently. The nature of pricing of telephone and other services has allowed higher-cost suburban services to be priced at the same rate as lower-cost city services.

The authors argue that continued dispersal poses major costs to society, especially concerning the inputs of private firms. The need for virtually all employees to own automobiles, for

example, increases wage demands. Auto dependence also increases our trade deficit because we must import so much oil. We already spend far more on travel and telecommunications than rival nations. The Japanese spend 9.4 percent of GNP on transportation, while we spend 15-22 percent. Traffic congestion imposes high costs on production. The authors claim that most metropolitan areas devote over half of their available land to road infrastructure. By undermining the tax base of central cities, society has been unable to invest properly in the education and training of the labor force, or in the infrastructure outside the downtown that is critical to productive efficiency. U.S. investment in education through the high school level is the lowest among the seven most industrialized nations—4.1 percent of GNP, compared to 4.6 percent in West Germany and 4.7 percent in Japan. We need much more investment in the labor force and infrastructure in central cities to remain competitive.

URBAN DECLINE

Andrews, Marcellus. 1994. "On the Dynamics of Growth and Poverty in Cities." *Citiscape* 1, 1 (August): 53-73.

This article presents a model of how poverty concentrations within cities are related to city growth rates. "The central theme of this article holds that the logic of meritocracy creates class divisions in the urban labor market which may undermine the very conditions that make rapid economic growth possible" (53). The need for high-skilled workers in a modern high-tech economy creates two classes of workers: those with the requisite skills, and other unskilled workers. But schools in many large cities are failing to provide their students with the skills needed to be in the first class. This failure creates a caste-like result, since the primary determinant of the school performance of children is the educational level of their parents.

The basic dynamic, Andrews points out, is as follows:

- Members of the "underclass" within cities strive to attain a higher standard of living and jobs suitable for high-skilled workers, but are frustrated by their inability to do so because of the poor quality of city schools. The lifestyles of the middle class have a demonstrable effect upon the underclass, encouraging them to want to consume more.
- The resulting frustration leads to criminal behavior and violence on the part of the underclass. Members of this class perceive that they have only two sources of income—transfer payments and crime.
- The behavior of the underclass drives middle-class (upper-tier) workers and households out of the city into the suburbs where they can escape from crime and violence.
- The departure of the middle class weakens the fiscal position of the city government, thereby reducing its ability to provide good quality schooling to the underclass. This creates a negative downward spiral—a "vicious circle."

A key variable in this dynamic system is the "middle-class ratio"—that is, the percentage of the total population consisting of middle-class residents.

Another key variable is the attitude of students towards academic achievement. The author argues that membership in the underclass causes anti-academic attitudes among students.

Andrews also argues that there is a "critical failure ratio" among city students

which determines whether the middle class will grow or decline within the city. If the actual failure rate among students (which determines whether they will become middle-class or under-class members) rises above this critical rate, the middle-class ratio will decline because the behavior of the underclass, then larger, will drive middle-class residents out. If the actual failure rate is below the critical level, then more students will graduate into the middle-class, and the incentives for middle-class residents to leave is reduced—even though greater competition in the labor market among the larger numbers of middle-class workers may cause the unemployment rate to rise.

The author regards this entire situation as a negative externality—an unintended consequence of technological change that has raised the skill requirements for high-wage workers. But it is society that has provided unequal access to learning among its young people. Thus, "the increasing importance of knowledge capital in economic growth contributes to the problem of urban poverty." (63)

The future of the city, and particularly its ability to change the way it grows, may ultimately depend upon the willingness of the middle class to remain in the city despite the difficulties of caste division and crime that are the underside of the role of knowledge capital in economic life. In turn, a national government policy that encourages the exodus of middle-class citizens from the city may make significant urban reform and reconstruction impossible. (63)

The federal government must recognize the role of knowledge capital in unwittingly exacerbating the urban crisis. In particular any urban policy that intends to make cities into virtuous circles must recognize the folly of forcing local governments to deal with the negative aspects of knowledge capital with diminishing economic resources. Further, a macroeconomic growth strategy that emphasizes human capital must carefully address the inequality, poverty, violence, and crime that result from educational failure. (63)

Bradbury, Katharine L., Anthony Downs, and Kenneth Small. 1982. *Urban Decline and the Future of American Cities.* Washington, DC: Brookings Institution.

A central component of this book is the idea that every city has certain specific social functions, and therefore changes in its ability to perform those functions constitutes *urban decline.* In contrast, a low level of ability to perform those functions—a static concept—constitutes *urban distress.* The authors point out that not all cities with high urban distress are declining. Some may even be growing rapidly—cities with high poverty rates and high immigration, for example.

The specific index of *urban decline* used in this study is based upon change over time of four variables: the unemployment rate, per capita income, the violent crime rate, and the government debt burden. The *index of urban decline* was calculated by ranking all cities for each of these variables, and assigning points to each based on its *relative position* in the ranking on each variable. Cities in the lowest third (in terms of desirability) received a -1 for that specific variable; cities in the highest third, a +1, and cities in the middle third, zero. The scores of each city on all four variables were then summed. The highest possible index score was +4 and the lowest was -4. A similar index was computed for *city urban distress.* This index was based on five variables, each at a single point in time: the unemployment rate, the

incidence of poverty, the violent crime rate, the percent of housing considered old, and the city's tax revenue relative to that of its metropolitan area.

It is notable that neither city population change nor city employment change was used as part of the decline measure. The reason is that not all population declines are bad (if the city is overcrowded to start). Moreover, the authors used declining population as a separate measure that they related to the index of decline. They reasoned that the unemployment rate captured some aspect of employment change.

Two other measures were computed in this study: *city disparity*, a measure of the difference between each central city's scores for these variables and the score of its suburban areas; and *city divergence*, a measure of the rate of change in city disparity over time.

This book contains a relevant discussion of the future of large cities. It points out that although both self-reinforcing and self-limiting factors are involved in urban decline, the former seem to be much more powerful than the latter. Hence the concept of a *self-reinforcing downward spiral* of decline is validated by the book's analysis.

Downs, Anthony. 1994. *New Visions for Metropolitan America.* Washington, DC. The Brookings Institution.

The most dangerous result of growth management policies, claims Downs, is that they help perpetuate the concentration of very poor households in depressed neighborhoods in big cities and older suburbs. These neighborhoods, containing a small percentage of the nation's population, are riddled with four problems that are undermining social cohesion and economic efficiency: crime and violence, poor families, poor public education, and the lack of labor integration. Downs makes the argument that these problems are aggravated by low-density growth, which most people favor, so they don't seem to threaten the status quo. But if they are allowed to fester, says Downs, they will gravely impair the political unity, productivity, and economic efficiency of American society and the personal security of everyone.

The situation is not clear-cut, and it is difficult for communities to decide how best to respond to rapid growth. Downs seeks to clarify this situation by answering the following series of questions: Are the undesirable conditions really caused primarily by growth? Which policies might succeed in ameliorating them? Which might have severe side effects or make conditions worse? Is limiting local growth desirable at all for either a given locality or society as a whole? If so, what should the goals of such limitations be? To what extent do communities need to coordinate growth management policies with other communities to achieve effective results? Can the multiplicity of governments in metropolitan areas manage growth effectively, or does that arrangement need to be modified? If so, how?

In addition to attempting to answer these questions, Downs considers the problems associated with rapid metropolitan growth from a perspective that encompasses inner-city problems as well as examines the effects of growth management in communities that have tried to alter the course of urban growth. Downs also analyzes three other ways growth could occur—alternatives that might reduce the problems that have arisen from the pattern of unlimited low-density development—focusing on the relationships between

central cities and their suburbs. Finally, Downs attempts to identify the policies likely to be most effective in helping to resolve growth-related problems.

Downs concludes with a call for America to strengthen the bases for its continued unity by placing more emphasis on social solidarity and less on individualistic values, beginning in early school years, and by engaging the news media and advertising industry in the discussion. He proposes that we begin by persuading residents of suburbs across the country that their concerns in many ways are similar to those of central city residents. This would lay a political foundation for major federal funding of nationwide programs that disproportionally aid central cities and their residents, both of which are vital to the long-run prospects of the entire U.S. economy.

Ihlanfeldt, Keith R. 1995. "The Importance of the Central City to the Regional and National Economy: A Review of the Arguments and Empirical Evidence." *Citiscape* 1, 2 (June): 125-150.

This article reviews most of the literature on the linkages between central cities and suburbs. According to the author, there are five basic linkages: (1) Outsiders' perceptions of the appeal of an entire metropolitan area are influenced by conditions prevailing within its central city; (2) Cities contain many amenities valued throughout their regions; (3) Individual cities may provide a "sense of place" valued by both their residents and outsiders; (4) Fiscal problems in central cities may eventually raise taxes on suburbanites and thereby reduce suburban economic development; and (5) Agglomeration economies create special roles for central cities in their regional economies.

The author does not cite two other linkages that are believed to be important: (1) Cities provide low-cost housing for low-wage workers employed in—and necessary for—activities in suburbs where those workers cannot afford to live; and (2) Cities provide many jobs for suburban residents that increase suburban incomes.

The author claims that there is no empirical evidence either supporting or denying the first four factors he cites; therefore he dispenses with them in two pages. He does not deny that these linkages exist, but says that no one knows how strong or important they are because no studies have measured them. He devotes most of his article to agglomeration economies, which have been studied at length and by many people.

Agglomeration economies are, essentially, increasing returns to scale in processing activities. Ihlanfeldt refers to them as "the economies of large-scale production, commonly considered, [and] the cumulative advantages accruing from the growth of industry itself—the development of skill and know-how; the opportunities for easy communication of ideas and experience; the opportunity of ever-increasing differentiation of processes and of specialization in human activities." (128, quoted from Nicholas Kaldor—1970)

Agglomeration economies are divided into two types: *localization economies* that arise from the concentration of similar activities (such as a single industry) either in one place or very near each other; and *urbanization economies* that arise from the location of an activity in an area that has a wide diversity of activities—so production costs decline as the size of the area concerned rises. Urbanization economies generate benefits

for all types of firms located in an area; whereas localization economies generate benefits only for those firms in industries that are highly concentrated in an area. Central cities are considered to have advantages over their suburbs for both types of economies.

Both types of agglomeration economies have three major causes: (1) labor market economies; (2) scale economies in the production of intermediate inputs; and (3) communication economies. Labor market economies cause localization economies because the concentration of many similar firms together creates a large pool of workers skilled in that industry, and reduces search and training costs for the firms. Urbanization economies also arise from large diversified labor pools. However, these labor pool economies do not favor central cities much over suburbs in large metropolitan areas.

The other two causes of agglomeration economies, however, clearly favor central cities. Both types involve face-to-face contacts, which occur most efficiently in or around downtown areas. The importance of communications economies has also been increased by the shift from goods-producing to information-producing activities. Innovations in communications technology, however, have made face-to-face contacts less necessary for the sharing of information.

The author reviews numerous empirical studies of these economies. One of the more interesting shows that both suburban firms and central city firms rely heavily on central-city suppliers for certain corporate services, such as investment banking, commercial banking, and legal, auditing, and actuarial services. The study, authored by Stanbeck in 1991, dealt with 14 large metro areas, and also demonstrated that suburban companies tend to be smaller and more likely to be in manufacturing than central city companies.

Several other studies have correlated conditions, such as levels of per capita income in cities and their suburbs. These studies all show positive linkages between cities and suburbs. Voith (1994), for example, shows that positive city income growth is highly correlated with positive suburban income growth.

The author's conclusions are:

- Significant linkages clearly exist.
- The maturation of the suburbs has weakened these linkages over time.
- Telecommunications changes will NOT greatly weaken the importance of central cities.
- "The hypothesis that cities make an important contribution to regional and national economic growth is attractive," though not fully proven (139).

Kunstler, James. 1993. *The Geography of Nowhere: The Rise and Decline of America's Man-Made Landscape.* New York: Simon & Schuster.

Kunstler has written a polemic—a true "exagger-book"—about the aesthetic and other qualities of metropolitan development in the United States, especially during the post World War II era. The tone of this book is conveyed in the following quotations from the first chapter:

> More and more we appear to be a nation of overfed clowns living in a hostile cartoon environment.
>
> Eighty percent of everything ever built in America has been built in the last fifty years, and most of it is depressing, brutal,

> ugly, unhealthy, and spiritually degrading.
>
> To me, it is a landscape of scary places, the geography of nowhere, that has simply ceased to be a credible human habitat.

These statements convey the spirit in which Kunstler denounces everything American. There seems to be nothing about American life that appeals to him. He attacks individualism, low-density development, business, you name it:

> Riverside seems a template for all the ghastly automobile suburbs of the postwar era—individual houses on big blobs of land along curvy streets. (49)
>
> Yet, for all their artificiality and impermanence, the early railroad suburbs were lovely places to live.

He decries architectural modernism and the art-deco style, and high-rise office buildings generally. But his greatest enemy is the automobile and highways. Still, he admits that:

> The suburban subdivision was unquestionably a successful product. For many, it was a vast improvement over what they were used to.... The main problem with it was that it dispensed with all the traditional connections and continuities of community life, and replaced them with little more than cars and television. (105)

The development of suburbs drained activity out of cities: "The cities, of course, went completely to hell. The new superhighways ... drained them of their few remaining taxpaying residents." (107)

The separation of households and activities inherent in low-density suburbs has also ruined any sense of community life, according to Kunstler. And because of the spending of all public money on highways, all other aspects of public life have become impoverished.

> The motive force behind suburbia has been the exaltation of privacy and the elimination of the public realm. (189)

This book contains no statistics, no quantitative analyses, and no databases. It is an endless diatribe expressing the author's contempt for modern suburban, auto-oriented life. He claims we can no longer live this type of life because it has become too costly, both in economic and social terms. The social costs include the destruction of community and family life. In the last chapter, Kunstler puts forth policy suggestions including the following:

- We must rebuild our cities and towns.
- We shall have to give up mass automobile use. (248)
- We should adopt the approach of the new urbanism in designing small towns. (He specifically discusses Seaside and Peter Calthorpe's pedestrian pockets as cures for all the ills he has been blasting. Mandatory open space zoning is also praised.)
- Until we do these things, "the standard of living in the United States is apt to decline sharply, and as it does the probability of political trouble will rise." (274)
- We will have to give up our fetish for extreme individualism and rediscover public life.... We will have to down-scale our gigantic enterprises and institutions—corporations, governments, banks, schools, hospitals, markets, farms—and learn to live locally, hence responsibly.

He offers no guidance about how to achieve these ends, however.

Ledebur, Larry C., and William R. Barnes. 1992. *Metropolitan Disparities and Economic Growth: City Distress and the Need for a Federal Local Growth Package.* Washington, DC: National League of Cities. March.

This is a statistical study of the relationship between income disparities in central cities and their suburbs on the one hand, and metropolitan area growth rates on the other. The basic conclusion is that: "During the period 1988-1991, metropolitan areas with greater internal disparities tended to perform less well economically than metropolitan areas with lesser disparities" (1).

Overall, central city per capita income as a percentage of suburban per capita income has declined from 105 percent in 1960 to 96 percent in 1973, to 89 percent in 1980, and to 59 percent in 1987. Much of this article aims at justifying a substantial federal aid package to cities, especially cities in distress. Data on children being raised in poverty, by race, are presented. In 1990, 45 percent of all black children under the age of four were being raised in poverty, compared to 38 percent of Hispanics and 20.6 percent of all children. These proportions were higher in central cities, and lower in suburbs.

Orfield, Myron. 1997. *Metropolitics: A Regional Agenda for Community and Stability.* Washington, DC: Brookings Institution Press and Lincoln Institute of Land Policy.

In this study published jointly by the Brookings Institution and the Lincoln Institute of Land Policy, Orfield asserts that the way to restrain suburban sprawl is for central cities and rural and environmental interests to ally themselves with older and inner-ring suburban communities.

Until this occurs, Orfield maintains new suburbs will continue to siphon off the tax base from older cities and suburbs. Further, unrestrained growth will continue to consume farmland and forests, threatening regional ecosystems.

These problems call for a sweeping realignment of traditional political divisions. According to Orfield, reformers must: unite voters in central cities and declining suburbs; demonstrate to these voters that tax-base sharing lowers their taxes and improves local services; and convince them that fair housing will stabilize residential change in their communities.

Orfield's ultimate strategy is the creation of a regional authority in each metropolitan area, whose mission would be to encourage new suburbs to permit the development of affordable housing according to a fair-share formula. Other goals for this regional authority would be to help bring about tax-base sharing, limits on outward expansion of the metropolitan boundary, and efficient use of new and existing infrastructure.

Richmond, Henry R. 1995. *Regionalism: Chicago as an American Region.* Chicago: John D. And Catherine T. MacArthur Foundation. December 6.

This is the most comprehensive attack on sprawl yet launched. Henry Richmond, one of the architects of the Oregon state planning system, has collected every known argument against sprawl and woven them into one long polemic—but a relatively sensible one. Among the arguments he marshals against sprawl:

- Sprawl concentrates poverty in inner-city areas, undermining their fiscal viability. This concentration also

produces a host of other negative conditions.

- Sprawl undermines the transition of the inner-city unskilled workforce to a high-tech workforce.
- Sprawl thereby weakens the international competitive positions of U.S. metropolitan areas.
- Sprawl reduces the efficiency of businesses and the productivity of agricultural land.
- Sprawl undermines equality of opportunity within metropolitan areas, thereby raising inner-city unemployment with all the resulting pernicious effects.
- Sprawl destroys the viability of inner-city schools and contributes to students' failure to make the proper labor-force transition.
- Sprawl breeds crime that drives viable firms and households out of cities, and weakens the ability of young people raised there to sustain themselves economically.
- Sprawl undermines middle-class security, especially the security of working-class households whose investments in home equities are jeopardized by racial transition.
- Sprawl damages the environment in terms of air pollution, and water pollution; it ruins historic buildings and wrecks environmentally sensitive sites.
- Sprawl undermines the sense of community in suburban areas, and the solidarity of our entire society by separating suburban residents from city ones.
- Sprawl makes urban development inefficient by generating indecisive governments, disputes, and delays that add to costs.

Richmond believes that a significant number of public policies at all levels have generated sprawl, and perpetuate it. He catalogs these at length. He then presents a political analysis of why these forces are not likely to change.

After having set forth all these points in general, he applies the argument to the Chicago region in detail. He then sets forth his recommendations on how to attack sprawl and the many institutional supports underlying it. In this regard, he comes up with a more comprehensive set of ideas than anyone else. As a result, this document is an invaluable reference for both arguments against sprawl and possible tactics to remedy it. It has not been given widespread publicity, but it is a very solid linkage of causes and remedies.

Thompson, J. Phillip. 1996. "Urban Poverty and Race." In Julia Vitullo-Martin, ed., *Breaking Away: The Future of Cities.* New York: Twentieth Century Fund: 13-32.

This author discusses the status of poverty and its relationship to race in inner-city areas, primarily in reference to New York City. He points out that the middle-class is still dominant in most large American cities, but it has become a minority-group middle class as whites continue to leave the city. In six of the nation's eight largest cities, a majority of the population in 1990 consisted of minority-group members—only Philadelphia (48 percent minority) and San Diego (42 percent) were exceptions. In New York, the number of persons with incomes above the median remained about the same in the 1980s, but the ethnic composition changed to become minority-dominated, as the white population fell by 432,000.

Thompson reviews various theories of why poverty persists in inner-city neighborhoods.

- The *cultural deprivation theory* stresses that some families are less intelligent than others, and a deprived culture is partly a genetic phenomenon. A newer view is that poor families are stuck in poor communities, where conditions are ripe for a negative subculture to develop around excessive teenage sexual promiscuity, a separate street language, and a depreciation of academic achievement. Both views stress deviancy and immorality of behavior among many poor people, with the newer theory attributing the behavior to the spatial isolation of the poor and especially of the poor blacks from white culture. Christopher Jencks claims that centuries of racial subordination and prejudice have created an unwillingness among blacks to do certain types of work or to work in white cultural environments. Black alienation from certain types of jobs is rarely discussed in analyses of poverty.
- The *racial discrimination theory* says that black poverty in particular is caused primarily by continued racial discrimination and the resulting spatial segregation. Massey and Denton, advocates of this view, argue that housing discrimination isolates poor blacks in poverty-concentrated neighborhoods with other poor blacks as their only neighbors. But discrimination itself is not new; so how can it explain rising crime rates or family instability, which are recent developments? Massey and Denton claim that white prejudice and discrimination cause spatial isolation, which in turn results in cultural deprivation.
- The *structural transformation theory* claims that black unemployment results from a change in labor markets and industry that has shifted more jobs to the higher-skill category and moved industrial jobs out of big cities where racial minorities live. William Julius Wilson is a leading proponent of this view. But unemployment does not explain many of the other pathologies of inner-city poverty areas. Wilson also claims the departure of middle-class blacks from poverty areas has removed good role models, and the resulting negative culture is the result of economic deprivation and lack of jobs. But is it not clear whether cultural traits of blacks, rather than discrimination by whites, causes whites not to hire black workers.
- The *social breakdown theory* claims that poverty itself does not cause a cultural shift to negative values. Many poor neighborhoods do not exhibit such traits—especially poor areas occupied by immigrants. There are a variety of cultures in poor neighborhoods, and only in those where family networks break down does the culture of poverty arise.

What remedies to alleviate poverty might be used? Cultural deprivation theorists stress the personal responsibility of the poor themselves, and claim they need to change their behavior. Their remedies involve orphanages for children of misbehaving mothers; forcing all poor people to work—including mothers; forcing fathers to pay for support for children; and making all government benefits temporary. (It appears that these arguments were embodied in the recent welfare "reform" bill.)

A major problem with this approach is that it assumes job opportunities exist for the poor with wages high enough to support decent living standards. This is not the case; public jobs programs would be necessary if all poor people were forced to work. Also, making all mothers work would reduce supervision over children and might worsen the children's behavior. Cultural deprivation theorists

do not study or seem to care about the internal dynamics of poor communities, and pay too little attention to what might result if their remedies are tried.

Racial discrimination theorists want strong anti-discrimination measures, and a big effort to spatially integrate society racially. This would require immense movements of people, a scheme that is politically opposed by the vast majority of Americans, including Congress.

Structuralist theorists want labor market changes, such as the introduction of a public jobs Marshall Plan for inner cities, job travel and information center programs to link inner-city workers to suburban jobs, and provision of day care, job training and drug treatment programs for inner-city residents. These remedies are quite expensive.

Local-oriented strategies include enterprise and empowerment zones to improve conditions where the poor live now. The purpose is to create "vibrant" businesses where poor unemployed people are located. Community-based efforts fit into this view, and many such efforts are now underway across the nation. Building local housing is one of their major activities. A whole host of questions is raised by the author that might be answered by more careful study of community activities currently underway.

Thompson explores why the election of black mayors and city officials has not improved conditions in inner-city neighborhoods very much, if at all. And he asks why black leadership has not increased black participation in politics. Among the reasons he cites are: (1) Black mayors have no control over national trends toward decentralization of jobs; (2) The shift of population to the suburbs has reduced the national political power of big-city mayors of all types in Congress and in the state legislature, reducing the willingness of these bodies to aid cities; (3) The need of individual cities to maintain favorable tax rates and bond ratings prevents mayors from engaging in redistributive activities—as observed by Paul Peterson in *City Limits*; (4) The fear of being charged with racism has prevented criticism of black local leadership by either whites or blacks; and (5) The civil rights movement has become conservative and has not shifted from national issues to local ones to support black local leaders.

HUD's rules against building public housing in poor communities have blocked the efforts of many black mayors to put new low-rise public housing units in inner-city poverty areas, thereby upgrading those areas. In New York City, court actions have prevented giving preference in public housing projects to persons living in nearby communities. Voting district formation has reduced representation by minorities on city councils and in Congress. Struggles over crime rates have pitted civil rights advocates—who want less incarceration of blacks—against local residents who want more secure neighborhoods. Similar struggles have occurred over schools. Those who want better schools have tried to shift disruptive students into separate "academies"—a move that is opposed by traditional civil rights advocates.

> The problems of inner-city poverty demanded an agenda from black mayors dealing with neighborhood economic development, reform of education, police, human services, public housing bureaucracies, and relations with Latinos and Asians. Such an agenda might have required alteration of traditional liberal coalitions that elect black mayors, with possible fallout from municipal and teachers' unions, civil rights organizations, and fellow black

> politicians. Few black mayors have pursued such a politically risky and administratively arduous course. (31)

Thompson recommends supporting community-building strategies, because little help will come from the federal government. These strategies cannot end poverty, but they may improve the quality of life in inner-city areas.

URBAN RENEWAL

Calthorpe, Peter. G. 1993. *The Next American Metropolis: Ecology, Community, and the American Dream.* Princeton: Princeton University Press.

This book, written by an architect and urban planner, looks at the spirit of American communities and the "new urbanism" approach to altering that spirit. He primarily discusses changes in urban design, and presents relatively little quantified analysis. As the author says, "Social integration, economic efficiency, political equity, and environmental sustainability are the imperatives which order my thinking about the form of community" (11). He contrasts those themes to the excessive privatization and individualism he believes have been embodied in the suburban development process in the post-1945 period.

> The scale of our environment is now set in proportion to large institutions and bureaucracies rather than community and neighborhood (11).

> The suburb was the ... physical expression of the privatization of life and specialization of place which marks our time (9).

> The alternative to sprawl is simple and timely: neighborhoods of housing, parks, and schools placed within walking distance of shops, civic services, jobs, and transit—a modern version of the traditional town (16).

As is the case for most planners, Calthorpe dislikes the automobile and the scaling of the urban landscape to accommodate it. He wants to change the scale to allow walking to suburban transit and linkages among outlying areas and the downtown area by transit. Caltorpe wants to make both housing units and lots smaller, link neighborhoods by walking paths, and encourage accessory housing. He strongly supports regional growth management, channeling growth inward to in-fill sites and limiting outward extension.

> At the core of this alternative, philosophically and practically, is the pedestrian.... Pedestrians are the lost measure of a community, they set the scale for both center and edge of our neighborhoods.... Two complementary strategies are needed. A tough regional plan which limits sprawl and channels development back to the city or around suburban transit stations; and a matching greenbelt strategy to preserve open space at the edge of the region. We cannot revitalize inner cities without changing the patterns of growth at the periphery of metropolitan regions; it is a simple matter of the finite distribution of resources. (20)

This calls for regional policies and governance which can both educate and guide the complex interaction of economics, ecology, jurisdiction, and social equity.... Adding transit oriented new towns and new growth areas can reinforce the city's role as the region's cultural and economic center (32).

Three constituencies—environmentalists, enlightened developers, and

> inner-city advocates—can find common purpose in regional planning goals. They can form a powerful coalition (36).
>
> Identifying rational infill and revitalization districts, New Growth Areas and potential New Town sites should be the work of an agency which spans the numerous cities and counties within a metropolitan area. Lacking such entities, counties, air quality boards, and regional transportation agencies often take on the tasks without legal power to fully implement the results. Regional governments are needed if growth is to be managed and directed in a sustainable manner (51).

Suburbs are built upon a fundamentally wrong spirit and orientation:

> The rise of the modern suburb is in part a manifestation of a deep cultural and political shift away from public life.... Socially, the house fortress represents a self-fulfilling prophecy. The more isolated people become and the less they share with others unlike themselves, the more they *do* have to fear.... The private domain, whether in a car, a home, or a subdivision, sets the direction of the modern suburb... In fact, one of the primary obstacles to innovations in community planning remains the impulse toward a more gated and private world (37).

Calthorpe's design strategy is based upon three major principles:

> First ... the regional structure of growth should be guided by the expansion of transit and a more compact urban form; second, ... our ubiquitous single-use zoning should be replaced with standards for mixed-use, walkable neighborhoods; and third, .. our urban design policies should create an architecture oriented toward the public domain and human dimension rather than the private domain and auto scale (41).

He advances the concept of the TOD, or Transit Oriented Development—a basic building block in his regional development scheme. It features "pedestrian pockets" within one-quarter of a mile of transit stops—an easy walking distance. These pockets contain mixed-use development including commercial centers and public services. Farther out from the stations are secondary areas containing primarily housing. He believes automobile usage in such communities would be much lower than it is now, because more people would walk to activities. There would be both urban TODs and neighborhood TODs (for lower-density areas). Average residential densities of 10 units per acre would be maintained to support bus service, with higher densities to support rail transit. In other areas, he recommends net densities of 18 units per acre. Calthorpe would also like a 40-60 percent split between transit and auto usage, even though that split still implies a majority of travel by autos.

His larger regional scheme shows transit stops one mile apart. Each TOD around such a stop contains 288.5 acres—a circle of 2,500 feet in radius. A key element in the planning process is what fraction of the land should be used for housing. At 40 percent, housing would consume 115.4 acres; at 65 percent, it would consume 187.5 acres. Next, he asks what average density of housing would prevail? Calthorpe suggests a range from 10 to 25 units per acre, but in another section, he indicates that neighborhood TODs should have minimum densities of 7 units per acre (5,600 persons per square mile) and a minimum average of 10 units per acre (8,000 persons per

square mile—just a bit higher than the city of Los Angeles). In urban TODs, the minimum density should be 12 units per acre, with an average of 15 units, and with maximums set by local plans. At 15 units per net acre, the gross density would be 15,600 persons per square mile if the residential land coverage was 65 percent. Gross density would be 12,000 persons per square mile if residential coverage was 50 percent—the coverage used to calculate other statistics in this paragraph.

According to Calthorpe, secondary areas should have a minimum average density of 6 units per net acre, or 4,800 persons per square mile with 50 percent residential land coverage. This, he says, should be the minimum permissible density anywhere in the developed region.

Much of the book sets forth design guidelines for parks, commercial areas, transit stops, and a set of specific projects developed by Calthorpe embodying his ideas.

Clark, Charles S. 1995. "Revitalizing the Cities: Is Regional Planning the Answer?" *CQ Researcher*, 5, 38 (October 13): 897-920.

This article is an analysis of whether regional planning and other arrangements are necessary ingredients in any effective strategy to halt the decline of so many large cities. It is a broad overview of the issues involved condensed into a few pages. The analysis begins with a description of how out-migration to the suburbs is still occurring in large cities, partly in response to the much higher crime rates in the cities. Clark presents a potpourri of quotations on all sides of the issue, rather than a clear or straightforward analysis leading in a single direction. As a result, the article presents few conclusive results. Studies showing linkages between suburban and city prosperity are cited. Proponents of regionalism, including David Rusk and Anthony Downs are quoted; and cities such as Portland and the Twin Cities are cited as models. Yet, "in all of U.S. history, voters have approved only 20 city-county consolidations while a hundred have been voted down, according to ... HUD." (904) Selling regionalism as a way to help the poor is considered "the kiss of death" politically. The best way to proceed, says Clark, is to develop practical approaches to regional relationships and try to sell them in individual areas.

Katz, Peter. 1994. *The New Urbanism: Towards an Architecture of Community.* New York: McGraw Hill.

This book contains five very short essays on "the new urbanism," plus copious illustrated examples of projects carried out under that rubric. The authors include the primary players in this field: e.g., Peter Calthorpe, Andres Duany, and Elizabeth Plater-Zyberk. Calthorpe's essay is a very condensed version of his book (discussed earlier).

Andres Duany and Elizabeth Plater-Zyberk have written an essay about the neighborhood, the district, and the corridor. It is only a few pages long and has little or nothing to do with sprawl.

Elizabeth Moule and Stefanos Polyzoides provide an essay about the street, the block and the building. However, the scale of this article is too "micro" to be applicable to sprawl.

Todd W. Bressi's essay, entitled *Planning the American Dream* discusses the overall approach of the "new

urbanists," repeating much of what is in Calthorpe's book. He claims that the suburban explosion after World Wars I and II achieved certain desirable outcomes, but at heavy costs. The suburban explosion "reinforced the Victorian notion that a neighborhood was a protective enclave requiring insulation from commerce, work, and traffic, and held that the functional and literal center of a neighborhood should be an elementary school." The suburbanization movement also "liberated significant numbers of people from crowded, unhealthy living conditions." But it created the following problems: (1) It raised the cost of homeownership and acceptable housing too high for many households; (2) It forced people to spend more and more time commuting [this point is debatable]; (3) It undermined the mobility of people who cannot afford cars or cannot drive them; (4) It created air pollution; (5) It absorbed attractive rural landscape into urban uses, and (6) Most important of all but most problematic—it undermined civic life.

The main principles of the new urbanism, as he describes them, are as follows:

- The center of each neighborhood should be defined by a public space and activated by locally oriented civic and commercial facilities.
- Each neighborhood should accommodate a range of household types and land uses.
- Cars should be kept in perspective.
- Architecture should respond to the surrounding fabric of buildings and spaces and to local traditions.

New urbanists draw upon several past traditions, including the City Beautiful and Town Planning movements.

> Calthorpe has written that in theory 2,000 homes, a million square feet of commercial space, parks, schools and day care could fit within a quarter-mile walk of a station, or about 120 acres.

The strategy of the new urbanists is to change local zoning regulations to force the adoption of their principles, or at least to permit them to be followed.

In fact, it has been difficult to implement TOD schemes, since most areas do not have rail transit systems. Some critics claim that the new urbanists emphasize visual style over planning substance. They claim that the large-scale proposals seem to continue sprawl, rather than change it. Moreover, the critics argue that the impact of the new urbanists' approach will be minimal unless some type of regional governance is more widely adopted. Finally, the new urbanists have largely ignored the growing divisions of wealth and power among households. As Katz notes: "New Urbanism is a welcome step forward, but it is only a step."

The remainder of the book is a series of illustrated case studies that detail the new urbanism approach to designing residential and nonresidential neighborhoods.

Ravitch, Diane. 1996. "The Problem of the Schools: A Proposal for Renewal." In Julia Vitullo-Martin, ed., *Breaking Away: The Future of Cities.* New York: Twentieth Century Fund 77-87.

The author criticizes New York's schools because they are run by a top-heavy bureaucracy that makes all decisions centrally and leaves almost no authority for decision making within individual schools themselves. The results are terrible—only about 50 percent of all students who enter high school graduate, even after 5 years of classes. According to Ravitch, we now demand that our schools educate all young people, something that was never done in the past. We must educate them, she says in order to prepare them for life in a hightech world. To do this, we must abandon

centralized control and change to a system in which "each school must be managed by a group of adults who have direct, personal, and professional responsibility—and accountability—for the success of their students." (81)

> It may be that the best direction for reforming the schools is to seek a diversity of providers that are publicly monitored, rather than a bureaucratic system controlled by the mandates of a single government agency. What would a system look like in which a government did the steering and let many others do the rowing (82)?

She advocates three major principles for radical reform:

Autonomy—Each school should control its own budget and hire (and fire) its own teachers and other personnel. Each should be told how much money it has (based upon enrollments, plus allowances for disadvantaged students) and allowed to allocate that money as it sees fit—knowing that it would be rigorously audited by public officials.

Choice—Teachers should be able to freely decide where they will work, and students and parents should be able to decide where they want to send their children to school.

Quality—The centralized authorities should set standards for performance, periodically assess performances of every school, and constantly inform parents and the public of the results. Central authorities would also oversee large capital improvements, negotiate union contracts (without inhibiting schools from hiring whomever they wish), approve the creation of new schools, and audit performance and finances.

Schools that want to manage their own affairs should be allowed to conduct elections among staff and parents to become chartered schools, and immediately be given autonomy. This would permit successful schools to become self-governing right away. A second element of the strategy would include contracting out the management of several or many schools to specific organizations. A basic idea is to encourage as many new schools to be formed as possible. A third element in the strategy is to provide means-tested scholarships to poor students who could choose to use them in whatever schools they wanted. These would essentially be vouchers paid to the students or their parents, not to the institutions themselves—thereby finessing the religious school issue. This procedure has been successfully adopted in some other programs around the country.

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This chapter presents the bibliography of sprawl. Of the approximately 500 citations that follow, almost all (475) deal directly with sprawl, whether or not it is specifically identified by that term. Approximately five percent of the citations comprise general references and data sources. A number and letter appear after each citation and are found in the key below. The numbers serve to sort the literature into five impact categories—*Public/Private Capital and Operating Costs, Transportation and Travel Costs, Land/Natural Habitat Preservation, Quality of Life, and Social Issues*—plus a sixth category termed *Related Materials.* The letters sort the literature by the type of analysis used in the study. These are *descriptive, secondary, case study, engineering/per capita, retrospective, prospective, and econometric/regression analyses.* The summation of numbers and letters for the entire bibliography serves as the basis for statements made concerning both the literature and analysis concentrations of Chapter 8.

KEY

NUMBER (SUBSTANTIVE CONCERN)		LETTER (TYPE OF ANALYSIS)	
1	Public/Private Capital and Operating Costs	A	Descriptive/Conceptual Analysis
2	Transportation and Travel Costs	B	Secondary/Survey Analysis (Government Data or Other Sources)
3	Land/Natural Habitat Preservation	C	Case Study (Single or Multiple Locations)
4	Quality of Life	D	Engineering/Per Capita Analysis
5	Social Issues	E	Retrospective Analysis
6	Related Material	F	Prospective Analysis
		G	Econometric/Regression Analysis

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Abbreviations used without definitions in TRB publications:

AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
IEEE	Institute of Electrical and Electronics Engineers
ITE	Institute of Transportation Engineers
NCHRP	National Cooperative Highway Research Program
NCTRP	National Cooperative Transit Research and Development Program
NHTSA	National Highway Traffic Safety Administration
SAE	Society of Automotive Engineers
TCRP	Transit Cooperative Research Program
TRB	Transportation Research Board
U.S.DOT	United States Department of Transportation

EXHIBIT 7

Estimated Annual Property Tax Distribution
North Plaza Drive Industrial Park

	Growth projections (see Note 6)							
	Note 1		Note 2		Note 3		Note 4	
	Current (Frozen)		Annexation		Land Improvements		Build Out	
	Rate	Revenue	Rate	Revenue	Rate	Revenue	Rate	Revenue
County	20.0%	14,400	15.9%	25,848	15.9%	122,679	15.9%	526,539
Fire	4.9%	3,528	0.0%	3,528	0.0%	3,528	0.0%	3,528
Visalia City	0.0%	0	10.2%	7,344	10.2%	69,462	10.2%	328,542
ERAF	22.0%	15,840	22.0%	31,680	22.0%	165,660	22.0%	724,460
All Others	53.1%	38,232	51.9%	75,600	51.9%	391,671	51.9%	1,709,931
Total	100.0%	72,000	100.0%	144,000	100.0%	753,000	100.0%	3,293,000

Note 1: Current Assessed Value (AV) (outside city)

480	gross acres
15,000	per acre
7,200,000	Total AV
72,000	Annual Tax Revenue (rounded)

Note 2: Projected AV upon annexation (inside city)

480	gross acres
30,000	per acre
14,400,000	Total AV
144,000	Annual Tax Revenue (rounded)

Note 3: Projected AV upon land improvements (street improvements per Note 5, including installation of utilities)

480	gross acres
90%	conversion to net acres (see Note 5)
432	net acres
174,240	per acre ($4 per sq ft)
75,271,680	Total AV
753,000	Annual Tax Revenue (rounded)

Note 4: Projected AV upon build out

480	gross acres
90%	conversion to net acres (see Note 5)
432	net acres
25%	conversion to building pad
108	net acres
3,049,200	per acre ($70 per sq ft)
329,313,600	Total AV
3,293,000	Annual Tax Revenue (rounded)

Note 5: Conversion to net acres to account for half width street improvements on perimeter of each 160 acre section plus an interior cul-de-sac to service minimum 10 acre parcels

Note 6: Projected annual revenues were computed by freezing the existing tax allocation (Note 1) and then adding the increase due to annexation, improvements and build out using the new allocation %. No inflation assumptions have been incorporated.

EXHIBIT 8

Does "Smart Growth" Matter to Public Finance?

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The opinions expressed in this paper are those of the authors and do not necessarily reflect the opinions of the Department of Housing and Urban Development or the U.S. government at large.

Abstract. This paper addresses four fundamental questions about the relationship between "smart growth," a fiscally motivated anti-sprawl policy movement, and public finance: Do low-density, spatially extensive land use patterns cost more to support? If so, how large of an influence does sprawl actually have? How does the influence differ among types of spending? And, how does it compare to the influence of other relevant factors? The analysis, which is based on the entire continental United States and uses a series of spatial econometric models to evaluate one aggregate (total direct) and nine disaggregate (education, fire protection, housing and community development, libraries, parks and recreation, police protection, roadways, sewerage, and solid waste disposal) measures of spending, provides the most detailed evidence to date of how sprawl affects the vast sum of revenue that local governments spend every year.

1. Introduction

During the 2002 fiscal year, the 87,576 local governments in the United States—counting all counties, boroughs, municipalities, townships, school districts, and special districts—channeled over $1.14 trillion toward the provision of public services. Of this amount, 38.72% ($441.43 billion) was spent on education services, 11.15% ($127.07 billion) was spent on social services and income maintenance, 9.22% ($105.15 billion) was spent on environmental services and housing, 9.05% ($103.21 billion) was spent on public safety, 5.64% ($64.32 billion) was spent on transportation services, 4.66% ($53.11 billion) was spent on administrative services, and 3.85% ($43.88 billion) was spent paying interest on debt; the remaining 17.71% ($201.92 billion) was spent on utilities, insurance trusts, and other miscellaneous activities and operating costs (Census of Governments 2005). As shown in Table 1, which lists 2002 population, gross state product, and expenditure patterns by state, across all categories, local governments spent a combined national average of $3,959 per capita, a value that, in total, represents 10.95% of the gross domestic product.

Although many factors influence the allocation, distribution, and volume of this spending, there is a growing conviction among urban and regional policymakers that the character of the built environment is one of them. Specifically, the kind of low-density, spatially extensive pattern of growth commonly characterized as "sprawl" (Bruegmann 2005) is thought to raise the cost of public services because it fails to capitalize on economies of scale and/or optimize on facility location. On the other hand, more compact modes of development are believed to reduce costs by concentrating residents together and creating locational efficiencies in access and delivery. The thinking is that, because public finance ultimately plays out across geographic space, the dimensions of the development it supports matter in substantive ways.

Based on this reasoning, advocates of "smart growth," a movement that seeks a holistic rethinking of the contemporary approach to land use planning, have advanced policy frameworks that, among other things, specifically emphasize the importance of fiscal health (DeGrove 2005). For example, the State of Maryland's (1998) *Smart Growth and Neighborhood Conservation Act* establishes "priority funding areas," or specific districts where development is supported via public investment in capital facilities and other needs. Similarly, more established state land use planning mandates in Florida, Oregon, Washington, and elsewhere promote contiguity of growth and concurrency, which requires capacity in necessary infrastructure and services to be in place before development can proceed (see Knaap et al. 2001). What makes the present push for smart growth so striking is that it and its fiscally motivated anti-sprawl policies have been enjoined by states as diverse as Arizona, Maine, Michigan, and Tennessee (Gray 2005). The movement has

also gathered broad-based support at the local level, and, perhaps for that reason, it has produced remarkably consistent land use patterns in communities across the country (Song 2005). In short, on the promise of limiting sprawl and its financial discontents, smart growth has rapidly swept the United States and brought about far-reaching changes in the way that state and local governments plan for development.

But, beyond this political and on-the-ground progress loom difficult questions about the veracity of connections between the built environment and the cost of public services. In particular, there is little empirical evidence that sprawl is more expensive to support and, in fact, research on the issue has produced conflicting results. Moreover, there is no reason to believe that the relationship, if any, applies to all types of expenditures in the same way—it may be, for example, that the influence of the built environment cuts in both directions, raising some costs and lowering others depending on the nature of the service in question. Do low-density, spatially extensive land use patterns cost more to support? If so, how large of an influence does sprawl actually have? How does the influence differ among types of spending? And, finally, how does it compare to the influence of other relevant factors? The answers to these questions are key to understanding how well the anti-sprawl policies of smart growth line up with its objective of promoting fiscal health.[1]

2. Background Discussion

2.1 Measuring and Explaining Sprawl

Sprawl is defined here as the kind of low-density, spatially extensive pattern of development that has become prevalent throughout the United States over the course of the last 50 years (Fulton et al. 2001; Glaeser and Kahn 2004; Bruegmann 2005; Úlfarsson and Carruthers 2006). The best way—and, at present, virtually the only way—to measure the reach and pace of sprawl nationally is via the USDA's (2001) National Resources Inventory (NRI), which provides estimates of the amount of land in major land use categories at the county level for the years 1982, 1987, 1992, and 1997. A limitation of the NRI is that, at high resolution, it is known to have a wide enough margin of error that reported values for, say, the amount of developed land in a given county, may

[1] Note here that public finance is only one of several core concerns of smart growth, which, in fact, has a very broad quality-of-life orientation. For example, the *Smart Growth Network* describes the movement as being motivated by "...a growing concern that current development patterns—dominated by what some call "sprawl"—are no longer in the long-term interest of our cities, existing suburbs, small towns, rural communities, or wilderness areas. Though supportive of growth, communities are questioning the economic costs of abandoning infrastructure in the city, only to rebuild it further out. Spurring the smart growth movement are demographic shifts, a strong environmental ethic, increased fiscal concerns, and more nuanced views of growth." See: *www.smartgrowth.org/about/default.asp?res=1280.*

be imprecise. As a result, the data is not reliable enough to know with certainty that there are "exactly x number of acres of developed land in county i," so some of its documentation cautions against using it at that level. Because this limitation is sometimes viewed as an issue (Burchfield et al. 2006), it is important to be clear that the warning is there mainly to comply with data reporting requirements set forth by the Office of Management and Budget, which is responsible for the quality of information collected and disseminated by the federal government.[2] All of that said, the NRI does an excellent job of capturing how development patterns vary cross-sectionally and longitudinally or, in other words, how land use in county i differs from land use in county j and how land use in county i has changed between two or more points in time, t. Used in this way, the data measures land use representatively, even if individual data points are imprecise in some cases.

To demonstrate the validity of using the NRI for cross-sectional analysis, Figures 1 and 2 compare its (1997) measure of developed land area to the Census Bureau's (2000) measure of urbanized land area[3] in all counties located in the continental United States. Specifically, Figure 1 is a scatter plot that registers acres of developed land on the x-axis and acres of urbanized land on the y-axis and Figure 2 is a histogram of the absolute value of the difference between the two as a percentage of total county land area.[4] Both charts reveal a high degree of correspondence between the two estimates of land use: The trend line fit to the scatter plot has an R^2 of 0.91 and the histogram indicates that, in 80% of the sample, the difference is a value that ranges between just one and five percent of total county land area. Together, Figures 1 and 2 indicate that the NRI data provides a good overall representation of how development patterns vary across the country, at least with respect to another commonly used measure of land use.

Since this comparison is admittedly rather coarse, it is reassuring that other researchers have come to similar conclusions about the ability of the NRI to representatively measure land use. For example, a recent comparison by Irwin and Bockstael (2006) finds that the NRI lines up exceptionally well with land cover data derived from multispectral satellite imagery. The analysis

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[2] The authors have discussed this directly with NRI staff and the reason for the cautionary statement is that the data has statistical properties that require a level of analytical expertise above-and-beyond that of the public at large in order to use and interpret it properly. A statement by OMB on federal data reporting requirements is available online, in the *Federal Register*: *http://www.whitehouse.gov/omb/fedreg/2006/092206_stat_surveys.pdf*.

[3] The Census Bureau categorizes every census block in the country that has an average population density of 1,000 people per square mile, or about 1.5 people per acre, as urban, so summing the area of these blocks by county yields an estimate of the spatial extent of the built-up area within each county. Note that this measure is based on average population density, not actual land use, and some counties register no urbanized land area at all—in these instances, the NRI's measure of developed land area is correspondingly very small.

[4] The histogram is of the values resulting from this calculation: |developed land area – urbanized land area| / total county land area. Note that there are nine counties that do not appear on the histogram because these outliers stretch the figure out too far to be easily readable; in these cases, the differences are 21%, 23%, 25% (× 2), 29% (× 2), 36%, 38%, and 93%.

involves data for just the State of Maryland and uses somewhat larger (multi-county) areas than are of interest here, but the two measures are nearly identical and their close relationship apparently holds across the size-of-place hierarchy, because there is little difference among urban, suburban, exurban, and rural groupings of counties. So, although imperfect, the NRI is consistent with alternative data sources and it remains virtually the only one presently available for comparing land use patterns across the country as a whole.

Returning now to the matter at hand, Figures 3 and 4 illustrate the reach and pace of sprawl in the United States during recent years. Figure 3, which maps changes in aggregate density, measured as the number of people plus jobs per acre of developed land, shows that only about a fifth of all counties (691 out of 3,075) grew more dense between 1982 and 1997. Meanwhile, Figure 4, which maps the proportion of land absorption that took place during the last five years of the whole 15-year timeframe,[5] shows that the trend toward sprawl appears to have accelerated: In nearly half of all counties (1,285 out of 3,075) more than 50% of the overall change in developed land occurred between 1992 and 1997. If the trend were more-or-less constant, the pattern shown on the map would not emerge because the 5-year rate of land absorption would instead be closer to 33%.

The nation's land use has evolved in this way mostly because of population growth combined with rising incomes and falling commuting costs—an early cross-sectional analysis of sprawl found that these basic factors explain nearly 80% of variation in the spatial extent of regions' urbanized land area (Brueckner and Fansler 1983)—but other, more nuanced factors also play a role. In particular, three market failures, the failure of development to internalize (1) the benefits of open space, (2) the social costs of traffic congestion, and (3) the cost of the services that it requires, contribute to a sub-optimal pattern of land use (Brueckner 2000). While each of these is important to understanding sprawl, the third is central to the present analysis because, as a corollary, it suggests that growth would be more dense if it had to pay the full cost of the services needed to support it. In fact, both theoretical (Brueckner 1997; McFarlane 1999) and empirical (Pendall 1999) analyses show that impact fees, which attempt to correct for this problem, promote compact development. So, even though sprawl is largely explained by basic human ecology, it is also fueled by more complicated market failures, at least one of which is linked to public finance. Either way, if the connections between the built environment and the cost of public services are as substantial as many policymakers judge them to be, the trend documented in Figures 3 and 4 suggests that the consequences of sprawl may indeed be quite large.

[5] This figure is calculated as the ratio of the change in developed land area during the last five years and the change in developed land area during the entire time period, or $\Delta_{1992-1997} / \Delta_{1982-1997}$.

2.1 Smart Growth as a Policy Response

Acting on public finance oriented (among other) concerns, a number of states have adopted legislation aimed at limiting sprawl (Carruthers 2002). This began with what is often described as the "first wave" of state land use legislation that evolved out of the environmental movement of the 1960s and 1970s. At the time, the main objective was to create mechanisms for overseeing local decision-making processes, particularly with respect to the conversion of farmland and "developments of regional impact," such as major capital facilities and shopping centers. During the 1980s, the "second wave" of state land use legislation popularized the concept of "growth management," an approach to land use planning that emphasizes the need to accommodate, rather than limit, development through a coordinated effort among local governments. It was during this period that the nationwide conversation first began to shift toward identifying the policy-relevant problems of sprawl and developing specific mechanisms, like concurrency, for addressing them in ways other than restricting growth outright. Finally, the "third wave" of state land use legislation, which emerged in the 1990s, brought "smart growth," with its holistic orientation toward quality of life, to the forefront of urban and regional policy. These frameworks often cast local, rather than state, governments as the agents of land use reform and almost unilaterally cite environmental and/or fiscal motivations for confronting sprawl. The practical appeal of smart growth combined with its on-the-ground success has given it considerable political traction: As of 2005, legislation had been adopted by 20 states[6] and many other initiatives have been implemented independently at the local level (see DeGrove 1984, 1992, 2005 for a complete accounting of the history summarized here).

As opposed to sprawl, the benefits of smart growth for public finance are believed to be at least twofold (Knaap and Nelson 1992). First, advocates often argue that, for many public services, the cost per unit—that is, per person or household—of output is higher for low-density development because it fails to capitalize on economies of scale, which are achieved by concentrating users together. Second, spatially extensive development, whatever the density, is accused of making it difficult to optimize on facility location, especially if it happens in a noncontiguous way. Simply put, the reasoning is that sprawl is inefficient because, other things being equal, the cost of public services is negatively influenced by density and positively influenced by the spatial extent of developed land.

[6] Arizona, Colorado, Connecticut, Delaware, Florida, Kentucky, Maine, Maryland, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, Oregon, Pennsylvania, Rhode Island, Tennessee, Utah, Washington, and Wisconsin (Gray 2005).

The rejoinder for years has been that the "harshness" of high-density, compact built environments acts as a countervailing force that, after a point, overrides any financial efficiency they may achieve (Ladd 1998). Central cities, for example, often require large amounts of public investment for things like police protection and roadway maintenance due to their social complexity and economic primacy, which affect how intensively services are used. The reasoning here is that, like other commodities, public services are subject to both economies and diseconomies of scale, with the latter being a consequence of the kind of congestion, disorder, social pathologies, and other problems found in many densely populated areas. However, it is too rarely pointed out that the connection to the built environment in-and-of-itself may not be as strong as it has been made out to be—a paper by Gordon and Richardson (1997) is a good example—because the perspective seems, at times, to conflate the influence of land use with problems that have more to do with the deterioration and strife experienced by many aged, built-up areas of the country. From this line of reasoning, it follows that high-density, compact development patterns may well be less expensive to support and that the "harshness" of these environments is a different issue that must be dealt with separately.

The few empirical analyses of the relationship between the built environment and the cost of public services have, over time, produced results that are consistent with both of the perspectives just described. Research on the first dimension of sprawl, the density of developed land, essentially began with the Real Estate Research Corporation's (RERC 1974) much-maligned *Costs of Sprawl*. The study finds that low-density development is as much as twice as expensive to support as high-density development, but it has been extensively criticized for, among other things, its failure to control for other relevant factors (Altshuler and Goméz-Ibáñez 1993). Since then, refinements on the approach have mainly continued to find that low-density land use patterns are more expensive to support, but, unfortunately, most produce few generalizable conclusions due to their site-specific focus (see Frank 1989 and Burchell 1998 for reviews and Spier and Stephenson 2002 for an example). Meanwhile, public finance oriented work by Ladd and Yinger (1991) and Ladd (1992, 1994) finds a u-shaped relationship between the number of people per square mile of county land area and per capita spending and, so, concludes that high-density areas are ultimately more, not less, expensive to support. Last, a study of land use patterns by Carruthers and Úlfarsson (2003) finds evidence that density does lower the cost of many services; the analysis measures density via developed land area, not county land area, but it is primarily a hypothesis testing exercise, so it stops short of attempting to measure the magnitude of the relationship between sprawl and public finance in a detailed way.

Research on the second dimension of sprawl, the spatial extent of developed land, emanates from Lösch-style (1954) locational analysis, where the problem is to optimize on the placement of centralized facilities (see Thisse and Zoller 1983). This has traditionally been done on the basis of accessibility and coverage but other criteria, such as equity—which is accepted by many planners as a normative benchmark of urban form (Lynch 1981)—can also be used (Mulligan 1991, 2000; Farhan and Murray 2006). In the present context, the spatial extent of developed land matters in terms of the number and size of facilities needed to serve a given population, plus in terms of the span of the infrastructure needed to support day-to-day activities and deliver services effectively. But, even though capital improvements planning is central to land use planning (Kaiser et al. 1995), very little work has been done to identify how the spatial extent of developed land affects public finance; instead, this dimension of sprawl is usually just treated as implicit in density. A notable exception is a study by Hopkins et al. (2004), which finds that carefully planned development can save revenue by relying on fewer and larger facilities. The analysis by Carruthers and Úlfarsson (2003) also finds evidence that the spatial extent of developed land increases the cost of many public services but, as with density, no attempt is made to measure the size of the influence. In sum, even though locational analysis has long been used for facilities planning, relatively little is known about how the horizontal dimension of sprawl affects public finance.

3. Empirical Analysis

3.1 Modeling Framework

The point of departure for the empirical analysis is a so-called "spillover model" that results from strategic interaction among local governments (Brueckner 1998, 2003):

$$e_i = R(e_j, X_i), \tag{1}$$

where per capita expenditure on public services in jurisdiction i, e_i, depends on per capita expenditure on public services in surrounding jurisdictions j, e_j, plus a vector of local characteristics, X_i. R is described as a "reaction function," (Brueckner 2003, page 177) because it results from jurisdiction i's calculated response to the spending of proximate jurisdictions. Although spillovers can take different forms—for example, due to competition, emulation, and/or other kinds of government behavior—they are treated as a composite here because the focus is squarely on sprawl as a cost factor.

The relationship in equation (1) can be estimated with a spatial lag model (Anselin 1988, 2002), expressed as:

$$e_i = \beta \sum_{j \neq i} \omega_{ij} e_j + X_i \Gamma + \upsilon_i. \quad (2)$$

In this equation, ω_{ij}, $\forall j \neq i$, represents a set of spatial weights that aggregate public spending by jurisdictions near to i into a single composite variable; β represents an estimable parameter that describes how per capita expenditure in jurisdiction i is influenced by per capita expenditure in nearby jurisdictions; Γ represents a vector of estimable parameters; and υ_i represents an unobserved, stochastic error term. This modeling framework was originally applied by Case et al. (1993) in a behavioral analysis of state-level spending and is often used in public finance oriented research (see Revelli 2005 for a recent review). Overall, the results of this work show that, because it plays out across geographic space, public finance is subject to systematic spatial dependence.

The present analysis applies the modeling framework just described to examine per capita expenditure on public services, e, by local governments (including state and federal government transfers) at the regional level by using counties as the spatial units, i and j. This adaptation, which is similar to work done by Kelejian and Robinson (1992, 1993), means that each observation generally contains multiple jurisdictions—including the county itself, plus municipalities, school districts, special districts, and, potentially, others—so the spillovers that the analysis captures are really the net of interaction among many entities at multiple tiers of government. It is for this reason that the effect is simply labeled a "composite spillover" and no attempt is made to understand the specific nature of the mechanism/s involved.[7] Even so, the strategic interaction framework is adopted for both theoretical and empirical reasons: First, to recognize the presence of an underlying behavioral model of public finance and second, to avoid an econometric misspecification that does not account for the spatial dependence introduced by various forms of strategic interaction.

Moving on, in addition to the spatially lagged dependent variable, equations (1) and (2) contain a vector, X_i, representing relevant explanatory variables. The specification of the empirical model originates from early work done by Bergstrom and Goodman (1973) and Borcherding and Deacon (1972) and the choice of specific variables is based directly on more recent work done by Ladd and Yinger (1991), Ladd (1992, 1994), Carruthers and Úlfarsson (2003), Solé-Ollé (2005), and Solé-Ollé and Bosch (2005). Although the specification does not match any of these identically—due to data availability, the different purposes of the analyses, and so on—care was taken to ensure it corresponds to the extent possible. In particular, five

[7] Identifying different types of spillovers and their behavioral mechanisms is a complicated venture in-and-of-itself: See, for example, Esteller-Moré and Solé-Ollé (2001), Revelli (2001, 2002, 2003), Bordignon et al. (2003), Lundberg (2006), and Solé-Ollé (2006).

categories of factors, pertaining to the cost of and demand for public services, are hypothesized to influence per capita spending: *Built Environment*, *Political Structure*, *Growth and Demographics*, *Sources of Revenue*, and *Size and Primacy*. The first category is measured via the density of developed land, the percentage of county land area that is developed, the median housing value, and the percentage of housing built before 1940; the second category is measured via the per capita number of municipalities and the per capita number of special districts; the third category is measured via the rate of population change, per capita income, the percentage of the population that is white, the percentage of the population that is less than five years old, and the average household size; the fourth category is measured via the percentage of tax revenue that comes from property taxes, per capita federal revenue, per capita state revenue, and per capita long-term debt; and, last, the fifth category is measured via county land area, the ratio of employment to population, and the average government wage, plus dummy variables for metropolitan and micropolitan counties.

Like the specifications used in other research, this specification is oriented around variables measuring the cost of and demand for local government spending. The key cost factors in the model are: The average government wage, a measure of input costs, and the ratio of employment to population, which measures competition in the job market and, also, how intensively services are used by people who may be nonresidents. Other variables measuring costs include what Ladd (1992, page 278) calls "environmental cost factors," such as the density of developed land and the percentage of county land area that is developed, which describe sprawl, the object of this analysis. (Note here that total county land area is held constant, so the percentage of county land area that is developed measures the spatial extent of development or, in other words, the horizontal dimension of sprawl.) The key demand factors in the model are: Per capita income, a fundamental measure of demand, the median housing value, a measure of the median voter's stake in the outcome of public spending (Fischel 2001), and the percentage of tax revenue that comes from property taxes, which measures the tax price for residents, albeit somewhat roughly because other taxes are also paid. Additional variables measuring demand include factors that relate to the preferences of the population, such as the relative number of young children, and the availability of resources, such as intergovernmental revenue and public indebtedness. Across the board, factors that raise costs and demand, like high government wages and high per capita incomes, are expected to positively influence spending while factors that lower them, like weak employment markets and high tax prices, are expected to negatively influence spending.

Given the principles of smart growth, it is expected that sprawl raises the cost of public services because it fails to capitalize on economies of scale and/or optimize on facility location. If this is the case, other things being equal, per capita spending will be negatively influenced by density and positively influenced by the percentage of county land area that is developed. The two fragmentation variables, per capita municipalities and per capita special districts, are included to control for the political geography of local government finance; generally speaking, if the Tiebout hypothesis (1956) is correct, greater fragmentation will lower per capita spending by way of intergovernmental competition. Finally, there is every reason to suspect upfront, as many residents do, that the rate of population growth negatively influences per capita spending because the existing population almost always finances new development (Ladd 1994). This fear, justified or not, is precisely what led to the widespread adoption of local growth controls during the 1970s and 1980s (Glickfield and Levine 1992).

3.2 Data and Econometric Specification

The empirical model is used to analyze per capita expenditure by local governments in all 3,075 counties[8] of the continental United States during the 2002 fiscal year (Census of Governments 2005). The geographic scope of the analysis is shown in Figure 5, a map of per capita total direct spending by county. Inspection of the figure quickly reveals two major patterns: Expenditures are clustered by both state and region, including, in the latter case, in a way that spills across state lines. The first pattern suggests that fixed effects should be added to an empirical specification of equation (2) in order to account for unobserved factors common to all counties located within the same state; it also suggests that the model should be estimated in a manner that deals with heteroskedasticity introduced by variation in unobservable characteristics relevant to that level. Even more important, the second pattern reinforces the choice of modeling frameworks because spatial relationships that are not confined by state boundaries are clearly visible, even to the naked eye. As already mentioned, failing to account for this pattern of spatial dependence would produce a misspecified model and, ultimately, biased and inefficient estimates of Γ (Anselin 1992).

The modeling framework described in the preceding section is applied identically (for the sake of comparability) to one aggregate and nine disaggregate measures of public spending: Total direct expenditure, education, fire protection, housing and community development, libraries,

[8] The actual number of county equivalents is slightly greater, due to a number of independent cities such as Baltimore, Maryland St. Louis, Missouri, and cities throughout Virginia. These were integrated with appropriate counties when the data was compiled because some data—from the BEA's Regional Economic Information System, for example—is not available at that level, but the entire surface of the continental United States is still represented in the data set.

parks and recreation, police protection, roadways, sewerage, and solid waste management. A description of each measure of spending, taken from the survey form that the Census of Governments uses to collect the data, is provided in Table 2. Table 3 lists the source, units of measurement, and descriptive statistics for all of the continuous variables involved in the analysis; zero values were excluded from the calculations for certain measures of spending because counties where none occurred end up getting dropped in the estimation process. Note that all explanatory variables except for the spatially lagged dependent variable are lagged in time to 1997; this was done in part because the NRI data, which is used for the two measures of sprawl, is available only up until that year. The time lag also makes good practical sense given how the public planning process works, because there is usually a long delay between when expenditure decisions are made and when they are carried out. In order to be consistent, 1997 values of variables collected from decennial census data were estimated by using a time-weighted average of 1990 and 2000 values.

Applying this dataset to equation (2) results in the following structural model of per capita local government expenditure, written in matrix form:

$$e_s^* = \beta_s We_s^* + \Phi_s + X\Gamma_s + \upsilon_s. \qquad (3)$$

Here, all notation is the same as above, except that e^* indicates that per capita public expenditure is in natural log form (Carruthers and Ulfarsson 2003) and so is its spatial lag, We^*; s denotes each of the ten measures of public spending; Φ represents a vector of state fixed effects, including one for Washington, DC; and W is a 3,075 × 3,075 ($n \times n$) row-standardized weights matrix that describes the spatial connectivity of the data set. The weights matrix was created using the center of each county's population—that is, a point, calculated using census tract-level data, identifying where people are concentrated rather than the geographic center—to identify neighbors. In the scheme, each county i is related to all counties j having population centers located within 50 miles of its own population center or, in the 65 cases where the distance is greater than 50 miles, to a single nearest neighbor. The connectivity of the resulting spatial weights matrix is illustrated in Figure 6.

Last, the behavioral underpinning of the model says that proximate counties are influenced by each other, so We is endogenous to e, and equation (3) cannot be properly estimated using ordinary least squares (OLS). That is, because per capita spending in county i depends on per capita spending in counties j and the other way around, there is a "chicken-or-egg" problem that must be resolved by choosing an appropriate estimator. The approach used here is a spatial two-stage least squares (S2SLS) strategy developed by Kelejian and Prucha

(1998), which involves first regressing We_s on X and WX, the spatial lag of X, to produce predicted values of the endogenous variable and then using the predicted values, $\hat{We}_s$, in place of the actual values in equation (3). The only shortcoming of this strategy is that the exogenous variables, X and WX, are not always good predictors of We_s, so, as a precautionary step, an additional instrument derived from the "three group method"—wherein the instrument is assigned a negative one, zero, or one depending on whether the value of the original variable, We_s, is in the bottom, middle, or top third of its ordinal ranking (Kennedy 2003)—is included in the first stage regression (see, for example, Fingleton and López-Bazo 2003; Fingleton 2005; Fingleton et al. 2005). Like the alternative, maximum likelihood (ML) estimation, this strategy yields efficient, unbiased parameter estimates, even in the presence of spatial error dependence (Das et al. 2003). Recent examples of other work in the area of public finance that use this estimator as opposed to, or along with, an ML estimator include Esteller-Moré and Solé-Ollé (2001), Revelli (2002, 2003), Baicker (2005), and Solé-Ollé (2006).[9]

3.3 Estimation Results

The S2SLS estimation results for the various structural models are shown in Tables 4 – 7; to better illuminate the spatial component of the analysis, the first of these, the table for total direct spending, also includes results for a model estimated via OLS without the spatial lag. Nearly all of the parameter estimates are statistically significant and the adjusted R^2 values, which range from a low of 0.25 (for the housing and community development equation) to a high of 0.68 (for the roadways equation), show that the models do a good job of explaining how per capita spending varies across the United States, especially given that they were not specifically tailored to the individual types of services. As already noted, the number of observations differs from model-to-model because counties where no spending took place during the 2002 fiscal year were dropped in the estimation process. In addition to the parameter estimates and the values of their corresponding t-statistics, the tables list elasticities, η_k, which were calculated for each of the continuous explanatory variables at the mean values of the regressors using the appropriate set of counties—that is, the calculations were made after accounting for dropped observations, so they reflect only those that were actually included in the individual models. The elasticities are considered in detail in the next section, which applies the findings of the empirical analysis to address each of the four policy questions that were posed in the introduction. For now, working

[9] In practice, all of the spatial variables, We_s and WX were calculated in *GeoDa*, a program designed for spatial analysis and computation (Anselin 2003; Anselin et al. 2006), then imported into *EViews*, an econometrics program, with the rest of the data, e_s and X, where the two-stage least squares (2SLS) regressions were run using panel settings to identify the states as cross-sections for fixed effects and as clusters for White-adjusted standard errors.

down though the list of explanatory variables, the following paragraphs summarize the estimation results in a general way.

To begin with, the spatially lagged dependent variables, We_s, register positive and highly significant spillover effects in all of the equations. The mediating influence of the strategic interaction is illustrated in Table 4, which includes OLS estimates alongside the S2SLS estimates. Adding the spatial lag to the model and re-estimating it with the appropriate technique lowers the value of most of the parameter estimates, sometimes by a wide margin. For example, compared to the OLS estimates, the S2SLS estimates of the parameters on the two variables measuring sprawl, the density of developed land and the percentage of county land area that is developed, are 15.97% and 5.15% smaller, respectively; on average, the absolute value of the difference in the parameters from the first regression to the second is 10.17%. Because the dependent variables and their spatial lags are both in log form, the parameters on the spatial lags are interpreted as elasticities, so a 1% change, whether positive or negative, in per capita total direct spending in the surrounding region produces a localized ~0.20% change in total direct spending. Of course, the size of this effect varies substantially among the nine disaggregate measures of spending: The elasticity on the spatial lag of per capita spending on police protection (0.3767) is by far the largest and the elasticity on the spatial lag of per capita spending on education (0.1119) is the smallest. Taken as a group, these estimates show that local governments engage in exactly the kind of strategic interaction that motivates the modeling framework, and, just as importantly, that the resulting pattern of spatial dependence in public finance persists even after accounting for the kind of state-level correlation absorbed by the fixed effects.

Next, in the *Built Environment* category, the parameter on the density of developed land, the first measure of sprawl, carries a negative sign and is statistically significant in the total direct, education, parks and recreation, police protection, and roadways models; it is negative and insignificant in all other cases, except for housing and community development where it is positive and highly significant. The parameter on the second measure of sprawl, the percentage of county land area that is developed (holding county land area constant), is positive and statistically significant in all cases except for housing and community development and solid waste management. Median housing value, a demand factor, and the percentage of housing built before 1940, an additional cost factor, also have a positive influence in most of the equations. The only equation where median housing value negatively influences spending is for housing and community development, a service that is mainly channeled to blighted areas in need of redevelopment and/or where people receive rental subsidies, such as assistance under the Section 8 voucher program (Pendall 2000). Meanwhile, aged development requires higher levels of

spending for rehabilitation and maintenance of physical infrastructure like roadways and sewerage. As explained further below, the results from the two measures of sprawl yield clear evidence that smart growth, with its anti-sprawl policies, matters to public finance: The estimates consistently indicate that high-density, compact development costs less to support than low-density, spatially extensive development. More broadly, these findings represent a large step forward in urban and regional policy evaluation, because they are the most detailed measurements to date of the relationship between the built environment and public finance.

The remaining categories of control variables also reveal important relationships. First, in the *Political Structure* category, the two fragmentation variables, per capita municipalities and per capita special districts, supply little evidence that intergovernmental competition lowers the cost of public services. In fact, municipal fragmentation apparently increases per capita spending on education and roadways, possibly by exacerbating various locational inefficiencies; likewise, special districts, which have rapidly reshaped public finance over the past several decades (Foster 1997), appear to have a positive, rather than negative, influence. Second, in the *Growth and Demographics* category, the parameter on the rate of population change is almost always highly significant and negative; the parameter on per capita income is positive whenever significant; the parameter on the percentage of the population that is white is mostly significant, but its sign differs from equation-to-equation; the parameter on the percentage of the population that is less than five years old is mostly insignificant but is very large and positive in the education equation; and the average household size is negative and statistically significant in all but a few of the models. Overall, this category of explanatory variables indicates that rapid population growth negatively influences existing residents' share of spending and that, other things being equal, per capita spending is greater in regions with a high per capita income (at least for select services, like libraries and parks and recreation), a greater proportion of minorities, and younger, smaller families. Third, members of the *Sources of Revenue* category, which, with the exception of the percentage of tax revenue that comes from property taxes, nearly always have a positive influence when significant, provide insight how local governments finance their spending. In two cases, fire protection and parks and recreation, per capita state revenue carries the perverse (negative) sign and is statistically significant, but these may be spurious correlations—or, it may be that certain state funding comes with strings attached that end up causing communities to divert spending away from these particular services. The tax price is interesting because it positively influences per capita spending on education; although this variable, as a demand factor, is expected to carry a negative sign, the positive sign in this case makes at least tentative sense given the interdependency between school quality and property values (Fischel 2001). Fourth, in the

County Size and Primacy category, the parameters on the three cost factors, county land area, the ratio of employment to population, and the average government wage, are always positive when significant and the metropolitan and micropolitan dummy variables show how the different types of spending vary up and down the regional hierarchy. Finally, note that, in order to conserve space, all of the state fixed effects have been suppressed from the tables.

4. Policy Evaluation

The introduction to this paper posed four questions about the reasoning behind the kind of fiscally motivated, anti-sprawl policy frameworks that have swept the United States over the past several decades: Do low-density, spatially extensive land use patterns cost more to support? If so, how large of an influence does sprawl actually have? How does the influence differ among types of spending? And, how does it compare to the influence of other relevant factors? The answers to these questions, which are based on the findings of the empirical analysis, yield clear evidence that smart growth matters to public finance.

4.1 Do Low-density, Spatially Extensive Land Use Patterns Cost More to Support?

The estimation results listed in Tables 4 – 7 show that the density of developed land has a negative effect on five key measures of local government spending: Total direct, education, parks and recreation, police protection, and roadways. The four disaggregate measures are particularly important because, going in order, they are the first, second, sixth, and third largest of the nine types of spending considered here: On average, they account for 44.95%, 6.33%, 1.45%, and 3.76% of total direct spending. Further, if one-tailed hypothesis tests had been assumed—on the grounds that the direction of influence was anticipated in advance—density would have registered a negative effect on fire protection, libraries, and sewerage, too. Density carries the expected negative sign in the model for spending on solid waste management but it does not come close to being statistically significant, even assuming a more liberal one-tailed hypothesis test. The remaining case, housing and community development, which is positively influenced by density, is sensible, because of the higher cost of land acquisition and construction, among other things, in built-up areas. Next, the spatial extent of developed land, measured as the percentage of county land area that is developed while holding county land area constant, has a positive influence in all but two instances, where it does not approach statistical significance. In sum, the results for these two variables show that, other things being equal, the kind of low-density, spatially extensive development patterns that characterize sprawl cost more to support than the high-density, compact development patterns that the smart growth movement advocates.

4.2 How Large of an Influence Does Sprawl Actually Have?

The magnitude of sprawl's overall influence on public finance in the United States is estimated by applying the elasticities for density (η = –0.0136) and percent developed (η = 0.0246) from the total direct expenditure model to two alternative land use scenarios: The first assumes that all counties nationwide developed in a way that was 25% more compact (more dense and less expansively developed) than they are and the second assumes that all counties in the country developed in a way that was 50% more compact.[10] The dollar values associated with these changes are calculated by obtaining the product of: (1) the relevant elasticity, (2) the relevant percent difference, (3) per capita total direct spending during the 2002 fiscal year, and (4) county population. The first scenario suggests that, if the nation's land use patterns had somehow evolved differently, and development everywhere was 25% more dense, public services would cost, in net, $3.63 billion less annually; if it were that much less expansive, public services would cost $6.56 billion less annually. The second scenario suggests that, if development everywhere was 50% more dense, public services would cost $7.25 billion less annually; if it were that much less expansive, public services would cost $13.12 billion less annually. Capitalized at 5%—more-or-less the current long-term interest rate that most local governments are subject to—as an approximation of opportunity costs, the annual values from the two scenarios translate into $72.75 billion and $131.20 billion (25%) and $145.07 billion and $262.40 billion (50%).

Clearly, these numbers are artificial in that they assume a uniformly different outcome of growth throughout the entire country but they nonetheless give a general sense of just how large of an influence sprawl may have had on public finance. That said, the hypothetical savings, especially vis-à-vis the long-term (capitalized) opportunity costs, are nontrivial enough that some places may wish to identify how to better connect financial planning to land use planning: With a population of 88,000 and per capita total direct expenditures of about $3,200, the average county would annually save $1.18 million ($2.36 million) if it were 25% (50%) more dense and $2.13 million ($4.27 million) if it were that much less developed. Like before, capitalizing these values shows that the opportunity costs are large: $23.59 million ($47.18 million) and $42.67 million ($85.33 million) if development was 25% (50%) more compact. In an era of far reaching budget cuts and increased fiscal conservatism among the general public, these figures seem big enough to merit consideration.

[10] The average density of all counties in the country is 2.49 people plus jobs per acre of developed land, so, on average, these scenarios imply densities of 3.11 and 3.73 people plus jobs per acre of developed land, respectively; the average proportion of county land area that is developed 8% so, on average, these scenarios imply 6% and 4%, respectively.

4.3 How Does the Influence Differ Among Types of Spending?

The elasticities reported for the individual expenditures in Tables 5 – 7 show that the magnitude of sprawl's influence depends on the service in question. The density of developed land has the largest absolute effect on housing and community development (η = 0.1124); then on roadways (η = –0.0562); then on parks and recreation (η = –0.0362); then on education (η = –0.0345); and then on police protection (η = –0.0222). So, sprawl lowers the cost of the first of the services affected by density, likely because land and other inputs cost less, but raises the cost of the last four to a decreasing degree. The spatial extent of developed land, meanwhile, has the largest effect on parks and recreation (η = 0.1048); then on fire protection (η = 0.0872); then on sewerage (η = 0.0718); then on libraries (η = 0.0534); then on police protection (η = 0.0370); then on roadways (η = 0.0321); and then on education (η = 0.0128). In more qualitative terms, this dimension of sprawl has the largest influence on services having centralized facilities that may have to be replicated when they otherwise would not; a more moderate influence on linear infrastructure systems that connect to centralized facilities; and the smallest influence on facilities/services that receive heavy day-to-day use. As a set, the elasticities illustrate that there is wide variation in how public finance is affected by the underlying pattern of land use.

4.4 How Does the Influence of Sprawl Compare to the Influence of Other Relevant Factors?

Direct comparison of the various elasticities needs to be tempered by a recognition that they relate different types of explanatory variables, expressed in different units of measurement, to per capita spending. That said, the parameters are, by definition, unit-free metrics and so lend themselves to the kind of general comparison that is of interest here, as long as differences in the nature of what they describe are kept in mind. The column of elasticities listed for the spatial lag model of total direct expenditure in Table 4 shows that the influence of many factors, including the density of developed land (η = –0.0136) and the spatial extent of developed land (η = 0.0246), turns on the one-hundredths of a percent mark. Exceptions to this, where the relationships turn on the tenths of a percent mark, are the spatially lagged dependent variable (η = 0.2039), the percentage of the population that is less than five years old (η = 0.4065), the average household size (η = –0.7777), per capita state revenue (η = 0.1416), and the ratio of employment to population (η = 0.2836).

The larger an elasticity, the more responsive spending is to changes in the corresponding variable, so, at first glance, the figures reported in Table 4 suggest that, categorically, demographic factors have the largest influence on public spending patterns. This finding is not

surprising, given that people's socioeconomic circumstances are what determines what they demand from their local governments. But, in practice, demographic conditions do not vary too far from their mean, so modest cross-sectional differences end up corresponding to relatively large differences in per capita spending. Consider, for example, that the standard deviation of the average household size is only 8.80% of the mean, whereas, for the density and spatial extent of developed land, the standard deviations are 104.94% and 161.75% of the mean, respectively. In short, factors with little variance register a larger influence, because they rarely, if ever, differ from place-to-place by much. Moreover, compared to other factors that may readily be influenced by public policy—most demographic conditions, such as the number of young children, are not among them—the influence of sprawl is large. In particular, the elasticities on the density and spatial extent of developed land are on the level with those for median housing value (η = 0.0843), the percentage of housing built prior to 1940 (η = 0.0337), the rate of population change (η = –0.0251), and most sources of revenue. And, here again, the two measures of sprawl deviate much further from their mean than most of these, which are generally more uniform across the country. So, to answer the question in brief: Compared to other relevant factors, the influence of sprawl is sizable.

5. Summary and Conclusion

This paper began by outlining the connections between smart growth and public finance, then opened an investigation into them by: (1) reviewing previous research pertaining to the topic; (2) estimating a series of spatial econometric models for measuring how the built environment and other relevant cost and demand factors influence local service expenditures; and (3) evaluating the nature and extent of the relationship. The results of the analysis link one of the main ideas behind smart growth—namely, that low-density, spatially extensive development patterns are more expensive to support—directly to public finance. While there is a lot of variation in how the density and the spatial extent of development influence different types of services, other things being equal, sprawl, as a cost factor, nearly always raises per capita spending, and the effects translate into large dollar values when summed across the entire country. They are also quite large on a case-by-case basis when capitalized at a conventional long-term lending rate as approximations of opportunity costs. These findings strongly suggest that the reasoning behind fiscally motivated, anti-sprawl smart growth policy frameworks is sound. Several conclusions and directions for future research follow.

Foremost, the results of the analysis link one of the main ideas behind smart growth to public finance via local government spending, an intermediate output, but they do not necessarily extend to the final outputs that residents eventually enjoy. Going forward, a key question that must be addressed is: Do high-density, compact development patterns make any difference for service quality, or do they just make services less expensive to provide? This question is critical for the smart growth movement because it cuts to the core of its holistic, quality-of-life orientation. It is important to remember, for example, that the point of departure for much of the previous research on how development patterns affect public finance was concern for the poor fiscal health and corresponding depravity that the 1960s, 1970s, and 1980s visited upon many built-up areas of the United States (Ladd and Yinger 1991). Public finance in-and-of itself is closely related to quality-of-life (Gyourko and Tracy 1989, 1991) but, ultimately, it is the low crime rates, good schools, and other tangible outcomes of local government spending that influence where people choose to live (see, for example, Bayoh et al. 2006). For this reason, to the extent that it can ensure that public services are delivered both cost effectively and at a high level of quality, smart growth stands to play a major part in determining places' comparative advantage.

In addition, given its holistic orientation, further evaluations of smart growth should examine its ability to actually achieve more desirable living conditions. The land use reform movement that produced most of the contemporary anti-sprawl policy frameworks was led, at first, by an environmental awakening (Popper 1981) and, later, by critical thought regarding the extent to which development patterns actually serve the best interests of their inhabitants (Calthorpe 1993; Duany et al. 2000). Recent work by Song and Knaap (2003, 2004) shows that people place a premium on housing located in "neo-traditional," or "new urbanist," developments, suggesting that a distinct market for smart growth may have emerged. Whether this is simply a product of aesthetics or of a more complex blend of architectural, environmental, fiscal, and other factors remains an open question, though. The need to resolve the issue is brought into stark relief by the fact that, even though urban and regional policymakers are responsible for shaping settlement patterns into what they somehow "ought to be," they have so far advanced few defensible criteria for favoring one outcome over another (Talen and Ellis 2002). Lynch's (1981) classic work, *Good City Form*, delineates a set of very specific normative criteria—vitality, sense, fit, access, control, efficiency, and justice—for evaluating alternative modes of land use, but policymakers have too often failed to rigorously connect smart growth, or any of its goals, to a framework of this sort. The results presented here indicate that sprawl is not efficient from the standpoint of public finance but, with further research, other criteria, such as

equity and justice, may turn out to be important as well. Lynch's framework holds great promise for helping to advance the cause of smart growth because it provides a source of structure for analyzing land use policies in terms of the quality-of-life benefits they are meant to produce.

Each of these conclusions is highly general because the analysis presented in this paper focuses on aggregate, county-level patterns of public spending. It is not clear that the findings would apply in exactly the same way on a community-by-community basis, so readers should be cautious about interpreting the results in that way. That is, the analysis observes the relationship between sprawl and public finance at the county level, not at the municipal or neighborhood levels, where the principals of smart growth are normally applied. Counties can contain literally hundreds of individual governmental entities—Cook County, Illinois, where Chicago is located, had 539 general and special purpose governments in 2002—so a great deal of heterogeneity lies beneath the surface of the results presented here. Determining whether or not, and just how, the financial consequences of sprawl play out across more localized areas requires further research using individual jurisdictions as the unit of analysis. It may be, for example, that that the size of jurisdictions and the size of the regions they are embedded in are important mediating factors. Similarly, the overall trajectory of growth through time may also make a difference, especially in instances where large areas are often committed to development via comprehensive planning, zoning, and other forms of land use planning before they are actually filled in (Carruthers and Mulligan 2007). In future research, these and other important jurisdiction-level issues deserve careful thought and analysis.

Finally, as an extension of this need for more locally oriented work, the nature of the strategic interaction registered by the empirical models should be investigated further. Specifically, a procedural goal of many smart growth programs is to promote cooperation among local governments as a means of meeting broader societal objectives (Carruthers 2002). Theoretical research (Haughwout 1997, 1999) and applied policy analysis (Orfield 1997, 2002) alike show that, in the case of public finance, there is a great deal of fiscal interdependency within regions and that cooperation, rather than competition, can produce net benefits for all of those involved. Determining how the spillovers captured by the kind of spatial reaction functions estimated here reconcile with this "regionalist" view would also require with the use of disaggregate, jurisdiction-level data, plus, at the very least, discriminating among different forms of interaction in order to more precisely represent the motivations and behavior of individual governments. Although a project like this would be highly involved, particularly if it were done for the entire country, taking the step would add great depth to the study of smart growth by better integrating it with theory of local government behavior. In the end, such an approach is

necessary in order to develop a full understanding of the complex ways in which smart growth matters to public finance; in the meantime, this paper has taken key steps in that direction.

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Table 1. 2002 Population, Gross State Product, and Local Government Expenditures by State

State	Population	GSP ($ mil.)	Expenditure			State	Population	GSP ($ mil.)	Expenditure		
			Total ($ mil.)	Per Capita	Percent GSP				Total ($ mil.)	Per Capita	Percent GSP
US	287,984,799	$10,412,244	$1,140,082	$3,959	10.95%	MO	5,681,045	$187,090	$17,266	$3,039	9.23%
AL	4,480,139	$123,763	$14,642	$3,268	11.83%	MT	910,395	$23,913	$2,262	$2,485	9.46%
AK	640,699	$29,741	$3,051	$4,762	10.26%	NE	1,726,753	$60,571	$7,769	$4,499	12.83%
AZ	5,438,159	$173,052	$20,404	$3,752	11.79%	NV	2,167,867	$82,389	$9,055	$4,177	10.99%
AR	2,706,606	$71,221	$6,123	$2,262	8.60%	NH	1,274,666	$46,106	$3,493	$2,740	7.58%
CA	34,988,088	$1,363,577	$181,512	$5,188	13.31%	NJ	8,576,089	$377,824	$31,826	$3,711	8.42%
CO	4,498,407	$181,246	$19,363	$4,304	10.68%	NM	1,855,400	$53,414	$5,397	$2,909	10.10%
CT	3,458,382	$167,235	$11,211	$3,242	6.70%	NY	19,164,755	$802,866	$123,857	$6,463	15.43%
DE	805,767	$46,991	$2,127	$2,640	4.53%	NC	8,312,755	$301,254	$28,577	$3,438	9.49%
DC	564,624	$67,176	$7,832	$13,871	11.66%	ND	633,571	$20,007	$1,766	$2,787	8.82%
FL	16,677,860	$522,340	$61,756	$3,703	11.82%	OH	11,404,651	$385,657	$42,720	$3,746	11.08%
GA	8,581,731	$307,443	$30,960	$3,608	10.07%	OK	3,487,076	$95,343	$9,384	$2,691	9.84%
HI	1,234,401	$43,806	$2,077	$1,683	5.74%	OR	3,522,342	$115,113	$13,916	$3,951	12.09%
ID	1,343,973	$38,276	$3,743	$2,785	9.78%	PA	12,324,415	$424,820	$43,527	$3,532	10.25%
IL	12,586,839	$486,182	$51,384	$4,082	10.57%	RI	1,069,550	$37,040	$2,894	$2,706	7.81%
IN	6,154,739	$203,296	$20,687	$3,361	10.18%	SC	4,102,568	$122,274	$12,374	$3,016	10.12%
IA	2,934,340	$97,810	$9,928	$3,383	10.15%	SD	760,368	$25,826	$2,011	$2,645	7.79%
KS	2,712,454	$89,875	$9,098	$3,354	10.12%	TN	5,790,312	$191,394	$21,128	$3,649	11.04%
KY	4,088,510	$121,633	$9,995	$2,445	8.22%	TX	21,722,394	$775,459	$77,108	$3,550	9.94%
LA	4,475,003	$134,360	$13,523	$3,022	10.07%	UT	2,336,673	$73,646	$7,599	$3,252	10.32%
ME	1,296,978	$39,027	$3,386	$2,611	8.68%	VT	616,274	$19,419	$1,616	$2,622	8.32%
MD	5,442,268	$202,840	$17,682	$3,249	8.72%	VA	7,286,061	$288,840	$24,033	$3,298	8.32%
MA	6,411,568	$287,191	$25,035	$3,905	8.72%	WA	6,066,319	$233,971	$26,875	$4,430	11.49%
MI	10,039,379	$347,014	$39,489	$3,933	11.38%	WV	1,804,529	$45,259	$3,980	$2,206	8.79%
MN	5,023,526	$199,271	$22,200	$4,419	11.14%	WI	5,439,137	$189,508	$22,077	$4,059	11.65%
MS	2,866,349	$68,550	$8,000	$2,791	11.67%	WY	499,045	$20,326	$2,365	$4,739	11.63%

Sources: Bureau of Economic Analysis (2002, 2006) and Census of Governments (2005).

Table 2. Public Expenditure Variables

Variable	Description
Total Direct Expenditures	Sum of direct expenditures, including salaries and wages
Education	Expenditures on local schools.
Fire Protection	Expenditures incurred for fire fighting and fire prevention, including contributions to volunteer fire units.
Housing and Community Development	Expenditures on urban renewal, slum clearance, and housing projects.
Natural Resources	Flood control, soil and water conservation, drainage, and any other activities for promotion of agriculture and conservation of natural resources.
Libraries	Expenditures on libraries.
Parks and Recreation	Expenditures on parks and recreation, including playgrounds, golf courses, swimming pools, museums, marinas, community music, drama, celebrations, zoos, and other cultural activities.
Police Protection	Expenditures on municipal police agencies, including coroners, medical examiners, vehicular inspection activities, and traffic control and safety activities.
Roadways	Expenditures for construction and maintenance of municipal streets sidewalks, bridges and toll facilities, street lighting, snow removal, and highway engineering, control, and safety.
Sewerage	Expenditures for construction, maintenance, and operation of sanitary and storm sewer systems and sewage disposal plants.
Solid Waste Management	Expenditures on street cleaning and the collection and disposal of garbage.

Source: Census of Governments, form F-28, 2005 Annual Survey of Local Government Finances.

Table 3. Source, Units, and Description of Continuous Variables

			Descriptive Statistics				
Variable	Source	Units	Mean	Median	Maximum	Minimum	Standard Deviation
Per Capita Total Direct	COG, REIS	$	3,220.77	2,970.36	23,676.37	227.93	1,362.98
Per Capita Education	COG, REIS	$	1,449.76	1,357.08	6,935.84	44.79	480.60
Per Capita Fire	COG, REIS	$	49.31	38.44	1,442.15	0.05	51.57
Per Capita Housing	COG, REIS	$	53.08	35.06	870.33	0.04	63.57
Per Capita Libraries	COG, REIS	$	20.43	15.04	356.51	0.02	22.84
Per Capita Parks	COG, REIS	$	47.68	31.22	1700.40	0.07	66.63
Per Capita Police	COG, REIS	$	120.94	108.79	1200.66	0.60	75.84
Per Capita Roadways	COG, REIS	$	205.34	154.61	1914.18	0.13	175.55
Per Capita Sewerage	COG, REIS	$	67.67	50.93	1164.47	0.10	71.03
Per Capita Solid Waste	COG, REIS	$	46.43	38.89	990.33	0.01	42.31
Density	NRI, REIS	#	2.49	2.04	64.26	0.04	2.61
% Developed	NRI, COG	%	0.09	0.04	1.00	0.00	0.13
Median Housing Value	Census	$	85,634.15	76,521.00	759,966.00	5,174.65	45,962.78
% Housing >1940	Census	%	0.20	0.16	0.61	0.00	0.13
Per Capita Municipalities	COG	# (1,000s)	0.30	0.17	4.09	0.00	0.38
Per Capita Special Districts	COG, REIS	# (1,000s)	0.53	0.22	14.44	0.00	0.88
Population Change	COG, REIS	%	0.06	0.05	0.77	–0.39	0.08
Per Capita Income	REIS	$	22,716.03	22,051.55	78,125.29	5,498.18	5,131.32
% White	Census	%	0.86	0.92	1.00	0.05	0.16
% <5 Years Old	Census	%	0.10	0.10	0.18	0.06	0.01
Average Household size	Census	#	2.66	2.62	5.38	0.83	0.23
% Property Tax	COG	%	0.79	0.82	1.00	0.16	0.16
Per Capita Federal Revenue	COG, REIS	$	79.38	45.70	5,038.61	0.00	163.14
Per Capita State Revenue	COG, REIS	$	1,033.36	953.99	7,415.72	0.00	439.59
Per Capita Long-term Debt	COG, REIS	$	1,917.46	1,072.07	12,2810.20	0.00	4,950.10
County Land Area	COG	# (1,000s ac)	616.00	396.00	12,841.00	10.00	836.00
Employment Ratio	REIS	%	0.38	0.37	2.93	0.08	0.14
Average Wage of Government Job	REIS	$	27,614.64	26,528.16	61,626.56	14,534.40	5,840.15

Notes: COG is the US Bureau of Commerce's Census of Governments; REIS is the US Bureau of Economic Analysis' Regional Economic Information System; NRI is the US Department of Agriculture's National Resources Inventory; Census is the US Census Bureau; all dollar values are expressed in 2002 constant dollars; zero values are excluded from the capital facilities, education, fire protection, housing and community development, libraries, natural resources, parks and recreation, roadways, sewerage, and solid waste calculations.

Table 4. OLS and S2SLS Estimates of Total Direct Equation

	OLS			S2SLS		
	Estimated Parameter	Elasticity	*t*-value	Estimated Parameter	Elasticity	*t*-value
Constant	7.59E+00 ***	-	42.06	6.06E+00 ***	-	18.29
Spatial Lag	-	-	-	2.04E-01 ***	0.2039	5.93
Built Environment						
Density	–6.49E-03 ***	–0.0162	–2.51	–5.45E-03 **	–0.0136	–2.10
% Developed	3.05E-01 ***	0.0259	5.97	2.89E-01 ***	0.0246	5.59
Median Housing Value	1.15E-06 ***	0.0985	6.18	9.85E-07 ***	0.0843	5.28
% Housing <1940	1.97E-01 ***	0.0384	2.72	1.73E-01 ***	0.0337	2.40
Political Structure						
Per Capita Municipalities	3.98E-02 $^{n/s}$	0.0119	1.49	2.79E-02 $^{n/s}$	0.0084	1.04
Per Capita Special Districts	5.68E-02 ***	0.0299	4.06	5.53E-02 ***	0.0291	4.13
Growth and Demographics						
Population Change	–4.88E-01 ***	–0.0295	–4.37	–4.15E-01 ***	–0.0251	–3.76
Per Capita Income	1.88E-06 *	0.0427	1.64	1.60E-06 $^{n/s}$	0.0363	1.39
% White	–1.18E-01 *	–0.1008	–1.84	–1.16E-01 *	–0.0993	–1.86
% <5 Years Old	4.31E+00 ***	0.4470	5.85	3.92E+00 ***	0.4065	5.36
Average Household size	–2.85E-01 ***	–0.7588	–4.45	–2.93E-01 ***	–0.7777	–4.66
Sources of Revenue						
% Property Tax	2.27E-01 ***	0.1790	3.52	1.96E-01 ***	0.1545	3.04
Per Capita Federal Revenue	1.31E-04 *	0.0104	1.73	1.28E-04 *	0.0102	1.69
Per Capita State Revenue	1.33E-04 ***	0.1374	3.36	1.37E-04 ***	0.1416	3.49
Per Capita Long-term Debt	1.71E-05 ***	0.0328	11.98	1.70E-05 ***	0.0326	11.73
County Size and Primacy						
County Land Area	2.85E-05 ***	0.0176	3.80	2.49E-05 ***	0.0154	3.54
Employment Ratio	7.62E-01 ***	0.2898	6.87	7.46E-01 ***	0.2836	6.64
Average Government Wage	–1.25E-06 $^{n/s}$	–0.0345	–0.83	–1.23E-06 $^{n/s}$	–0.0340	–0.80
Metropolitan	–2.92E-02 **	-	–2.25	–2.55E-02 **	-	–2.00
Micropolitan	8.22E-03 $^{n/s}$	-	0.61	1.00E-02 $^{n/s}$	-	0.76
n		3,075			3,075	
Adjusted R^2		0.60			0.61	

Notes: All models were estimated using White-adjusted standard errors clustered by state; all state fixed effects have been suppressed to conserve space; *** denotes two-tailed hypothesis test significant at $p < 0.01$; ** denotes two-tailed hypothesis test significant at $p < 0.05$; * denotes two-tailed hypothesis test significant at $p < 0.10$; $^{n/s}$ denotes two-tailed hypothesis test not significant.

Table 5. S2SLS Estimates of Education, Fire Protection, and Housing and Community Development Equations

	Education			Fire Protection			Housing and Community Development		
	Estimated Parameter	Elasticity	*t*-value	Estimated Parameter	Elasticity	*t*-value	Estimated Parameter	Elasticity	*t*-value
Constant	5.40E+00 ***	-	18.30	3.80E+00 ***	-	7.07	6.26E+00 ***	-	8.76
Spatial Lag	1.12E-01 ***	0.1119	3.08	2.23E-01 ***	0.2235	4.01	1.97E-01 ***	0.1970	3.58
Built Environment									
Density	–1.39E-02 ***	–0.0345	–6.07	–1.27E-02 n/s	–0.0318	–1.64	4.22E-02 ***	0.1124	2.91
% Developed	1.50E-01 ***	0.0128	4.08	1.02E+00 ***	0.0872	5.88	2.92E-01 n/s	0.0276	1.34
Median Housing Value	9.49E-07 ***	0.0813	4.57	4.87E-07 n/s	0.0418	0.70	–2.80E-06 ***	–0.2463	–3.37
% Housing < 1940	–1.56E-01 *	–0.0303	–1.81	5.34E-01 **	0.1039	2.41	2.83E-01 n/s	0.0549	0.81
Political Structure									
Per Capita Municipalities	4.89E-02 **	0.0147	1.99	–1.01E-01 n/s	–0.0304	–1.22	–3.78E-01 ***	–0.1028	–2.56
Per Capita Special Districts	3.56E-02 ***	0.0186	3.62	3.71E-02 n/s	0.0193	1.09	1.15E-01 **	0.0526	2.05
Growth and Demographics									
Population Change	–3.96E-01 ***	–0.0240	–3.29	–1.33E-01 n/s	–0.0081	–0.39	–9.97E-01 **	–0.0594	–2.12
Per Capita Income	9.96E-07 n/s	0.0226	1.24	8.93E-06 **	0.2029	2.38	–2.59E-06 n/s	–0.0590	–0.43
% White	–5.81E-02 n/s	–0.0496	–0.96	–1.20E-01 n/s	–0.1025	–0.71	–1.81E+00 ***	–1.5376	–7.42
% < 5 Years Old	6.33E+00 ***	0.6561	9.41	1.38E+00 n/s	0.1426	0.71	–1.50E+00 n/s	–0.1547	–0.44
Average Household size	–1.36E-01 **	–0.3606	–2.37	–5.92E-01 ***	–1.5753	–4.57	–9.02E-01 ***	–2.3975	–3.69
Sources of Revenue									
% Property Tax	4.29E-01 ***	0.3391	8.44	–1.16E+00 ***	–0.9120	–4.56	–2.43E-01 n/s	–0.1903	–0.84
Per Capita Federal Revenue	4.44E-05 n/s	0.0035	1.27	2.33E-04 ***	0.0186	3.03	1.06E-03 ***	0.0853	3.46
Per Capita State Revenue	2.32E-04 ***	0.2399	5.44	–2.14E-04 ***	–0.2214	–3.43	6.99E-05 n/s	0.0718	0.69
Per Capita Long-term Debt	–6.35E-07 n/s	–0.0012	–0.84	3.46E-06 n/s	0.0067	0.80	–6.57E-06 n/s	–0.0131	–1.28
County Size and Primacy									
County Land Area	1.16E-05 **	0.0072	2.45	6.05E-05 **	0.0374	1.96	4.42E-05 n/s	0.0262	1.23
Employment Ratio	1.81E-01 **	0.0690	3.30	1.80E+00 ***	0.6841	6.34	1.86E+00 ***	0.7240	5.29
Average Government Wage	2.26E-06 n/s	0.0624	1.63	7.04E-06 n/s	0.1946	1.39	–3.35E-06 n/s	–0.0940	–0.41
Metropolitan	–1.11E-02 n/s	-	–0.99	2.89E-01 ***	-	5.32	1.73E-01 ***	-	2.61
Micropolitan	–3.14E-05 n/s	-	0.00	3.32E-01 ***	-	7.55	5.91E-02 n/s	-	0.92
n			3,071			3,056			2,564
Adjusted R^2			0.51			0.42			0.25

Notes: All models were estimated using White-adjusted standard errors clustered by state; all state fixed effects have been suppressed to conserve space; *** denotes two-tailed hypothesis test significant at $p < 0.01$; ** denotes two-tailed hypothesis test significant at $p < 0.05$; * denotes two-tailed hypothesis test significant at $p < 0.10$; n/s denotes two-tailed hypothesis test not significant.

Table 6. S2SLS Estimates of Libraries, Parks and Recreation, and Police Protection Equations

	Libraries			Parks and Recreation			Police Protection		
	Estimated Parameter	Elasticity	*t*-value	Estimated Parameter	Elasticity	*t*-value	Estimated Parameter	Elasticity	*t*-value
Constant	7.52E-01 $^{n/s}$	-	1.62	7.09E-01 $^{n/s}$	-	1.24	3.76E+00 ***	-	12.21
Spatial Lag	1.63E-01 ***	0.1628	3.06	2.60E-01 ***	0.2598	5.34	3.77E-01 ***	0.3767	9.17
Built Environment									
Density	−1.25E-02 $^{n/s}$	−0.0320	−1.59	−1.44E-02 **	−0.0362	−2.30	−8.91E-03 *	−0.0222	−1.76
% Developed	6.02E-01 ***	0.0534	2.80	1.22E+00 ***	0.1048	6.38	4.36E-01 ***	0.0370	4.27
Median Housing Value	2.25E-06 ***	0.1966	2.77	1.91E-06 **	0.1649	2.51	1.13E-06 ***	0.0968	2.91
% Housing < 1940	4.60E-02 $^{n/s}$	0.0088	0.14	1.82E-01 $^{n/s}$	0.0354	0.65	1.60E-01 $^{n/s}$	0.0312	1.28
Political Structure									
Per Capita Municipalities	−3.10E-01 ***	−0.0869	−2.89	−2.01E-01 *	−0.0592	−1.91	−7.96E-02 *	−0.0239	−1.91
Per Capita Special Districts	6.81E-02 **	0.0332	2.04	−2.58E-02 $^{n/s}$	−0.0133	−0.41	2.94E-02 $^{n/s}$	0.0155	1.16
Growth and Demographics									
Population Change	−3.27E-01 $^{n/s}$	−0.0204	−1.04	−9.34E-01 **	−0.0568	−2.33	−4.08E-01 **	−0.0247	−2.53
Per Capita Income	8.84E-06 *	0.2013	1.81	1.20E-05 ***	0.2734	2.65	1.20E-06 $^{n/s}$	0.0273	0.63
% White	3.98E-01 *	0.3401	1.87	9.48E-01 ***	0.8101	5.19	−3.32E-01 ***	−0.2836	−4.11
% < 5 Years Old	8.91E-01 $^{n/s}$	0.0923	0.36	2.96E+00 $^{n/s}$	0.3066	1.55	1.44E+00 $^{n/s}$	0.1495	1.35
Average Household size	−1.74E-01 $^{n/s}$	−0.4625	−1.08	−1.53E-01 $^{n/s}$	−0.4071	−1.20	−4.58E-01 ***	−1.2183	−5.91
Sources of Revenue									
% Property Tax	3.37E-01 $^{n/s}$	0.2662	1.21	−7.73E-01 ***	−0.6099	−3.37	−4.01E-01 ***	−0.3171	−3.82
Per Capita Federal Revenue	9.35E-05 $^{n/s}$	0.0075	0.90	1.88E-04 *	0.0150	1.67	−2.82E-05 $^{n/s}$	−0.0022	−0.54
Per Capita State Revenue	−3.96E-05 $^{n/s}$	−0.0412	−0.60	−1.68E-04 ***	−0.1740	−2.71	5.83E-05 **	0.0602	2.14
Per Capita Long-term Debt	1.41E-05 ***	0.0269	3.59	6.19E-06 *	0.0121	1.81	6.60E-07 $^{n/s}$	0.0013	0.33
County Size and Primacy									
County Land Area	8.10E-05 ***	0.0511	2.58	1.16E-04 ***	0.0721	3.97	1.44E-05 $^{n/s}$	0.0089	1.20
Employment Ratio	1.60E+00 ***	0.6151	5.24	2.67E+00 ***	1.0197	7.19	1.01E+00 ***	0.3837	6.54
Average Government Wage	2.15E-06 $^{n/s}$	0.0599	0.34	3.76E-06 $^{n/s}$	0.1042	0.63	5.03E-06 **	0.1389	2.06
Metropolitan	4.23E-02 $^{n/s}$	-	0.81	1.53E-01 ***	-	3.09	8.95E-02 ***	-	3.94
Micropolitan	−6.19E-02 $^{n/s}$	-	−1.08	1.46E-01 ***	-	3.12	5.04E-02 ***	-	2.81
n			2,818			3,012			3,075
Adjusted R^2			0.34			0.46			0.60

Notes: All models were estimated using White-adjusted standard errors clustered by state; all state fixed effects have been suppressed to conserve space; *** denotes two-tailed hypothesis test significant at $p < 0.01$; ** denotes two-tailed hypothesis test significant at $p < 0.05$; * denotes two-tailed hypothesis test significant at $p < 0.10$; $^{n/s}$ denotes two-tailed hypothesis test not significant.

Table 7. S2SLS Estimates of Roadways, Sewerage, and Solid Waste Management Equations

	Roadways			Sewerage			Solid Waste Management		
	Estimated Parameter	Elasticity	*t*-value	Estimated Parameter	Elasticity	*t*-value	Estimated Parameter	Elasticity	*t*-value
Constant	3.18E+00 ***	-	8.47	3.78E+00 ***	-	7.01	3.39E+00 ***	-	5.51
Spatial Lag	1.90E-01 ***	0.1898	5.23	1.45E-01 ***	0.1448	2.84	3.06E-01 ***	0.3064	6.16
Built Environment									
Density	–2.25E-02 ***	–0.0562	–3.29	–1.58E-02 n/s	–0.0399	–1.64	–8.85E-03 n/s	–0.0222	–0.89
% Developed	3.78E-01 **	0.0321	2.09	8.33E-01 ***	0.0718	4.49	2.66E-01 n/s	0.0229	1.41
Median Housing Value	1.35E-06 ***	0.1155	2.76	2.36E-06 ***	0.2035	3.82	3.87E-07 n/s	0.0333	0.42
% Housing < 1940	5.97E-01 ***	0.1164	3.75	7.40E-01 ***	0.1451	3.30	3.11E-01 n/s	0.0603	1.07
Political Structure									
Per Capita Municipalities	2.45E-01 ***	0.0738	4.66	–1.16E-01 n/s	–0.0347	–1.49	–2.52E-01 ***	–0.0750	–3.12
Per Capita Special Districts	9.42E-02 ***	0.0497	3.23	–6.45E-03 n/s	–0.0033	–0.21	7.47E-02 **	0.0376	1.98
Growth and Demographics									
Population Change	–3.77E-01 *	–0.0227	–1.66	–5.50E-02 n/s	–0.0033	–0.16	–1.35E+00 ***	–0.0812	–3.94
Per Capita Income	8.92E-07 n/s	0.0203	0.32	1.51E-06 n/s	0.0344	0.35	–5.07E-06 n/s	–0.1153	–1.16
% White	5.18E-01 ***	0.4428	3.63	–1.22E-01 n/s	–0.1046	–0.72	–2.81E-01 n/s	–0.2397	–1.70
% < 5 Years Old	3.72E+00 ***	0.3857	2.65	–4.29E+00 **	–0.4435	–2.32	–1.26E-01 n/s	–0.0130	–0.06
Average Household size	–2.86E-01 ***	–0.7610	–3.62	–1.77E-01 n/s	–0.4712	–1.21	–5.04E-01 ***	–1.3409	–2.86
Sources of Revenue									
% Property Tax	1.35E-01 n/s	0.1067	0.76	–6.92E-01 ***	–0.5456	–2.68	–5.44E-02 n/s	–0.0429	–0.25
Per Capita Federal Revenue	1.36E-05 n/s	0.0011	0.27	1.09E-04 n/s	0.0087	1.21	–1.15E-04 n/s	–0.0090	–1.23
Per Capita State Revenue	1.24E-04 ***	0.1283	2.64	3.64E-05 n/s	0.0377	0.59	8.31E-05 n/s	0.0859	1.56
Per Capita Long-term Debt	6.95E-06 ***	0.0134	2.91	5.89E-06 n/s	0.0114	1.37	1.91E-06 n/s	0.0037	0.46
County Size and Primacy									
County Land Area	4.79E-05 ***	0.0296	3.13	5.26E-05 ***	0.0327	2.44	8.33E-05 ***	0.0509	2.49
Employment Ratio	7.66E-01 ***	0.2916	4.87	1.56E+00 ***	0.5946	3.59	1.49E+00 ***	0.5674	6.13
Average Government Wage	–1.67E-06 n/s	–0.0461	–0.51	–5.58E-06 n/s	–0.1545	–1.18	6.14E-07 n/s	0.0170	0.10
Metropolitan	–1.49E-01 ***	-	–4.56	2.07E-01 ***	-	4.13	–9.22E-02 **	-	–1.94
Micropolitan	–1.19E-01 ***	-	–5.08	2.41E-01 ***	-	6.65	3.34E-02 n/s	-	0.68
n			3,056			2,979			2,995
Adjusted R^2			0.68			0.36			0.31

Notes: All models were estimated using White-adjusted standard errors clustered by state; all state fixed effects have been suppressed to conserve space; *** denotes two-tailed hypothesis test significant at $p < 0.01$; ** denotes two-tailed hypothesis test significant at $p < 0.05$; * denotes two-tailed hypothesis test significant at $p < 0.10$; n/s denotes two-tailed hypothesis test not significant.

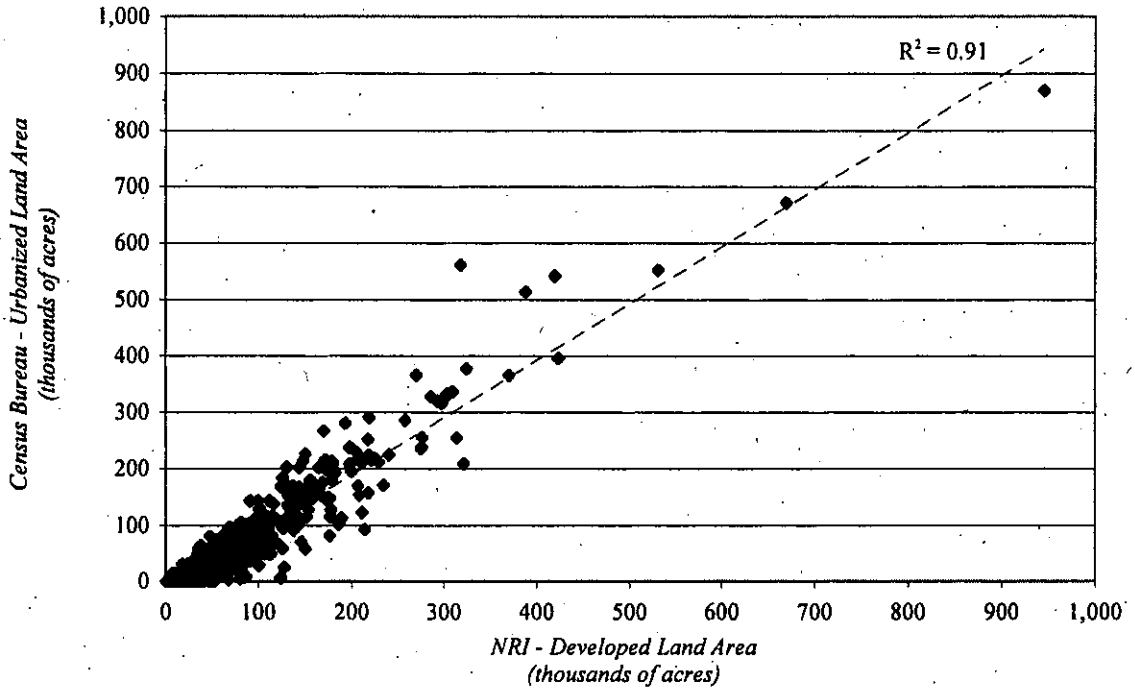

Figure 1. The NRI Measure of Developed Land Versus the Census Bureau's Measure of Urbanized Land

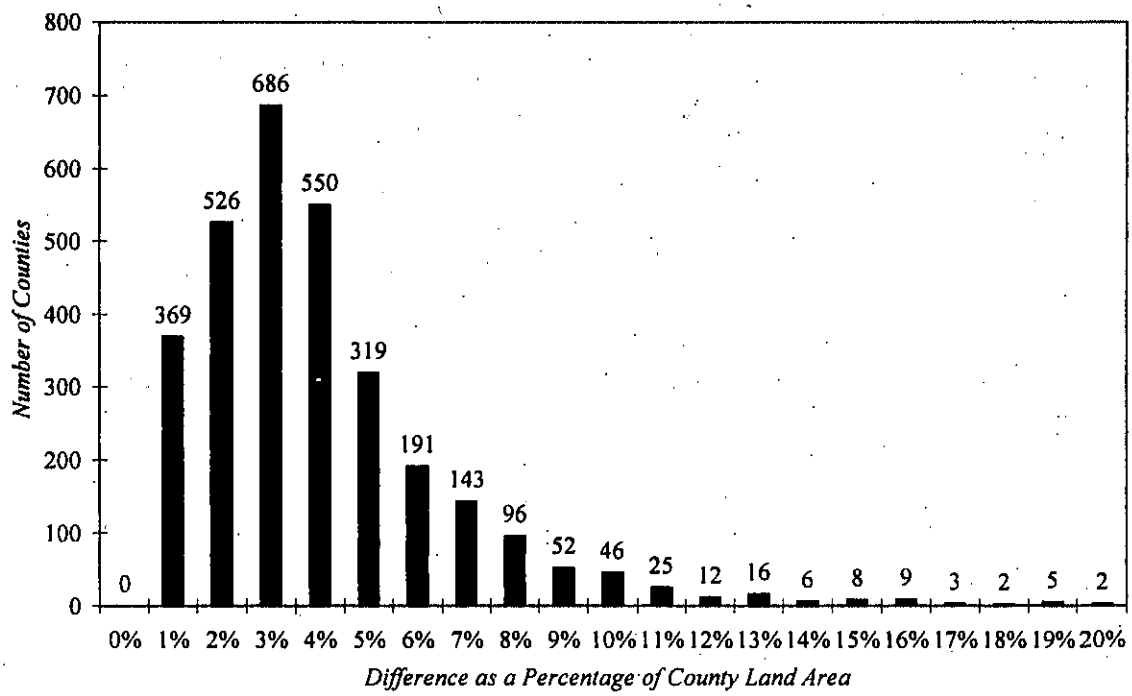

Figure 2. Absolute Value of the Difference Between Acres of Developed Land (NRI) and Acres of Urbanized Land (Census) as a Percentage of County Land Area

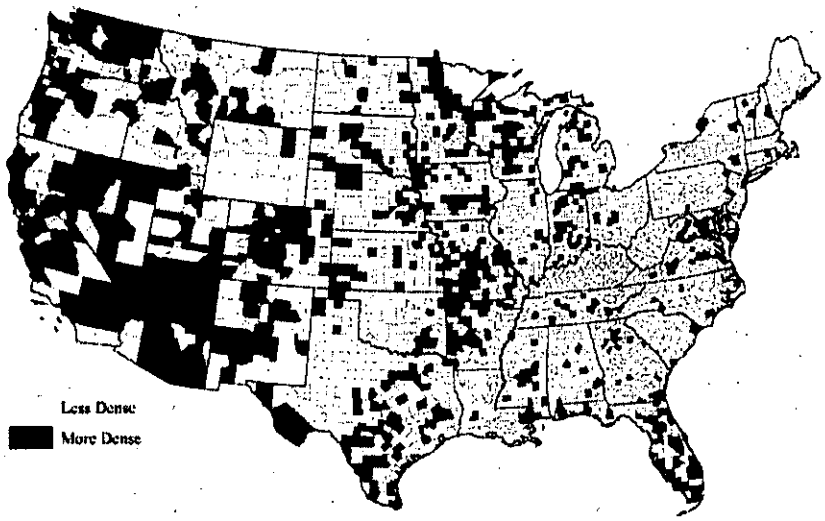

Figure 3. Change in Density, 1982 – 1997

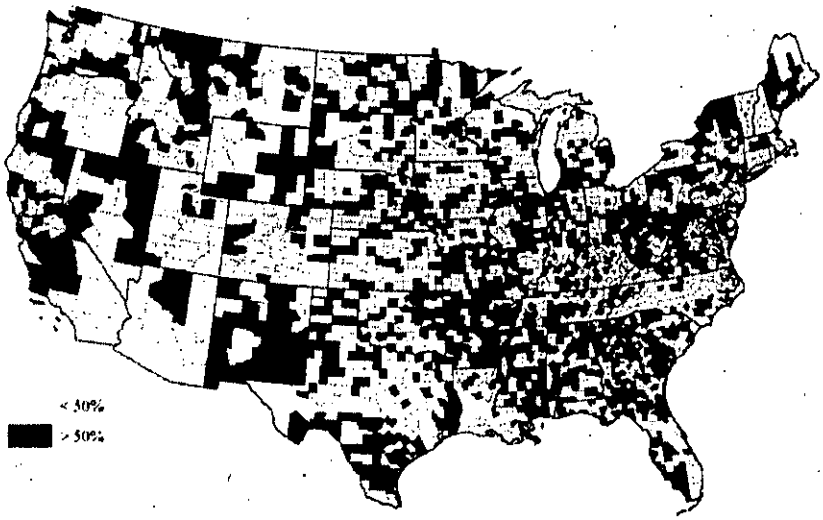

Figure 4. Percent Land Absorption, 1992 – 1997

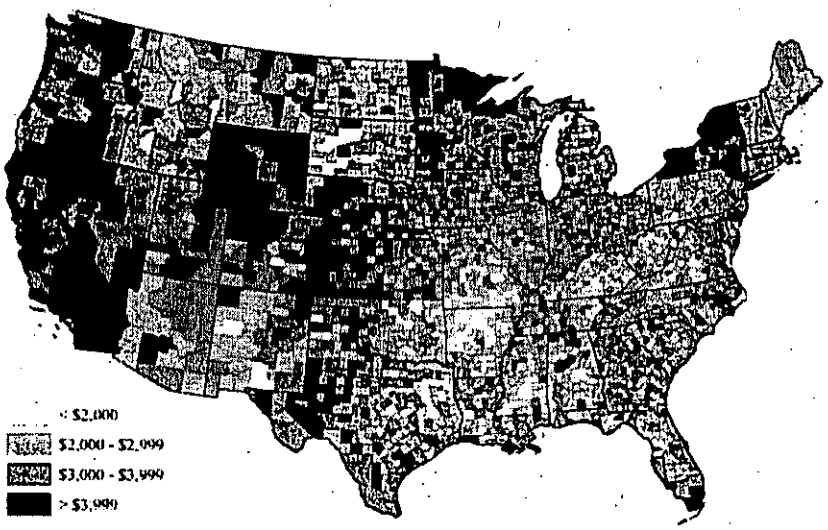

Figure 5. Per Capita Total Direct Expenditure, FY 2002

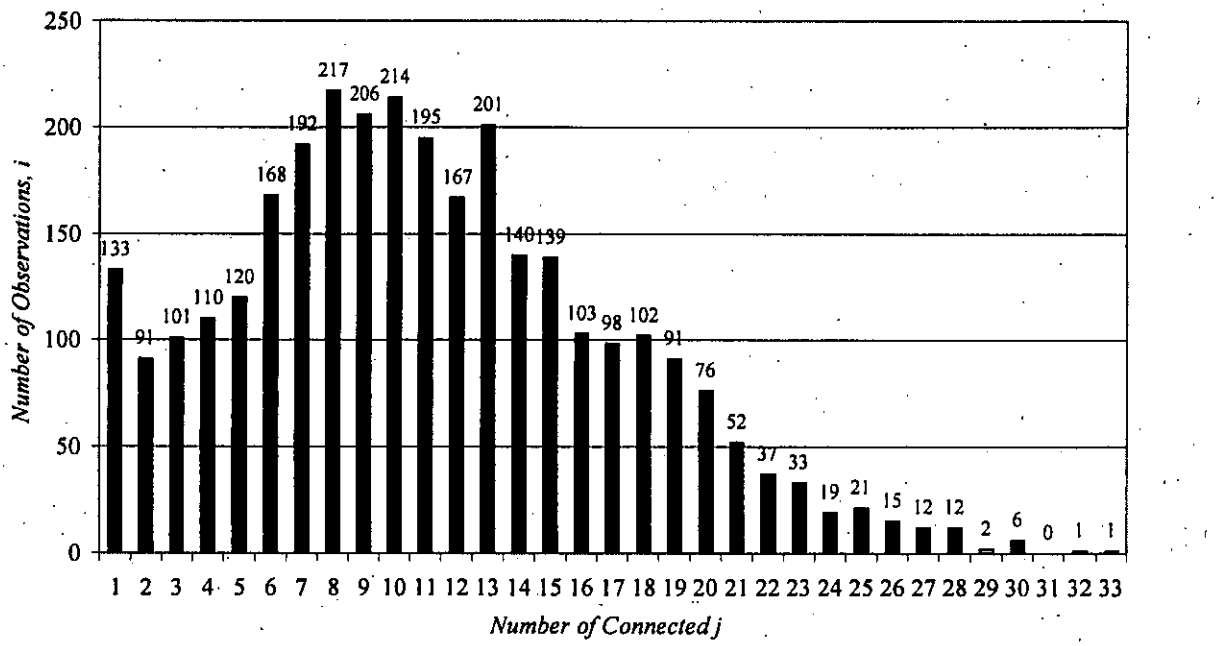

Figure 6. Connectivity of W_{ij}

EXHIBIT 9

BAAQMD CEQA GUIDELINES
Assessing the Air Quality Impacts of Projects and Plans

Prepared by the Planning and Research Division of the
Bay Area Air Quality Management District
939 Ellis Street
San Francisco, CA 94109

December, 1999

This document is intended to serve as a guide for those who prepare or evaluate air quality impact analyses for projects and plans in the San Francisco Bay Area. The GUIDELINES include information on legal requirements, BAAQMD rules, plans and procedures, methods of analyzing air quality impacts, thresholds of significance, mitigation measures, and background air quality information. Copies and updates are available from the BAAQMD Public Information Office at (415) 749-4900. Questions on content may be addressed to the BAAQMD's Planning and Transportation Section at (415) 749-4995.

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CHAPTER 3 - ASSESSING AIR QUALITY IMPACTS

3.1 Introduction

This chapter provides guidance on how to evaluate the impact(s) of a proposed project or plan[11] on local and regional air quality. The impact assessment portion of an environmental document should evaluate all stages of a project. This chapter addresses the following issues:

- Information that should be discussed in the description of the project's environmental setting
- Evaluating emissions from project construction
- Calculating emissions from project operations, including:
  - mobile source (or "indirect") emissions
  - localized carbon monoxide concentrations
  - stationary source emissions
  - odor impacts
  - toxic air contaminants
- Cumulative impacts

The basic method for calculating project emissions is to apply specific emission factors to sources of air pollutants whose magnitude and characteristics are either known or estimated. Emission factors may be defined as standardized relationships between particular sources of air pollution, such as motor vehicles or pieces of industrial equipment, and their air pollutant emissions. For example, emission factors for motor vehicles generally specify the amount (in grams) of certain air pollutants emitted, per mile traveled. This chapter provides emission factors and quantification procedures for construction activities, motor vehicles, and stationary sources. This chapter also describes methods for evaluating air quality impacts that are not easily quantified, such as impacts associated with objectionable odors.

Once the impacts of a proposed project have been identified, a determination must be made as to whether the project would have a significant adverse impact on the environment. Significance criteria discussed in Chapter 2 of these Guidelines should be used in making this determination. For any potentially significant impacts, mitigation measures should be incorporated into the project to reduce the impact(s) to a level of insignificance. Chapter 4 provides guidance on mitigation measures.

CEQA requires that the project description include a list of agencies that are expected to use the EIR in their decision-making, and a list of the approvals for which the EIR will be used (State CEQA Guidelines Section 15124(d)). If the project will require a permit from the District, all applicable District regulations should be cited in the project description section of the EIR.

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[11] This chapter discusses how to evaluate the air quality impacts of development projects and plans. For the sake of brevity, this chapter generally refers only to "project(s)". The reader should note, however, that unless specifically noted otherwise, the discussion also addresses plans.

3.2 Environmental Setting

In order to assess whether a proposed project would have a significant air quality impact, it is necessary to prepare a detailed description of the environmental setting in which the project would be located. Developing the environmental setting, or baseline, is necessary for establishing a basis for comparing the project's subsequent air quality impacts. The environmental setting should also discuss the adverse health effects of air pollutants. With respect to air quality impacts, the description of the project's environmental setting should include the following components:

- Climate and topography influencing the project's impacts on local and regional air quality should be described. Appendix D provides an overview of how climate and topography affect air quality conditions. Appendix D also provides more detailed information on climate, topography and pollution potential for various climatological subregions in the Bay Area.

- Existing air quality conditions should be described. A discussion of trends and expected future conditions (without the project) also should be included. Data from the air quality monitoring station(s) closest to the project site should be included. Appendix C provides ambient air quality monitoring data. Appendix C also provides projections of expected emissions for future years.

- Any sensitive receptors located near the project site should be identified. Areas that are currently undeveloped but that may include sensitive receptors in the future, for example a future school site or residential area, also should be identified.

- Sources of air pollutants located near the project site (including existing sources *at* the project site, if applicable) should be identified. The description of existing air pollution sources should include criteria pollutants, toxic air contaminants and nuisance emissions such as odors and dust. More detailed information regarding existing emissions, including emissions of odors and toxic air contaminants, may be obtained by contacting the District.

- The transportation system serving the project site should be described. Describe traffic conditions, including traffic volumes and levels of service; transit service; and other relevant transportation facilities such as bicycle facilities, shuttle services, telecommuting centers, etc. The discussion of the existing transportation system should describe both current conditions and future conditions without the project.

- Any special circumstances, such as sources of odors, toxic air contaminants or accidental releases of hazardous materials located near the project site, should be described.

- Provide a discussion of why air pollution is a concern, including adverse health effects of criteria and toxic pollutants, nuisance impacts such as odors and dust, and other effects such as reduced visibility and plant damage. Appendix B provides information on effects of air pollution.

Special emphasis should be placed on air quality resources that are rare or unique to the region and would be affected by the project (State CEQA Guidelines Section 15125 (a)). Regulatory requirements identify areas which are pristine and classified as Class I airsheds. These airsheds are subject to specific standards (Prevention of Significant Deterioration requirements). Within the Bay Area, the Point Reyes National Seashore is designated as a Class I area. Projects proposed in the vicinity of that area should note the project's proximity to a Class I area in the description of the project setting.

3.3 Evaluating Construction Emissions

Construction activities result in air pollutant emissions and should be addressed in environmental documents. Although construction-related emissions are generally temporary in duration, they can be substantial and can represent a significant impact on air quality. This is particularly true with respect to emissions of PM_{10}. Construction-related emissions come from a variety of activities including: 1) grading, excavation, roadbuilding and other earthmoving activities, 2) travel by construction equipment, especially on unpaved surfaces, and 3) exhaust from construction equipment. Demolition of buildings also generates PM_{10} emissions, and is of particular concern if the building(s) contain any asbestos-bearing materials.

PM_{10} emissions from construction activity can vary considerably depending on factors such as the level of activity, the specific operations taking place, and weather and soil conditions. As noted in Section 2.3, the District emphasizes implementation of effective and comprehensive control measures rather than detailed quantification of construction emissions. The District urges Lead Agencies to consider the size of the construction area and the nature of the activities that will occur, and require the implementation of all feasible control measures (indicated in Table 2).

If a Lead Agency wants to quantify construction emission, however, generalized emission factors are available. U.S. EPA has developed an approximate emission factor for construction-related emissions of total suspended particulate of 1.2 tons per acre per month of activity. This factor assumes a moderate activity level, moderate silt content in soils being disturbed, and a semi-arid climate. ARB estimates that 64% of construction-related total suspended particulate emissions is PM_{10}.[12] This yields the following **emission factors for uncontrolled construction-related PM_{10} emissions:**

- 0.77 tons per acre per month of PM_{10}, or
- 51 lbs. per acre per day of PM_{10}.[13]

The emission factors provided above are approximate values and do not reflect site-specific conditions and operations. EPA recommends that if construction emissions from a specific site are to be quantified, the construction process should be divided into component operations (e.g., bulldozing, loading of excavated materials, vehicular traffic, etc.) and more specific emission factors should be used. See Section 13.2.3, Heavy Construction Operations, and related sections

[12] California Air Resources Board, Methods for Assessing Area Source Emissions in California, September 1991.
[13] EPA's emission factor was derived based on the assumption that construction activity occurs 30 days per month. See Section 13.2.3, Heavy Construction Operations, U.S. EPA, Compilation of Air Pollutant Emission Factors, Volume I: Stationary, Point and Area Sources, AP-42, 5th Edition, January 1995.

of U.S. EPA, Compilation of Air Pollutant Emission Factors, Volume I: Stationary, Point and Area Sources, AP-42, 5th Edition, January 1995 for further information.

In addition to particulate emissions from earthmoving, air pollutants also are emitted in the exhaust of construction equipment. Table 7 presents emission factors for estimating construction equipment emissions (assuming an average of 0.27 gallons of fuel burned per cubic yard of earth moved). These emission factors represent a composite fleet of heavy and light duty construction equipment in the Bay Area. Emissions from construction equipment during building construction, as differentiated from earthmoving in site preparation, vary greatly from project to project. Table 7 can be used to estimate construction exhaust emissions based on gallons of fuel consumed or cubic yards of material moved. Lead Agencies also may consult the most recent edition of U.S. EPA's AP-42 for emission factors for specific types of construction equipment.

TABLE 7
HEAVY AND LIGHT DUTY CONSTRUCTION EQUIPMENT EXHAUST EMISSION FACTORS

Contaminant	gm/yd^3*	gm/gallon**
PM_{10}	2.2	8.0
CO	138.0	511.0
ROG	9.2	34.0
NO_x	42.4	157.0
SO_x	4.6	17.0

* Grams per cubic yard of earth moved. ** Grams per gallon of fuel burned.

Project construction sometimes involves the demolition of existing buildings. Demolition also produces PM_{10} emissions. PM_{10} emissions from demolition activities may be estimated using the following emission factor: 0.00042 lbs PM_{10} per cubic feet of building volume.[14] Buildings constructed prior to 1980 often include building materials containing asbestos. As noted in Section 2.3, Thresholds of Significance, the demolition, renovation or removal of asbestos-containing building materials is subject to District Regulations. The District's Enforcement Division should be consulted prior to commencing demolition of a building containing asbestos building materials.

The emission factors provided above represent uncontrolled emissions. Section 2.3, Thresholds of Significance, and Section 4.2, Mitigating Construction Impacts, provide information on mitigating construction-related emissions. If an environmental document will include quantification of construction emissions, the Lead Agency should be sure to apply the estimated control effectiveness to the appropriate emission source. For example, watering a construction site can reduce PM_{10} emissions from earthmoving activities, but will not reduce equipment exhaust emissions.

[14] South Coast Air Quality Management District, CEQA Air Quality Handbook, April 1993.

3.4 Calculating Emissions from Project Operations

Introduction

Several types of emissions should be considered when evaluating the impacts of a project's operations. For many types of land use development projects, the principal sources of air pollutant emissions are the motor vehicle trips generated by the project. These are often referred to as "indirect sources" and include projects such as shopping centers, office buildings, arenas and residential developments. The evaluation of an indirect source's impact should consider localized pollutants such as carbon monoxide and PM_{10}, as well as regional pollutants such as ozone. This section describes methods for estimating total project emissions from motor vehicles (see "Calculating Mobile Source Emissions"), as well as methods for estimating localized CO concentrations (see "Calculating Carbon Monoxide Concentrations").

Most land use projects also generate "area source" emissions. Area sources are sources that individually emit fairly small quantities of air pollutants, but which cumulatively may represent significant quantities of emissions. Water heaters, fireplaces, lawn maintenance equipment, and application of paints and lacquers are examples of area source emissions.

Certain projects also may generate stationary, or "point", source emissions. Although most area sources discussed above are usually stationary, the terms stationary or point source usually refer to equipment or devices operating at industrial and commercial facilities. Examples of facilities with stationary sources include manufacturing plants, quarries, print shops and gasoline stations.

Depending on the nature of the proposed project and/or the land uses near the project site, other air quality impacts associated with project operation may arise. These impacts include odor problems, emissions of toxic air contaminants and accidental releases of hazardous/toxic materials. Most of this chapter addresses the evaluation of the impacts a project would have on the surrounding environment. However, with respect to potential impacts related to odors, toxics, and accidental releases it is equally important to also consider the impact of the surrounding environment on the proposed project. For example, if a residential development were proposed for a site near an existing wastewater treatment plant, exposure of the new residents to objectionable odors would be a significant air quality impact associated with the project.

Calculating Mobile Source Emissions

As noted above, virtually all land use development projects result in indirect source emissions due to the motor vehicle trips generated by the project. The following discussion describes how to calculate these emissions.

Whenever possible, the air quality impact analysis for a project should be based on the results of a traffic study conducted specifically for the project. The number of vehicle trips that a project will generate, and the average speed and length of the trips, will vary depending on a variety of factors such as the specific nature of the project and its location. If project-specific data are not available, then the default values provided in this chapter may be used. The most recently

published set of trip generation rates from the Institute of Transportation Engineers (ITE) also may be used.

Transportation analyses for projects consisting of two or more land uses often adjust the number of anticipated new vehicle trips to account for internal trips. These adjustments (or "capture rates") reflect the fact that some trips at multi-use projects will occur internally to the project. As a result, the total number of new vehicle trips associated with the project would be less than the sum of the trips expected from all of the individual land uses. Traffic studies for such projects should include a clear explanation of all capture rate assumptions. Internal trips should be excluded from the air quality analysis only if they are expected to occur by walking, bicycling or other nonpolluting mode.

Traffic studies for commercial projects often distinguish between primary trips and pass-by and diverted linked trips.[15] The air quality analysis for such projects should include emissions from pass-by and diverted linked trips. While the emissions from these trips will be lower than for primary trips (due to shorter trip lengths), they still do produce emissions (trip end emissions and some running emissions). Adjustments can be made to trip length and cold start/hot start assumptions for pass-by and diverted linked trips. Assumptions regarding pass-by and diverted linked trips should be clearly identified and the underlying rationale explained.

ARB calculates motor vehicle emissions using computer models. Currently, ARB is using the Motor Vehicle Emissions Inventory model (MVEI). Motor vehicle emission factors are calculated with the EMFAC model, which is a component of MVEI. ARB periodically revises emission factors. At the time of this writing (December 1999), the most current set of motor vehicle emission factors is MVEI7G, Version 1.0c. The emission factors provided in these Guidelines (Table 10) are based on MVEI7G,1.0c. The differences between successive versions of the model can lead to significant variation in estimates of mobile source emissions calculated using these emission factors. As of December 1999, ARB was preparing updated emission factors ("EMFAC2000"), but it is uncertain when the new emission factors will be released. As future revisions to the model are approved by ARB, the District will revise the emission factors in Table 10. Lead Agencies should always use the most recent emission factors prepared by the District.

URBEMIS7G

The Air Resources Board developed the URBEMIS model to calculate mobile source emissions associated with various types of land use projects, using EMFAC emission factors and ITE trip generation rates. URBEMIS calculates emissions of ROG, NO_x, CO and PM_{10}, as well as total vehicle trips. ARB's last update of the model was URBEMIS5, released in 1995. In 1998, the San Joaquin Valley Unified Air Pollution Control District coordinated an update of the URBEMIS model, released as URBEMIS7G. The new version is different from previous versions in several ways. URBEMIS7G uses more recent motor vehicle emission factors, EMFAC7G, as well as updated ITE trip generation rates. It can calculate construction emissions

[15] Primary trips are trips made specifically to visit a particular facility. Pass-by trips are trips made as intermediate stops on the way to a primary trip destination. Diverted linked trips are trips attracted from roadways near a facility, but which require a diversion from the roadway to another roadway to access the facility.

and area source emissions, and also can estimate emission reductions from construction and area source mitigation measures. URBEMIS7G also can calculate air quality benefits of mitigation measures to reduce motor vehicles emissions. The model includes options to minimize "double-counting" of trips in mixed use projects and to account for "pass-by" trips.

URBEMIS7G is a sketch planning tool for calculating criteria air pollutant emissions from land use development projects. URBEMIS7G is not appropriate for calculating air pollutant emissions associated with plans. Other models, such as the Direct Travel Impact Model (DTIM), may be used to quantify (mobile source) air pollutant emissions associated with plans.

The program provides default values for all modeling parameters for several regions within California, including the San Francisco Bay Area. The user may use the default values or may provide project-specific values for parameters including trip generation, trip length, trip speed, vehicle fleet mix, percentage of cold starts, and temperature. The District recommends that the following input assumptions be used for projects in the San Francisco Bay Area. If project-specific travel data are available, that data should be used. The source(s) of any project-specific data should be described.

Recommended URBEMIS7G Inputs for the San Francisco Bay Area

Trip Generation - Use the default values for the San Francisco Bay Area or the most recent version of ITE's *Trip Generation* manual if project-specific data are not available.

Fleet Mix – Generally, use the default values for the San Francisco Bay Area. If evaluating a project that is likely to have a different fleet mix, e.g., an industrial project with many heavy duty vehicle trips, make the necessary adjustments.

Temperature - Meteorological conditions in the Bay Area vary considerably between climatological subregions. Refer to Appendix D for subregional information. Use mean summer maximum temperatures for all pollutants except CO. Use mean winter minimum temperatures for CO.

Trip Length - Use the data in Table 9 or the most recent edition of MTC's *Bay Area Travel Forecasts* if project-specific data are not available.

Variable Starts - Use the default values for the San Francisco Bay Area if project-specific data are not available.

Trip Speed - Use 25 mph for San Francisco and 30 mph for all other Bay Area counties if project-specific data are not available.

Percent Trip - Use the default values for the San Francisco Bay Area if project-specific data are not available.

The URBEMIS7G program and Users'Guide is available free of charge on the ARB's website, at www.arb.ca.gov/urbemis7/urbemis7.htm. Because of URBEMIS7G's many enhancements, its

ease of use, and its ready availability, the District strongly encourages Lead Agencies to use the model to estimate motor vehicle emissions from development proposals. Because URBEMIS7G includes the most current emission factors (EMFAC7G), as well as other improvements, older versions of URBEMIS should not be used.

Manual Calculation

The District has developed a methodology for manually calculating mobile source emissions associated with land use development. The manual method may be useful for project screening purposes or for quickly generating rough estimates of project impacts. For this calculation it is necessary to provide the following inputs: trip generation rate, average trip length, exhaust emission factors (varying by analysis year), and trip end emission factors.

As previously noted, project-specific traffic data should be used in the air quality analysis whenever it is available. If project-specific data are not available, the default values provided in these Guidelines may be used. Table 8 provides trip generation rates for various types of land uses. The trip generation rates provided in Table 8 are based on data in the Institute of Transportation Engineers (ITE) *Trip Generation*, 6th Edition, 1997. For land use projects not included in Table 8 and for which project-specific data are not available, consult the most recent edition of ITE's *Trip Generation* manual.

Table 9 provides average trip lengths for each of the nine Bay Area counties. These trip lengths were derived from MTC travel data used by the District in the preparation of the Bay Area mobile source emission inventory.

Table 10 provides emission factors, based on MVEI7G,1.0c. The emission factors in Table 10 are representative of Bay Area driving conditions and the District's emission inventory. They reflect the mix of vehicles typical of Bay Area roadways, as well as climatic conditions assumed in the emission inventory. The emission factors also include the benefits of the 1995 motor vehicle Inspection and Maintenance program and reformulated fuels requirements.

Table 11 provides trip end emission factors. These include start emissions for ROG, NO_x and CO (reflecting cold and hot start emissions consistent with Bay Area driving conditions) and "hot soak" emissions for ROG. The total mobile source emissions from a project are the sum of trip end emissions and "running" emissions.

TABLE 8
AVERAGE TRIP GENERATION RATES FOR SELECTED LAND USES

LAND USE	UNIT OF MEASURE	TRIP RATE	LAND USE	UNIT OF MEASURE	TRIP RATE
RESIDENTIAL			***INDUSTRIAL***		
Single Family Housing	D.U.	9.6	Light Industrial	1000 GSF	7.0
Apartment	D.U.	6.6	Industrial Park	1000 GSF	7.0
Resid. Condominium	D.U.	5.9	Manufacturing	1000 GSF	3.8
Mobile Home Park	D.U.	4.8	Warehousing	1000 GSF	5.0
RETAIL			Mini Warehouse	1000 GSF	2.5
Discount Store (Saturday)	1000 GFA	72.0	***OFFICE***		
Factory Outlet Center (Saturday)	1000 GFA	41.0	General Office Building	1000 GSF	11.0
Shopping Center (Saturday)	1000 GLA	50.0	Corp. Headquarters Building	1000 GSF	7.7
Supermarket (Saturday)	1000 GSF	177.6	Gov't Office Building	1000 GSF	68.9
Convenience Market (24 hour) (Saturday)	1000 GSF	863.1	Medical/Dental Office Building	1000 GSF	36.1
INSTITUTIONAL			Office Park	1000 GSF	11.4
High School	1000 GSF	13.3	Business Park	1000 GSF	12.8
Community College	1000 GSF	18.4	Research and Development Center	1000 GSF	8.1
Church (Sunday)	1000 GSF	36.6	***RECREATIONAL***		
Hospital	1000 GSF	16.8	Movie Theater (w/Matinee) (Saturday)	screen	529.5
Library	1000 GSF	54.0	Racquet Club (Saturday)	1000 GSF	24.5
Post Office	1000 GSF	108.2	Golf Course (Saturday)	Acre	5.8
LODGING					
Hotel	Room	8.2			
Motel	Room	5.6			

GSF = Gross Square Feet; GLA = Gross Leasable Area; GFA = Gross Floor Area; D.U. = Dwelling Unit

All rates are for weekdays unless otherwise noted.

For some land uses, trip rates will vary depending upon size of project. See the most recent edition of *Trip Generation*, Institute of Transportation Engineers.

Source: Institute of Transportation Engineers, *Trip Generation*, 6th Ed. 1997.

TABLE 9
AVERAGE TRIP LENGTH (in miles) BY COUNTY AND YEAR

County	1995	2000	2005	2010	2015
Alameda	7.7	7.7	7.7	7.3	7.0
Contra Costa	7.5	7.5	7.5	7.2	6.9
Marin	8.0	8.0	8.2	7.7	7.2
Napa	6.5	6.5	6.5	6.2	5.9
San Francisco	6.5	6.5	6.2	6.0	5.9
San Mateo	8.0	7.8	7.7	7.5	7.2
Santa Clara	6.9	6.9	6.9	6.9	6.9
Solano	10.4	10.1	9.8	8.8	8.2
Sonoma	7.2	7.0	6.9	6.5	6.2
District Average	7.5	7.4	7.3	7.6	6.9

Average trip lengths are based on MTC data used in preparation of Bay Area mobile source emission inventory.

TABLE 10
AVERAGE EXHAUST EMISSION RATES

	Emissions (grams per mile)				
Year	ROG	NO_x	CO	SO_x	PM_{10}
1995	1.08	2.04	13.45	0.06	0.47
2000	0.62	1.42	7.27	0.03	0.45
2005	0.36	0.97	4.63	0.03	0.44
2010	0.22	0.76	3.66	0.03	0.44
2015	0.15	0.66	3.07	0.03	0.44

Notes:

1) Emission rates from CARB's MVEI7G,1.0c (5/97).
2) Fleet mix as per CARB's MVEI7G,1.0c (5/97).
3) Inspection and Maintenance Program effectiveness included.
4) Ambient temperatures consistent with District Planning Inventory (varies throughout region).
5) ROG emission rates include evaporative running loss emissions.
6) Particulate matter emission rates include exhaust, tire wear, and entrained road dust emissions.
7) Trip end emissions are not included and must be calculated separately as described in the text.

Mobile source emissions from land use projects may be calculated using the equation provided below. A separate calculation must be made for each pollutant.

$$E = (U \times T) \times [(L \times R) + S]$$

Where:

E equals total emissions (of each pollutant), in grams per day;

U equals number of units in the project, e.g. number of dwelling units or thousands of square feet in shopping center buildings (see units in Table 8);

T equals trip generation rate, or average trips per day generated per unit of land use (Table 8);

L equals average trip length, in miles per trip (Table 9);

R equals motor vehicle emission rate, or emission factor, for each pollutant, by analysis year (Table 10);

S equals trip end emissions, comprised of start emissions for ROG, NO_x and CO, and "hot soak" emissions for ROG (Table 11).

To convert grams per day to pounds per day, divide the total by 454. To convert grams per day to tons per day, divide the total by 908,000.

TABLE 11
TRIP END EMISSION FACTORS
(grams per trip)

Year	ROG	NO_x	CO
1995	3.44	1.89	49.89
2000	2.20	1.35	35.53
2005	1.36	1.08	21.07
2010	0.79	0.89	12.85
2015	0.50	0.78	8.33

Calculating Carbon Monoxide Concentrations

Emissions and ambient concentrations of carbon monoxide have decreased greatly in recent years. These improvements are due largely to the introduction of cleaner burning motor vehicles and motor vehicle fuels. No exceedances of the State or national CO standard have been recorded at any of the region's monitoring stations since 1991. The Bay Area has attained the State and national CO standard.

Despite this progress, however, localized CO concentration still warrant concern in the Bay Area and should be addressed in environmental documents. The reasons for this are twofold. First, State and federal laws require the region to attain *and maintain* ambient air quality standards. The region must ensure that increased motor vehicle use and congestion do not nullify the great strides that have been made with respect to ambient concentrations of CO. Secondly, the region must safeguard against localized high concentrations of CO that may not be recorded at monitoring sites. Because elevated CO concentrations are generally fairly localized, heavy traffic volumes and congestion can lead to high levels of CO, or "hotspots," while concentrations at the closest air quality monitoring station may be below State and national standards.

A variety of computer models have been developed to estimate local CO concentrations resulting from motor vehicle emissions. One of the most common models is CALINE4, developed by and available from the California Department of Transportation. The District has developed a simplified screening method, which is based on CALINE4 and takes into account CO field studies conducted by the District in the Bay Area. The screening method enables the user to manually calculate local CO concentrations resulting from motor vehicles. Except for very large projects, the District recommends that the manual method be used to estimate CO concentrations. The resulting estimated CO concentrations should be compared to State and national CO standards to determine whether the project would have a significant air quality impact. If the results of the manual method indicate CO concentrations below the standards, then no further CO analysis is required. If the manual method predicts concentrations above the standards, the Lead Agency may either: make a finding of a significant impact and identify mitigation measures, or conduct a more detailed analysis using the CALINE4 model. Similarly, if the results of a CALINE4 analysis indicate a significant impact, mitigation measures should be identified. The effectiveness of any proposed mitigation measure(s) should be quantified by estimating the effects of the measure(s) on traffic volumes and/or speeds, and CO concentrations.

Manual Calculation of CO Concentrations

The following procedure is designed to provide a reasonable estimate of carbon monoxide concentrations near roads under worst case conditions. It is a simplified version of CALINE4. The District suggests that the full CALINE4 model be used, instead of this simplified formula, for any projects or plans that will generate 10,000 or more motor vehicle trips per day. The full CALINE4 model also may be used for smaller projects if the simplified screening method indicates that an air quality standard may be exceeded.

In the Bay Area, the highest CO concentrations usually occur in winter, on cold, clear days and nights with little or no wind. Low wind speeds inhibit horizontal dispersion and radiation inversions inhibit vertical mixing. Worst case conditions are built into the simplified model formula. Default conditions are as follows:

1. wind direction parallel to the primary roadway, 90° angle to secondary road;
2. wind speed less than 1 meter per second;
3. extreme atmospheric stability (class F);
4. receptor at edge of the roadway.

The carbon monoxide concentration, C, is the sum of a background value, C_o, and the total contribution from local traffic C_t,

$$C = C_o + C_t$$

The total contribution from local traffic, C_t, is the sum of the contributions from each contributing local road, C_i,

$$C_t = C_{i1} + C_{i2}$$

The contribution from one road, C_i, can be computed by the formula:

$$C_i = C_{ri} \times \frac{V_i \times EF_i}{V_r \times EF_r}$$

where:

C_{ri} is a reference case concentration for the i-th roadway,
V_r is the traffic volume for the reference case,
V_i is the traffic volume for the i-th roadway,
EF_r is the emission factor for the reference case,
EF_i is the emission factor for the i-th roadway,

Table 12 gives reference case concentrations for various road configurations with traffic volumes of 1000 vehicles per hour and emission factors of 100 grams per mile. The concentration relative to this reference case is then computed in parts per million (ppm), by the formula:

$$C_i = \frac{C_{ri} \times V_i \times EF_i}{100{,}000}$$

where Cr_i is taken from Table 12, V_i is the estimated traffic volume in vehicles per hour, and EF_i is the emission factor taken from Table 10 for the appropriate year of analysis.

The following discussion provides guidance on how to use the formulas provided above, and describes in detail each step of the manual method for calculating CO concentrations.

TABLE 12
REFERENCE CARBON MONOXIDE CONCENTRATIONS (ppm)

Roadway Type	Primary Road (Highest Volume Road)						Secondary Road (Intersecting Road)					
	(receptor distance from edge--in feet)											
At Grade	**At Edge**	**25'**	**50'**	**100'**	**300'**	**500'**	**At Edge**	**25'**	**50'**	**100'**	**300'**	**500'**
2 lane	14.0	7.6	5.7	4.0	1.7	0.9	3.7	2.7	2.2	1.7	1.0	0.8
4 lane	11.9	7.0	5.4	3.8	1.6	0.9	3.3	2.6	2.2	1.7	1.1	0.8
6 lane	9.5	6.1	4.9	3.5	1.6	0.8	2.8	2.3	2.0	1.7	1.1	0.9
8 lane	8.5	5.7	4.6	3.4	1.5	0.8	2.6	2.2	1.9	1.6	1.1	0.9
Depressed 15 feet												
2 lane	20.9	8.2	4.7	3.3	1.5	0.8	4.8	2.4	1.4	1.1	0.8	0.5
8 lane	15.4	6.3	3.6	2.7	1.3	0.7	3.7	1.9	1.1	1.0	0.7	0.6
Depressed 30 feet												
2 lane	26.8	7.9	3.4	1.7	0.8	0.3	5.2	3.2	2.0	0.8	0.4	0.3
8 lane	21.3	6.0	2.3	1.1	0.6	0.2	4.1	2.7	1.7	0.7	0.5	0.4
Elevated 15 feet												
2 lane	14.0	7.3	5.7	4.0	1.7	0.9	3.7	2.6	2.2	1.7	1.0	0.8
8 lane	8.5	5.4	4.6	3.4	1.5	0.8	2.6	2.1	1.9	1.6	1.1	0.9
Elevated 30 feet												
2 lane	14.0	7.3	5.4	4.0	1.7	0.9	3.6	2.6	2.2	1.7	1.0	0.8
8 lane	8.5	5.4	4.3	3.4	1.5	0.8	2.5	2.1	1.9	1.6	1.1	0.9

Notes: Normalized CO concentration is calculated based on the following assumptions: wind direction parallel to the highest volume roadway; wind speed less than 1 meter per second; extreme atmospheric stability (class F); receptor at edge of roadway; emission rate = 100 gm/mi.; vehicles per hour = 1,000; surface roughness = 100 cm; mixing cell width = roadway width (2 lane = 40 ft; 4 lane = 64 ft; 6 lane = 88 ft; 8 lane = 112 ft).

This simplified model was adapted from CALINE3 and CALINE4 (California Department of Transportation) by Mike Kim, Senior Transportation Engineer, BAAQMD.

Step by Step Procedure for CO Analysis

Make separate computations for current conditions, future no-project conditions (including cumulative), and future conditions with the project. For future year project and no-project conditions, select an analysis year corresponding to the estimated year of project completion. Also use the procedure to show the effects of mitigation measures, where such effects are quantifiable.

1. Identify intersections and/or roadway links that will be most impacted by the proposed project, according to the traffic impact analysis. An analysis should be made for each such intersection and link. (Include a map showing these points.)

2. Obtain peak-hour traffic volumes in both directions on each roadway considered for each year of consideration. If only average daily traffic is known, assume 10% for peak hour volumes. Use actual traffic counts, if available, for current year. Traffic levels for future years should include traffic generated by the proposed project plus other estimated growth distributed among roadway links.

3. Obtain the CO emission factor for each roadway, for each relevant year from Table 10. (Interpolate if necessary.)

4. Determine the number of lanes and type of each roadway. (Do not count turning or parking lanes.) If the road is to be altered, use the appropriate width for the year being analyzed.

5. Based on the number of lanes, obtain the reference one hour concentration for each roadway from Table 12. The road with the most traffic should be considered the "Primary Road". Be careful to use the proper reference factor in the table if the receptor is not at the edge of the road or if one or both of the roadways is elevated or depressed.

6. Compute each roadway's contribution to the total concentration by using the equation above. If modeling an intersection, add the concentrations of all roadways.

7. Add the total roadway (local) contribution to the one hour background value from the background map (Figure 3) to obtain the estimated worst case concentration. Interpolate between isopleth lines and apply rollback factors for future years (Table 13) to determine the appropriate background value. Refer to the discussion below for guidance on determining background values.

8. To obtain the worst case eight hour concentration, multiply the one hour value for the local contribution by 0.7 (persistence factor). Add this derived eight hour local contribution to the eight hour background level (Figure 4). Interpolate between isopleth lines and apply rollback factors (Table 13) to determine the appropriate background value. Refer to the discussion below for guidance on determining background values.

Determining Background CO Concentrations

As noted above, estimating a project's impact on ambient CO concentrations involves adding the contribution from the project to existing background levels. Background carbon monoxide is defined as that part of the ambient CO concentration that is not attributable to traffic sources from a nearby street or intersection. Thus, during stagnant conditions, the background conditions at a site may include carbon monoxide emitted from outside the modeling area, as well as carbon monoxide emitted within the modeling area during the previous time periods.

In order to determine a reasonable background CO concentration, refer to Figures 3, 4 and 5 and Table 13. Figures 3 and 4 are isopleth maps of the Bay Area Air Basin showing estimated one hour and eight hour background CO values, respectively, in parts per million (ppm) for 1992. The maps are based on 1990 to 1992 CO concentration data from multiple monitoring sites of various types located throughout the region. Table 13 provides rollback factors to be used in conjunction with the isopleth maps when determining CO background concentrations for years beyond 1992. 1992 background values may be derived from the maps according to the following procedures, after first locating the project on the map.

If the project site happens to fall on an isopleth (contour) line, use the value marked for that line. If the project is determined to be between two different isopleth lines (i.e., between 3.0 and 6.0 or between 6.0 and 9.0 ppm), interpolate to select the appropriate intermediate value. Calculate the shortest distance to the lower and higher isopleths. Call these distances X and Y, respectively. Divide X by the sum of X + Y. Multiply this quotient by 3.0 ppm, and add this product to the lower isopleth value, I. This methodology is illustrated in Figure 5 and is represented by the following formula:

$\{[X / (X+Y)] \times 3.0 \text{ ppm}\} + I_L$ = CO background concentration in ppm, where

I_L = the lower isopleth concentration
X = shortest distance to lower isopleth
Y = shortest distance to higher isopleth

TABLE 13
FUTURE YEAR CARBON MONOXIDE ROLLBACK FACTORS

*Rollback Factors to be used in conjunction with Figures 3 and 4 to determine one hour and eight hour average carbon monoxide background concentrations from 1993 to 2010**

Year	Rollback Factor
1992	1.0
1993	.97
1994	.94
1995	.90
1996	.87
1997	.84
1998	.81
1999	.78
2000	.75
2001	.73
2002	.70
2003	.67
2004	.65
2005	.63
2006	.62
2007	.60
2008	.59
2009	.59
2010	.58

*After the 1992 carbon monoxide background concentration has been determined, estimates of any year through 2010 can be made using the factors above. For the year desired, multiply the 1992 concentration times the appropriate factor. For example, if the 1992 concentration is 6.0 ppm, the 1999 concentration is calculated to be (6.0 ppm) x (.78) = 4.7 ppm.

Note: Ambient concentrations of carbon monoxide are expected to decline, *on average*, in future years. This will occur because emission controls on new vehicles will reduce CO emission rates faster than vehicle travel increases. (*Local* CO emissions and concentrations might increase under conditions of intense development and increasing travel. These procedures are intended to assess such situations.)

FIGURE 3

ONE HOUR CO BACKGROUND CONCENTRATIONS

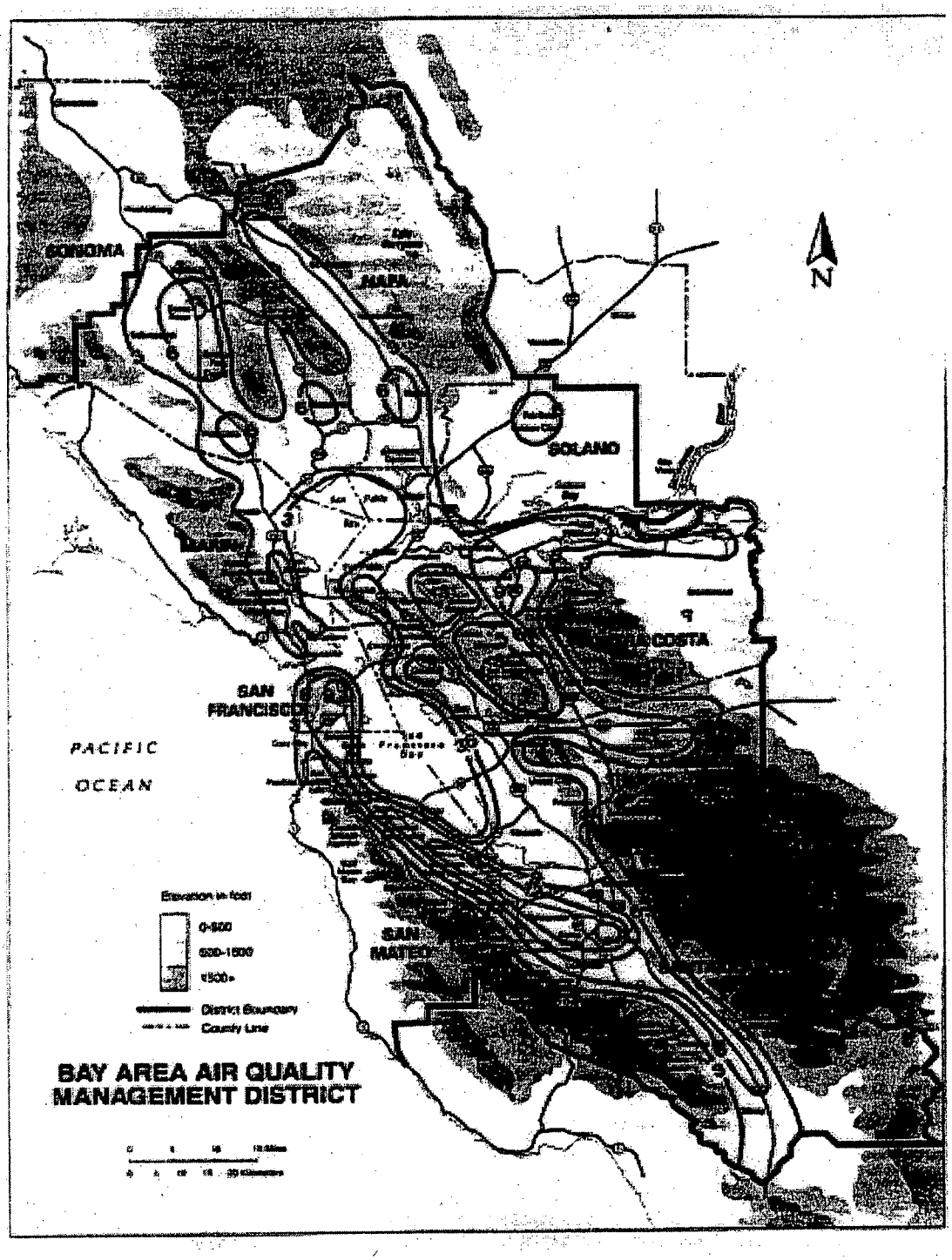

FIGURE 4

EIGHT HOUR CO BACKGROUND CONCENTRATIONS

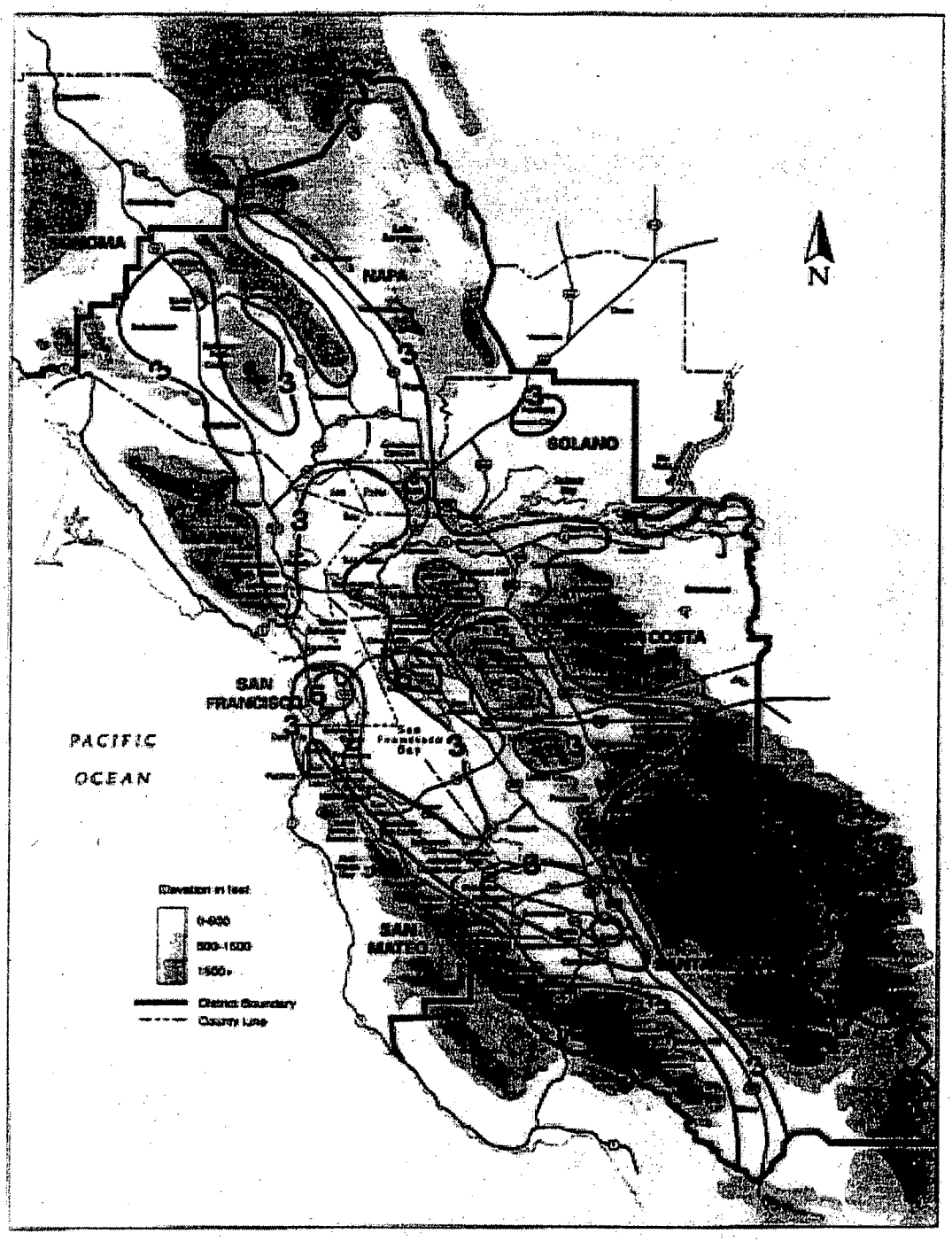

FIGURE 5

DETERMINING CO BACKGROUND CONCENTRATIONS EXAMPLE

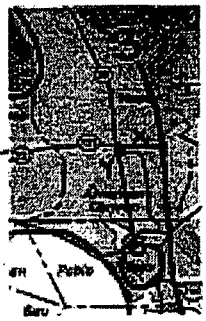

Figure 1A:

Intersection of Rtes. 29 and 121 in Napa County:
An intersection project at this location would be between the 3.0 and 6.0 isopleths. The shortest distance to the 3.0 isopleth is represented by line segment X, and measures 5mm. The shortest distance to the 6.0 isopleth is represented by line segment Y, and measures 13mm. The background concentration for the project would thus be found as follows:

(5mm)/(5mm + 13mm) = 5/18 = .28

(.28)(3.0 ppm) + 3.0 ppm = the background concentration = 3.83 ppm

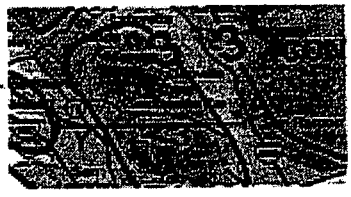

Figure 1B:

Project on I-680 in San Ramon:
A project on this section of interstate would be between the 3.0 and 6.0 isopleths. The shortest distance to the 3.0 isopleth is represented by line segment X, and measures 2mm. (Note that the project is roughly equidistant from 2 distinct 3.0 isopleths. One is due east, and one is due west.) The shortest distance to the 6.0 isopleth is 23mm. The background concentration for the project would thus be found as follows:

(2mm)/(2mm + 23mm) = 2/25 = .08

(.08)(3.0 ppm) + 3.0 ppm = the background concentration = 3.24 ppm

Figure 1C:

Project on I-980 in Oakland roughly intermediate between I-580 and I-880:
Such a project is located within a peak on the map. The shortest distance to the 6.0 isopleth forming the boundary of the peak is 2mm, and is represented by the line segment X. The distance to the centroid is also 2mm, and is represented by line segment Z. The background concentration for the project would be calculated as follows:

(2mm)/(2mm + 2mm) = 2/4 = .5

(.5)(2.9 ppm) + 6.0 ppm = the background concentration = 7.5 ppm

If the project is located within a "peak" on the map (i.e., within an enclosed area free of a higher isopleth), use the following procedure. (Such a peak could be above a 3.0, 6.0 or 9.0 ppm isopleth.) Measure the shortest distance to the isopleth forming the boundary of the peak. Call this distance X. Measure the distance to the centroid of the enclosure. Call this distance Z. Divide X by the sum of X + Z. Multiply this quotient by 2.9 ppm, and add this product to the boundary isopleth value, I_B. This methodology is illustrated in Figure 5 and is represented by the following formula:

$$\{[X / (X + Z)] \times 2.9 \text{ ppm}\} + I_B = \text{CO background concentration in ppm, where}$$

I_B = boundary isopleth concentration
X = shortest distance to boundary isopleth
Y = distance to centroid

For projects located in areas of the map below the 3.0 isopleth, a background concentration of 2.5 ppm should be assumed.

Example Calculation

Situation: Analysis year: 2000

Intersection of 6-lane highway and a 4-lane road at grade level.

Receptor point at edge of roadway.

Background one hour CO concentration is 9.0 ppm.

Background eight hour CO concentration is 6.0 ppm.

	Primary Road	Secondary Road
Hourly Traffic Volume	3400	2700
Equation	$\frac{(9.5)(3400)(7.27)}{100,000}$	$\frac{(3.3)(2700)(7.27)}{100,000}$

1-Hr Local Concentration: 2.4 + 0.7 = 3.1 ppm

1-Hr Total Concentration: 3.1 (intersection) + 9.0 (1-hr background) = 12.1 ppm

8-Hr Local Concentration: (3.1) x (.7) = 2.2 ppm

8-Hr Total Concentration: 2.2 (intersection) + 6.0 (8-hr background) = 8.2 ppm

Evaluating Diesel Engine Exhaust Emissions

As noted in Section 1.4, ARB in 1998 identified diesel engine particulate matter as a toxic air contaminant, and is evaluating what regulatory action may be needed to reduce public exposure. ARB and the District do not currently have recommended methodologies for Lead Agencies to use in quantifying impacts from diesel exhaust emissions. Because of the potential public health impacts, however, the District strongly encourages Lead Agencies to consider the issue and address potential impacts based on the best information available at the time the analysis is prepared. Particular attention should be paid to projects that might result in sensitive receptors being exposed to high levels of diesel exhaust. This applies both to situations where a new or modified source of emissions is proposed near existing receptors and to new receptors locating near an existing source. Facilities that may have substantial diesel exhaust emissions include the following.

- Truck stop
- Warehouse/distribution center
- Large retail or industrial facility
- High volume transit center
- School with high volume of bus traffic
- High volume highway
- High volume arterial/roadway with high level of diesel traffic

The most current information regarding ARB programs to reduce emissions from diesel engines is available at ARB's website at http://www.arb.ca.gov/toxics/diesel/diesel.htm.

Estimating Stationary Source Emissions

Environmental documents for proposed stationary sources of air pollutants should include a detailed analysis of the project's emissions of criteria pollutants and toxic air contaminants. The document also should describe District regulations applicable to the project and summarize how project design and operations will comply with applicable regulations. Lead Agencies should consult the District's Permit Services Division for guidance on calculating emissions from stationary sources of air pollutants.

For stationary sources being evaluated at an early planning stage, only a general planning or zoning classification may be available, e.g. "research and development" or "light industry". Use of specific emission factors may be difficult. In such cases, the best estimate of future uses should be made. Where an industry designation like "electronic components" or "food processing" is known or assumed, generalized emission factors may be used. Table 14 provides generalized estimates of air contaminant emissions for various categories of industrial land uses in the region. These generalized emission factors were derived from information in the District's emission inventory. Caution should be exercised in using these figures because of the wide range of facilities under each of the categories. However, they may be useful as first estimates of contaminant levels to be expected when only the general category of development is known.

These estimates do not include emissions that can be expected from motor vehicles attracted to these facilities. The indirect source emissions should be calculated separately, as explained earlier in this chapter. Total emissions generated by a proposed project would be the sum of the direct and indirect emissions calculated.

TABLE 14
GENERALIZED EMISSION FACTORS
FOR SELECTED INDUSTRY GROUPS*

Industry Group (Sub-groups)	Average Emissions per Facility (lbs/acre/day)				
	Part.	Org.**	NO_x	SO_2	CO
Manufacturing					
Food Canning (2032, 2033)	0.3	0.5	19.0	22.0	2.2
Paper Prod.(2643, 2647, 2649, 2653, 2654)	0.2	4.4	2.8	0.01	0.6
Printing & Publishing (2700-2771)	3.5	31.0	42.0	0.2	6.0
Inorganic Chemicals (2812, 2813, 2816, 2819)	1.6	0.6	4.9	2.6	5.9
Paints, Varnishes, etc. (2851)	0.2	20.0	0.5	0.0	0.1
Organic Chemicals (2861, 2865, 2869)	1.4	8.5	3.0	0.5	1.6
Petroleum Refining (2911)	1.4	18.0	26.0	16.0	1.3
Paving & Roofing (2951, 2952)	17.0	1.9	11.0	0.7	5.3
Plastic Products, Misc. (3079)	1.1	51.0	0.6	0.0	0.1
Stone, Clay, Glass & Concrete Prod. (3200-3299)	14.0	2.4	17.0	4.6	3.0
Iron & Steel Foundries (3321, 3324, 3325)	11.0	44.0	5.0	2.8	23.0
Metal Containers (3411, 3412)	0.5	90.0	5.5	0.03	0.8
Heating Equipment (3433)	0.1	2.7	0.2	0.00	0.03
Metal Work (3443, 3444, 3448, 3449)	5.3	11.0	1.3	0.01	0.2
Metal Coating (3471, 3479)	0.3	13.0	0.8	0.00	0.1
Machinery, except electrical (3500-3599)	72.0	23.0	0.5	0.02	0.1
Semiconductors, etc. (3674)	0.1	32.0	0.3	0.01	0.1
Electronic Components (3679)	0.1	5.6	0.1	0.00	0.02
Instruments (3800-3873)	0.3	23.0	1.4	0.01	0.2
Other					
Electric Utility plus Other Services (4931)	17.0	12.0	410.0	78.0	32.0
Petroleum Bulk Stations & Terminals (5171)	0.01	150.0	0.1	0.02	0.01
Dry Cleaning Plants (7216)	0.00	6.6	0.1	0.00	0.01
General Hospitals (8062)	2.9	2.3	30.0	0.2	6.0
National Security (9711)	2.8	2.5	22.0	0.01	5.5

* Based on U.S. Standard Industrial Classification (S.I.C.) Code groupings. As compiled by the Statistical Policy Division, Office of Management and Budget.

** Table lists total organic gases (TOG). Reactive organic gases (ROG) is virtually the same for the industrial categories.

3.5 Evaluating Odor Impacts

As noted in Chapter 2, an analysis of potential odor impacts should be conducted for both of the following situations: 1) a potential source of objectionable odors is proposed for a location near existing sensitive receptors, *and* 2) sensitive receptors are proposed to be located near an existing source of objectionable odors. Section 2.3 discusses thresholds of significance for odor impacts.

Odor problems vary greatly. The occurrence and severity of odor impacts depends on numerous factors, including: the nature, frequency and intensity of the source; wind speed and direction; and the sensitivity of the receptor(s). Therefore, to the extent feasible, the analysis of potential odor impacts should be based on District experience and data regarding similar facilities in similar settings. Lead Agencies should consult the District's Enforcement Division for information regarding specific facilities and categories of facilities, and associated odor complaint records.

Any project that would result in an odor source and sensitive receptors being located closer to one another than the distances indicated in Table 4 should be subjected to a more detailed analysis. (Table 4 lists types of facilities that commonly emit objectionable odors.) For any projects triggering the screening level distances in Table 4, the District's Enforcement Division should be contacted for information regarding odor complaints. For projects involving a new receptor being located near an existing odor source(s), the District's inventory of odor complaints for the nearest odor emitting facility(ies) should be reviewed for the previous three years. Odor complaints should be mapped in relation to the odor source to establish a general boundary of any existing impacts.[16] The location of the proposed project should be identified.

For projects involving new receptors locating near an existing odor source where there is currently no nearby development, and for new odor sources locating near existing receptors, the analysis should be based on a review of odor complaints for similar facilities.

In assessing potential odor impacts, consideration also should be given to local meteorological conditions, particularly the intensity and direction of prevailing winds. Refer to Appendix D or contact the District for local meteorological data.

3.6 Evaluating Impacts of Toxic Air Contaminants

The District limits emissions of and public exposure to toxic air contaminants (TACs) through a number of programs. TAC emissions from new and modified stationary sources are limited through an air toxics new source review program, which implements the District's Risk Management Policy via the District's permitting process for stationary sources. TAC emissions from existing sources are limited by: 1) District adoption and enforcement of rules aimed at specific types of sources known to emit high levels of TACs (e.g., chrome plating operations), and 2) implementation of the Air Toxics "Hot Spots" (AB 2588) Program. Appendix E provides more detailed information on District air toxics programs.

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16 Due to confidentiality requirements regarding odor complaints, only the block number will be provided for mapping. The name of the complainant, date of complaint, and specific address of the complainant will not be provided.

When considering potential impacts related to TACs, Lead Agencies should consider both of the following situations: 1) a new or modified source of TACs is proposed for a location near an existing residential area or other sensitive receptor, and 2) a residential development or other sensitive receptor is proposed for a site near an existing source of TACs.

For the first scenario, a source of TACs proposed near sensitive receptors, the Lead Agency should consult with the District's Toxics Evaluation Section for information regarding anticipated TAC emissions, potential health impacts and control measures. Preparation of the environmental document should be closely coordinated with the District review of the facility's permit application.

For the second scenario, sensitive receptors locating near sources of TACs, the Lead Agency should consult the District's Toxics Evaluation Section to review information gathered pursuant to the AB 2588 Program. AB 2588 requires plants emitting TACs to prepare inventories of TAC emissions from the facility. The District has prioritized these facilities based on the quantity and toxicity of the emissions, and their proximity to areas where the public may be exposed. Facilities put in a "high priority" category were required to prepare a comprehensive, facility-wide health risk assessment. The Lead Agency should review the health risk assessments for facilities subject to AB 2588 on file at the District offices. For facilities for which risk assessments have been conducted, these assessments may be used to identify an area around the facility within which individuals would be exposed to cancer or noncancer risks that would be identified as significant impacts. For facilities for which risk assessments have not been conducted, the District's Toxics Evaluation Section should be consulted to determine whether location of nearby sensitive receptors would expose individuals to cancer or noncancer risks that would be considered significant.

3.7 Evaluating Impacts of Accidental Releases of Hazardous Materials

Health and safety impacts associated with accidental releases of acutely hazardous materials (AHMs) should be evaluated when: 1) a facility storing or using AHMs is proposed near an existing residential area or other sensitive receptor, and 2) a proposed project would result in new receptors locating near an existing facility storing or using AHMs. As noted in Section 2.3, this evaluation should be based on the analyses conducted pursuant to the Risk Management Prevention Program (RMPP) process. Lead Agencies should consult with the local administering agency of the RMPP process (usually the county health department) for guidance in evaluating impacts from accidental releases.

3.8 Evaluating Cumulative Impacts

The evaluation of a project's cumulative impacts should be based on an analysis of the consistency of the project with the local general plan and the local general plan with the regional air quality plan. Refer to the discussion in Section 2.3 of these Guidelines regarding Cumulative Impacts and Plan Impacts for guidance on evaluating cumulative impacts.

3.9 Evaluating Plans

Planning documents such as city and county general plans, specific area plans and redevelopment plans should be evaluated for their potential air quality impacts. The evaluation of a plan's air quality impacts should focus on an analysis of the plan's consistency with the most recently adopted regional air quality plan. At the time of this writing, the most recently adopted regional air quality plan is the *Bay Area 1997 Clean Air Plan* (CAP). (As the CAP is updated in future years, the analysis should evaluate consistency with the updated CAP.)

To evaluate local plan consistency with the CAP, the Lead Agency should consider the following: the local plan's consistency with CAP population and vehicle use projections, the extent to which the plan implements CAP transportation control measures, and whether the plan provides buffer zones around sources of odors and toxics. Refer to Section 2.3, Thresholds of Significance, for guidance on how to determine whether a local plan is consistent with the CAP.

In most cases, quantification of future air pollutant emissions is not necessary as part of this analysis. If a Lead Agency does quantify emissions, note that the URBEMIS7G model discussed previously should not be used to analyze plan impacts. Other models, such as DTIM or BURDEN, may be more appropriate. There may be some instances where quantification of a plan's air quality impacts is appropriate. For example, a specific plan or a redevelopment plan might lead to increased traffic congestion (and possibly cause high CO concentrations) or result in substantial growth in stationary sources of air pollutants. Lead Agencies should consider including a quantitative assessment of a plan's impacts if warranted by special circumstances.

Del Strange
464 E. Jackson Ave.
Tulare, CA 93274
April 11, 2008

Board of Supervisors,
Planning Commission and
David Bryant, Project Planner
COUNTY OF TULARE
Resource Management Agency
Government Plaza
5961 South Mooney Boulevard
Visalia, CA 93277-9394

RE: Lack of Response to Procedural Matters Regarding the "Tulare County General Plan 2030 Update"and Consequent Inability to Comment on Same.

Dear Supervisors, Commissioners and Mr. Bryant:

To date, I have not received a response to the procedural issues raised in my March 12, 2008 letter to you regarding the above-referenced matter.

Enclosed, please find copies of my February 26 and March 12, 2008 letters to you on the above.

Under the circumstances, as delineated in my referenced correspondence to you, I am unable to effectively comment on this project without first having answers to these very basic procedural issues.

Please respond immediately to each issue raised and then allow sufficient time to prepare and submit my comments on this most important project. I have been patiently waiting for several months now to participate, pending your response(s).

Awaiting your reply.

Thank you.

Respectfully yours,

Del Strange

c.c. Julia Roberts, Deputy Counsel, Tulare County - County Counsel

encl. My letters on said project, dated February 26 and March 12, 2008.

Del Strange
464 E. Jackson Ave.
Tulare, CA 93274
March 12, 2008

Board of Supervisors,
Planning Commission and
David Bryant, Project Planner
COUNTY OF TULARE
Resource Management Agency
Government Plaza
5961 South Mooney Boulevard
Visalia, CA 93277-9394

RE: Comments on Procedural Matters Regarding the "Tulare County General Plan 2030 Update" Public Comment and Hearing Timing, Acceptance and Written Responses to **ALL** comments received.

Dear Supervisors, Commissioners and Mr. Bryant:

To date, I have not received a response to the procedural issues that I raised at the February 26, 2008 joint public hearing on the above-referenced matter, nor to my letter of the same date, copy enclosed.

Of major concern is the fact that significant missing documents and correctory information was released on the date of the above-referenced public hearing, including missing pages in Appendix C of the Background Report; corrected pages to Appendix C of the Background Report; missing Appendices A, B and C of the Background Report; and missing pages in the General Plan Update Goals and Policy Report.

It is my understanding that the public review period for the Draft EIR, which includes all of the supporting documentation released by the lead agency, has been extended to April 15, 2008. (See staff cover letter regarding the correctory information released, dated February 26, 2008, copy enclosed.)

In addition, that any comments received thereafter, including those yet to be received at the April 23, 2008 continued public hearing on this project, both written and oral, will not be treated equally and will not be responded to in writing as part of the Response to Comments document in the Final EIR. Yet, it is known that, due to time constraints during the February 26 joint public hearing, not all public comments were received orally. Some people may not be able to write down their comments and, therefore, wish to make their comments verbal. The process established for this project as I understand it, however, does not allow for equal treatment of those oral comments yet unheard.

Consequently, it is my recommendation that the public review period be extended to a date at least 7 to 14 days after the scheduled April 23, 2008 continued public hearing to allow adequate time for anyone who may wish to follow up with written comments after hearing a detailed staff/consultant report on the project, which was not provided at the intial joint public hearing, to do so.

In addition, that all comments received, both written and oral, during the extended public review period, including those yet to be received at the April 23 continued public hearing, must be treated the same as those received prior to said extension; i.e., that all comments will be responded to in writing in the Response to Comments document of the Final EIR, etc.

It is my understanding that, based upon prior County precedent on other CEQA-related projects and in the interest of complying with the true intent of CEQA, the above should be taken into serious consideration to allow full and complete participation in the General Plan Update by all agencies, organizations and citizens of Tulare County.

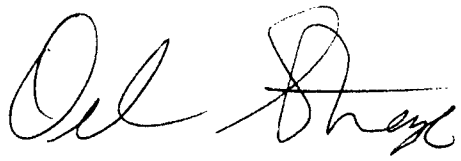
Therefore, may I suggest that the public review period remain open and be extended to **Friday, May 2, 2008, at 12:00 noon.**

In addition, for ease of review and comment, that a "Master Index to 'Tulare County General Plan 2030 Update' Documents" be made available to everyone at the earliest possible time. (See my letter to you dated February 26, 2008, page 2, copy enclosed.)

Please review and comment on the above at the earliest possible time. I will be looking forward to your timely response to these important procedural issues regarding this major and far-reaching project for the County and its citizens.

Thank you for the opportunity to comment.

Respectfully yours,



c.c. Julia Roberts, Deputy Counsel, Tulare County - County Counsel

encl. My letter on said project, dated February 26, 2008.
RMA Staff Cover Letter, dated February 26, 2008.

Del Strange
464 E. Jackson Ave.
Tulare, CA 93274
February 26, 2008

Board of Supervisors,
Planning Commission and
David Bryant, Project Planner
COUNTY OF TULARE
Resource Management Agency
Government Plaza
5961 South Mooney Boulevard
Visalia, CA 93277-9394

RE: Comments on the "Tulare County General Plan 2030 Update" Documents, Including the Draft Environmental Impact Report.

Dear Supervisors, Commissioners and Mr. Bryant:

It is most encouraging to see that the above-referenced project has reached this milestone, as it is an extremely important process in the molding of County policies and implementation measures needed to guide us through the decades ahead.

It is with the understanding that comments submitted by each and every agency, organization or individual are welcomed and needed in order to effectively tailor the General Plan, and that the documents involved must be complete and easy to follow, that I make these comments.

I find that the documents are extremely difficult to follow, in that they are not appropriately identified, organized, and/or cross-referenced. In addition, certain of the documents were missing at the time of initial release and distribution, bringing into question whether or not all agencies, organizations, and/or individuals have been either made aware of their availability and/or provided copies of same in a timely manner.

As an example, I was not made aware that Appendices A, B, and C of the Background Report were missing, as well as other documents from other volumes of the General Plan 2030 Update, until yesterday. I called Mr. Bryant inquiring about same and picked them up late yesterday.

As a result, I have not had adequate time to study these "new" documents and effectively incorporate that information into the comments that I had hoped to present to you today. Unfortunately, I will not be able to materially comment at this time.

The question is, "How many others have been placed in the same situation?" "How many cannot effectively comment under the circumstances? How many simply will not comment due to the confusion?

Consequently, I would like to recommend that this joint public hearing be continued for a minimum of two weeks until such time as all parties have received all documents and have had sufficient time to review and prepare comments on same.

In addition, I would highly recommend that a "Master Index to the 'Tulare County General Plan Update' Documents" be prepared and distributed to all parties as well. I feel that such an index is necessary and would be extremely helpful to anyone reviewing these documents. (See enclosed suggested outline of same).

Thank you for the opportunity to comment.

Respectfully yours,

Del Strange

(Suggested Outline)

MASTER INDEX TO "TULARE COUNTY GENERAL PLAN 2030 UPDATE" DOCUMENTS

I. **Draft Environmental Inpact Report** (December 2007)

Appendices:

A Notice of Preparation including agency & public comments received (April 25, 2006) - included in document.

B Background Report (December 2007) - separate document. [Should be labeled: "Appendix B" on cover]

Appendices:

A Excerpts From Tulare County CEDS (June 2004) - separate document. (Pp. A-1 through A-9 and Exhibits 1-0 through 1-28)(1)

B Tulare County Improvement Standards - separate document. (Plates B-1 through B-8 and WS-1 through WS-13, with WS-12 missing - ?)(1)

C Water Resources (Revised July 2007) - separate document. (Pp. C-1 through C-27)(1)

C Goals & Policies Report (January 2008) - separate document. [Should be labeled: "Appendix C" on cover]

Part III - Community Plans

Adopted Community Plans - separate documents.(2)

1982 Kings River Plan - separate documents.(2)

Adopted Mountain Subarea Plans - separate documents.(2)

D Air Quality Analysis (Year 2007) - included in document.

E Issues and Alternatives Report/"Policy Alternatives" (August 2005) - Includes Planning Commission's preferred land use alternative.(1)

F General Plan Summary(2)

II. **Public Comment Matrix** - Summary of Changes (July 2007)

(1) Document just received (2/25/08).

(2) Unknown whereabouts of document - ?

RESOURCE MANAGEMENT AGENCY

5961 South Mooney Blvd.
Visalia, CA. 93277
Phone (559) 733-6291
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Britt L. Fussel	Engineering
William Hayter	Comm. & Dev. Service
Jean P. Brou	Transportation
George Finney	Planning
Hal Cypert	Support Services
Roger Hunt	Administrative Services

HENRY HASH, DIRECTOR

RECEIVED 2/25/08

February 26, 2008

To Whom it May Concern:

Subject: County of Tulare General Plan 2030 Update Background Report Correctory Information #2.

The following pages C-25, C-26, and C-27 have been corrected, and Figures 4-1 through 4-8 were inadvertently omitted from Appendix C of the General Plan 2030 Update Background Report. Please insert the following pages into Appendix C of the Background Report; 1) insert Figures 4-1 through 4-8 into Appendix C at the end of the report and; 2) replace pages C-25, C-26, and C-27 with the attached corrected pages C-25, C-26, and C-27. The review period of the Draft EIR review period will be extended to April 15, 2008. We apologize for any inconvenience this may have. INCONVENIENT — TAX DEADLINE!

If you should have any questions comments or concerns please contact me at 559-733-6291 or by email at dpbryant@co.tulare.ca.us.

Sincerely,

David P. Bryant

David P. Bryant,
Division Manager
Special Projects

From: "Kenneth Bluestein" <k7lbluestein@earthlink.net>
To: <DPBryant@co.tulare.ca.us>
Date: 04/14/2008 7:53 PM
Subject: Comment on General Plan

April 13, 2008

Dave Bryant
Division Manager-Special Projects
Tulare County Resource Management Agency
5961 S. Mooney Blvd.
Visalia, CA 93277

Dear Mr. Bryant, Chairwoman Conway, and Members of the Board,

We appreciate the opportunity to comment on the General Plan Update

We strongly urge the county to provide a General Plan Update that will keep growth in the existing urbanized areas and will provide strong, clear policies that promote growth in urbanized areas to the extent the areas want and can accommodate growth.

This would include consideration of water resources, sewage treatment, and infrastructure to support the growth. If the infrastructure does not exist, the developers must contribute to offset costs the County will need to invest in developing and maintaining this infrastructure.

As you know the Central Valley is the breadbasket of the world. We must protect these lands. Once the development occurs, irrevocable damage results and this land will be lost for future agricultural needs. Also, development will increase the pollution in the Central Valley. We already have poor air quality and receive air pollution from other developed areas.

Development must be located in existing development boundaries unless the development is directly related to agricultural. Thus, the development that occurs must be efficient either through mandates or use of incentives. Firmly limit the circumstances under which boundaries can be expanded.

The updated General Plan must discourage premature conversion of agricultural lands and loss of natural resources to developed land. It could provide incentives to revitalize existing areas.

The updated General Plan must provide strong, clear policies with concrete, enforceable implementation measures that include timeframes, funding, and departments in charge of monitoring and enforcement.

Sincerely,

Ken and Laurie Bluestein
PO Box 846
Springville, CA 93265
(559) 539-2500

Karen Bodner
Michael Olecki
42480 Kaweah River Drive
(PO Box 445)
Three Rivers, CA 93271

April 14, 2008

Tulare County Resource Management Agency
ATTN: David Bryant, Project Planner
Government Plaza
5961 South Mooney Boulevard
Visalia, CA 93277

RE: General Plan 2030 Update and Draft Environmental Impact Report (SCH No. 2006041162)

Dear Mr. Bryant:

Enclose are comments on the Draft EIR circulated in connection with the General Plan 2030 Update. Because of the considerable number of documents comprising the General Plan Update, our comments focus on the Foothill Growth Management Plan.

Preparing the many documents that comprise the Update has been a massive undertaking, and we appreciate the tremendous effort the County has put into the process, and the opportunity to comment on them. We have been impressed over the past several years with the County=s efforts to include the people of Tulare County in formulating the County=s vision of the future. Unfortunately, the resulting documents do not seem to reflect the opinions and priorities expressed at the many meetings held around the County.

Where the consensus of many meetings was that the General Plan should provide clear guidelines that will unambiguously protect the rural and agricultural lifestyle we cherish, the current GPU instead leaves much up to chance and =market forces.= The vagueness of the GPU, no doubt designed to give the County maximum flexibility in future planning decisions, also denies the County knowable, reliable guidelines. The DEIR, in attempting to evaluate the potential impacts that could result from implementation of the GPU, has been stymied = it=s hard to know what bumps might be in the road when you don=t know what route you=re going to take.

Unfortunately, in addition to being inconsistent, incomplete, contradictory, vague, and weak, the DEIR doesn=t provide an adequate baseline from which it could reasonably forecast potential impacts of adopting and implementing the GPU, and doesn=t adequately disclose or evaluate potential significant adverse environmental impacts and measures to avoid or mitigate them. The DEIR also doesn=t present a reasonable range of alternatives to the GPU, including one that is designed to achieve what the people want: focused growth in existing communities and their already-designated urban development zones. By incorporating all the GPU=s goals and policies into each =alternative= the DEIR skewed the analyses.

To achieve what every EIR must, both the GPU and the DEIR must be extensively revised and corrected. Because such extensive revisions are necessary to make the DEIR meaningful, both it and the revised GPU should be re-circulated after revision.

It will not be easy to fix the weaknesses in the current GPU documents. But Tulare County, and its future, are worth the effort. Thank you for considering our comments.

Sincerely,

Karen Bodner
Michael Olecki
Karen@grodsky-olecki.com
Michael@grodsky-olecki.com

Karen Bodner
Michael Olecki
42480 Kaweah River Drive
(PO Box 445)
Three Rivers, CA 93271

RECEIVED APR 15 2008

Tulare County Resource Management Agency
ATTN: David Bryant, Project Planner
Government Plaza
5961 South Mooney Boulevard
Visalia, CA 93277

The following comments supplement those submitted in the accompanying cover letter, regarding the Tulare County General Plan 2030 Update DEIR, with a focus on the Foothill Growth Management Plan. Please consider these documents together.

INTRODUCTION

Although the Foothill Growth Management Plan (the "FGMP") is not identified in the DEIR[1] as an element of the General Plan that has been changed, the FGMP, as reinterpreted in the General Plan Update (the "GPU"), has in fact been changed in significant ways.

The Foothill Growth Management Plan drafted in 1981 (hereinafter the "1981 Plan") was designed, with input from the Board of Supervisors, the Planning Commission, and the Foothill Citizens Advisory Committee, to

> formulate (a) land use policy for the foothill region which 1) rationally directs urban growth into specific areas of the foothills in order to protect its fragile environment; 2) maintains the agricultural viability of the foothills by identifying areas to be maintained or encouraged for intensive and extensive agricultural use; and 3) accommodates urban/rural growth in the areas serviceable by public agencies in a safe and cost-efficient manner.

FGMP (1981) p.1, 11.

In attempting to create a uniform set of land use designations and development standards applicable to all areas of the County, the GPU has lost sight of the fundamental fact that "the limitations imposed by factors such as excessive slope, present development patterns, increased wildfire potential, service availability, water availability, soil limitations for septic tanks, [and] site accessibility" demand development standards specifically adapted to the Foothills. 1981 Plan at p. 11. The Revised FGMP should recognize – as did the 1981 Plan – that conditions in the Foothills (and in the Mountain areas) are very different from conditions on the Valley Floor.

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[1] All references to the DEIR, and the Foothill Growth Management Plan (GPU version) are to the Adobe Acrobat versions of these documents posted and made available to the public by the County on the Tulare County General Plan Update web page, http://generalplan.co.tulare.ca.us/documents.html.

Instead, the current, revised version of the Foothill Growth Management Plan (the "Revised FGMP.") downplays the need to protect the fragile foothill environment, minimizes the goal of maintaining the agricultural viability of the foothills (reducing the number of Foothill Agriculture-specific policies from three to one), and instead focuses extensively on directing growth to the foothills, with small regard for the region's ability to support such growth.

In addition to not calling the public's attention to the fact that the FGMP has been changed[2], the DEIR does not compare the provisions of the two plans to make clear what has been changed and in what ways, doesn't provide any – let alone a sufficient – rationale for the changes, doesn't establish or analyze baseline conditions upon which it could evaluate the potential impact of the proposed changes, and doesn't assess the potential direct or indirect negative impacts of the changes, either on an individual or cumulative basis.

Moreover, the DEIR does not disclose that the Revised FGMP fails to include, even by reference, the substantial additional data resulting from the federally-funded, in-depth study of the Foothill area, which are contained in the Appendices to the 1981 Plan:

X a description of the Foothill region; socioeconomic, housing and land use data; a detailed baseline description of environmental factors, including climate, air quality, watershed data, geological and soils information (including an in-depth soil matrix), and biological factors (including vegetation and wildlife data.)

X a study of Foothill Circulation Systems, including specific data on traffic volume by road and area, and expected impacts of anticipated growth

X an examination of existing public service systems and utilities in the Foothills fire protection (including identification of County and State fire stations and the service areas they cover); law enforcement (identifying the exiting Sheriff's office locations and service areas); school districts; health care providers; solid waste disposal services; public utilities; water and liquid waste systems; and public libraries serving the area

X legal authority for Specific Plans

X an explanation of the Site Plan review process applicable to the Foothills, including Foothill Extension and Development Corridors

X a detailed Environmental Impact Report (including comments)

X implementing Resolutions of the Tulare County Planning Commission and Board of Supervisors, including findings of fact and preliminary amendments to the 1981 Plan

X definitions of terms used in the 1981 Plan, and

X detailed maps, including maps of

---

[2] In fact, the County has many times represented that the FGMP has not been changed, but is being incorporated into the GPU.

X the Foothill Growth Management Plan area (identifying lands designated as ▪valley agriculture extension▪, ▪foothill extension▪, ▪extensive agriculture▪ and ▪development corridor▪, as well as scenic highways and roads);
X Foothill Development Corridors, including designations of land use and circulation patterns
X land capacity (identified by use-suitability);
X slopes and flood-prone areas; and
X vegetation (including identification of critical deer winter habitat)

Nor does the Revised FGMP update this information by providing equivalent current data.

The Revised FGMP also has completely eliminated, without having disclosed these provisions as having been deleted, the following provisions in the 1981 Plan:

Community Identity policies 1, 2, and 5
Agriculture policies 2 (zoning to protect viability of foothill agriculture) and 3 (limit residential development densities in Success Valley)
New Development policies 1 (Development proposals shall conform to all development standards) and 5 (To the greatest extent possible, new residential development should be compatible with existing residential development patterns).
Environmental Protection/Flora & Fauna policies 1 (prohibit removal of native trees) & 2 (prevent encroachment of development into riparian areas)

The DEIR does not disclose the elimination of these provisions in the Revised FGMP, and has not, therefore, addresses any of the potential impacts elimination of these provisions may have.

As a result of these failures, and the deficiencies set out below, the DEIR is inadequate under CEQA and California state laws, and must be completely revised to provide the reliable analysis of the potential impacts that may be expected if the GPU is adopted and implemented. In light of the significance of the changes made, and the inevitable impact eliminating currently-existing protections will have, such an analysis requires establishment and/or analysis of current baseline conditions, upon which it could reasonably evaluate the impact of the potential direct or indirect changes that could result from adoption and implementation of the GPU, on both an individual basis and as a whole.

I. THE DEIR IS INADEQUATE BECAUSE ITS ANALYSES REGARDING THE FGMP ARE BASED ON FAULTY DATA

Any analyses or predictions the DEIR makes regarding the potential impact adoption and implementation of the GPU will have on the Foothill region are fatally flawed from the outset because there are NO implementation measures AT ALL for **over 85%** of the Revised FGMP policies. Without enforceable implementation measures, the goals and policies of the Revised FGMP are merely wishful thinking, and cannot be relied on in any meaningful evaluation of potential direct, indirect, or cumulative impacts resulting from adoption or implementation of the

GPU.

Moreover, ALL analyses, throughout all sections of the GPU, that cite or rely on Revised FGMP policies or implementation measures that do not exist, or that do not correspond to the portion cited, are faulty. A few examples (and these are examples only) demonstrate that these errors are not minor or few in number; the DEIR is replete with inconsistencies:

X The ERM impact analyses dealing with fish and wildlife habitat, including those of protected species, in the DEIR point to FGMP policies F-5.1 and F-9.1, 9.5, 9.12, 9.13, 9.15 and 9.20, and FGMP Implementation Measure (▪IM▪) 21, as mitigating the impact of the GPU on several ▪sensitive habitats and species.▪ *See, e.g.,* Table ES-4 at page ES-28 through 30.

Leaving aside the labeling inconsistency (FGMP policy numbers are designated as FGMP-x, not F-x), FGMP-5.1 deals with preserving agricultural land (not sensitive habitats or species); FGMP-9.5 deals with Alternative Sewage Disposal. Similarly, IM 21 provides for an amendment to the Zoning Ordinance to include a Planned Development-Foothill Zone ▪ a development not likely to mitigate loss of habitat for wildlife. More perplexing is the fact that there *are no* FGMP policies 9.12, 9.13, 9.15 or 9.20.

X PFS5, evaluating the GPU▪s impact on runoff water and drainage, concludes that the GPU▪s impact will be less than significant, and cites F-9.2 as one of the mitigating, supporting policies. The Revised FGMP-9.2 (Provision of Adequate Infrastructure) has no identified corresponding implementation measure. With no means of implementing policy FGMP-9.2, it is impossible for the DEIR to have concluded that it will in any way contribute to mitigation.

X The DEIR cites F-7.1 (Preservation of Scenic Highways); F-7.2 (Identification of Scenic Highways); F-7.3 (Development Along Scenic Highways); F-7.4 (Development Within Scenic Corridors); and F-9.19 (Maintenance of Scenic Vistas), in mitigation of the possibility that ▪The General Plan Update would substantially degrade the existing visual character or quality in areas of the County.▪ DEIR ES-24 - 25. As provided in the Revised FGMP, however, 7.1 addresses an inventory of historical places; 7.2 (preparation of archeological map); 7.3 (protection of archeological or historical sites); and 7.4 and 9.19 simply don▪t exist.

X Impact HS-1 cites F-9.7, 9.8, 9.11 and 9.12, as well as FGMP Implementation measures 7, 14 and 34 as mitigating factors for the possibility that the GPU will result in soil erosion or loss of topsoil. Not one of these cited FGMP policies exists in the Revised FGMP. In addition, of the cited Implementation Measures, measure 14 addresses cluster development to protect scenic corridors (and is silent on erosion matters) and measure 34 deals with review of financing plans for area plans.

X Impacts HS-2, HS-3 and HS-4 are concerned with safety issues related to geologic stability; HS-2 cites F-9.10; HS-3 cites F-9.7, 9.8, 9.11 and 9.12; and HS-4 cites F-9.10 as mitigation measures. None of these policies are found in the Revised FGMP.

X Similarly, the ERM analysis regarding preservation of historic or archeological sites cites FGMP policies 8.1, 8.2 and 8.3 (again, referring to them as F-8.1, 8.2 and 8.3) as ▪designed to address the important cultural resource issues of the FGMP including development of a historical sites inventory, preparation of an archeological sensitivity map, and the protection of significant cultural resource sites.▪ DEIR at 4-39. However, none of the cited provisions support the claimed analysis: FGMP-8.1 deals with Riparian Area Development; 8.2 addresses Development Drainage Patterns, and 8.3 concerns Development in Flood Plains.

X On page 4-73 of the DEIR, the Health and Safety analysis, F-9.10 is cited as prohibiting development in foothill areas considered geologically hazardous. But there is no F-9.10 (or even a FGMP-9.10). Similarly, F-9.17 is cited in support of the DEIR▪s finding that the GPU▪s impact on transportation will be less than significant; F-9.17 supposedly encourages construction of development along major travel routes. But again, policy F-9.17 (or FGMP 9.17) is missing from the Revised FGMP.

Given the maze of non-conforming provisions, the inconsistencies and contradictions between them, and the failure of the DEIR to base its analysis on specific, existing policies and implementation measures that actually provide what the DEIR says they provide, the DEIR does not provide meaningful guidelines on which the public and decision-makers may rely. (And, although these comments focus on the FGMP section of the DEIR and GPU, it is reasonable to assume that the problems plaguing the FGMP portion of the DEIR are also present in other areas.) Accordingly, the DEIR does not meet the standards required by CEQA.

The DEIR ▪ and the GPU on which it is based ▪ should and must be completely revised, and recirculated for public comment.

II. UNDISCLOSED CHANGES TO THE 1981 PLAN THAT WEAKEN THE FGMP: PROVISIONS COMPLETELY OMITTED FROM THE REVISED FGMP

Overall:

As noted above, the 1981 Plan resulted from an extensive federally-funded study that provided an inventory of socioeconomic, environmental, circulation and public services/utilities data for the foothill region. That data, incorporated in the 1981 Plan Appendices, constitutes the very foundation of the Plan, and is **entirely absent** from the Revised FGMP.

The Revised FGMP does not incorporate the 1981 Plan by reference, and as a result, the omitted provisions and data will be without legal force.

We strongly suggest, given the extensive revisions and corrections that must be made to remedy the inadequacies of the Revised FGMP ▪ and since the County▪s often-stated intention was not to have changed the FGMP at all ▪ that the 1981 FGMP in its entirety simply be incorporated by reference into the GPU in its entirety, as has been done with the Rural Valley Lands Plan.[3]

Specific Provisions:

The Introduction to the Revised FGMP refers in many sections to ▪the **Land Use Diagram.** (see, e.g., page 3-1). No Land Use Diagram is included in the Revised FGMP.

> Please provide a detailed Land Use Diagram that specifically indicates all elements in the FGMP that reference the Diagram. Please also indicate current uses by land type or character, riparian or wetland areas, population density where appropriate, roads and highways (specifically indicating which are scenic roads or highways or candidates to become scenic roads or highways), traditional or critical wildlife habitat, etc.

The Introduction to the Policies section of the 1981 Plan establishes that

> [t]he overall objective of the study is to accommodate development within the foothills while recognizing limitations imposed by factors such as excessive slope, present development patterns, increased wildfire potential, service availability, water availability, soil limitations for septic tanks, site accessibility, etc.... Further, the policies reflect the fact that even though land may be physically capable of being developed, other overriding factors such as the preservation and protection of foothill-grazing lands may limit such activity.

1981 Plan at 11.

These statements, which set out the fundamental underpinnings of the Foothill Growth Management Plan, and explicitly recognize the limitations that must inform all development decisions in the Foothills, have been deleted from the Revised FGMP.

> Please explain why the Revised FGMP has completely eliminated this crucial statement of fundamental principals underlying the Foothill Growth Management Plan, and assess

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[3] The Rural Valley Land Plan was adopted in 1975, six years prior to the FGMP; there can thus be no valid argument that the FGMP is too out of date to remain in its current form.

1) what the direct, indirect, and cumulative impacts of deleting this statement of principals will be; 2) how those impacts have been or will be measured; and 3) how the County will mitigate the impacts resulting from the elimination.

The Level Two land use analysis in the 1981 Plan provides that property that falls outside the 15-minute attack time of a year-round county fire station is to be designated as **open space or agricultural** land. The Revised FGMP omits this criterion from the list of factors used to designate land as open space or agricultural. See Revised FGMP at 3.2 This omission would allow lands more than 15 minutes distant from a fire station to be developed, putting property and perhaps lives at risk.

Please revise the Revised FGMP to reinstate the requirement that lands beyond a 15 minute attack time be designated as open space or agricultural land.

In describing the **circulation plan** set out in the 1981 Plan, the Revised FGMP asserts that the circulation plan ▪is designed to consider existing natural and physical features in order to maintain the environmental hazards associated with road building activities.• Id. at 3-3. In contrast, the 1981 Plan establishes that the circulation plan is designed to *minimize* such hazards. There is a considerable difference between maintaining hazards and minimizing them.

Please correct this inappropriate statement of policy.

The Revised FGMP, at page 3-4, states that ▪When a **preserve** within a corridor is disestablished it must be zoned consistent with the requirements of the Williamson Act.• The 1981 Plan provides that ▪When a preserve within a corridor is disestablished it should be immediately rezoned to the Planned Development -Foothill (PD-F) Zone.•

Please explain the basis for, and the potential direct, indirect, and cumulative impacts of, this change.

The Revised FGMP contains a ▪**Foothill Growth Management Plan• map** (Fig. 3.1) which outlines Development Corridors within the Foothills, but without identifying the various different Corridors, and without the additional information found in the corresponding 1981 Plan map.

Please explain the rationale for substituting this map for the FGMP map contained in the 1981 Plan, and omitting the additional data shown on the 1981 map (identifying lands designated as ▪valley agriculture extension•, ▪foothill extension•, ▪extensive agriculture• and ▪development corridor,• as well as scenic highways and roads.)

The Revised FGMP retains language from the 1981 Plan which asserts that ▪The general plan map for each development corridor, along with the policies, development standards, and site plan review process, constitute• the FGMP. Revised FGMP, page 3-6; 1981 Plan at page 9. The Revised FGMP further states that ▪The site plan review process and development standards will control development on a site-specific basis. The implementation strategies will give the County

the tools needed to guide development in a manner consistent with the FGMP.. Id.

> Please explain how the Revised FGMP will control development when a) it does not include the referenced maps; b) it has omitted many of the policies contained in the 1981 Plan, c) has replaced the detailed Development Standards set out in the 1981 Plan (pages 38 - 45) with a mere 11 generic provisions that deal primarily only with fire protection measures; d) does not retain the site plan review process contained in the 1981 Plan, and e) has omitted implementation measures for an overwhelming proportion of the policies it does include.
> Please also explain 1) how the potential direct, indirect, and cumulative impacts of these omissions have been or will be measured; 2) how the County will mitigate the potential direct, indirect, and cumulative impacts resulting from the omission of these sections, and 3) provide the analysis and rationale underlying the decision to delete these sections.

Policy 2 of the Community Identity section in the 1981 Plan required **new commercial development** to first ▪be considered for those areas of Springville, Three Rivers, and Lemon Cove which are suitable for commercial development.▪ P. 12. The Revised FGMP now requires the County only to ▪encourage▪ new commercial development to first consider these communities, without the requirement that the location itself be suitable ▪ as determined by the standards and principals which have been deleted from the Revised FGMP ▪ for the proposed commercial use.

In changing the language of the provision to require the County to ▪encourage▪ consideration of these communities, the Revised FGMP has also shifted the decision-making power from the County ▪ which formerly could determine where a proposed enterprise would be appropriate based on all relevant factors ▪ to the commercial enterprise, which most likely is not in possession of all the information available to the County.

> Please explain the analysis and rationale for shifting the decision-making power (which in effect is a basic land-use determination) away from the County. Please also explain 1) what the potential direct, indirect, and cumulative impacts of changing this provision will be; 2) how the potential direct, indirect, and cumulative impacts have been or will be measured; 3) what baseline data has been compiled on commercial location decision-making; and 4) how the County will mitigate the potential direct, indirect, and cumulative impacts resulting from the deletion of this provision.

FGMP-1.14 in the Revised FGMP now requires the County to designate existing, legally conforming commercial uses not located in the established communities of Three Rivers, Springville and Lemon Cove with appropriate use designations, whereas the 1981 Plan made assignment of such use designations discretionary. See Goal 1, Policy 4 at page 12. FGMP-1.14 is implemented by IM 8.

> Please explain the analysis and rationale behind this change divesting the County of discretion in this land-use determination. What is its anticipated direct, indirect, and

cumulative impact, and on what data is this expectation based?

Please explain how FGMP-1.14 will be implemented by IM 8, which deals specifically with substantial improvements or expansions of commercial uses outside the established communities, and requires them to conform to the FGMP development standards.

Policy 3 of the New Development section in the 1981 Plan mandated that "new development **shall** be designed in a manner which preserves the visual quality of the foothill setting...." 1981 Plan, page 13 (emphasis added). This provision has been stripped of its force in the Revised FGMP, which now requires only that the County "encourage" design that preserves visual resources. See **FGMP-1.7.**

Please explain 1) why this provision was revised to weaken it; 2) what the potential direct, indirect, and cumulative impacts of changing this provision will be; 3) how the potential direct, indirect, and cumulative impacts of new development that chooses not to respond to the County's "encouragement" on the visual resources of the foothills have been or will be measured; 4) what new baseline data has been compiled on the potential direct, indirect, and cumulative impacts of such development; and 5) how the County will mitigate the potential direct, indirect, and cumulative impacts resulting from the weakening of this provision. Please also provide the analysis and rationale underlying the decision to change the provision from a mandatory one.

Policy 6 of the 1981 Plan's New Developments section limited **neighborhood commercial centers** to those of "a type and size to service a neighborhood". The Revised FGMP has removed this limitation, and will permit any developments "that provide neighborhood services" " which may be interpreted to mean any commercial enterprise as long as customers are drawn from the neighborhood. See **Revised FGMP-1.8**, page 3-6. In addition, this provision has increased the allowable size of neighborhood commercial centers from 5 acres to 10 acres.

Please explain 1) why this provision was revised to remove the type and size limitations, thus weakening its ability to preserve the character of Foothill communities; 2) why the permissible size of a commercial center has been doubled in size; 3)what the potential direct, indirect, and cumulative impacts of changing this provision will be; 4) how the potential direct, indirect, and cumulative impacts of this change have been or will be measured; 5) what data has been compiled on the potential direct, indirect, and cumulative impacts of such potentially uncontrolled development on foothill neighborhoods; and 6) how the County will mitigate the potential direct, indirect, and cumulative impacts resulting from the weakening of this provision.

Please provide the analysis and rationale underlying each response.

Please also revise the caption on FGMP-1.8 to read "Neighborhood Commercial Centers" rather than "Commercial Neighborhood Centers", as the connotations of each are quite different.

FGMP-1.9 has materially changed Goal 3 Policy 7 of the 1981 Plan. The Revised FGMP has deleted the 1981 Plan•s requirement that commercial recreation uses **shall be located** in close proximity to unique natural features, replacing it with language that merely requires the County to ▪encourage commercial recreation uses near• such natural features. The change in language alters the purpose of the policy from establishing a limitation on commercial locations (i.e., requiring commercial recreation uses to be located close to the natural feature they plan to exploit) to a policy urging the County to encourage new commercial ventures near such features.

Please explain 1) why this provision was changed to alter its focus; 2) what the potential direct, indirect, and cumulative impacts of changing this provision will be on traffic patterns, air quality, wildlife and human populations and habitat, and on the natural features located in the foothills; 3) how the potential direct, indirect, and cumulative impacts of this change have been or will be measured; 4) what baseline data has been compiled on the potential direct, indirect, and cumulative impacts of such a change; and 5) how the County will mitigate the potential direct, indirect, and cumulative impacts on fragile natural features and the foothill population (human and wildlife) resulting from implementation of this provision. Please also provide the analysis and rationale underlying the decision to change the provision.

Please explain how this provision, requiring the County to encourage commercial recreational uses, will be implemented by IM 7, which deals with Site Plan Review.

FGMP-1.10 has removed the 1981 Plan•s restriction on the location and design of mobilehome projects (which ▪shall be located and designed in a manner which is compatible with existing development•)(1981 Plan New Development policy 9) and replaced it with a weaker provision that merely ▪encourages• compliance with the former standard.

Please explain 1) why this provision was revised to weaken it; 2) what the potential direct, indirect, and cumulative impacts of changing this provision will be; 3) how the potential direct, indirect, and cumulative impacts of the new, more lenient policy have been or will be measured; 4) what data has been compiled on the potential direct, indirect, and cumulative impacts of the revision; and 5) how the County will mitigate the potential direct, indirect, and cumulative impacts resulting from the weakening of this provision. Please also provide the analysis and rationale underlying the decision to change the provision from a mandatory one.

FGMP-1.11 has materially changed New Development policy 10 in the 1981 Plan. Whereas the 1981 Plan made allowance of light industrial uses in a development corridor discretionary, and subject to a conditional use permit, FGMP-1.11 now makes the granting of such light industrial uses mandatory. (▪The County shall allow....•) FGMP-1.11 also has exchanged the previously required conditional use permit for a special use permit.

Please explain why this provision was revised to remove the County•s discretion in

approving light industrial uses in foothill development corridors and made such approval mandatory.

Please also explain 1) what the potential direct, indirect, and cumulative impacts of changing this provision will be; 2) how the potential direct, indirect, and cumulative impacts of this mandatory approval measure have been or will be measured; 4) what baseline data has been compiled on the potential direct, indirect, and cumulative impacts of such potential development; and 5) how the County will mitigate the potential direct, indirect, and cumulative impacts resulting from the weakening of this provision. Please also provide the analysis and rationale underlying the decision to change the provision from a discretionary to a mandatory one.

FGMP-3.2, formerly New Development policy 11 in the 1981 Plan, now mandates approval of rock, sand and gravel excavation operations in the foothills upon approval of a mining permit; in the 1981 Plan, a conditional use permit was required. FGMP-3.2 has also eliminated from the factors that must be considered in granting the mining permit the "social and economic impact" elements previously required under the 1981 Plan.

Please explain what effect the change from a conditional use permit to a mining permit will have. Why was consideration of social and economic impacts of such excavation operations removed from the factors that must be considered before approving the permit? Please also explain 1)what will the potential direct, indirect, and cumulative impacts of changing this provision overall be; 2) how the potential direct, indirect, and cumulative impacts have been or will be measured; 4) what data has been compiled on the potential direct, indirect, and cumulative impacts of such mandatorily-approved activities; and 5) how the County will mitigate the potential direct, indirect, and cumulative impacts of such activities, especially as concerns social and economic concerns in the area of the excavations. Please also provide the analysis and rationale underlying the decision to change the provision from a mandatory one.

FGMP-4.2 has changed policy 3 of the Recreation/Open Space section in the 1981 Plan, by encouraging private recreational "uses" rather than "areas."

Please advise what potential direct, indirect, and cumulative impacts the change from "areas" to "uses" may have, and what the County will do to mitigate such potential direct, indirect, and cumulative impacts.

FGMP-5.1 substantially changes Agricultural Lands policy 1 in the 1981 Plan. Where FGMP-5.1 now provides only that "The County shall maintain and preserve extensive and intensive agricultural uses in the foothills", the provision on which it is based provided much more: "Protect extensive and intensive agricultural **areas as identified by the FGMP from encroachment of non-agricultural uses through the use of large lot exclusive agriculture zoning.**" By omitting the statement of means by which these agricultural lands shall be maintained, the FGMP removes one level of protection from these properties.

Given the County•s emphasis on preserving agricultural lands, please provide the analysis and rationale behind the modification of this provision. Please also explain 1) what the potential direct, indirect, and cumulative impacts of changing this section will be; 2) how the potential direct, indirect, and cumulative impacts have been or will be measured; 3) what baseline measures of currently existing foothill agricultural land have been compiled; and 4)how the County will mitigate the potential direct, indirect, and cumulative impacts resulting from the weakening of this section.

The remaining Foothill Ag policies of the 1981 Plan, **Policies Ag 2 and 3**, have been completely eliminated from the Revised FGMP. Policy 2 required the County to maintain ag zones to protect and enhance the viability of agriculture in the foothills through adequate minimum parcel sizes; Policy 3 limited residential development densities within the Success Valley to avoid conflicts with ag uses.

Please explain 1) why these provisions were deleted; 2) what the potential direct, indirect, and cumulative impacts of deleting these provisions will be on continued agricultural uses in the foothills; 3) how the potential direct, indirect, and cumulative impacts on foothill agriculture have been or will be measured; 4) what new baseline data has been compiled on foothill agricultural uses; and 5) how the County will mitigate the potential direct, indirect, and cumulative impacts resulting from the deletion of these provisions. Please also provide the analysis and rationale underlying the decision to delete the provisions.

FGMP-6.1 has changed the County•s responsibility to protect scenic county roads to a responsibility to protect County scenic roads; the former does not require that a scenic road have been officially designated as a Scenic Road, the latter does.

Please revise this provision to return it to its original intent of protecting county scenic roads, whether or not officially designated as a Scenic Road. If the provision will not be returned to its original condition, please provide the analysis and rationale for not doing so, and also explain 1) what the potential direct, indirect, and cumulative impacts of the change will be; 2) how the potential direct, indirect, and cumulative impacts have been or will be measured; 3) what data has been compiled to justify the change; 4) how the County will mitigate the potential direct, indirect, and cumulative impacts resulting from the modification of this provision.

FGMP-6.1 is •implemented• by IM 12, which requires the County to maintain agricultural zones with minimum parcel sizes, IM 16, which deals with Williamson Act cancellations, and IMs 17-19 (extensive agriculture zoning).

Please explain how IMs 12 and 16 - 19 implement the scenic roads protection contemplated by FGMP-6.1.

The second goal under the Flora and Fauna section of the 1981 Plan requires the County to

▪**Prevent encroachment** of development onto riparian woodland habitats.. **FGMP (1981) p. 18.** This policy has been completely erased from the proposed FGMP; it simply doesn▪t appear. Accordingly, neither does the implementation provision that specifically designated major riparian areas of each identified development corridor as open space.

Please explain 1) why this provision was deleted; 2) what the potential direct, indirect, and cumulative impacts of deleting this provision will be on riparian woodland habitats; 3) how the potential direct, indirect, and cumulative impacts on the woodlands, waterways, and area wildlife have been or will be measured; 4) what new baseline data has been compiled on riparian woodland habitats; 5) how the County will mitigate the potential direct, indirect, and cumulative impacts resulting from the deletion of this provision. Please also provide the analysis and rationale underlying the decision to delete the provision.

The **Development Standards** set out in the 1981 Plan contained specific standards regarding

X residential density (dependant on the amount of water available and slope)
X lot design
X grading
X erosion controls (including requirements that cuts be planted with native plant materials)
X drainage
X vegetation removal (restricting removal or grading around native trees)
X open space requirements
X preserving areas adjacent to watercourses
X building on slopes greater than 30%
X environmentally, archaeologically, or historically sensitive areas (to be maintained as common open space)
X well and community water system standards
X street construction and maintenance standards
X parking requirements
X fire protection
X scenic highway corridor provisions, and
X Foothill-specific building standards (including establishing maximum building heights, setbacks and sideyard requirements for buildings along scenic roads, and minimum lot sizes).

These Development Standards have all been **deleted** from the Revised FGMP and replaced with a mere 11 provisions, which deal only with fire protection measures (standards a, b, c, d, f, g, I and k), and visibility of street house numbers from the main roadway (which in most foothill communities will be a considerable distance from the house itself, and is also primarily a fire protection measure). The remaining two measures, h and j, address parkland buffer zones, and bridge carrying capacity▪ again, essentially fire protection measures.

Please explain 1) why the former detailed standards were deleted and replaced with generic, fire-protection-related standards only; 2) what the potential direct, indirect, and cumulative impacts of deleting the former detailed standards will be; 3) what data has been compiled on which to evaluate the appropriateness of replacing the former comprehensive Foothill-specific standards with a generic fire-protection standard; 4) how the potential direct, indirect, and cumulative impacts have been or will be measured; 5) how the County will mitigate the potential direct, indirect, and cumulative impacts resulting from the replacement of these standards. Please also provide the analysis and rationale underlying each response.

FGMP-6.3 requires development along all scenic highways and routes to meet "the development standards of this FGMP."

Please explain how this provision may be enforced, since this FGMP (as opposed to the 1981 Plan) does not incorporate any development standards specific to scenic highways and routes.

FGMP 8.14 has removed the County's obligation to identify rare and endangered species and wildlife of special concern, and to protect their habitat against encroachment by development, and replaced it with a provision that obligates the County to protect such habitat only "[w]here special status species have been identified...". As worded, FGMP-8.14 would permit the County to protect the habitat of rare and endangered species, and of wildlife of special concern, if the species had not attained official designation as "rare," "endangered," or "of special concern."

Please explain who is now responsible for identifying such "special status" species? Where is a "special status" species defined?

Please explain 1) why this provision was deleted; 2) what the potential direct, indirect, and cumulative impacts of deleting this provision will be; 3) how the potential direct, indirect, and cumulative impacts have been or will be measured; 4) what baseline measures have been taken against which to measure the potential direct, indirect, and cumulative impacts of deleting this provision; 5) how the County will mitigate the potential direct, indirect, and cumulative impacts resulting from the deletion of this provision. Please also provide the analysis and rationale underlying the decision to delete this provisions.

By comparison with the Revised FGMP, Level II of the 1981 Plan identifies wildlife habitats in each development corridor, and Level III designates sensitive wildlife areas as open space in each development corridor.

Please identify where in the Revised FGMP these habitats and designated open space wildlife areas are identified. If the Revised FGMP does not identify these habitats and open space wildlife areas, please explain 1) why this data and implementation measure were deleted; 2) what is the status of previously-designated open space under the revised

FGMP; 3)what the potential direct, indirect, and cumulative impacts of deleting this data and implementation measures will be on the habitats and designated wildlife open spaces; 3) how the potential direct, indirect, and cumulative impacts have been or will be measured; 4) what baseline measures have been taken against which to measure the potential direct, indirect, and cumulative impacts of deleting these provisions; and 5) how the County will mitigate the potential direct, indirect, and cumulative impacts resulting from the deletion of this data and implementation measure.

FGMP 8.17 has narrowed the scope of the 1981 provision dealing with reducing vehicle emissions by discouraging scatter development from "the entire foothill region" to "the foothills."

Please explain 1) why this provision was deleted; 2) what the potential direct, indirect, and cumulative impacts of deleting this provision will be; 3) how the potential direct, indirect, and cumulative impacts have been or will be measured; 4) what baseline measures have been taken against which to measure the potential direct, indirect, and cumulative impacts of deleting this provision; 5) how the County will mitigate the potential direct, indirect, and cumulative impacts resulting from the deletion of this provision. Please also provide the analysis and rationale underlying the decision to delete this provisions.

Please identify the boundary line for "the foothills"? What analysis has been done to justify reducing the scope of the provision? While admittedly a general term, at least "Foothill region" makes clear that it includes an area around the foothills as well as the foothills themselves.

The 1981 Plan Development Standards provide specific guidelines for **vegetation removal**, including measures required to protect native trees. There are no corresponding provisions in the Revised FGMP.

Please explain 1) why these provisions were deleted; 2) what the potential direct, indirect, and cumulative impacts of deleting these provisions will be; 3) how the potential direct, indirect, and cumulative impacts have been or will be measured; 4) how the County will mitigate the potential direct, indirect, and cumulative impacts resulting from the deletion of these provisions. Please also provide the analysis and rationale underlying the decision to delete the provisions. What baseline data has been compiled on native vegetation, including trees, to ensure ongoing protection of foothill vegetation?

The 1981 Plan sets out **specific building standards** setting maximum building heights, minimum property widths for properties along scenic highways, setbacks, well or water systems, street standards, and fire protection. It also sets specific requirements for construction and business signage within scenic highway corridors. None of these provisions appear in the Revised FGMP.

Please explain 1) why these provisions were deleted; 2) what the potential direct, indirect,

and cumulative impacts of deleting these provisions will be; 3) how the potential direct, indirect, and cumulative impacts have been or will be measured; 4) what baseline measures have been taken against which to measure the potential direct, indirect, and cumulative impacts of deleting these provisions; 5) how the County will mitigate the potential direct, indirect, and cumulative impacts resulting from the deletion of these provisions. Please also provide the analysis and rationale underlying the decision to delete these provisions.

Goals 1 (Community Identity), 2 (Preserving Community Values) and 3 (New Development) of the 1981 Plan have been co-mingled in the Revised FGMP, such that goals have been **downgraded** into policies (see, e.g., Goal 2, which is now FGMP-1.3), policies have been completely omitted (see, e.g., Community Identity policies 1, 2, and 5), and the overall effect of the revision is to make the guidance the FGMP is supposed to provide, more difficult to obtain.

Please provide the analysis and rationale underlying the decision to co-mingle these provisions, which disrupts the organization of the 1981 Plan, makes the document more difficult to use and to correlate to the 1981 Plan, and appears to have resulted in wholesale errors or intentional changes and omissions to a document the County repeatedly has said has not been changed.

III POLICIES WITH NO CORRESPONDING IMPLEMENTATION MEASURE; IMPLEMENTATION MEASURES WITHOUT CORRESPONDING POLICIES

▪An implementation measure is a specific measure, program, procedure, or technique that carries out plan policies. . . . Implementation measures should describe actions that are concrete and measurable so their completion can be easily monitored in annual reports.▪ Tulare County General Plan, Goals and Policies Report, p. 1-9.

The DEIR utterly fails to comply with this standard because:

There are NO identified corresponding Implementation Measures for FGMP-1.2; 1.5; 1.7; 1.10, 1.11; 1.12; 1.13.

There are NO identified corresponding Implementation Measures for FGMP-2.2 or 2.3.

There are NO identified corresponding Implementation Measures for FGMP-4.2 or 4.3.

There are NO identified corresponding Implementation Measures for FGMP-5.1.

There are NO identified corresponding Implementation Measures for FGMP-6.2 or 6.3.

There are NO identified corresponding Implementation Measures for **ANY** of the provisions of FGMP-8 other than as pertains to development in the Frazier Valley watershed. (Implementation Measure 25).

There are NO identified corresponding Implementation Measures for FGMP-9.2, 9.3, 9.4 or 9.5.

There are NO identified corresponding Implementation Measures for FGMPs 10.3 or 10.4.

> Please explain 1) why no implementation measures have been included for these policies; 2) what the potential direct, indirect, and cumulative impacts of omitting implementation measures for these policies will be; 3) how the potential direct, indirect, and cumulative impacts of these omissions have been or will be measured; 4) what baseline measures have been taken against which to measure the potential direct, indirect, and cumulative impacts of omitting implementation measures for these policies; 5) how the County will mitigate the potential direct, indirect, and cumulative impacts resulting from the omissions of these measures. Please also provide the analysis and rationale underlying the decision to leave these policies with no implementation measures.

Given the astounding **lack of implementation measures for over 85%** of the Revised FGMP's policies, these policies are no more than wishful thinking. The DEIR analyses that cite to, reference, or rely on policies outlined in the Updated FGMP are therefore without foundation. If the Revised FGMP is made part of the GPU rather than incorporating the existing, 1981 Plan (which has worked reliably and well for over 25 years), the Foothill region will have no enforceable guidelines, and development in the Foothills will be able to take place at the whim of the developer. Even if County staff want to implement the policies, they will be subject to challenge, as the County will have no legal foundation upon which to require adherence to what are in essence mere hopeful statements.

Again, we urge the County to incorporate the 1981 Plan in its entirety into the GPU.

The DEIR is also deficient, because it relies for its analysis on faulty underlying documents and provisions contained (or not contained but referenced) in the Goals and Policy Report and Background Report. For example, with respect to FGMP provisions cited as supporting or mitigating factors in the DEIR (see also discussion above):

Implementation Measure 15 implements "FGMP-5.3." There is no FGMP-5.3.

Implementation Measure 21 implements FGMP-7.3, 7.4, and 7.5. There are no FGMP policies 7.3, 7.4 or 7.5.

There are "Implementation Measures" for FGMP-9.6, 9.7 and 9.14. Again, there are no policies 9.6, 9.7 or 9.14.

Implementation Measures 31 through 34 "implement" policies FGMP-10.5, 11.1 and 11.4. But again, these policies appear **nowhere** in the Revised FGMP.

Please identify why the policies identified in these IMs have apparently been deleted from the Revised FGMP and specify what the deleted policies were.

FGMP-3.1 (Innovative Residential Design) and **3.2** are supposedly implemented by IMs 10-12. However, IMs 10 and 11 deal specifically with changes to the Badger Development Corridor; IM 12 deals with minimum agricultural parcel sizes.

Please explain how these implementation measures apply to FGMP-3.1 and 3.2.

FGMP-4.1 (Identification of Environmentally Sensitive Areas) is identified as being implemented by IM 14, which deals with cluster development.

Please explain how IM 14 will implement FGMP-4.1.

FGMP-7.1 (Inventory of Historical Sites) is implemented by IMs 20 - 22. IM 20 requires the use of cluster development; IM 21 requires a Planned Development-Foothill zone; and IM 22 addresses zoning in Success Valley.

Please explain how IMs 20 - 22 implement FGMP-7.1.

FGMP-7.2 & 7.3 (Preparation of Archeological Sensitivity Map and Protection of Historical or Archeological Sites) are also implemented by IMs 21 and 22. IM 21 requires a Planned Development-Foothill zone; and IM 22 addresses zoning in Success Valley.

Please explain how IMs 21 and 22 implement FGMP-7.2 and 7.3.

Implementation Measure (IM) 23, which claims to implement Policies 8.1, 8.2 and 8.3 notes that an archeological sensitivity map has been prepared for Tulare County, for use in determining areas of the foothills that may be archeologically sensitive. But Policies 8.1 through 8.3 deal with riparian area development, development drainage patterns, and development in floodplains, respectively.

Please explain how IM 23 can implement Policies 8.1, 8.2 or 8.3.

FGMP-8.11 requires the county to prohibit development on slopes of 30% or greater unless the inherent problems of developing on steep slopes can be overcome. There is no identified corresponding Implementation Measure.

Please explain 1) why there is no implementation measure for this policy; 2) what the potential, indirect, and cumulative impacts of failing to provide an implementation measure for this policy will be; 3) how the potential , indirect, and cumulative impacts have been or will be measured; 4) what baseline measures have been taken against which to measure the potential direct, indirect, and cumulative impacts of omitting an implementation measure for this policy; 5) how the County will mitigate the potential

direct, indirect, and cumulative impacts resulting from the omission of an implementation measure for this policy. Please also provide the analysis and rationale underlying the decision to omit implementation measures for this policy.

The only implementation measure that comes even close to addressing FGMP-8.11 is FGMP Implementation Measure 4, which requires only ▪information in the site plan review process to delineate▪ slopes of that magnitude. Then, the review ▪will prescribe a project design▪ that will maintain 30% slopes ▪generally free of improvements▪.

Even assuming that IM 4 was intended to implement FGMP-8.11, how does an implementation measure that requires only information to delineate slope, and that permits some improvements on slopes of 30%, implement a policy that PROHIBITS ANY development on slopes of 30% or more unless mitigated?

The **information note** on page 3-10 refers users to **Chapter 5, Land Use Policy LU-1.7, and Chapter 8, Environmental Resources Management**, for further provisions dealing with slopes. However, LU-1.7 only requires a geological report for development on slopes over 15%. The only identified IM for LU-1.7 requires only that the County develop a database of identified potentially unstable soils and slopes. (IM 6) Thus, there appears to be NO implementation measure anywhere in the GPU that will lead to the result sought in FGMP-8.11 ▪ prohibition of development on 30% slopes.

Please explain 1) how LU-1.7, which requires a geological report for slopes over 15%, and the implementation measure for LU-1.7 (IM6), which requires creation of a database, inform FGMP-8.11, which prohibits development on slopes over 30%.

Please also explain how LU-1.7 will be implemented by IM6.

Other provisions of the GPU are contradictory: HS-2.3 merely ▪discourages▪ construction and grading on slopes in excess of 30% ▪ and once again, there is no identified corresponding implementation measure. ERM-7.3 prohibits construction or road-building on slopes in excess of 30% ▪ ▪unless otherwise provided for in this General Plan.▪

Given the many many inconsistent and contradictory provisions throughout the GPU, it is difficult to tell what may be ▪otherwise provided for in this General Plan.▪ And once again, there are no identified corresponding IMs for either HS-2.3 or ERM 7.3.

Please explain how FGMP 8.11, HS-2.3, ERM 7.3 and LU-1.7 1) can be reconciled; 2) provide guidance to the public and future officials regarding land use decisions.

FGMP-8.7, which seeks to minimize soil disturbances through cluster development, narrower road widths, minimized cut and fill projects, and conforming roads to natural contours, again, has no corresponding implementation measure. IM 14, which supposedly implements FGMP 4.1, and which is not identified in connection with FGMP-8.7, requires the County to promote cluster

development, but is silent on the remaining elements of FGMP-8.7.

By comparison, the 1981 Plan specifies that development standards will prescribe open space requirements, narrower road widths, grading and slope stabilization plans for slopes over 15%.

Please explain 1) why this provision has no implementation measure; 2) what the potential direct, indirect, and cumulative impacts of omitting this provision, and specifically, of eliminating the specific provisions of the 1981 Plan will be; 3) how the potential direct, indirect, and cumulative impacts have been or will be measured; 4) what baseline measures have been taken against which to measure the potential direct, indirect, and cumulative impacts of omitting this provision; 5) how the County will mitigate the potential direct, indirect, and cumulative impacts resulting from the omission of implementation measures for this policy. Please also provide the analysis and rationale underlying the decision to leave this policy with no implementation measure.

Please also explain in clear and explicit terms, how IM 14 will ▪promote▪ the use of cluster developments. Please also explain why IM 14, which is part of the Foothill Growth Management Plan, applies only to protecting designated scenic corridors, rather than the Foothill region generally. What analysis was done to determine that such limited scope was warranted? Please explain what the potential direct, indirect, and cumulative impacts of limiting the application of this IM to scenic corridors will be; 3) how the potential direct, indirect, and cumulative impacts have been or will be measured; 4) what baseline measures have been taken against which to measure the potential direct, indirect, and cumulative impacts of so limiting this provision; 5) how the County will mitigate the potential direct, indirect, and cumulative impacts resulting from the limited scope of this IM.

FGMP-8.13 requires the County to encourage developers to use landscaping plants compatible with native vegetation. (The 1981 Plan provides that landscaping for developments ▪should contain plant material compatible with native vegetation.) Again, there is no identified corresponding IM.

Please clarify that ▪native vegetation▪ means vegetation native to the particular area to be landscaped. Please also explain what discrete, measurable standards apply to determine whether a landscaping plant is ▪compatible▪ with native vegetation.

Please explain 1) why this FGMP-8.13 has no implementation measure; 2) what the potential direct, indirect, and cumulative impacts of omitting implementation measures for this policy will be; 3) how the potential direct, indirect, and cumulative impacts have been or will be measured; 4) what baseline measures have been taken against which to measure the potential direct, indirect, and cumulative impacts of omitting implementation measures; 5) how the County will mitigate the potential direct, indirect, and cumulative impacts resulting from the omission of implementation measures for this policy. Please also provide the analysis and rationale underlying the decision to leave this policy with no

implementation measure

IM 27 which is not identified as implementing FGMP 8 13 requires the County to review landscaping plans through the site plan review process to ensure that "areas to be landscaped are "compatible with surrounding native vegetation This language appears to have been taken from the 1981 Plan but it is not clearly linked to any part of Policy 8 Instead this IM is linked to FGMP 9 14 which doesn't exist

Please explain what policies 9 10 9 12 9 13 9 15 9 17 and 9 20 which are referred to and relied on in the DEIR analyses and which apparently did exist in an earlier version of the GPU provided

Please also explain 1) why these policies and their implementation measures were deleted from the GPU 2) what the potential direct indirect and cumulative impacts of omitting these policies and implementation measures will be 3) how the potential direct indirect and cumulative impacts have been or will be measured 4) what baseline measures have been taken against which to measure the potential direct indirect and cumulative impacts of deleting these policies and implementation measures 5) how the County will mitigate the potential direct indirect and cumulative impacts resulting from the deletion of these policies and implementation measures Please also provide the analysis and rationale underlying the decision to delete these policies and implementation measures

FGMP 9 1 formerly part of New Development in the 1981 Plan is supposedly implemented by IM 24 FGMP 9 1 prohibits approval of new development that exceeds the maximum physical holding capacity (based on water availability and soils) IM 24 however provides only that "environmentally sensitive and riparian areas within development corridors are designated as open space on the County's Land Use Diagram

Please explain how IM 24 implements FGMP 9 1 Where is the County's Land Use Diagram? Please provide a copy of the Diagram and include it in the Revised FGMP

FGMP 10 1 requires the County to encourage development projects within a definable geographic area of a development corridor to comply with a common development or specific plan designed for that area The goal of this policy provision is integration of efficient road systems community values infrastructure improvements and open space patterns **FGMP 10 2** requires the County to ensure that developments in the foothills can be adequately served by existing County fire and Sheriff's facilities

FGMPs 10 1 and 10 2 are purportedly implemented by **IMs 28 31** However these IMs are inapposite and deal instead with ensuring that the magnitude of proposed projects can be supported by the available water effluent holding capacity drainage plan and wastewater disposal systems

Please explain how IMs 28 31 implement FGMP 10 1 and 10 2

MINOR CORRECTIONS

Please note that there is no policy labeled FGMP 1 1 (the section begins with FGMP 1 2)

Please correct the apparent typographical error at 3 3 last line on the page so that the final sentence reads "Rather than treat these lands instead of "Rather than tread

Please delete the final "s from the word "designations in FGMP 6 5
Please correct IM 5 to read "committee of rather than "committee or

Please note that FGMP Implementation Measures 14 and 20 are identical Please address the duplication

FGMP 8 19 Please delete the words "shall be encouraged at the end of the sentence as duplicative (and a carry over from the 1981 language)

The DEIR also refers to F 6 1 (Protect Ag land) this policy is actually FGMP 5 1

Thank you for considering these comments

From: "Karen Bodner" <karen@grodsky-olecki.com>
To: <dpbryant@co.tulare.ca.us>
Date: 04/15/2008 11:26 AM
Subject: Comments on DEIR
Attachments: DEIR cover letter.doc; FGMP comments KB2.doc

Dear Mr. Bryant:

Attached are our comments on the Tulare County General Plan Update 2030 DEIR. I understand from Laurie Schwaller, who spoke with you yesterday, that you are accepting electronic submissions in lieu of hard copy. If the County will require hard copy either mailed or delivered, I will be happy to provide them, but will expect this transmission to bring any such supplemental filing within the scope of the filing deadline.

Out of an abundance of caution, and to ensure that the comments are timely filed, I am also sending a copy to eosorio@co.tulare.ca.us, with whom I spoke this morning, and who indicated she would ensure they reached you.

Thank you for your consideration of our comments.

Karen Bodner

From: "Karen Bodner" <karen@grodsky-olecki.com>
To: "David Bryant" <DPBryant@co.tulare.ca.us>
Date: 04/16/2008 2:12 PM
Subject: Errata - Bodner/Olecki DEIR comments submitted 4/15/08

Dear Mr. Bryant:

Please correct the inadvertent omission of the word "not" between the words "to" and "protect" at the beginning of the last sentence in the first paragraph of our comment on FGMP-8.14, page 14 of 22, submitted yesterday. The sentence should have read

"As worded, FGMP-8.14 would permit the County to not protect the habitat of rare and endangered species, and of wildlife of special concern, if the species had not attained official designation as Arare,@ Aendangered,@ or Aof special concern" etc.

Thank you.

Karen Bodner

From: "Laurel Firestone" <laurel.firestone@communitywatercenter.org>
To: <DPBryant@co.tulare.ca.us>
Date: 04/14/2008 10:37 PM
Subject: Comments on the Draft Environmental Impact Report for the General Plan
Attachments: CWC EIR Comments.pdf

Dear Mr. Bryant,
Please find attached written comments to the Draft Environmental Impact Report on the Tulare County General Plan Update. These comments are meant to supplement a joint letter we are submitting with the Center on Race Poverty and the Environment and other groups on the General Plan Update. Feel free to contact me if you have any questions or concerns. We look forward to working with you on this important effort.
Sincerely,
--
Laurel Firestone
Co-Director & Attorney at Law
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313 N. West St.
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April 14, 2008

Dave Bryant
Div. Manager- Special Projects
Tulare County Resource Management Agency
5961 S. Mooney Blvd.
Visalia, CA 93277

Re: Tulare County General Plan Update 2025

Dear Mr. Bryant:

The Community Water Center respectfully submits these supplementary comments on the Draft Environmental Impact Report (DEIR) for the Tulare County General Plan Update 2025.

Water Quality Impacts

The DEIR fails to identify, analyze, address, or mitigate significant water quality impacts of this General Plan that will affect the environment and public health, particularly as they impact the drinking water sources of many communities, hamlets, and rural private well owners in the county.

Currently 20% of small public water systems in the County have nitrate violations.[1] Other public water systems in the County have arsenic, uranium, and DBCP levels above legal limits.[2] In addition, a 2006 study of 181 private wells in Tulare County showed that 40% of private wells tested had nitrate over the Maximum Contaminant Level (MCL) (the most widespread drinking water contaminant) and approximately 75% had at least one contaminant over safe limits.[3] The number of systems in violation has been increasing significantly in recent years, as have contaminant levels in many areas.[4]

[1] California Department of Health Services. "Local Primacy Agency Annual Evaluation Report, Tulare County, Fiscal Year 2005-2006."
[2] Number of violations are reported in the Department of Public Health's annual violation reports available at http://ww2.cdph.ca.gov/certlic/drinkingwater/Pages/Publications.aspx
[3] State Water Resources Control Board's Groundwater Ambient Monitoring and Assessment Program for domestic wells, available at http://www.waterboards.ca.gov/gama/voluntry.html#tulare.
[4] See the Department of Public Health's annual violation reports available at http://ww2.cdph.ca.gov/certlic/drinkingwater/Pages/Publications.aspx, as well as data on nitrate levels of public water systems available from the Tulare County Environmental Health's drinking water program.

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However, despite discussion of the widespread and increasing water quality challenges in the background report, written comments on the Draft General Plan Update, and written response to comments by Tulare County Environmental Health staff, the DEIR incorrectly, and without any clear basis, states that the general plan will not significantly impact water quality. Furthermore, because of this determination, the DEIR fails to analyze, address or mitigate these significant water quality impacts to human health and the environment.

All evidence in the record (including the comments from Tulare County Environmental Health staff in the written response to comments to the Draft General Plan Update) indicates that drinking water quality problems will continue to increase as a result of this General Plan, unless strong and significant steps are taken to mitigate these problems.

Specifically, the general plan fails to identify and analyze the environmental and public health impacts caused by continuing and increasing levels of land use practices that contribute to groundwater contamination (i.e. fertilizer application, manure application, application of sewer system discharges to land, septic systems). For example, the vast majority of wastewater treatment facilities in the County have been given violations by the Regional Water Quality Control Board for violations related to groundwater contamination. The water quality impact of these continued violations, or an analysis of how these systems will be improved to mitigate this impact, is not included in the DEIR. Such an analysis of water quality impacts is particularly important considering the significant increase in waste treatment needed to accommodate the projected growth and development.

The DEIR should analyze the water quality impacts of continuing and increasing levels of the primary sources of drinking water contamination, particularly nitrates, and develop mitigation measures to address those impacts. Nitrates come from fertilizer application to land, manure and animal waste application to land, and septic and sewer treatment waste to land. These sources will all continue or increase in intensity according to the General Plan. Additionally, with increased groundwater pumping and unmitigated water supply impacts, current groundwater quality problems will be further exacerbated. Therefore, without mitigation measures, there will be a significant impact on groundwater quality, which will greatly impact drinking water quality and human health.

In a separate joint letter on this draft General Plan Update, we have outlined specific policies and implementation measures that should be considered as mitigation measures for these impacts. Many of these policies and mitigation measures are already being pursued through the Tulare County Water Commission and county staff. By ignoring water quality, this DEIR undermines all the work county staff, Water Commissioners,

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and many county residents and other partners have already begun to develop efforts to address these challenges.

Water Supply Impacts

Additionally, the DEIR states that there are no feasible mitigation measures to reduce the significant impact on water supply. However, the DEIR fails to analyze a number of mitigation measures, including an alternative analogous to the City of Visalia's groundwater ordinance. In a separate joint letter on this Draft General Plan Update, we include a number of other policies and implementation measures that should be discussed as additional feasible mitigation measures.

Thank you for the opportunity to provide comments on this DEIR. We look forward to working with the county to secure safe, clean and affordable water for all county residents.

Sincerely,

Laurel Firestone
Co-Executive Director & Attorney at Law

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www.communitywatercenter.org

CENTER for BIOLOGICAL DIVERSITY

Via Overnight Mail, with Attachments

April 14, 2008

Dave Bryant
Div. Manager - Special Projects
Tulare County Resource Management Agency
5961 S. Mooney Blvd.
Visalia, CA 93277

Re: Comments on the Draft Environmental Impact Report for the Tulare County General Plan 2030 Update, State Clearinghouse No. 2006041162

Dear Mr. Bryant:

These comments are submitted on behalf of the Center for Biological Diversity on the Draft Environmental Impact Report ("DEIR") for the Tulare County General Plan 2030 Update, State Clearinghouse No. 2006041162 ("the General Plan Update"). The Center for Biological Diversity ("Center") is a non-profit conservation organization dedicated to the protection of native species and their habitats through science, policy, and environmental law. The Center's Climate, Air, and Energy Program works to reduce greenhouse gas emissions to protect biological diversity, our environment, and public health. We work to educate the public about the impacts of climate change on our world and the animals and plants that live in it and to build the political will to enact solutions. The Center has over 40,000 members throughout California and the western United States, including in Tulare County. Center members will be directly impacted by the Project.

Under state law, the general plan is the "constitution for all future developments." *Napa Citizens for Honest Gov't v. Napa County*, 91 Cal. App. 4th 342, 355 (2001). As the future land-use planning document for the County, general plan policies and land use determinations have profound implications for global warming. While climate change is a global issue, it will take the efforts of local government to bring about any meaningful improvements to the reduction of greenhouse gas emissions. This letter will focus on the Center's concern that the DEIR fails to fully evaluate and mitigate the greenhouse gas emissions resulting from the General Plan Update. Curbing greenhouse gas emissions to limit the effects of climate change is one of the most urgent challenges of our time. Fortunately, the California Environmental Quality Act ("CEQA"), Cal. Pub. Res. Code §§ 21000 et seq., 14 Cal. Code Regs. § 15000 et seq. ("Guidelines"), sets forth a clear and mandatory process to address the Project's greenhouse gas and global warming impacts. Unfortunately, while the DEIR recognizes that the Project's contribution to global warming is significant, it fails to fully quantify this contribution, fully consider alternatives, or adopt the many measures that would lessen the County's contribution to global warming. The County cannot lawfully approve the project until the required CEQA

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analysis has been completed and all feasible alternatives and mitigation measures are adopted.

I. THE LAND USE ELEMENT DOES NOT MEET THE REQUIREMENTS OF GOVERNMENT CODE SECTION 65302.

Government Code § 65302(a) requires that a land use element designate "the proposed general distribution and general location and extent of the uses of land" for specified purposes and "include a statement of the standards of population density and building intensity recommended for the various districts and other territory covered by the plan." Indeed, absent a clear understanding of the proposed location and intensity of land uses, in conjunction with population density standards for the various regions, the General Plan Update's impacts cannot be properly ascertained.

As presented in the proposed General Plan Update, the land use element only appears to describe land use designations and indicate whether the given designation is allowed in a city, community, hamlet or other incorporated area. (General Plan Goals and Policies Report at 5-5.) Beyond this very general description, the Land Use Element does not appear to indicate with any specificity the location and extent of each of these uses. Indeed, as the Land Use Element also states that "[i]ncreased density or intensity above that specified may be permitted pursuant to an adopted community plan or specific plan to achieve planning goals in this General Plan," the General Plan would appear to contemplate virtually any type of development at any location. (General Plan Goals and Polices Report at 5-7.) In addition, the land use element does not appear to contain population density standards. While a map or maps that actually delineate proposed land uses and population standards might exist or be cobbled together from existing data, "uncoordinated documents .... make resort to [the General Plan] for planning information an awkward exercise and would also seem to generate doubt concerning the integrity of the plan." *Camp v. Board of Supervisors of Mendocino County*, 123 Cal. App. 3d 334, 349 (1981) (land use element that did not correlate density and land use classifications with locations within county failed to comply with section 65302).

The heart of the general plan is the land use element. The land use element defines the jurisdiction's commitment to a particular level of development for the area covered – in this case, the entire unincorporated area of the County. Land use and density information planned for specific areas of the County is critical to accurately assessing virtually all of the environmental impacts of the proposed plan. With regard to global warming impacts, the location of future development relates directly to the greenhouse gases generated from transportation and vehicle miles traveled. The General Plan's failure to provide any specificity regarding the type and location of future growth in the County not only violates Government Code § 65302, but, as described below, infects the entire environmental analysis of Project impacts under CEQA.

II. THE DEIR MUST SET FORTH THE THREAT OF GREENHOUSE GAS POLLUTION AND GLOBAL WARMING

The DEIR fails to even briefly discuss the grave threats posed by global warming to California and the world. (DEIR at 4-46.) Moreover, the DEIR's reference to "disagreement

canary in the coal mine for climate warming. Now as a sign of climate warming the canary has died."[5] Other observed consequences of the warming climate include sea level rise, increased frequency of droughts, floods, and heat waves and substantial increases in the duration and intensity of hurricanes.[6]

The IPCC now states with "very high confidence" that most of the warming observed over the past 50 years is the result of human generation of greenhouse gases, including carbon dioxide, methane, and nitrous oxide.[7] The rapid warming observed since the 1970s has occurred in a period when the increase in greenhouse gases has dominated over all other factors.[8] The largest known contribution to global warming is from carbon dioxide.[9] Fossil fuel combustion is responsible for more than 75% of human-caused carbon dioxide emissions with the remainder due to land-use change (primarily deforestation).[10] The global atmospheric concentration of carbon dioxide has increased from a pre-industrial value of about 280 parts per million (ppm) to 379 ppm in 2005, a level that has not been exceeded during the past 650,000 years (during which carbon dioxide concentrations remained between 180 and 300 ppm)[11] and probably during the last 20 million years.[12] In 2006, carbon dioxide concentrations reached a new high of 381.2 ppm.[13] As greenhouse gas concentrations increase, more heat reflected from the earth's surface is absorbed by these greenhouse gases and radiated back into the atmosphere and to the earth's surface.[14] Consequently, the higher the level of greenhouse gas concentrations, the larger the degree of warming experienced.

At current growth rates and continued reliance on fossil fuels, atmospheric concentrations of carbon dioxide would likely exceed 1,000 ppm by the end of the century, resulting in an average global temperature increase of more than 5°C.[15] This is equivalent to the change in temperature since the last ice age – an era in which Europe and North America were

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sea ice in 2007, some scientists have predicted that "the Artic Ocean could be nearly ice-free at the end of the summer by 2012." Seth Borenstein, Ominous Arctic Melt Worries Experts, Associated Press, Dec. 11, 2007.

[5] Elizabeth Kolbert, *Testing the Climate*, THE NEW YORKER (Dec. 24, 2007).

[6] *Frequently Asked Questions*, *supra* note 2, at 107, 111.

[7] *IPCC WG 1 Summary*, *supra* note 1, at 2-3. "Very high confidence" is defined at "at least a 9 out of 10 chance of being correct." *Id.* at 3 n.7; *Frequently Asked Questions*, *supra* note 2, at 97.

[8] *Frequently Asked Questions*, *supra* note 2, at 120. Natural external factors influencing the climate, such as solar and volcanic forcing would likely have produced a cooling effect in the absence of increases in anthropogenic greenhouse gas concentrations. IPCC, *Climate Change 2007: Synthesis Report, Summary for Policymakers* at 5, (Nov. 16, 2007).

[9] *Frequently Asked Questions*, *supra* note 2, at 100.

[10] *Id.* at 115.

[11] *Id.*

[12] Joseph G. Canadell et al., *Contributions to accelerating atmospheric CO_2 growth from economic activity, carbon intensity, and efficiency of natural sinks*, 4 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCE 18866 (Nov. 20, 2007).

[13] World Meteorogical Organization, Greenhouse Gas Bulletin: The State of Greenhouse Gases in the Atmosphere Using Global Observations through 2006 (Nov. 23, 2007).

[14] Greenhouse gases have a warming effect because, when solar radiation is reflected by the earth, greenhouse gases capture this thermal radiation and reradiate it back to earth, much like the effect of a common garden greenhouse resulting in the "greenhouse effect." *Frequently Asked Questions*, *supra* note 2, at 98.

[15] United Nations Foundation & Sigma XI, Confronting Climate Change: Avoiding the Unmanageable and Managing the Unavoidable (Feb. 2007) at 48; United Nation Development Programme, *Human Development Report 2007/2008: Fighting climate change: Human solidarity in a divided world* at 3, 18 (2007).

as to the speed of global warming and the extent of the impacts attributable to human activities" ignores both the current scientific consensus on climate change, which has now determined that the link between greenhouse gas emissions and global warming is highly certain, and Executive Order S-3-05 and the California Global Warming Solutions Act of 2006 (AB 32), which squarely link greenhouse gases with global warming.

In order to conform to CEQA's informational mandates and properly inform the public and decision makers of the significance of the Project's contribution to greenhouse gases, the DEIR must first adequately discuss the threat posed by greenhouse gas emissions and avoid minimizing or discounting the severity of global warming's impacts. *See* Guidelines § 15151. *See, e.g., Laurel Heights Improvement Ass'n v. Regents of Univ. of Cal.* ("Laurel Heights I"), 47 Cal.3d 376, 392 (1988) (EIR is intended "to demonstrate to an apprehensive citizenry that the agency has, in fact, analyzed and considered the ecological implications of its action."); Guidelines § 15151 (requiring an EIR be detailed, complete, and reflect a good faith effort at full disclosure). A discussion of global warming impacts need not be lengthy, but should, at a minimum, convey the magnitude of the threat posed by global warming to humans and the environment. For the County's convenience, a scientific background on global warming and the specific threats posed to California is provided below.

A. Scientific Background on Climate Change

There is no longer credible scientific dispute that the climate is warming. In its most recent assessment, the Intergovernmental Panel on Climate Change ("IPCC") concluded that "[w]arming of the climate is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting snow and ice, and rising mean sea level."[1] Expressed as a global average, surface temperatures have increased by about 0.74°C over the last hundred years, with 11 of the 12 warmest years on record having occurred in the past 12 years.[2] One consequence of warmer temperatures is an increased likelihood of precipitation falling as rain rather than snow, leading to increased rains, reduced snowpacks, and consequently diminished water resources in summer, when they are most needed.[3] This past September, Arctic sea ice plummeted to a record-low level not anticipated by most climate models until 2050, leading scientists to predict that the Arctic could be ice-free in summer by 2030.[4] As stated by Jay Zwally, a climate expert at NASA, "the Arctic is often cited as the

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[1] IPCC, *Summary for Policymakers*, *in* CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS, CONTRIBUTION OF WORKING GROUP I TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE at 4 (Susan Solomon et al. eds., Cambridge Univ. Press 2007) [hereinafter "IPCC WG 1 Summary"]. The IPCC was established by the World Meteorological Organization and the United Nations Environment Programme to provide an authoritative international statement of scientific understanding of climate change. The IPCC was awarded the Nobel Peace Prize in 2007 along with Al Gore "for their efforts to build up and disseminate greater knowledge about man-made climate change, and to lay the foundations for the measures that are needed to counteract such change." The Noble Peace Prize 2007, *http://nobelprize.org/nobel_prizes/peace/laureates/2007/.*

[2] *IPCC, 2007: Frequently Asked Questions*, *in* CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS, CONTRIBUTION OF WORKING GROUP I TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE at 103.

[3] *Id.* at 106.

[4] National Snow & Ice Data Center, *Artic Sea Ice Shatters All Previously Record Lows*, Oct. 1, 2007, *available at* http://www.nsidc.org/news/press/2007_seaiceminimum/20071001_pressrelease.html. Based on the startling loss of

under more than one kilometer of ice.[16] The growing consensus among climate scientists is that the threshold for dangerous climate change, whereupon a potential "tipping point" is reached and ecological changes become dramatically more rapid and out of control, is estimated at a temperature increase of around 2°C from pre-industrial levels, or an atmospheric concentration of carbon dioxide of approximately 450 ppm.[17] In 2006, Dr. James E. Hansen, Director of the NASA Goddard Institute for Space Studies, and NASA's top climate scientist, stated: "In my opinion there is no significant doubt (probability > 99%) that . . . additional global warming of 2° C would push the earth beyond the tipping point and cause dramatic climate impacts including eventual sea level rise of at least several meters, extermination of a substantial fraction of the animal and plant species on the planet, and major regional climate disruptions."[18] Moreover, according to Hansen, just 10 more years of "business-as-usual" global emissions will make it difficult, if not impossible, to keep atmospheric concentrations of greenhouse gases at levels necessary to avoid a temperature increase above 2°C.[19] Indeed, given the recent extreme losses in arctic sea ice, scientists at the National Snow and Ice Date Center have concluded that "the observed changes in the arctic indicate that this feedback loop is now starting to take hold."[20]

Keeping the climate within the 2°C threshold requires significant reductions in the world's greenhouse gas emissions. To reach this objective, it is estimated that developed countries would have to target an emissions peak between 2012 and 2015, with 30 percent cuts by 2020 and 80 percent cuts from 1990 levels by 2050.[21] In recognition of need for immediate action, California has committed itself though Executive Order S-3-05 and the California Global Warming Solutions Act of 2006 (AB 32) to reduce the state's emissions to 1990 levels by 2020 and by 80% reductions from 1990 levels by 2050. Ca. Health & Safety Code § 38550; Cal. Executive Order S-3-05 (2005). However, even the ambitious emission reductions reflected in Executive Order S-3-05 are now believed to be insufficient to avoid the worst consequences of global warming because, based on the alarming and unpredicted rate of loss of arctic sea ice and

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[16] *Human Development Report*, *supra* note 15, at 3.

[17] *Human Development Report*, *supra* note 15, at 3, 27, 46; *see also* IPCC, Working Group III, *Climate Change 2007: Mitigation of Climate Change, Technical Summary* (2007) at 42 (showing relationship between global mean temperature increase and atmospheric concentration of greenhouse gases). According to climate models, stabilization at 450 ppm provides a fifty-fifty chance on limiting global mean temperature increases to 2° C. *Human Development Report*, *supra* note 15, at 46; IPCC, Working Group III, Climate Change 2007: Mitigation of Climate Change, Technical Summary (2007) at 42 (showing range of potential temperature increases along spectrum of atmospheric concentrations of greenhouse gases). Stabilization at 550 ppm carries an 80 percent probability of overshooting the 2°C climate threshold. Malte Meinshausen, On the Risk of Overshooting 2°C, Paper presented at Scientific Symposium: Avoiding Dangerous Climate Change. Symposium on Stabilization of Greenhouse Gases, 1-3 February 2005, MettOffice Hadley Centre Exeter, UK, London: Department for Environment, Food and Rural Affairs.

[18] Hansen, J., et al. 2006. Global temperature change. Proceedings of the National Academy of Sciences of the United States of America 103:14288-14293.

[19] Hansen, J., et al. 2007. Climate change and trace gases. *Phil. Trans. R. Soc.* 365:1925-1954.

[20] National Snow & Ice Data Center, Artic Sea Shrinks as Temperatures Rise, Oct. 3, 2006. Loss of sea ice is subject to a tipping point because, as sea ice melts in response to rising temperatures, it creates a positive feedback loop: melting ice means more of the dark ocean is exposed, allowing it to absorb more of the sun's energy, further increasing air temperatures, ocean temperatures, and ice melt.

[21] Human Development Report, *supra* note 15, at 48.

other recent climate change observations, scientists now state that "humanity must aim for an even lower level of GHGs."[22]

The costs of taking no action to reduce greenhouse gas emissions far outweigh the costs of stabilizing emissions. The Stern Review of the Economics of Climate Change, a comprehensive report commissioned by the British government, recently concluded that allowing current emissions trajectories to continue unabated would eventually cost the global economy between 5 to 20 percent of GDP each year within a decade, or up to $7 trillion, and warned that these figures should be considered conservative estimates.[23] By contrast, measures to mitigate global warming by reducing emissions were estimated to cost about one percent of global GDP each year, and could save the world up to $2.5 trillion per year.[24] The Stern Report determined that if no action is taken to control greenhouse gas emissions, each ton of CO_2 emitted causes damage worth at least $85.[25]

B. Impacts to California from Global Warming

Climate change poses enormous risks to California. Scientific literature on the impact of greenhouse gas emissions on California is well developed.[26] The California Climate Change Center ("CCCC") has evaluated the present and future impacts of climate change to California and the project area in research sponsored by the California Energy Commission and the California Environmental Protection Agency.[27] The severity of the impacts facing California is directly tied to atmospheric concentrations of greenhouse gases.[28] According to the CCCC, aggressive action to cut greenhouse gas emissions today can limit impacts, such as loss of the Sierra snow pack to 30%, while a business-as-usual approach could result in as much as a 90% loss of the snowpack by the end of the century. As aptly noted in a report commissioned by the California EPA:

> Because most global warming emissions remain in the atmosphere for decades or centuries, the choices we make today will greatly influence the climate our children and grandchildren inherit. The quality of life they experience will

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[22] Hansen, J. et al., *Target Atmospheric CO_2: Where Should Humanity Aim?* [DRAFT]. In *Target Atmospheric CO2: Where Should Humanity Aim?*, James Hansen, the premier NASA climatologist, now concludes that "[i]f humanity wishes to preserve a planet similar to that on which civilization developed, paleoclimate evidence and ongoing climate change suggest that CO_2 will need to be reduced from its current 385 ppm to at most 350 ppm." An emissions pathway whereby developed countries would reduce emissions to 80% below 1990 levels as envisioned under Executive Order S-03-05 is geared to cap atmospheric concentrations of CO_2 at approximately 450 ppm. *See, e..g,* UNDP, Human Development Report 2007/2008, Fighting climate change: Human solidarity in a divided world (2007) at 46-50.

[23] Stern, Sir Nicholas, Stern Review: The Economics of Climate Change (October 30, 2006) (Executive Summary).

[24] *Id.*

[25] *Id.*

[26] Additional reports issued by California agencies are available at http://www.climatechange.ca.gov, and IPCC reports available at http://www.ipcc.ch/.

[27] Cayan, et al. 2007. Our Changing Climate: Assessing the Risks to California. California Climate Change Center (*hereinafter* Our Changing Climate), *available at* http://www.climatechange.ca.gov/biennial_reports/2006report/index.html.

[28] *Id.*; Hayhoe, K., et al. 2004. *Emissions pathways, climate change, and impacts on California. PNAS* 101 no. 34:12422-12427.

depend on if and how rapidly California and the rest of the world reduce greenhouse gas emissions.[29]

Some of the types of impacts to California and estimated ranges of severity – in large part dependent on the extent to which emissions are reduced – are summarized as follows:

- A 30 to 90 percent reduction of the Sierra snowpack during the next 100 years, including earlier melting and runoff.
- An increase in water temperatures at least commensurate with the increase in air temperatures.
- A 6 to 30 inch rise in sea level, before increased melt rates from the dynamical properties of ice-sheet melting are taken into account.
- An increase in the intensity of storms, the amount of precipitation and the proportion of precipitation as rain versus snow.
- Profound impacts to ecosystem and species, including changes in the timing of life events, shifts in range, and community abundance shifts. Depending on the timing and interaction of these impacts, they can be catastrophic.
- A 200 to 400 percent increase in the number of heat wave days in major urban centers.
- An increase in the number of days meteorologically conducive to ozone (O_3) formation.
- A 55 percent increase in the expected risk of wildfires[30]

By providing details as to the ranges of proposed impacts, and indicating that the higher-range of impact estimates are projected if greenhouse gas emissions continue to increase under a "business as usual" scenario, decision-makers and the public will be better informed of the magnitude of the climate crisis and the urgency with which it must be addressed.

III. THE DEIR FAILS TO ADEQUATELY QUANTIFY CURRENT BASELINE EMISSIONS, EMISSIONS AT BUILDOUT AND EMISSIONS FROM PROJECT ALTERNATIVES

The DEIR's analysis of the Project's greenhouse gas emissions is inadequate, incomplete, and does not reflect a good faith effort at full disclosure because the DEIR does not provide any information about the County's baseline emissions or of the emissions resulting from build-out and the various General Plan alternatives. Guidelines § 15151 (an EIR "should be prepared with a sufficient degree of analysis to provide decision-makers with information which enables them to make a decision which intelligently takes account of environmental consequences."). "CEQA advances a policy of requiring an agency to evaluate the environmental effects of a project at the earliest possible stage in the planning process." *City of Redlands v. County of San Bernardino*, 96 Cal. App. 4th 398, 410 (2002). "[B]y deferring full environmental assessment of the consequences of [the General Plan Update], the County has

[29] Our Changing Climate, *supra* note 7, at 2.
[30] *Id.* at 15.

failed to comply with CEQA's policy and requirements." *Id.* Without estimating the greenhouse gas pollution resulting from the General Plan Update and from the proposed alternatives, there is simply no legitimate way that the DEIR can then adequately discuss alternatives, avoidance, and mitigation measures to reduce those impacts.

A. Baseline Emissions

First, the DEIR's calculation of existing emissions is incomplete. Under CEQA, an "EIR must include a description of the physical environmental conditions in the vicinity of the project, as they exist at the time the notice of preparation is published." Guidelines § 15125(a); *see also Environmental Planning & Information Council v. County of El Dorado (EPIC)*, 131 Cal.App.3d 350, 355 (1982) (effect of general plan amendment must be compared against actual environment, not assumptions in existing general plan). Here, the DEIR's analysis of existing greenhouse gas emissions is limited to emissions from onroad vehicle emissions and dairy and feedlot emissions. No emission numbers are provided from energy use, water consumption, wastewater treatment, or solid waste disposal -- all significant sources of greenhouse gas emissions.

Not only are significant sources of greenhouse gas emissions omitted from the DEIR, but the DEIR may also misstate those that are included. The DEIR's estimation of vehicle emissions does not appear to have any correlation to existing land uses and accordingly, cannot accurately describe actual baseline conditions. (DEIR Appendix D.) The DEIR also understates emissions from County dairy and feedlot emissions. To estimate emissions from dairies and feedlots, the DEIR relies on the *Tulare County Draft Phase I Animal Confinement Facilities Plan Supplemental Program EIR.* (DEIR at 4-50.) However, the *Draft Phase I Animal Confinement Facilities Plan Supplemental Program EIR* only calculates methane emission from dairy and feedlot operations. Methane represents only a fraction of the total GHG emissions from dairies, which are also significant sources of nitrous oxide and carbon dioxide.[31] Accordingly, the DEIR must be revised to fully reflect emissions from dairy and feedlot operations.

In its recent white paper, CEQA & Climate Change, Evaluating and Addressing Greenhouse Gas Emissions from Projects Subject to the California Environmental Quality Act (Jan. 2008), the California Air Pollution Control Officers Association (CAPCOA) set forth methodologies for analyzing greenhouse gas pollution in a proposed general plan update.[32] It is incumbent on the County to "disclose all it can" about project impacts and educate itself on methodologies that are available to measure project emissions. *Berkeley Keep Jets Over the Bay Comm. v. Board of Port Comm'rs ("Berkeley Jets")*, 91 Cal. App. 4th 1344, 1370 (2001).

An example methodology set forth by CAPCOA:

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[31] O'Mara, F. 2004. Greenhouse gas production from dairying: reducing methane production. *Advances in Dairy Technology* 16:295-309; *see also* Comments on Draft Supplemental EIR for Tulare County Phase I Animal Confinement Facilities Plan from Center for Biological Diversity to Tulare County Recourses Management Agency, dated March 5, 2008.

[32] CAPCOA, *CEQA & Climate Change, Evaluating and Addressing Greenhouse Gas Emissions from Projects Subject to the California Environmental Quality Act* at 65-68, 83(Jan. 2008) (*hereinafter* CAPCOA).

Source	Methodology
Direct Emissions	
Construction	URBEMIS (OFFROAD emission factors)
Mobile Sources	Short-Term: URBEMIS (EMFAC emissions factors). Long-Term: I-PLACE^{3}S/CTG SCM
Area Sources	Short-Term: URBEMIS (EMFAC emissions factors). Long-Term: I-PLACE^{3}S/CTG SCM
Indirect Emissions	
Energy Consumption	Short-Term: CCAR GRP & CEC. Long-Term: I-PLACE^{3}S/CTG SCM
Wastewater Treatment	CCAR energy use protocols, URBEMIS for transportation emissions
Solid Waste Disposal	CCAR energy use protocols, URBEMIS for transportation emissions

In addition to the methodologies set forth by CAPCOA, ICLEI's Clean Air/Climate Protection (CACP) software allows cities to calculate emissions reductions, track and quantify emission outputs, and develop emissions scenarios to inform the planning process.[33] As noted in the ICLEI Climate Action Handbook, "[e]xpertise in climate science is not necessary" to conduct an emissions inventory and compare this inventory against a forecast year.[34] "A wide range of government staff members, from public works to environment and facilities departments, can conduct an inventory."[35] ICLEI provides technical assistance and training to local government using the CACP software.

UPLAN is a GIS-based model for testing urban growth scenarios. UPLAN allows the user to change the assumed proportions on land use types, such as high-density commercial v. low-density commercial, or high, medium and low-density residential. UPLAN also allows the user to set various environmental and social constraints on growth, such as various levels of general plan compliance, turning on and off agricultural zoning and setting urban growth boundaries. The County's use of UPLAN would provide critical information on the emissions from General Plan alternatives and the benefits of potential mitigation measures.

B. The DEIR's Failure to Provide an Accurate and Stable Project Description Precludes an Informed Assessment of Project Emissions at Build-Out

[33] ICLEI-Local Governments for Sustainability is an international association of more than 650 local governments. Cities, counties, towns and villages around the world are members of ICLEI. Since 1993, ICLEI and has grown from a handful of local governments participating in a pilot project to more than 300 who are providing national leadership on climate protection and sustainable development. ICLEI's mission is to improve the global environment through local action. On the issue of global warming, for example, ICLEI provides resources, tools, peer networking, best practices, and technical assistance to help local governments measure and reduce greenhouse gas emissions in their communities.

[34] ICLEI, U.S. Mayors' Climate Protection Agreement, Climate Action Handbook at 8.

[35] *Id.*

The DEIR's estimate of future emissions is inadequate for several reasons. First, as with the estimations of baseline emissions, the DEIR fails to calculate the emissions generated by energy use, water consumption, wastewater treatment, and solid waste. Second, the DEIR's failure to provide any specificity regarding the location and densities of proposed land uses makes it impossible to assess future emissions. As the court determined in *County of Inyo v. City of Los Angeles,* 71 Cal.App.3d 185, 192-93 (1977):

> Only through an accurate view of the project may affected outsiders and public decision-makers balance the proposal's benefit against its environmental cost, consider mitigation measures, assess the advantage of terminating the proposal (i.e. the "no project" alternative) and weigh other alternatives in the balance. An accurate, stable and finite project description is the *sine qua non* of an informative and legally sufficient EIR.

As presented in the DEIR, it is impossible to understand what type of growth is envisioned under the General Plan because the DEIR does not provide any specificity as to the location, type, and density of future land uses. Absent this information, future project emissions cannot be properly assessed. For example, vehicle emissions are contingent on vehicle miles traveled, which is dependent on the location and mix of particular land uses. Similarly, energy consumption differs depending on the type, mix and density of uses. To comply with both CEQA and California planning law, the General Plan must be revised to specify the land use and densities planned for specific areas of the County and then assess the resulting greenhouse gas emissions. By failing to include this data in the DEIR, decisionmakers and the public are precluded from evaluating the environmental impacts of the Project.

C. The DEIR Must Compare Emissions Generated by the Project and Proposed Alternatives

Once emissions from the proposed General Plan Update are fully quantified, the DEIR should compare the Project with the emission resulting from the various project alternatives. UPLAN is one type of modeling software that allows for emission to be measured using differing land use and growth assumptions. Only by comparing emissions among alternatives will decision makers and the public be properly informed of the global warming impacts of the project.

IV. TO PROPERLY EVALUATE THE SIGNIFIGANCE OF PROJECT IMPACTS ON GLOBAL WARMING, THE DEIR MUST COMPARE EMISSIONS RESULTING FROM THE PROJECT WITH REDUCTIONS REQUIRED UNDER AB 32 AND EXECUTIV ORDER S-3-05

Although the Project is a 2030 General Plan Update, the DEIR's significance criteria for greenhouse gas emissions is whether the project "conflicts with the state goal of reducing greenhouse gas emissions in California to 1990 levels by 2020, as set forth by the timetable established in AB 32, California Global Warming Solutions Act of 2006." (DEIR at 4-

48). This significance criteria ignores California's mandate under Executive Order S-3-05 to sharply reduce emissions after 2020 to 80% below 1990 levels by 2050. While the trajectory of reductions under Executive Order S-3-05 has not been definitely established, the DEIR should make an appropriate assumption, such as a linear decrease to 2050 to determine significance criteria for 2030 (approximately 27% below 1990 levels). Setting significance criteria at 2020 targets for a 2030 General Plan Update is fundamentally flawed.

Rather than compare the Project with emissions targets, the DEIR states that "the emission level at which project generated CO_2E would result in or contribute to a significant impact has not been defined." (DEIR at 4-67.) The DEIR's failure to compare emissions does not constitute a good faith effort at full disclosure under CEQA. Guidelines § 15151. As acknowledged by CAPCOA, because of California's emission reduction mandates, GHG emissions associated with the general plan area in 1990 is relevant to evaluating the impacts of the general plan buildout.[36] Once Project emissions are fully quantified, they should be compared with County emissions from 1990 and percentages below 1990 levels to determine compliance with AB 32 and Executive Order S-3-05.

Comparing oranges to apples, the DEIR absurdly states that "the increase in greenhouse gases by the General Plan Update of 1 percent of the state AB 32 goal places the project in conflict with the goal of the state to reduce up to 174 million metric tons of CO_2E/yr." (DEIR at 4-67.) This comparison is utterly misleading and irrelevant to AB 32 compliance. Indeed, while the County's future emissions might by 1% of California's total, the County consists of far less than 1% of the population of the State. To evaluate compliance with AB 32, the DEIR must look at whether and to what extent County emissions will decrease from current levels, not how future levels emissions might compare to California's total emissions budget. Under the DEIR's own limited calculations, buildout would result in close to a 1.5 million ton/year increase in CO_2 from onroad vehicle emission, approximately 75% *above* current levels. This falls far short of AB 32 goals, which require reductions to 1990 levels from existing levels by 2020 (approximately a 25% decrease in emissions) and falls even further from the reductions necessary by 2030. Accordingly, the DEIR must be revised to compare the Project emissions with the County's 1990 emissions as well as the additional reductions under Executive Order S-3-05.

V. THE DEIR MUST ANALYZE THE ADDITIONAL EFFECT GLOBAL WARMING WILL HAVE ON THE PROJECT IMPACTS

As briefly described above, global warming will affect California's climate, resulting in increased temperatures, a reduction in snowpack and precipitation levels and water availability. These factors will impact development under the General Plan Update, as well as exacerbate its own environmental impacts. Therefore, the County must consider these impacts in the DEIR. *See* Guidelines § 15126.2(a) (as EIR "shall also analyze any significant environmental effects the project might cause by bringing development and people into the area affected.")

[36] CAPCOA, *supra* note 32, at 66.

A. The DEIR Must Analyze Global Warming's Affect on Water Supply in Determining Project Water Supply Impacts

The DEIR fails to adequately address the impacts of climate change on water resources and availability relied upon by the Project.

The IPCC projects with "high confidence" that water supplies stored in mountain snowpacks such as the Sierra Nevada will decline around the world, reducing water availability in regions supplied by meltwater.[37] Most montane ice fields are predicted to disappear during this century, further exacerbating water shortages in many areas of the world.[38] The IPCC specifically identified the American West as vulnerable, warning, "[p]rojected warming in the western mountains by the mid-21st century is very likely to cause large decreases in snowpack, earlier snow melt, more winter rain events, increased peak winter flows and flooding, and reduced summer flows."[39] These changes would shift available water supplies from summer — when they are most needed by people, agriculture, and ecosystems — to earlier in the year.[40] The IPCC also warned that the results would include "a projected increase in the chance of summer drying in the mid-latitudes," which includes the American West, "with associated increased risk of drought."[41] All in all, the IPCC concluded that in North America, including the fast-growing western United States, "[r]educed water supplies coupled with increases in demand are likely to exacerbate competition for over-allocated water resources."[42]

The U.S. National Assessment water sector report also summarizes similar concerns:

> "More than 20 years of research and more than 1,000 peer-reviewed scientific papers have firmly established that a greenhouse warming will alter the supply and demand for water, the quality of water, and the health and functioning of aquatic ecosystems."[43]

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[37] IPCC 2007, *Summary for Policy Makers in* CLIMATE CHANGE 2007: IMPACTS, ADAPTATION AND VULNERABILITY, CONTRIBUTIONS OF WORKING GROUP II TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (M.L. Perry et al., eds., Cambridge Univ. Press 2007).

[38] Epstein, P.R. and E. Mills (eds.). "Climate change futures health, ecological, and economic dimensions." The Center for Health and the Global Environment, Harvard Medical School. Cambridge, Massachusets, USA. (2005).

[39] IPCC 2007, *Technical Summary in* CLIMATE CHANGE 2007: IMPACTS, ADAPTATION AND VULNERABILITY, CONTRIBUTIONS OF WORKING GROUP II TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE at 62 (M. Parry et al., eds. Cambridge Univ. Press 2007).

[40] The Rocky Mountain Climate Organization, NRDC 2008, "Hotter and Drier: The West's Changed Water Supply" S. Saunders et al.

[41] IPCC, G. Meehl et al. 2007, *Global Climate Projections in* CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS, CONTRIBUTION OF WORKING GROUP I TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (Susan Soloman et al., eds., Cambridge Univ. Press 2007).

[42] IPCC 2007, *Technical Summary*, *supra* note 39.

[43] Gleick, Peter H., 2000. Water: The Potential Consequences of Climate Variability and Change for the Water Resources of the United States. Report of the Water Sector Assessment Team of the National Assessment of the Potential Consequences of Climate Variability and Change, U.S. Global Change Research Program, Pacific Institute for Studies in Development, Environment, and Security.

In California the Legislature has recognized that greenhouse gas emissions and global warming pose serious threats to natural resources and the environment of California, from the potential adverse reduction in the quality and supply of water to the state from the Sierra snowpack.[44] A dry climate caused by global warming would impose large costs and challenges on California, severely affecting the economies of some rural and agricultural regions of the state.[45] There is strong evidence that wildfires, precipitation patterns, and snowmelt are already being influenced by anthropogenic climate change.[46] The recognized environmental impacts in the local and regional vicinity of the Project must be accounted for in the DEIR.

The impacts of climate change that must be addressed in water resources planning are varied and far reaching. The most significant impacts of global warming on water management are rising temperatures, increasing proportions of annual precipitation in the form of rainfall, disrupted streamflow timing, altered snowpack conditions, increased evaporation and transpiration, greater risk of fires, and sea level rise.[47] Climate change and variability will affect the timing, amounts, and form of precipitation, which in turn will affect all elements of water systems, from watershed catchment areas to reservoirs, conveyance systems, and wastewater treatment plants.[48] These systems are already stressed today due to a multitude of factors including limitations on supply from the Sacramento San Joaquin Delta.[49] Overdraft and contamination of groundwater sources have reduced the availability of groundwater supplies in many areas.[50] Saltwater intrusion in coastal aquifers is a problem in many areas.[51] Climate change has the potential to exacerbate these situations, requiring increased attention from water managers and municipal planners. These factors must be accounted for in the DEIR for this General Plan Update because it relies upon water resources that will be in greater scarcity in the future.

The combined threats of climate change and population growth pose serious threats to the water supply of the Sierra Nevada.[52] Evidence of warming trends is already being seen in winter temperatures in the Sierra Nevada, which rose by almost 2 degrees Celsius (4 degrees Fahrenheit) during the second half of the 20th century.[53] Trends toward earlier snowmelt and runoff to the San Francisco Bay-Delta over the same period have also been detected.[54] Future changes in snowpack are a great concern because snow levels have been

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[44] Health and Safety Code § 38501(a).
[45] California Climate Change Center, Climate Warming and Water Supply Management in California, J. Medellin et al. University of California, Davis (2006).
[46] Westerling, et al. "Warming and Earlier Spring Increases Western U.S. Forest Wildfire Activity." Sciencexpress, p.1, 10.1126, Science, 1128824 (July 6, 2006).
[47] NRDC, In Hot Water: Water Management Strategies to Weather the Effects of Global Warming" Nelson et. al. (2007) (*hereinafter* In Hot Water).
[48] Miller, Kathleen and David Yates, Climate Change and Water Resources: A Primer for Municipal Water Providers, AWWA Research Foundation and the University Corporation for Atmospheric Research (2005).
[49] Brue Tepper, "Delta Blues," LOS ANGELES LAWYER (2008).
[50] In Hot Water, *supra* note 47.
[51] *Id.*
[52] Sierra Nevada Alliance, Troubled Water of the Sierra, K. Timmer (2003).
[53] In Hot Water, *supra* note 47.
[54] Dettinger, Michael D. and Dan R. Cayan, Large-scale Atmospheric Forcing of Recent Trends Toward Early Snowmelt Runoff in California, Journal of Climate, 8:606-23 (1994).

predicted to retreat 500 feet in elevation in California for every rise of one degree Celsius.[55] Under a low emissions scenario Sierra snowpack is reduced 30-70%.[56] Under a higher emissions scenario snowpack would decline 74-90%, with impacts on runoff and streamflow. Combined with projected declines in winter precipitation, these changes could fundamentally disrupt California's water rights system.[57]

A significant body of analysis suggests that total streamflows in the future will be reduced in comparison with historical levels.[58] Analysis by the California Climate Change Center in 2006 found that climate change could lead to significant reductions in total reservoir inflows and total Delta inflows.[59] Approximately two-thirds of model runs revealed likely reductions in total inflows for major northern California reservoirs, with maximum projected reductions of approximately 12 percent.[60]

Sea level rise also has potentially severe impacts on water supply.[61] For example, for the San Francisco Bay and the Sacramento-San Joaquin River Delta, global warming impacts will compromise ecosystem health, water supply, and water quality.[62]

Scientists indicate that climate change will also exacerbate the problem of flooding by increasing the frequency and magnitude of large storms, which in turn will cause an increase in the size and frequency of flood events.[63] The increasing cost of flood damages and potential loss of life will put more pressure on water managers to provide greater flood protection.[64] At the same time, changing climate conditions (decreased snowpack, earlier runoff, larger peak events, etc.) will make predicting and maximizing water supply more difficult.[65] These changes in hazard risk and water supply availability must be considered during environmental review.

Water quality, in addition to water quantity and timing, will also be impacted. Changes in precipitation, flow, and temperature associated with climate change will likely exacerbate water quality problems.[66] Changes in precipitation affect water quantity, flow rates, and flow timing.[67] Shifting weather patterns are also jeopardizing water quality and quantity in

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[55] Roos, Maurice, *Accounting for Climate Change* in California Water Plan Update, Vol. 4, Reference Guide, Public Review Draft, California Department of Water Resources, at 5 (2005).
[56] Hayhoe, K et al, Emissions pathways, climate change, and impacts on California, *PNAS* 101 no. 34:12422-12427 (2004).
[57] *Id.*
[58] In Hot Water, *supra* note 47.
[59] California Climate Change Center, Estimated Impacts of Climate Warming on California Water Availability Under Twelve Future Climate Scenarios, Tingju Zhu et al, University of California, Davis (2006), *available* at http://www.climatechange.ca.gov/research/impacts/pdfs/CEC-500-2006-040.pdf (*last visited* April 12, 2008).
[60] *Id.*
[61] In Hot Water, *supra* note 47.
[62] *Id.*
[63] *Id.*
[64] *Id.*
[65] *Id.*
[66] *Id.*
[67] The following examples are cited in: Gleick, Peter H. et al., 2000. "Water: The Potential Consequences of Climate Variability and Change for the Water Resources of the United States." The report of the Water Sector Assessment

many countries, where groundwater systems are overdrawn.[68] Decreased flows can exacerbate the effect of temperature increases, raise the concentration of pollutants, increase residence time of pollutants, and heighten salinity levels in arid regions.[69]

B. The DEIR Must Analyze Global Warming's Affects on Wildfires in Determining Project Wildfire Impacts

Global warming will greatly affect the rate and intensity of wildfires in the area.[70] If temperatures rise into the medium warming range, the risk of large wildfires in the state could increase by 55%.[71] This is almost twice the increase expected if temperatures stay in the lower warming range.[72] The risk of wildfire is determined by a combination of factors in addition to temperature rise, including precipitation, winds, landscape and vegetation conditions, and, as a result the risk will not be identical throughout the state.[73] Thus, the DEIR must analyze how global warming will exacerbate project impacts on the likelihood and intensity of wildfires in the County.

C. The DEIR Must Analyze Global Warming's Affects on Air Quality in Determining Project Air Quality Impacts

Californians experience the worst air quality in the nation, with annual health and economic impacts estimated at 8,800 deaths (3,000–15,000 probable range) and $71 billion ($36–$136 billion) per year[74]. Ozone and particulate matter (PM) are the pollutants of greatest concern (maximum levels are about double California's air quality standards) and the current control programs for motor vehicles and industrial sources cost about $10 billion per year. Higher temperatures are expected to increase the frequency, duration and intensity of conditions conducive to air pollution formation.[75] As such, the County must consider this impact in its environmental analysis.

These are only examples of how global warming will impact development under the General Plan Update and intensify the environmental impacts it will already have. It is not an exhaustive list. Thus, when analyzing the risk of wildfire posed, or assessing the impact of

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Team of the National Assessment of the Potential Consequences of Climate Variability and Change," U.S. Global Change Research Program, Pacific Institute for Studies in Development, Environment, and Security.

[68] Epstein, P.R. and E. Mills, *supra* note 38.

[69] Schindler, D.W., Widespread Effects of Climatic Warming on Freshwater Ecosystems in North America, Hydrological Processes, Vol. 11, No. 8, pp.1043-1067 (2004); Mulholland et al., Effects of Climate Change on Freshwater Ecosystems of the South-eastern United States and the Gulf Coast of Mexico, Hydrological Processes, Vol. 11, pp.949-970 (1994).

[70] *See* IPCC, 2007: OBSERVATIONS: SURFACE AND ATMOSPHERIC CLIMATE CHANGE *in* CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS, CONTRIBUTION OF WORKING GROUP I TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE at 250, 252 (Susan Solomon et al. eds., Cambridge Univ. Press 2007).

[71] Our Changing Climate, *supra* note 27.

[72] *Id.*

[73] *Id.*

[74] *Id.* at 5.

[75] *Id.*

the General Plan Update on water supply and biological resources, the DEIR must take into account the effects of global warming on these resources.

VI. THE DEIR MUST ANALYZE AND ADOPT ALL FEASIBLE MITIGATION MEASURES TO REDUCE THE PROJECT'S GREENHOUSE GAS EMISSIONS

The DEIR recognizes that the greenhouse gas pollution resulting from the General Plan Update is a potentially significant impact because it "could conflict with implementation of state goals for reducing greenhouse gas emissions and thereby have a negative effect on Global Climate Change due to CO2 emissions from on-road vehicles and methane emissions from cattle and cattle manure." (DEIR at 4-64 through 4-65.) Because the General Plan Update's greenhouse gas emissions cumulatively contribute to global warming, the DEIR "must propose and describe mitigation measures that will minimize the significant environmental effects" identified by the DEIR. *Napa Citizens for Honest Gov't v. Napa County Bd. of Supervisors*, 91 Cal.App.4th 342, 360 (2001). CEQA requires that agencies "mitigate or avoid the significant effects on the environment of projects that it carries out or approves whenever it is feasible to do so." Pub. Res. Code § 21002.1(b). Mitigation of a project's significant impacts is one of the "most important" functions of CEQA. *Sierra Club v. Gilroy City Council*, 222 Cal.App.3d 30, 41 (1990). Therefore, it is the "policy of the state that public agencies should not approve projects as proposed if there are feasible alternatives or feasible mitigation measures which will avoid or substantially lessen the significant environmental effects of such projects." Pub. Res. Code § 21002. Importantly, mitigation measures must be "fully enforceable through permit conditions, agreements, or other measures" so "that feasible mitigation measures will actually be implemented as a condition of development." *Federation of Hillside & Canyon Ass'ns v. City of Los Angeles*, 83 Cal.App.4th 1252, 1261 (2000).

Enforceable mitigation measures integrated into the Development Code must be included before the General Plan Update can be approved. When mitigation measures are incorporated into a plan, the agency must take steps to ensure that they will actually be implemented as a condition of later development approved under the plan, "not merely adopted and then neglected or disregarded." *Federation of Hillside Canyon & Canyon Ass'ns v. City of Los Angeles*, 83 Cal.App.4th 1252 (2000). For mitigation measures that cannot be specifically formulated without a proposal for a specific facility, the general plan should include a firm commitment to future mitigation of significant impacts. *Rio Vista Farm Bureau Ctr. v. County of Solano*, 5 Cal.App.4th 351 (1992). Only rarely does the General Plan Update provide a firm commitment to future mitigation by including specific provisions of the development code as examples for mitigation.

In the DEIR, the County states that it "does not solidly advocate, promote or represent any one development scenario because any attempt to predict the exact pace and locations of future market-driven growth is considered speculative." (DEIR at ES-7). The County's utter abdication of its responsibility to ensure future growth proceeds in an orderly manner flies in the face of the very purpose of a General Plan. By implementing smart growth land use policies and other measures to reduce the impact of future development, the County can ensure that future growth leaves a positive legacy for future generations.

A. Greenhouse Gas Emissions Reduction Plan

One of the new policies adopted by the County to mitigate the General Plan's significant adverse impacts to greenhouse gas emissions is AQ-4.9, where the County commits to developing a Greenhouse Emissions Reduction Plan ("Plan"). (DEIR 4-67.) In this plan, the County will inventory the sources of greenhouse gases in the County, inventory these emissions at the 1990 and current levels and the projected levels for the year 2020, and set a target for the reduction of emissions "attributable to the County's discretionary land use decisions" and own internal operations. (*Id.*). By essentially deferring all analysis and mitigation until after project approval, measure 4.9 does not constitute adequate mitigation of the Project's greenhouse gas impacts.

First, the County must set targets for the reduction of emissions *prior* to setting out its land use policies. The County makes no commitments now to reducing greenhouse gas emissions, but instead defers it to some unknown time in the future. The County must commit to a targeted reduction of greenhouse gas emissions now and use that target as a guide in establishing its land use goals and policies described in the General Plan. Without this target, the County is blindly writing its constitution for its future, which in no way mitigates the General Plan's adverse environmental impacts.

Second, this so-called mitigating policy has no force. The County sets no timeline for completing the Plan or to ensuring that it will implement the measures necessary to meeting the targets eventually set by the Plan.

B. General Air Quality/Climate Change Policies

In the DEIR, the County points to policies "designed to improve air quality" as mitigation measures addressing the General Plan's impacts on greenhouse gas emissions. These policies are inadequate and must be amended.

1. The County must adopt a goal to reduce and minimize greenhouse gas emissions

Glaringly missing from the General Plan and any mitigation strategies, as mentioned above, is a goal backed by policies and implementation measures to reduce and limit greenhouse gas emissions in the County. Thus, the County must adopt goals and policies that promote efficient management and use of resources in order to minimize greenhouse gas emissions. Policies that address this goal include:

- committing to smart growth;
- adopting practices that promote efficient management and use of resources in order to minimize greenhouse gas emissions and shift to low-carbon and renewable fuels and zero emission technologies;
- fostering and restoring forests and other terrestrial ecosystems that offer

significant carbon mitigation potential.

Various implementation measures that will foster these goals and policies are discussed in detail throughout this section.

2. The County must consider greenhouse gases in its interagency cooperation policies:

As a way of mitigating the General Plan's impacts on greenhouse gas emissions, the County points to several policies regarding cooperation with local, state and community organizations to address air quality. The County must amend AQ-1.1 and 1.2 and their respective implementing policies to specifically mention greenhouse gas emissions, however. The County should adopt the following implementation measures, as well:

- play a leading role to encourage other local governments, especially those within the County, to commit to addressing climate change;

- participate in programs such as the Cities for Climate Protection Campaign to address local and regional climate change concerns.

3. The County must ensure that developers and project proponents adequately consider and mitigate greenhouse gas emissions in project proposals and environmental reviews

Again, the County's policies and implementing measures regarding cumulative air quality impacts and CEQA compliance fail to specifically include greenhouse gas emissions as a consideration and, therefore, are not adequate mitigation measures. As such, policies AQ-1.3 and AQ-1.5 and their respective implementation measures must be amended to require developers to evaluate and mitigate greenhouse gas emissions and to present adequate alternatives that limit and reduce these emissions. Accordingly, the County must also adopt an implementation measure incorporating greenhouse gas emissions assessments into land use planning documents and the EIRs for proposed projects.

4. The County must implement proposed state greenhouse gas emission reduction programs

Under policy AQ-1.7, the County states that it "shall monitor and support the efforts of CARB, under AB 32" to develop mitigation strategies local governments can implement. Further, the County will "ultimately 'consider' any such strategies once they become available." (DEIR at 9-4). This policy is weak and must be amended. Instead, it should state that the County *shall* implement proposed state programs to reduce greenhouse gas emissions and *shall* adopt all feasible CARB mitigation strategies, with an implementing measure to establish guidelines for determining the feasibility of these mitigation strategies.

C. Land Use

As noted by CAPCOA, "[t]he most effective way for local jurisdictions to achieve GHG emissions reductions in the medium- and long-term is through land use and transportation policies that are built directly into the community planning document."[76] The DEIR states that the EIR is "self-mitigating" because it relies on the policy framework and the goals, policies and measures set out under each element of the General Plan Update to reduce the project's impacts. (DEIR at 1-20). As discussed above, however, many of these policies and measures are unenforceable and inadequate under CEQA. Moreover, the County failed to consider additional mitigation measures that will substantially lessen the General Plan Update's impacts on greenhouse gas emissions.

1. Background: Land Use is Critical to Meeting Reduction Targets Set by AB 32 and Executive Order S-03-05:

Greenhouse gas emissions from the transportation section represents one-third of the total emissions of the United States.[77] The IPCC identifies land use planning as a key practice for mitigating greenhouse gas emissions from the transportation sector. For example, in addition to more fuel efficient and hybrid vehicles, the report identifies "modal shifts from road transport to rail and public transport systems; non-motorized transport (cycling, walking); land-use and transport planning" as "key mitigation technologies and practices currently commercially available."[78] Ultimately, "much of the rise in vehicle emissions can be curbed simply by growing in a way that will make it easier for Americans to drive less."[79]

Land use planning and design that reduces commuting requirements and the length and number of vehicle trips is *essential* to reducing the greenhouse gas contribution from the transportation sector. The Urban Land Institute describes needed transportation-related CO_2 emissions reductions as a three-legged stool, with one leg related to vehicle fuel efficiency, a second to the carbon content of the fuel itself, and a third to the amount of driving or vehicle miles traveled (VMT).[80] Since 1990, the number of miles Americans drive has grown three times faster than the U.S. population.[81] A large share of the increase in VMTs can be traced to the effects of a changing urban environment, namely to longer trips and people driving alone.[82] Population growth has been responsible for only a quarter of the increase in vehicle miles traveled because of the robust growth in VMTs.

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[76] CAPCOA, *supra* note 32 at 69.
[77] SAIC, Public Transportation's Contribution to U.S. Greenhouse Gas Reduction (Sept. 2007) at 5.
[78] *IPCC, 2007: Summary for Policymakers, in* CLIMATE CHANGE 2007: MITIGATION. CONTRIBUTION OF WORKING GROUP III TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 10, Table SPM.3, 12-13, 20, Table SPM.7, 21-22 (B. Metz, et al. eds., Cambridge Univ. Press 2007). *IPCC, 2007:* CLIMATE CHANGE 2007: MITIGATION. CONTRIBUTION OF WORKING GROUP III TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE Chapters 5, 12 (B. Metz, et al. eds., Cambridge Univ. Press 2007).
[79] Reid Ewing, et al., *Growing Cooler, The Evidence on Urban Development and Climate Change* 11-12 (Urban Land Use Institute) (October, 2007) at 14.
[80] *Id.* at 11.
[81] *Id.* at 2.
[82] *Id.*

Energy and climate policy initiatives at the federal and state levels have pinned their hopes almost exclusively on shoring up the first two legs of the stool, through the development of more efficient vehicles (such as hybrid cars) and lower-carbon fuels.[83] However, even implementation of the more stringent standards for vehicles and alternative fuels recently enacted in the Energy Independence and Security Act of 2007 – which, among other things, requires the U.S. Department of Transportation to set tougher fuel economy standards for vehicles and increases the Renewable Fuel Standards[84] - will not result in the necessary reductions in greenhouse gas emissions because projected increases in vehicle miles traveled offset gains made by increases in fuel efficiency and low carbon fuels. Meeting the emissions reduction from the transportation section also requires a sharp reduction in the growth in vehicle miles driven across the nation's sprawling urban areas, reversing trends that go back decades.[85]

Growth that focuses on compact development and community planning is known by a number of different names, such as "smart growth," "new urbanism," "walkable communities," and "transit-oriented developments."[86] These developments do away with single-use subdivisions and office parks, and instead mix shops, schools, offices and homes, and incorporate non-motorized and mass transit.[87] Compact, transit accessible, pedestrian-oriented, mixed-use development patterns and land reuse epitomize the application of the principles of smart growth.[88] Residents of such compact, mixed use developments drive significantly less than those who live in more sprawling areas. Overall, evidence shows that compact development will reduce the need to drive between 20 and 40 percent, as compared with sprawling, single-use development.[89]

Assuming that all new U.S. housing developments were smart growth, with half greenfield and half brownfield, the total nationwide savings after 10 years, based on a projected level of 24.3 housing starts from 2005-2020, would be in the range of 977 trillion miles of travel reduced; 5,690,000 trillion Btu saved; 49.5 billion gallons of gasoline saved; 1.18 billion barrels of oil saved; 595 million metric tons of CO_2 emissions reduced; and $2.18 trillion savings.[90] It is estimated that "smart growth could, by itself, reduce total transportation-related CO_2 emissions from current trends by seven to ten percent as of 2050. This reduction is achievable with land use changes alone."[91] Notably, these land use changes, controlled by local government, provide

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[83] *Id.* at 11.

[84] P.L. 110-140 (December 19, 2007). The tougher fuel economy standards will be implemented gradually, beginning in 2011 and ending in 2020 when the combined average fuel economy must be at least 35 miles per gallon. The mandatory Renewable Fuel Standard will increase the supply of alternative fuel sources by requiring fuel producers to use at least 36 billion gallons of biofuel by 20022.

[85] *Id.* at 10.

[86] *Id.* at 15, 18.

[87] *Id.*

[88] American Planning Association, Policy Guide on Smart Growth, ratified April 15, 2002, *available at* http://www.planning.org/policyguides/smartgrowth.htm. (*last visited* April 12, 2008).

[89] *Id.* at 20.

[90] California Energy Commission, 2006 Integrated Energy Policy Report Update, CEC-100-2006-001-CMF (Jan. 2007) at 79.

[91] *Id.* Also explaining that this assumption does not include other emission reduction measures such as higher fuel prices, carbon taxes, peak period road tolls, and other policies designed to make drivers pay more of the social costs of automobile use, nor does it include the energy saved in buildings with compact development or amount of CO2 absorbed by forests preserved by compact development.

permanent climate benefits that compound over time. "The second 50 years of smart growth would build on the base reduction from the first 50 years, and so on into the future. More immediate strategies, such as gas tax increases, do not have this degree of permanence."[92]

Thus, the County can effectively work to mitigate the substantial adverse impacts the General Plan Update will have on greenhouse gas emissions by strengthening its goals, policies and planned actions regarding smart growth, as this will minimize VMTs even as the County grows and develops over the next two decades.

2. The County must amend its Planning Framework:

The Planning Framework, or Component A, of the General Plan Goals and Policies Report serves as an "overview of the General Plan's development and organization and the geographic policies that will shape the future" of development in Tulare County. (DEIR at 3-1 to 3-2.) Because this framework acts as the overarching statement of the County's goals for the future and guides the County's design under all other elements of the General Plan Update, it must adequately describe the County's commitment to control growth and development in unincorporated areas. The policies set out in the Planning Framework, however, conflict with many of the goals and policies set out in the General Plan Goals and Policies Report. Cities, communities and hamlets must be able to control the growth occurring around their urban edges. This is the only way the County can "promote the principles of smart growth and healthy communities" – its stated policy under LU-1.1 (DEIR at 5-12). Loopholes in the planning framework allowing the County to consider development in unincorporated areas outside these urban edges conflict with this goal, as well as other goals stated throughout the General Plan Goals and Policies Report and will result in sporadic, poorly planned, leap frog development. Many of these goals, therefore, must be amended to effectively ensure that future growth in the County will not lead to environmentally degrading urban sprawl.

a. Confinement of urban growth:

The County purports to support and ensure urban development occurs in incorporated cities and/or established communities and hamlets. The goals, as written in the Planning Framework, however, create too many exceptions to the rule. They should be amended as follows:

- PF-1.2 should read: "The County shall ensure that urban development only takes place within incorporated cities," with no exceptions. The exceptions listed under PF-1.2 essentially nullify the County's statement that development should only occur in incorporated cities by permitting development in UABs or UDBs whenever the County finds that the development is "regionally significant." This is much too broad and, as discussed further below, the County must make more of an effort to permit incorporated cities to control development immediately outside their boundaries;

[92] *Id.*

- PF-2.2 and PF-3.2: Both of these frameworks allow the County to consider modifications of UDBs and HDBs at the request of developers, special districts or residents. Again, this is too broad, permitting the County to amend these boundaries and support development outside established communities. Such a loophole will lead to unnecessary sprawl outside city centers and override these communities' interest to control growth outside their established urban edges. The County should allow modification of the UDBs and HDBs only in the context of a comprehensive community plan update developed by the affected incorporated city or hamlet;

- PF-4.1: Under this policy framework, the County "shall establish UABs which define the area where land uses are presumed to have an impact upon the adjacent incorporated city." (DEIR at 2-10). The area within these UABs is considered the "next logical area in which urban development may occur," and they "may ultimately be expanded." (*Id.*) This policy should be deleted. It directly conflicts with goal PF-4, which states that urban growth will be directed with the incorporated cities' UDBs and that "all development in city fringe areas [will be] well planned . . ." (*Id.*) Additionally, it conflicts with other policies stated throughout the General Plan Update indicating the County's intent to promote infill development. Developing UABs will surely lead to rural sprawl outside the incorporated cities. Until it is shown that growth cannot be supported within the incorporated cities and their UDBs, the County should not designate land uses that will permit development outside the UDBs.

b. Collaboration with incorporated cities, communities and hamlets in considering development proposals:

To control development within designated urban boundaries, the County will have to actively work with local governments and community players in developing their community plans and considering development proposals in unincorporated areas. Accordingly, the County must adopt the following implementation measures:

- actively encourage annexation of lands proposed for intensified development in urban service areas or within established urban growth boundaries by calculating density at the lowest end of the Countywide Plan designation range, thereby allowing less-intensive development than permitted by the neighboring city or hamlet;

- refer review of *any* master plan, subdivision, or development proposal for land within any urban service area to the adjacent incorporated city, established community, or hamlet;

- encourage cities and towns to amend their general plans and implement ordinances as necessary to clarify their policies regarding development of

the unincorporated areas of their urban service areas and encourage annexation of those areas;

- strengthen the policy regarding revenue sharing and its respective implementation measure. PF-4.14 should be amended to require the County to consider revenue sharing whenever any master plan, subdivision, or development proposal for land outside the UDBs or HDBs is presented to the County. Accordingly the implementation measure must *require*, rather than *consider* the exploration of revenue sharing and develop a timeline for establishing revenue sharing guidelines;

- participate in LAFCO periodic review of adopted spheres of influence and service review studies of cities and towns and special districts and update County maps to show any changes to city spheres of influence or urban service areas;

- incorporate the adopted spheres of influence in County maps.

c. Mixed used opportunities should be considered in all areas

Under PF-3.4, the County directs that land use designations within HDBs "shall be based on a mixed use concept." (DEIR at 2-10.) This policy should also be adopted for Community Plans under PF-2.

d. Development of New Towns:

The policy set out in PF-5.1, whereby the County would evaluate developments of planned communities outside urban areas is unnecessary and must be removed. The policy should simply read that the County shall not permit development of new communities outside UDBs and HDBs. Any other policy permitting these planned communities under any circumstances conflicts with the County's goal to control growth within urban boundaries and facilitate smart growth throughout the planning region.

3. <u>The County must amend its land use mitigation strategies</u>:

The County recognizes that its land use polices spelled out in the General Plan Goals and Policies Report are methods of mitigating the impacts on greenhouse gas emissions. In many instances, however, these strategies are insufficient and must be amended. Other mitigation strategies must also be included.

a. Infill development:

While many of the policies and implementation measures regarding the County's goal of supporting infill development are strong, the County must add force to them by:

- defining infill development. Without providing the County's definition of "infill" it is difficult for the public and decision makers to determine the adequacy and extent of these policies. That is, the County must show that this is true infill development;

- amending LU implementation measure 4 by deleting "as appropriate" at the end and adding that those applying for a discretionary permit to develop outside UDBs and HDBs, whether in the form of a general plan or zoning amendment, etc., to demonstrate that their project cannot feasibly be placed within these boundaries. The county must also adopt guidelines establishing feasibility.

b. Community design and mixed-use development:

Under LU-1.1 the County commits to promoting mixing land uses, but it does not set out any specific implementation measures that would ensure these policies would adequately mitigate greenhouse gas emissions. Accordingly, the County should adopt the following implementation measures:

- establish commercial/mixed-use land use categories that will encourage mixed commercial/residential neighborhoods such as:

    - General commercial/mixed use that will allow a wide variety of commercial uses, including retail and service businesses, professional offices and restaurants in conjunction with mixed-use residential development;

    - Office commercial/mixed use that will encourage a mixture of professional, administrative and medical office uses, in conjunction with mixed-use residential;

    - Neighborhood commercial/mixed use that will permit smaller-scale retail and neighborhood-serving office and service uses in conjunction with residential development oriented toward pedestrians and located in close proximity to residential neighborhoods. Note that this will also facilitate implementation of the County's policy to encourage friendly streets, as defined under LU-7.3. (General Plan Goals and Policies Report at 5-19).

c. Green Building:

Requiring green building in development is critical to mitigating greenhouse gas emissions, because it is a method of development that increases efficiency in how buildings use

energy, water and materials so as to reduce their impacts on the environment and human health.[93] The five principles of green building include: site selection, resource efficiency, energy conservation, water conservation, and indoor environmental quality.[94] Green buildings themselves are those buildings that lower energy consumption, use renewable energy, conserve water, harness natural light and ventilation, use environmentally friendly materials and minimize waste.[95]

Buildings create environmental impacts throughout their lifecycle, from the construction phase to their actual use to their eventual destruction.[96] In the United States, buildings account for 40 percent of total energy use, 68 percent of total electricity consumption, and 60 percent of total non-industrial waste.[97] Buildings also significantly contribute to the release of greenhouse gases. In the U.S. they account for 38 percent of total carbon dioxide emissions.[98] More specifically, residential buildings cause up to 1,210 megatons of carbon dioxide, while commercial buildings create approximately 1,020 megatons.[99] This is because buildings require a lot of energy for their day to day operations. Most of the coal-fired power plants – one of the biggest sources of greenhouse gas emissions – slated for development in the United States will supply buildings with the energy they need. In fact, 76 percent of the energy these plants produce will go to operating buildings in the U.S.[100]

Using green building techniques, however, can substantially reduce buildings' influence in increasing greenhouse gas emissions. Green buildings help reduce the amount of energy used to light, heat, cool and operate buildings and substitute carbon-based energy sources with alternatives that do not result in greenhouse gas emissions. Currently green buildings can reduce energy by 30 percent or more, carbon emissions by 35 percent and water use by 30 to 50 percent.[101] The IPCC determined that "there is a global potential to reduce approximately 29 percent of the projected baseline emissions by 2020 cost-effectively in the residential and commercial sectors, the highest among all sectors."[102] The technologies available for green building are already in wide-use and include "passive solar design, high-efficiency lighting and appliances, highly efficient ventilation and cooling systems, solar water heaters, insulation materials and techniques, high-reflectivity building materials and multiple glazing.[103]

Additionally, the U.S. Green Building Council (USGBC), a private, nonprofit corporation, has established a nationwide green building rating system, called Leadership in

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[93] Jonathan Riker, *The Green Zone: Green building requirements must strike a balance between market economics and social needs*, The Los Angeles Lawyer (Jan. 2008) at 28.
[94] *Id.*
[95] Commission for Environmental Cooperation, Green Building in North America: Opportunities and Challenges (2008) at 16.
[96] *Id.* at 22.
[97] *Id.*
[98] *Id.*
[99] *Id.*
[100] *Id.* at 23.
[101] *Id.* at 23.
[102] *IPCC, 2007*: CLIMATE CHANGE 2007: MITIGATION. CONTRIBUTION OF WORKING GROUP III TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE Chapter 6, p. 389 (B. Metz, et al. eds., Cambridge Univ. Press 2007).
[103] *Id.*

Energy and Environmental Design (LEED). The LEED standard supports and certifies successful green building design, construction and operations. It is one of the most widely used and recognized systems, and to obtain LEED certification from the USGBC, project architects must verify in writing that design elements meet established LEED goals. Under the LEED system, projects can obtain points for achieving certain environmental and efficiency standards. The average LEED Certified building uses 32 percent less electricity and saves 350 metric tons of carbon dioxide emissions annually.[104]

Under LU-7.15, the County states that it "shall encourage the use of solar power and energy conservation building techniques in all new development." (General Plan Goals and Policies Report at 5-20). This policy is expanded under AQ-3.5, where the County says it will "encourage all new development, including rehabilitation, renovation, and redevelopment, to incorporate energy conservation and green building practices to the maximum extent feasible." (*Id.* at 9-6). This is not enough. The County must amend AQ-3.5 to *require* green building practices. Then, the County must amend LU-7.15 so that its language mirrors that in AQ-3.5. Additionally, the County must do the following:

- require that all new County buildings meet LEED standards;[105]
- require that new residential and commercial development, as well as major remodels of homes and businesses, meet green building standards and are LEED certified and that all new buildings in the County exceed Title 24 energy standards by 25 percent.[106] This will require the County to amend implementation measures LU 24 and AQ 13 (General Plan Goals and Policies Report at 5-24 and 9-9);
- require building projects to recycle or reuse a minimum of 50 percent of unused or leftover building materials;[107]
- offer incentives to encourage green building standards;
- provide information, marketing, training and education to support green building;
- explore a regional collaboration with local governments, nonprofits and other public organizations to share resources and develop green building polices and programs that are optimized on a regional scale.

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[104] Riker, *supra note* 97, at 28.
[105] *See* Alameda County Administrative Code Chapter 4.38, requiring all new County projects meet a minimum LEED Silver rating.
[106] *See* Town of Windsor Building and Housing Code Article 13, establishing green building standards and ratings for commercial and residential buildings.
[107] *See* Alameda County Administrative Code § 4.38.030.

d. Transit-oriented development:

The County should adopt a goal stating that it shall encourage transit-oriented development whereby it will locate mixed-use, medium to higher density development in appropriate locations along transit corridors. Such a policy will help the County fulfill its commitment to smart growth, as well as its positive transportation and circulation goals and policies that are geared to promoting and supporting alternative modes of transportation. The County's overarching policy under this goal will be directed at concentrating commercial and medium to high density residential development near activity centers that can be served efficiently by public transit and alternative transportation modes. It should add the following implementation measures to its policies under the transportation and circulation element of the General Plan:

- work with cities and towns and the transportation authorities to identify transit nodes appropriate for mixed-use development, and promote transit-oriented development through means including:
  - rezoning of commercial properties to residential and/or mixed use;
  - expanded zoning for multifamily housing;
  - flexible parking and building height limitations;
  - density bonus programs;
  - design guidelines for private and public spaces; and
  - incentives for redevelopment of underutilized areas, such as surface parking lots

  This measure will also implement TC-4.4 regarding the County policy to encourage "[n]odal land use patterns that support public transit." (General Plan Goals and Policies Report at 12-6);

- encourage more mixed uses, and enable prototype structures for use in neighborhood center zones that can be adapted to new uses over time;

- allow mixed use in commercial districts.

Finally, the County does not consider its transportation goals, policies and implementation measures and ways to mitigate greenhouse gas emissions from the General Plan Update. The County must incorporate these and reevaluate the impacts accordingly.

D. Energy Efficiency and Conservation:

In addressing energy resources in the general plan, the County sets a goal to "encourage energy conservation in new and existing developments." (General Plan Goals and Policies Report at 8-7). This goal, however, must be more concrete, with the County making a commitment to reduce total and per-capita nonrenewable energy waste and peak electricity demand through energy efficiency, conservation and promotion of renewable energy development. Additionally, the County should establish a permanent sustainable energy

planning process that includes specific targets and timelines for reducing energy use throughout the County[108] and adopt specific policies and implementation measures that will allow the County to meet these established targets and deadlines. Below are suggestions on how the County should amend its general plan to effectively mitigate the project's impacts on greenhouse gas emissions.

1. Integrate energy efficiency and conservation requirements that exceed state standards into the development review and building permit process:

Under ERM-4.1 the County adopts a new policy where it "shall encourage the use of solar energy, solar hot water panels, and other energy conservation and efficiency features in new construction and renovation of existing structures in accordance with state law." (General Plan Goals and Policies Report at 8-7 to 8-8). This policy only means that the County will encourage residents and developers to abide by state law. This is hardly a policy to effectively mitigate the project's impacts on energy consumption and greenhouse gases and meet the greenhouse gas emissions reduction targets as mandated by state law and executive order. Indeed, it goes without saying that the County will have to ensure that development under the General Plan does not violate state building codes. Thus, the County must adopt a mitigation strategy that will *require*, rather than encourage, energy conservation measures in new and existing structures to exceed state law requirements. Moreover, the County must set forth measures that describe how it will implement this policy. These measures should include:

- requiring energy efficiency and water conservation upgrades to existing residential and non-residential buildings at the time of sale, remodel, or additions. Berkeley's Residential Energy Conservation Ordinance (RECO) is an example of such a measure.[109] Under this ordinance, Berkeley establishes ten energy or water conservation measures that residential structures must incorporate. These include measures such as installing ceiling insulation, certain water efficiency technologies to shower fixtures and sink faucets and weatherstripping on all exterior doors.[110] The ordinance requires the seller to certify that some of these measures have been met prior to the sale or exchange of any residential structure or unit.[111] Similarly, Berkeley's Commercial Buildings – Energy Conservation Measures requires commercial building owners to conduct an energy audit of their building prior to the sale or major renovation of the building and that they have installed energy conservation measures, regarding heating, cooling, water, and lighting systems, among others;[112]

- requiring new residential construction to meet specific energy efficiency standards that go beyond those mandated by California law. For example, the City of Rohnert Park recently enacted an ordinance establishing

[108] *See* City of Sacramento, Creating a Sustainable City: 2008 Implementation Plan (2008).
[109] Berkeley's Residential Energy Conservation Ordinance (RECO), Berkeley Municipal Code Chapter 19.16.
[110] *Id.* at § 19.16.050(B).
[111] *Id.* at § 19.16.050(A).
[112] Berkeley Municipal Code Chapter 19.72.

minimum energy efficiency standards for all new low-rise residential construction of any size, low-rise residential additions over a specific size threshold and all residential and non-residential swimming pools and water features.[113] The ordinance requires residential buildings to include Energy Star appliances and that new and expanded residential structures meet specific energy use standards;[114]

- requiring that all new buildings be constructed to allow for future installation of solar energy systems. In its Community Greenhouse Gas Reduction Plan, the City of Arcata recommended that it adopt such requirements.[115] Additionally, Chula Vista's Energy Conservation Regulations mandate that all new residential units include plumbing specifically designed to allow later installation of systems that will rely on solar energy as the primary method of heating domestic potable water;[116]

- adopting and implementing a Heat Island Mitigation Plan that requires new residential buildings to have "cool roofs" with the highest commercially available solar reflectance and thermal emittance and adopt a program of building permit enforcement for re-roofing to ensure compliance with existing state building code "cool roof" requirements for non-residential buildings. Research shows that "cool roofs" can reduce air-conditioning energy use between 10 and 50 percent;[117]

- integrating renewable energy requirements into development and building standards, such as requiring onsite solar generation of electricity in new retail/commercial buildings and parking lots/garages (solar carports);

- working with local commercial, industrial, and agricultural operations to identify opportunities for energy efficiency in the storage, transport, refrigeration, and other processing of commodities, and requiring these operations to provide energy efficiency analyses in conjunction with required County approvals.

2. Adopt a policy to integrate energy efficiency into all County functions:

The County should commit itself to ensuring that its own facilities incorporate energy efficient technologies and conservation measures. Several counties and cities across the state have already begun this process and are committing themselves to continue along this path.[118] The County can implement this policy by:

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[113] City of Rohnert Park Municipal Code Chapter 14 at § 14.01.010.
[114] *See id.* at §§ 14.02.050(A); 14.02.060.
[115] City of Arcata, Community Greenhouse Gas Reduction Plan (Aug. 2006).
[116] Chula Vista Municipal Code § 20.04.030.
[117] H. Akbari, S. Konopacki, D. Parker, Updates on Revision to ASHARE Standard 90.2: Including Roof Reflectivity for Residential Buildings (2000); *see also* http://eetd.lbl.gov/HeatIsland/.
[118] *See* City of Sacramento, Creating a Sustainable City: 2008 Implementation Plan (*hereinafter* Sacramento Implementation Plan) (2008) at 5-7

- auditing County and agency buildings and retrofitting for energy efficiency;

- training and educating County employees on energy conservation measures;

- adopting a resolution or ordinance that will require the County to consider and investigate sources of renewable energy, such as installing solar photovoltaic systems to generate electricity for County buildings and operations[119]; using methane to generate electricity at the County wastewater treatment plant; and installing combined heat and power systems.

3. Require streetscape and parking area improvements for energy conservation:

In its General Plan the County sets out a policy where it "shall promote the planting and maintenance of shade trees along streets and within parking areas of new urban development to reduce radiation heating." (General Plan Goals and Policies Report at 8-8). This policy should be more forceful by changing *promote* to *require*.

4. Adopt a policy to facilitate and encourage energy efficiency technology and practices and renewable technologies through streamlined planning and development rules, codes, processing and other incentives:

One way the County can effectively promote and encourage businesses, residents and developers to implement energy conservation measures is to: (1) make it easier for them to incorporate energy efficiency and renewable energy technologies into their businesses and homes; and (2) offer incentives that make these technologies and practices economically feasible and attractive. Actions the County should take to implement this policy include:

- identifying and removing regulatory or procedural barriers to making energy improvements and producing renewable energy in building and development codes, design guidelines, and zoning ordinances;

- offering expedited permit processing and reducing building fees for developers, homeowners and facilities utilizing energy efficient technologies and conservation measures and/or renewable sources for energy production;

- evaluating and implementing opportunities for supporting new programs and promoting sustainable energy practices through financing

[119] Under the California Solar Initiative, the California Public Utilities Commission offers different incentives to government agencies, as well as private businesses and residents, for installing certain types of solar power systems. *See* California Public Utilities Commission, California Solar Initiative Program Handbook (Jan. 2008), *available at* http://www.cpuc.ca.gov/puc/energy/solar/ (*last visited* April 7, 2008).

mechanisms, such as pooled project funding, low-interest loans and state funds earmarked for energy efficiency and renewable energy. Additionally, the County should work with energy providers and state and federal agencies to secure tax exemptions and tax rebates for residential energy performance improvements;[120]

- developing a program to provide innovative, low-interest financing for energy efficiency and renewable energy projects. For example, Berkeley is currently exploring ways to develop a voluntary financing program that would allow the city to provide financing for the upfront costs of energy improvements, such as solar power installations, and recoup that cost through long-term assessments on individual property tax bills.[121]

5. Establish implementation measures to enforce the County's policy of participating with local and state programs that work to reduce energy consumption:

While the County's policy to play a part in local and state programs directed toward reducing citizens' consumption of natural and man-made energy sources set out in ERM-4.3 is a positive policy and mitigation strategy for reducing the project's contribution to greenhouse gases, it lacks teeth. Without detailing strategies the County will employ to implement this policy, it has no force and fails to provide the public and decision makers with information on what steps they should take to ensure this policy is followed over the life of the General Plan. Along these same lines, the county should amend policy ERM-4.4, changing the language from the "County *should* coordinate with local utility providers to provide public education on energy conservation programs" to the "County *shall*" do so. Some ways the County can implement these policies include:

- requiring new residential developments to participate in the California Energy Commission's New Solar Homes Partnership and include onsite solar photovoltaic systems in at least 50% of the residential units (see http://www.gosolarcalifornia.ca.gov/nshp/index.html);[122]

- working with local community organizations and utility providers to explore programs directed at educating, training and providing services for residents and businesses in energy reduction and conservation practices. For example, Smart Lights, a program funded through grants provided by the California Public Utilities Commission has assisted small business owners in Berkeley and Oakland in conducting lighting system audits and installing energy efficient lighting and refrigeration improvements.[123]

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[120] *See* City of Berkeley, Climate Action Plan, DRAFT (Jan. 2008) at 24;
[121] *See id.* at 24.
[122] *See also* California Public Utilities Commission, New Solar Homes Partnership Guidebook, Second Edition (July 2007).
[123] *See* Berkeley Climate Action Plan, *supra* note 122 at 29-30; *see also* http://www.smartlights.org/about.html (*last visited* April 7, 2008).

Another example of a program is the Low-Income Energy Efficiency (LIEE) Program, which is funded by the state and provides no-cost weatherization services and energy education to low-income households.[124]

6. Amend and expand its policy in identifying long-term energy strategies and programs:

The County's policy stated in ERM-4.5 to "participate with energy providers in identifying long range energy strategies and facilities" (GP 8-8) is too narrow. Instead the policy should read: "The County shall investigate and explore long-term energy strategies and programs to reduce energy consumption and increase reliance on renewable energy sources." Then the County should specifically detail specific actions that will guide it in its efforts to implement this policy such as:

- working with special districts, other county agencies and local utility provider to assess and develop joint initiatives for energy and water resource planning, resource conservation, and energy development;

- committing to purchasing a percentage of the County's energy needs from renewable resources, as several cities and counties have already begun to do.[125] This will require the County to work with its local utilities provider in gradually increasing the portion of electricity produced by the provider from renewable energy sources;

- investigating the feasibility of developing a locally or regionally-owned green utility under the Community Choice Aggregation ("CCA") model. This would allow the County to aggregate its electricity loads and purchasing renewable electricity to meet the city's electricity needs. Several cities and counties across the state have developed these municipal utility districts, which have allowed them to increase their use of renewable energy, as well as develop their own energy policies such as incentive and assistance programs and rebates and set their own electricity rates. Alameda Power and Telecom is only one example of a municipal utility district committed to providing green energy throughout the county.[126] Another example is Chula Vista's ordinance giving it the right to establish a municipal solar utility, which would allow it to facilitate the

[124] *See* California Public Utilites Commission, Low Income Energy Efficiency Program (LIEE), *available at* http://www.cpuc.ca.gov/PUC/energy/consumers/liee.htm (*last visited* April 7, 2008)
[125] *See* Sacramento Implementation Plan, *supra* note 120 at 5, 7 (stating that Sacramento currently meets 1 percent of its electricity needs from renewable energy sources and setting a goal to increase the purchase of renewable energy to meet 10 percent of the city's annual electricity usage).
[126] *See* Alameda Power and Telecom, Energy Efficiency and Rebates for Your Home, *available at* http://www.alamedapt.com/electricity/res_savings.html (*last visited* April 7, 2008); for a list of other statewide municipal utility districts *see* California Energy Commission, Go Solar California, *available at* http://www.gosolarcalifornia.ca.gov/utilities/munis.html (*last visited* April 7, 2008).

leasing of solar energy devices to make solar energy technologies more economically feasible for its residents.[127]

7. Amend renewable energy policy:

In ERM-4.6, the County sets out a policy where it "shall support efforts, when appropriately sited, for the development and use of alternative energy resources, including renewable energy such as wind and solar, biofuels and co-generation." (General Plan Goals and Policies at 8-8.) The County should make this policy more forceful by amending the language to: "The County shall promote and preserve opportunities for development of renewable energy resources." The County can then adopt specific implementation measures to enforce this policy such as:

- using Geographical Information Systems (GIS) to map and assess local renewable resources, the electric and gas transmission and distribution system, community growth areas anticipated to require new energy services, and other data useful to deployment of renewable technologies;

- identifying possible sites for production of energy using local renewable resources such as solar, wind, small hydro, biogas, and tidal and evaluating potential land use, environmental, economic, and other constraints affecting their development, and adopting measures to protect those resources, such as utility easements, rights-of-way, and land set-asides;

- providing information, marketing, training and education to support renewable resource use.

E. Agriculture

The County's agricultural operations offer an excellent opportunity to reduce the County's total greenhouse gas emissions. Additional mitigation is feasible, effective and should be incorporated into the General Plan Update. Promoting smaller, grazing-based livestock systems as an alternative to confined animal facilities, requiring the installation of digesters at all present and future large feedlot systems, and supporting the transition to biofiltered enclosures for concentrated livestock housing will not only reduce emission from additional dairy expansions, but also help to achieve emissions reductions from existing sources critical to meeting AB 32 targets. Fortunately, developing more sustainable animal agriculture can be a win-win situation for Tulare County residents and the dairy industry, as discussed in more detail below.

Animal agriculture is responsible for 18 percent of all greenhouse gas emissions resulting from human activity, including 35 to 40 percent of global methane emissions and 65

[127] Chula Vista Municipal Code Chapter 20.08.

percent of nitrous oxide emissions.[128] Though less prevalent in the atmosphere, methane and nitrous oxide are significantly more potent greenhouse gases than carbon dioxide. Because methane has a relatively short ten-year lifespan and is 21 times more warming than carbon dioxide[129], reductions in methane emissions can yield dramatic benefits in the near-term, helping to forestall the worst impacts of global warming.[130] Nitrous oxide emissions, which persist longer in the atmosphere than carbon dioxide (120 years) and are 310 times more potent, are another obvious target for immediate mitigation.[131] Fortunately, many promising mitigation strategies for livestock greenhouse gas emission reductions have been identified, and in many cases, mitigating these greenhouse gas emissions can be significantly less expensive than mitigating carbon dioxide emissions.[132]

1. Encourage grazing-based animal livestock systems wherever feasible

Many research and policy discussions today regarding animal agriculture and greenhouse gas emission reductions are focused on increasing efficiency and productivity of industrial agricultural operations.[133] There is also, however, abundant literature on the advantages of grazing-based livestock systems.[134] In addition to their numerous environmental and public health benefits, the economics of animal agriculture are also likely to evolve in favor of such systems. As public awareness of the environmental and health benefits of grass-fed and organic dairy products increases, there is a growing local, regional, national, and global demand for these products. The likely future increase in construction and operational costs of animal confinement facilities due to rising feed and fuel prices, coupled with a foreseeable expansion of environmental regulations, may make confined animal facilities a less economically attractive option.

Specific to global warming, several of these studies cite higher overall greenhouse gas emissions from animal confinement facilities than range-based systems, due to such factors

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[128] Steinfeld, H.P. et al., Livestock's Long Shadow: Environmental Issues and Options. Food and Agriculture Organization of the United Nations (2006), *available at* http://www.virtualcentre.org/en/library/key_pub/longshad/A0701E00.pdf (*accessed* March 5, 2008).

[129] U.S. Environmental Protection Agency (EPA), Global Mitigation of Non-CO_2 Greenhouse Gases, EPA 430-R-06-005. (2006a), *available at* http://www.epa.gov/climatechange/economics/downloads/GlobalMitigationFullReport.pdf (*accessed* March 5, 2008).

[130] *See* Quinn, P.K., et al, Short-Lived Pollutants in the Arctic: Their Climate Impact and Possible Mitigation Strategies (2007).

[131] EPA 2006a, *supra* note 129.

[132] *Id.*

[133] *See, e.g., id.*

[134] *See, e.g.,* U.S. Dept. of Agriculture and Natural Resources Conservation Service, Technical Note No. 1: *Profitable Grazing-Based Dairy Systems* (2007); Humane Society of the United States (HSUS), *An HSUS Report: The Impact of Animal Agriculture on Global Warming and Climate Change* (2007); Tara Garnett, Meat and Dairy Production and Consumption: Exploring the livestock sector's contribution to the UK's greenhouse gas emissions and assessing what less greenhouse gas intensive systems of production and consumption might look like (2007); Steinfeld et al., *supra* note 128; Kate Clancy, *Greener Pastures: How Grass-Fed Beef and Milk Contribute to Healthy Eating* (2006); Susan Subak, Global environmental costs of beef production, *Ecological Economics* 10:79 (1999); P.S. Thorne, Environmental health impacts of concentrated animal feeding operations: anticipating hazards – searching for solutions, *Environmental Health Perspectives* 115(2):296-7 (2007).

as higher manure methane emissions and other greenhouse gas emissions associated with feed production and facilities operation.[135] Moreover, efforts to increase efficiency and productivity of industrial agriculture as a means of reducing greenhouse gas and other emissions are coming under increasing scrutiny. In the complicated calculus of livestock emissions, any reductions in enteric fermentation methane due to increased efficiency or productivity must be balanced against all associated increases in emissions and other environmental/public health impacts, including but not limited to emissions of greenhouse gases in the production of these feeds and supplements.[136] Similarly, the greenhouse gas reduction benefits of many efficiency- and production-geared strategies only take effect if milk and meat production is held constant and the number of animals is thereby reduced. The EPA notes that if the number of animals is held constant, "intensive grazing" practices are more effective at reducing total livestock methane emissions than any of the other strategies analyzed (including increased feed efficiency, propionate precursors, antimethanogens, digesters, improved feed conversion, antibiotics, and bST).[137] It is important to include a full lifecycle analysis of the environmental impacts resulting from the construction and operation of any individual livestock facility.

2. Require all large confined animal facilities to install anaerobic digesters to capture methane emissions for energy use

Anaerobic digesters are widely regarded as the most effective mitigation for reducing manure methane emissions from confined animal facilities; they are also effective at reducing nitrous oxide emissions from manure.[138] The EPA described biogas recovery systems using anaerobic digesters as a "proven technology" as far back as 2002,[139] and as of November 2007, the US EPA reported that 111 operating digesters at US livestock facilities, including 15 in California.[140] Eighty percent of US digesters are used by the dairy industry.[141] Energy generated by anaerobic digesters at US agricultural facilities more than quadrupled between 2000 and 2007.[142] Existing federal methane recapture programs produce enough energy today to power 20,000 American homes and have reduced methane emissions by 1.5 million tonnes (carbon dioxide-equivalent).[143]

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[135] EPA 2006a, *supra* note 131; HSUS 2007, *supra* note 134; Subak, *supra* note 134.

[136] *See, e.g.* K. Kumar, et al., Antibiotic Uptake by Plants from Soil Fertilized with Animal Manure, *Journal of Environmental Quality* 34:2082-2085 (2005); L.S. Lee, et al., Agricultural contributions of antimicrobials and hormones on soil and water quality, *Advance in Agronomy* 93:1 (2007); HSUS 2007, *supra* note 134; Garnett, *supra* note 134; Gowri Koneswaran and Danielle Nierenberg, Global Farm Animal Production and Global Warming: Impacting and Mitigating Climate Change, *Environmental Health Perspectives* doi:10.1289/ehp.11034 (2008).

[137] EPA 2006a, *supra* note 131.

[138] *See, e.g.*, B. Amon, et al., Methane, nitrous oxide, and ammonia emissions during storage and after application of dairy cattle slurry and influence of slurry treatment, *Agriculture, Ecosystems and Environment* 112:153 (2006); K. Paustian, et al., *Agriculture's Role in Greenhouse Gas Mitigation, Pew Center on Global Climate Change*, A. Weiske, et al., Mitigation of greenhouse gas emissions in Europe conventional and organic dairy farming, *Agriculture, Ecosystems and Environment* 112:221-232 (2006).

[139] U.S. EPA, Managing Manure with Biogas Recovery Systems: Improved Performance at Competitive Costs (2002).

[140] U.S. EPA, Anaerobic Digesters Continue Growth in U.S. Livestock Market (2007c).

[141] *Id.*

[142] *Id.*

[143] HSUS 2007, *supra* note 134; *see also* U.S. EPA, U.S. Government Accomplishments in Support of the Methane to Markets Partnership: Agriculture (2007b), U.S. EPA 2007c, *supra* note 140; U.S. EPA, AgStar Digest (2006b).

A number of federal and state resources are available to assist California dairies with selecting and implementing a digester system that is customized to their facility. For example, the federal government has established programs, including AgStar and Methane to Markets, which support the capture and re-use of methane gas from animal agriculture using anaerobic digesters. USDA funding for anaerobic digester systems has exceeded $31 million since 2003.[144] The captured and processed methane is then used to power on-site generators or sold back to local utility companies, thereby yielding economic benefits for livestock operations.[145] In California, Pacific Gas and Electric Company ("PG&E") is partnering with dozens of dairies and digester companies to help facilitate the widespread use of this technology and reduce greenhouse gas emissions (*see e.g.,* (http://www.pge.com/news/news_releases/q1_2007/070320a.html). More information about PG&E's Net Energy Metering for Biogas Digester Generators program can be found online at http://www.pge.com/suppliers_purchasing/new_generator/ebio/. These programs demonstrate that capturing manure methane emissions via anaerobic digestion can be a win-win scenario for current and future dairy operations in Tulare County. Given the huge number of dairies in the County and the County government's key role in reviewing and regulating the environmental performance of its animal agriculture facilities, Tulare County is well-positioned to provide leadership in securing funding and financing arrangements for digester systems in partnership with utility companies and state agencies.

3. Develop Incentives and Financing Programs for Cow Enclosures Vented to Biofilters

Vented enclosures have been identified as best available control technology (BACT) for cow housing structures, milk parlors, feed storage, and manure storage at large confined animal facilities (over 1,000 head) (SJVUAPCD Rule 4570, § 5.6B-F). This technology is effective in controlling enteric and manure methane and nitrous oxide emissions in addition to criteria pollutants. Enclosed barns are commonly in use in other parts of the country where temperatures tend to be high, where they have been shown to decrease odor and significantly increase milk production by relieving heat stress in cows (*see, e.g.,* http://www.northfloridaholsteins.com/info.html).[146] Regarding biofilters, the San Joaquin Valley Air Pollution Control District's Dairy Permitting Advisory Group states that "today there are more than 500 biofilters in Germany and in the Netherlands. In agriculture, biofiltration is widely used to control emissions from enclosed swine facilities and has been reported to be used in dairy situations from enclosed, mechanically ventilated housing and manure storage areas."[147] These technologies are in use at dairies and are widely used at swine facilities, which are of the same category or class as dairies.[148] The San Joaquin Valley Air District concluded that "[t]his option alone may achieve highest VOC reductions of all the management practices proposed combined."[149] As the leading dairy producing county in California, Tulare County is uniquely

[144] U.S. EPA2007c, *supra* note 142.
[145] HSUS 2007, *supra* note 134; US EPA AgStar Handbook excerpts; US EPA 2006b, *supra* note 143.
[146] San Joaquin Valley Unified Air Pollution Control District, Final Draft Staff Report on Proposed Rule 4570 (Confined Animal Facilities) (May 18, 2006).
[147] Dairy Permitting Advisory Group, Recommendations to the San Joaquin Valley Air Pollution Control Officer Regarding Best Available Control Technology for Dairies in the San Joaquin Valley, Final Report (Jan. 31, 2006).
[148] SJVAUPCD 2006, *supra* note 146.
[149] *Id.* at 26.

positioned to publicize and promote this technology as a particularly promising tool to help meet statewide greenhouse gas emission reduction goals.

F. Waste

Decomposing organic waste emits carbon dioxide and methane, two major greenhouse gases. In fact, methane is the most important of the non-CO_2 pollutants, with a global warming potential 21 times greater than carbon dioxide, and an atmospheric lifetime of 12 years.[150] Methane constitutes approximately 20% of the anthropogenic greenhouse effect globally, the largest contribution of the non-CO_2 gases. Municipal solid waste landfills are the largest source of human-related methane emissions in the United States, accounting for about 25 percent of these emissions in 2004. Thus, waste reduction and recycling can significantly reduce and eliminate global warming pollution by reducing landfill methane emissions. Additionally, reducing waste and reusing materials can also reduce greenhouse gas emissions by reducing transportation-related emissions and add to overall energy savings by reusing items that would otherwise be manufactured.[151] Indeed, achieving California's 50% Statewide Recycling Goal and ultimately achieving zero waste are two measures identified in the Climate Action Team's Report to Governor Schwarzenegger critical to meeting AB 32 greenhouse gas reduction requirements.[152]

As such, the DEIR should include data on current county-wide recycling/composting levels and the extent to which waste can be reduced if recycling/composting programs were expanded and should consider mitigation measures that will reduce landfill waste and methane emissions from landfills located in the County.

1. Reducing waste

The County's policy to promote solid waste production must be amended to eventually achieve zero waste. California communities that have already adopted zero waste goals include Del Norte County, San Luis Obispo County, Santa Cruz County and San Francisco.[153] Other communities that have committed to reducing their waste by more than fifty percent include Alameda County (75 percent) and the City of Los Angeles (75%).[154] Furthermore, the County must adopt implementation measures for its policies concerning solid waste reduction and use of recycled materials by the County and private businesses and residents. Actions the County can take to meet this goal and achieve its policies, include:

- implementing an environmentally preferred purchasing program which could include giving bid preferences to contractors and suppliers that meet

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[150] Forster and Ramaswamy 2007.
[151] ICLEI Local Governments for Sustainability, U.S. Mayor's Climate Protection Agreement Climate Action Handbook at 16.
[152] California Climate Action Team, Climate Action Team Report to Governor Schwarzenegger and the Legislature (March 2006) at 41, 46.
[153] *See* Global Recycling Council, CA Zero Waste Communities Strategy at http://www.crra.com/grc/articles/zwc.html (*last visited* April 8, 2008).
[154] *Id.*

County established sustainability criteria. This is a policy several cities and counties are either considering or currently implementing[155];

- establishing a program and system for reuse or recycling of construction and demolition materials for government and non-governmental construction projects;
- requiring recycling in all government buildings and public schools;
- implementing an organics and yard debris collection and composting program;
- employing best management practices at landfill facilities and incorporating effective new practices as they become available;
- pursuing aggressive recycling, resource recovery and composting strategies throughout the County to divert waste from landfills;
- adopting policies and economic incentives and garbage rate structures so that recycling, reusing and composting is cheaper than throwing out or incinerating waste;[156]
- enacting educational programs to inform residents about reuse, recycling, composting, waste to energy, and zero waste programs and building community alliances with residents and businesses to help design and implement a zero waste reduction strategy. One way the County could do this is to establish a zero waste commission, as Berkeley has done, that can focus on establishing policies, monitoring success, and coordinating with community members.

2. Methane Capture for Energy Use

As briefly mentioned above in discussing energy conservation and reduction, the County should consider implementing a methane collection system for its landfills. This will not only assist the County in mitigating projected growth and development's impact on energy consumption, but will also assist the County in reducing greenhouse gas emissions from landfills to supplement its goals and policies to divert waste entirely.

Landfill gas (LFG) is created as solid waste decomposes in a landfill. This gas consists of about 50 percent methane (CH_4), the primary component of natural gas, about 50 percent carbon dioxide (CO_2), and a small amount of non-methane organic compounds. Instead

[155] *See* City of Sacramento, Creating a Sustainable City, A Master Plan to Move the City of Sacramento Towards Sustainability (2007) at 12; Sacramento Implementation Plan, *supra* note 120 at 4

[156] For a list of possible incentives the County could consider *See* Gary Liss, *Local Government Incentives for Zero Waste*, Grass Roots Recycling Network at http://www.grrn.org/zerowaste/articles/loc_gov_zw_incentives.html (*last visited* April 8, 2008).

of allowing LFG to escape into the air, it can be captured, converted, and used as an energy source. Using LFG helps to reduce odors and other hazards associated with LFG emissions, and it helps prevent methane from migrating into the atmosphere and contributing to local smog and global climate change. *See* http://www.epa.gov/lmop/overview.htm.

Landfill gas is extracted from landfills using a series of wells and a blower/flare (or vacuum) system. This system directs the collected gas to a central point where it can be processed and treated depending upon the ultimate use for the gas. From this point, the gas can be simply flared or used to generate electricity, replace fossil fuels in industrial and manufacturing operations, fuel greenhouse operations, or be upgraded to pipeline quality gas.

The generation of electricity from LFG makes up about two-thirds of the currently operational projects in U.S. Electricity for on-site use or sale to the grid can be generated using a variety of different technologies, including internal combustion engines, turbines and microturbines. Directly using LFG to offset the use of another fuel (natural gas, coal, fuel oil) is occurring in about one-third of the currently operational projects. This direct use of LFG can be in a boiler, dryer, kiln, greenhouse, or other thermal applications. It can also be used directly to evaporate leachate. Innovative direct uses include firing pottery and glass blowing kilns; powering and heating greenhouses and an ice rink; and heating water for an aquaculture (fish farming) operation. Current industries using LFG include auto manufacturing, chemical production, food processing, pharmaceutical, cement and brick manufacturing, wastewater treatment, consumer electronics and products, paper and steel production, and prisons and hospitals, just to name a few. Cogeneration (also known as combined heat and power or CHP) projects using LFG generate both electricity and thermal energy, usually in the form of steam or hot water. Several cogeneration projects have been installed at industrial operations, using both engines and turbines.

The efficiency gains of capturing the thermal energy in addition to electricity generation can make these projects very attractive. Information on landfill energy projects is available at http://www.epa.gov/lmop/overview.htm. Information on mitigation opportunities and costs is available at EPA, U.S. Methane Emissions 1990-2020: Inventories, Projections, and Opportunities for Reductions, EPA 430-R-99-013 (Sept. 1999) (excerpts attached).

G. Water

As described above, global warming is already having and will continue to have a serious impact on water supplies for the Western United States. The DEIR recognizes that the General Plan update will have a potentially significant impact on water supplies in the County and that, even after proposed mitigation measures are incorporated, it will have a significant and unavoidable impact on the County's water supplies and its need to expand or acquire new water supply entitlements. (DEIR at 4-120 to 4-136). While the County considers several ways to mitigate this plan's significant impact on water resources, several of these should be strengthened and more strategies should be considered.

1. Require new development to adopt specific water conservation measures

In WR-3.3, the County sets a policy to "review new development proposals to ensure the intensity and timing of growth will be consistent with the availability of adequate water supplies." (General Plan Goals and Policies report at 11-5). Under this policy, the new development projects will have to provide evidence "of adequate and sustainable water availability or a will serve letter" before the County will approve any entitlements. (*Id.*) This policy will be implemented through the adoption of an ordinance. (*Id.* at 11-9). While it is important that the County ensure that new development demonstrate existing infrastructure, this policy should be broader, allowing the County to consider additional implementation measures that will require new developments to not only demonstrate adequate water supplies exist, but also that it will incorporate effective water conservation techniques. Although the County states that it "shall incorporate provisions for the use of reclaimed wastewater, water conserving appliances, drought tolerant landscaping, and other water conservation techniques" into its building, planning and subdivision ordinances (General Plan Goals and Policies at 11-8), it does not specify what measures should be considered and whether or not new development will be *required* to incorporate specific water conservation methods. Moreover, its implementation measure of simply requiring that new development "provide suitable evidence of long-term water availability or will serve letter" is not sufficient for mitigating the project's and global warming's impacts on water supplies in the County.

Thus, WR-3.3 should be amended to read that the "County shall review new development to ensure it does not interfere with maintaining sustainable water supplies." Then the County can implement this policy by requiring new developments to demonstrate that the intensity and timing of the growth is consistent with available water supplies and by:

- requiring new construction or users to offset demand so that there is no net increase in demand in those water districts where there is insufficient water to serve new construction or uses requiring increased water supply;

- forbidding new construction or uses requiring increased water supply unless the County specifically finds that an adequate, long-term and sustainable water supply is available to serve the project;

- requiring documentation that new development projects with the potential to degrade or deplete surface water or groundwater resources will not adversely affect a basin or subbasin, including in-stream flows for aquatic habitat;

- minimizing demand for water in new development by encouraging service providers and service districts to incorporate water, wastewater and storm water infrastructures and by considering water-based service that reduce demand and draw on alternative supplies to be equivalent to new supplies. Water-based services include the application of state-of-the-art technology and practices; matching water quality to its end use; and financing local wastewater reuse in the same way centralized water supply options are financed;

- requiring water conservation on new construction;

- using reclaimed water for landscape irrigation in new developments and on public property and installing the infrastructure to deliver and use reclaimed water;

- requiring buildings to be water-efficient and mandating water-efficient fixtures and appliances in all new development and government buildings;

2. The County should require native and drought tolerant landscaping:

Under policy WR-3.5, the County commits to encouraging the use of "low water consuming, drought-tolerant and native landscaping" and emphasizing the "importance of utilizing water conserving techniques, such as night watering, mulching, and drip irrigation." (General Plan Goals and Policies Report 11-5). The County should be more forceful by *promoting* such landscaping through by:

- requiring site-appropriate, drought-tolerant low water use, native landscaping and ultra-efficient irrigation systems where appropriate for all development applications and re-landscaping projects and limiting the amount of water intensive landscaping to reduce the amount of water needed for irrigation and

- creating a landscaping master plan for public facilities that promote site appropriate, low-water-use and drought tolerant native plants in public facilities and that specifies appropriate species, methods and technologies for water-wise landscaping.

3. Adopt more extensive implementation measures to support its policies regarding an integrated regional water master plan and water resource planning:

Under WR-3.2 and 3.4, the County will work with other agencies and organization in the County to develop a regional master plan and will continue to participate in all state and regional planning efforts. (General Plan Goals and Policies Report at 11-5). The County does not set out specific implementation measures to indicate other ways it can contribute to such planning, however. The county should also consider the following mitigation and implementation measures:

- providing a Countywide Plan buildout information to water supply purveyors to use in the development of their respective Urban Water Management Plans (UWMPs). The water shortage contingency plan portion of the UWMP would enable the County to identify shortages on a consistent basis, to define water shortage stages and appropriate response measures, and to develop necessary ordinances, resolutions or rules to manage water shortages;

- working with water agencies to reduce energy uses from water facilities;

- working with water suppliers to study the efficiency and cost-effectiveness of rainwater harvesting systems and infiltration and recharging patterns of groundwater aquifers to assess the feasibility of using direct precipitation collection to supplement existing water sources;

- working with water agencies to resolve conflicting regulations regarding pretreated septic drip dispersal systems and appropriate graywater use, to evaluate the potential of small-scale portable graywater converter systems as possible sources for landscaping water, and to modify regulations as necessary to encourage safe graywater use.

4. Limit development in groundwater recharge areas:

While the County states that it will "carefully regulate" the type of development within groundwater recharge areas and basins, it should adopt a more forceful policy to limit urban encroachment and development in these areas entirely.

VII. THE DEIR FAILS TO CONSIDER A REASONABLE RANGE OF ALTERNATIVES

Under CEQA, a DEIR must consider and analyze a wide-range of alternatives to the project. "Without meaningful analysis of alternatives in the EIR, neither courts nor the public can fulfill their proper roles in the CEQA process." *Laurel Heights Improvement Ass'n v. Regents of University of California*, 47 Cal.3d 376, 404 (1988). Here, the DEIR fails to present "a reasonable range of potentially feasible alternatives." Guidelines § 15126.6(a).

The County's alternatives are hardly distinguishable, with the population distribution for unincorporated areas varying by only two to three percentage points under each alternative. According to the DEIR, 28 percent of growth will occur in unincorporated areas under the General Plan Update, 26 percent of growth will be placed in these areas under the city-centered alternative, 30 percent of growth will occur in these areas under both the rural communities and the transportation corridor alternative, and the County states that it cannot determine how much growth will be place in unincorporated areas under the confined growth alternative. (DEIR 7-3 to 7-4). Indeed, while the DEIR set forth a purported "City Centered" alternative, the nominal increase in city-centered growth resulting from this alternative suggests it is not city centered at all. The County must consider a range of alternatives that will place almost all growth in incorporated cities and established communities and hamlets and that will implement strong smart-growth principles and energy conservation measures. For example, an alternative that combines the city-centered and confined growth alternatives would likely result in no growth or very minimal growth in unincorporated areas. Additionally, the County must consider alternatives that incorporate strict energy and water conservation measures, require green building practices and mixed-use development and places development near alternative transportation nodes. Such alternatives would result in a significant reduction in greenhouse gas

emissions resulting from VMTs and energy consumption. It would also result in fewer greenhouse gas emissions from construction and development, as the County would not have to build new infrastructure throughout unincorporated. These alternatives would meet the County's basic goals and objectives of its General Plan Update and, therefore, must be considered by the County. (*See* DEIR at 7-2).

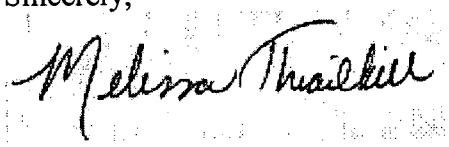
Finally, the County must explain its analysis of the alternatives in more detail so that the public and decision-makers can better determine how they would achieve the goals and objectives of the General Plan Update, lessen the environmental impacts resulting from growth and development and why the County eventually chose this General Plan Update, rather than more environmentally-friendly alternatives. Under the air quality impacts, for example, the County makes very general assumptions about VMTs and mobile and stationary emissions, concluding that, even under the city-centered and confined growth alternative, would essentially result in the same environmental harm as the General Plan Update. (*See* DEIR at 7-20 and 7-32). This is also true in the DEIR's analysis of transportation/traffic. (*See* DEIR at 7-22 and 7-34). It's not clear how the County came to this conclusion or whether it adequately and fully considered the alternative's impacts as compared to the General Plan Update's impacts.

CONCLUSION

In sum, the current DEIR did not adequately disclose, analyze, avoid, minimize, and mitigate the environmental impacts of the General Plan Update. Nor has the DEIR considered a reasonable range of alternatives. Therefore, the DEIR must be amended and recirculated before the County can legally adopt the General Plan Update.

Please do not hesitate to contact Melissa Thrailkill at (415) 436-9682 x.313 or mthrailkill@biologicaldiversity.org if you have any questions regarding these comments. Thank you for your time and consideration of our concerns.

Sincerely,



Melissa Thrailkill
Center for Biological Diversity

Enc: The following references are included for your review and inclusion in the administrative record.

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