Setting the Standard in Coyote Valley

A Scenarios for Sustainability (S2) Analysis of Preliminary Development Options

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REDEFINING PROGRESS

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I. Synopsis

Scenarios for Sustainability (S2) is an urban planning tool that provides decision makers with quantitative information about the degree to which alternative development options achieve environmental, economic, and social sustainability objectives. S2 combines elements of two well-known sustainability indicators created by Redefining Progress: the Ecological Footprint (EF) and the Genuine Progress Indicator (GPI). This report applies S2 to the debate over the future of San José's Coyote Valley by providing a preliminary comparison of the City's Specific Plan with the *Getting it Right* (GIR) vision advanced by Greenbelt Alliance.

Coyote Valley is a largely undeveloped tract of agricultural land just south of San José, some of which lies within the city's urban growth boundary, some within its sphere of influence. As it is the largest development project now contemplated in the Bay Area and as issues of sprawl, pollution, farmland loss, traffic congestion and affordability make daily headlines, all eyes are focused on how San José develops this sensitive area and if it can achieve a delicate balance between accommodation of growth and preservation of the Bay Area's unique quality of life.

The debate over how much and where to develop and what form that development should take is a debate that is often highly politicized but one that cries out for impartial analysis. S2 meets this need by addressing multifaceted concerns over environmental, economic, and social sustainability in a quantitative fashion. Here, our quantitative measures include the ecological footprint, the costs of lost farmland, non-market costs of carbon dioxide emissions, capital exports needed to pay for oil from afar, and equity in the distribution of housing types and access to open space. By providing quantitative measures of sustainability that vary as planning parameters are modified, S2 is a tool the City can use to design a final development plan in Coyote Valley that minimizes its ecological footprint and maximizes its contribution to genuine human progress.

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While a complete S2 analysis cannot be completed until the City releases a final Environmental Impact Report (EIR) and supporting documentation, our preliminary analysis suggests the following:

- By promoting a more compact urban form, a better mix of jobs and residences, and fewer vehicle miles traveled and by converting fewer acres of biologically productive land to impervious surface, GIR's ecological footprint will be at least 17% less than that of the Specific Plan.

- By preserving more agricultural land, reducing carbon dioxide emissions damage, and exporting fewer dollars out of the local economy to pay for imported oil relative to the Specific Plan, GIR will cost at least $6.4 million less each year in terms of externalized economic costs to future generations.

- GIR represents a 30% improvement in the equitable distribution of housing types as compared with the distribution envisioned by the Specific Plan.

- GIR would allow 7% more families to have immediate access to open space, thereby mitigating the tendency for open space to be clustered near high income areas alone.

Thus, in terms of S2 indicators of environmental, economic, and social sustainability, GIR appears to be a consistently superior approach. The remainder of this report is organized as follows. In Section II, we provide background information about Coyote Valley, the two development options we address, and the basic structure of our S2 analysis. In Sections III, IV, and V, we describe and report on the results of the environmental, economic, and social sustainability components of our S2 analysis. We offer conclusions and suggestions for future refinements in Section VI.

II. Background on Coyote Valley Development Options and S2

Coyote Valley is situated at the southernmost edge of the urbanized portion of the San Francisco Bay region, as shown in Figure 1. The region includes 6,800 acres of primarily rural land, situated between South San José and north Morgan Hill in Santa Clara County. Large-scale Coyote Valley development plans have been a source of controversy in the region for years, as the Valley comprises one of few remaining large developable areas in the urbanized San Francisco Bay Area.

Coyote Valley was once part of the Valley of Heart's Delight, combining fertile soil, a moderate climate and sufficient water flows to earn the reputation as an "agricultural Eden." Farmland in the 6,800-acre valley, especially in its northern two-thirds, have been dwindling steadily in recent years as the city has changed zoning designations to allow for urban and industrial development (Najeeb 2003). Now, the dominant agricultural uses for the land are row crops and forage. Other current uses within the remainder of the valley include orchards, plant nurseries and greenhouses, a mushroom producing facility, a driving range, a golf course, a county park, quarry ponds, and single-family residential uses. The Hamlet of Coyote includes some residential, industrial, and commercial uses in northeastern Coyote Valley. An IBM research/development facility is located in northwestern Coyote Valley, while the Metcalf Energy Center and the Metcalf substation are located along Monterey Road in the northeastern portion of mid-Coyote Valley (San José 2005).

Coyote Valley encompasses unique natural features, and therefore significant site constraints. Any development, no matter how well-designed, will result in irrevocable changes to the local ecosystem. Sections of the valley already have an especially high water table, which could lead to potential water-quality problems. The valley lies in a flood plain that threatens any potential development. Development threatens critical habitat for species such as the burrowing owl and silverspot butterfly as well as farms, ranches, and orchards.

When built out according to current proposals, Coyote Valley would have between 70,000-80,000 people, more than the combined populations of neighboring Morgan Hill and Gilroy. It would also support at least 50,000 jobs and 25,000-26,302 homes, exponentially increasing the need for public services such as schools, police, fire, and healthcare, in addition to the strain upon natural resources. Silicon Valley's built environment to date incorporates a traditional mix of low-density office buildings surrounded by large swaths of impervious parking lots and streets, all accessed via expressways. With Coyote Valley, the City must choose whether to continue this type of resource-intensive sprawl in the South Bay or provide a long overdue model of sustainable large-scale development.

As the largest site currently proposed for development in the San Francisco Bay Area, Coyote Valley represents a distinct opportunity to shape urban growth in the region. Given the amount of land affected and the intensity of proposed development, impacts of planning and land use decisions made in Coyote Valley will reverberate across the San Francisco Bay Area for decades to come.

The City of San José's Specific Plan

Coyote Valley has been slated for urban development since 1983 when the San José City Council amended its General Plan. North Coyote Valley is within the city's urban boundaries, as is mid-Coyote Valley. The latter, however, will need to be annexed into San José once the specific plan is approved by City Council. South Coyote's greenbelt is outside of the Urban Growth Boundary, but within the city's sphere of influence; as such the entire area must comply with the city's General Plan. At the time of the General Plan Amendment, the Council also established "triggers" to ensure that industrial development preceded housing development, and that adequate financial resources were available to support quality public services. More recently, the City's General Plan was amended to relax these trigger requirements and allow the preparation of a specific plan. Previously, neither development nor preparation of a specific plan could begin until these triggers were satisfied. Consistent with this amendment, the City Council, on August 20, 2002, initiated the Coyote Valley Specific Plan process by approving a 20-member Task Force.

The City Council also adopted a Vision Statement, including 16 expected outcomes as the guiding principles for the planning of an entirely new community within Coyote Valley. The principles call for the minimum development of 50,000 industry-driving jobs and 25,000 dwelling units within the North and Mid-Coyote Valley areas, while stating that the line (Greenline/Urban Growth Boundary) between central and southern Coyote Valley remain intact, in order to preserve the Greenbelt as a nonurban buffer. The plan must develop mechanisms to ensure that increments of housing may not move forward until the appropriate number of jobs is in place, in a parallel timeline to maintain a valley-wide jobs/housing balance. In addition, twenty percent of developed housing is to remain below market rate.

The City's Specific Plan as drafted calls for "highly livable" community that is "very urban, pedestrian and transit-oriented" and that "maximizes land use efficiency" (City of San José 2005). In the Plan, an artificial lake, over fifty acres in size, serves as the focal gathering place and commercial center for the valley while parks and open spaces are located throughout. At the edge of the town center is a transit hub, designed to link the valley's public transit system with Caltrain. Outside of this town center, the plan separates homes and jobs across the valley, with access provided through expansion of existing roads into a network of multi-lane thoroughfares (City of San José 2004). It is important to note that at this stage the Specific Plan is undergoing evaluation, and has not been finalized. Therefore, there is significant room for modifications should they be deemed appropriate.

The Greenbelt Alliance Getting it Right (GIR) Vision

A vision developed by Greenbelt Alliance in 2003 called *Getting it Right* (GIR) provides a distinct alternative to the City's Specific Plan. Based on the principles of smart growth and drawing on a range of expertise and stakeholder participation, GIR was developed through a yearlong process which mirrored the City's process for developing its Specific Plan. Greenbelt Alliance's GIR includes detailed proposals on land use and transportation, as well as policy recommendations to ensure that Coyote Valley builds community, protects the environment and agriculture, ensures social equity, and promotes economic vitality.

GIR illustrates a strategy for achieving San José's objective to develop Coyote Valley into a major employment center that attracts new jobs and revenue to the City. Rather than creating a land use monoculture that caters to a single industry sector, the community will be designed to accommodate a broad range of businesses and the services needed to support them—generating employment for a diverse workforce with the full range of education and skill levels. Higher density will also facilitate the provision of affordable workforce housing by lowering per unit construction costs and spreading those costs over more market-rate units. Compact, mixed-use development will locate parks, schools, child care, health care and other community services near transit to increases access to these resources by all in the community.

GIR addresses hydrology issues by establishing a comprehensive area-wide flood management system that protects existing and future development from flooding while also preserving natural habitat, creating recreational amenities, and accommodating agricultural needs. The design of the new community will preserve the pervious land needed to recharge the groundwater, maintain sustainable levels in the aquifer underlying the valley, and implement Best Management Practices. Additionally, the new community will maintain a compact form in order to preserve as much agricultural land as possible while establishing mechanisms for preventing future erosion of agricultural potential in the Valley.

A Comparison of Development Goals and Basic Design

Before we discuss how GIR and the Specific Plan as drafted differ in terms of RP's quantitative sustainability criteria, it is useful to compare the two with respect to development goals and selected elements of their basic design. Development goals for both alternatives are summarized in Table 1.[1] Both GIR and the Specific Plan address conservation of natural areas, economic viability, and equity, but in differing ways. In terms of conservation, GIR places a greater emphasis on biological diversity and natural ecosystems, while the Specific Plan has a greater emphasis on recreational space. In terms of economics, GIR is more concerned with economic stability as well as profitability while the Specific Plan is concerned with financial feasibility for developers. In terms of equity, GIR puts a greater emphasis on access to a range of community amenities including affordable housing, work, and community services, while the Specific Plan specifies only standards for housing affordability.

In terms of basic design, the GIR vision and the Specific Plan differ in terms of their developed areas, circulation systems, hydrological systems, and land use organizations. Figures 2 and 3 provide a visual comparison of these elements. Table 2 summarizes key differences. At the simplest level, GIR envisions a denser development than its counterpart. With residential densities averaging 28.5 units/acre (versus the City's 18 units/acre), GIR makes more efficient use of urban land and therefore preserves more undeveloped land. Most notably, that means the preservation of land east of Monterey Highway, which the City plans to develop. Higher densities affect sustainability in a number of ways, including reducing vehicle usage, protecting habitat and open space, and reducing the amount of impervious surfaces.[2]

The circulation systems of the two plans differ substantially in their emphasis on auto-based travel. GIR proposes an entirely grid-based road system, with all streets accessible to both pedestrians and bicyclists. In contrast, the City proposes a central parkway feature that loops around the main areas of the town, and cannot be crossed on foot except at designated overpasses and underpasses. Although both plans include a rapid transit system in Coyote Valley, only GIR directly connects that system to San José's existing light rail system, thus creating a direct transit link to regional jobs. The City's only regional transit provision would be Caltrain. As for the internal transit system, it has not been determined at the time of this publication who will operate the system and what the nature of it will be.

The City's most dramatic effort at altering the landscape of Coyote Valley would be the creation of a central lake as a natural amenity and flood management system. GIR does not include a lake, but instead relies on the existing creeks within the area to provide the same functions. This alternative has the significant advantage of lower cost, and it may provide ecological benefits as well.

Finally, the land use patterns of the two plans are substantially different. The City proposes that Coyote Valley's mixed use center be focused around the lake and along Santa Teresa Boulevard,

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[1] Tables and figures appear sequentially in Appendix 1.

[2] Impervious surfaces are mainly constructed surfaces - rooftops, sidewalks, roads, and parking lots - covered by impenetrable materials such as asphalt, concrete, brick, and stone. These materials seal surfaces, repel water and prevent precipitation and meltwater from infiltrating soils.

the central north-south artery, concentrating employment in the North Coyote Valley area. In contrast, GIR takes the neighborhood as its basic building block. It establishes a distinct town center comprised of mixed use and retail, along with six smaller such neighborhood centers. Employment is concentrated in the east of Coyote Valley. The distinctly multi-centered approach suggests that residents of Coyote Valley would have to travel less, and that amenities and essential services would be more widely accessible.

Scenarios for Sustainability Framework

Given that both GIR and the Specific Plan include implicit or explicit references to sustainability in their objectives, the GIR vision and the Specific Plan can be compared using sustainability measures developed by Redefining Progress as part of our Scenarios for Sustainability (S2) toolkit. The concept of sustainability is commonly understood as balanced attention to the three core domains: environmental, economic, and social.[3] These three domains are interdependent aspects of human society's ability to maintain its quality of life into the future. S2 provides a way to address environmental, economic, and social sustainability in a quantitative fashion. In performing S2 analysis, RP draws indicators of relevance from each of these domains on a case by case basis.

In the context of Coyote Valley, we selected one key indicator from the environment domain, three from the economic domain, and two from the social domain. To address environmental sustainability, we calculate the ecological footprint. As applied in an urban planning framework, the ecological footprint quantifies the ecological demands of particular development projects in a single measure. The footprint identifies direct impacts of a proposed development in terms of average "global" acres of bioproductive space as well as the additional amount of space needed to absorb pollutants and wastes.

To address economic sustainability, we draw from elements of RP's Genuine Progress Indicator (GPI). The GPI provides a more realistic measure of progress than the nationally accepted gross domestic product because it makes adjustments for income inequality, environmental degradation, depletion of non-renewable resources, and expenditures that are purely "defensive" in nature, such as those needed to clean up toxic waste In this application, we quantify the economic costs associated with lost farmland, carbon dioxide emissions, and export of income needed to pay for oil from afar. To address social sustainability, we draw on two measures of equity. These include measures of equity in the distribution of housing types and equitable access to open space.

Using these S2 indicators we compare GIR with the Specific Plan. Before we present the analysis, however, it is important to understand that our scope of analysis is severely limited by two factors. First, the two proposed developments bear little resemblance to anything that currently exists in the Coyote Valley area. Thus any analysis must rely on forecasting of behavioral and consumptive patterns such as patterns in transportation modes and frequencies. Second, little information is currently available to assist in forecasting. Although GIR has been

[3] For example, the Key National Indicators Initiative – the nation's most prominent effort to develop a consistent set of indicators for the nation – is subdivided into the three domains of environment, economy, and people. See http://keyindicators.org/.

completed for two years, a more detailed version of the City's plan is not expected in draft form for several more months. Preliminary documents provide some guidelines, but information remains limited. Nonetheless, an analysis at this stage can indicate at least some of the ways that GIR and Specific Plan differ in their potential for environmental, economic, and social sustainability. Our analysis follows.

III. Environmental Sustainability

In terms of environmental sustainability, the more sustainable plan is that which pollutes less, uses fewer resources, and preserves more undeveloped, natural areas. The ecological footprint captures these objectives in a single, quantitative measure. This section estimates the direct and indirect ecological footprint generated by the GIR vision and the Specific Plan, as they are currently configured. Additional details of the calculations are provided in Appendix 2: Methods and Sources of Information, and referenced as "MSI" with the numerical references referring to specific sections in that appendix.

A. Direct footprint acres.

As discussed earlier, the ecological footprint is a way to quantify both the direct and indirect ecological impacts of a proposed development project in terms of acres of bioproductive space on the planet. In terms of direct impacts, the calculations are relatively straightforward. Each of the development proposals will convert different acreages of one or more biomes used in the footprint analysis into built space.[4] These direct impact acreages are converted into acreage of global bioproductive space by applying equivalence factors that represent the relative productivity of each particular biome to the global average (MSI 1). So, for example, agricultural land has been shown to have 2.17 times the biological productivity of the global average, so the loss of one acre of agricultural land represents a loss of 2.17 acres of global bioproductive space (Venetoulis and Talberth 2005).

To estimate direct footprint impacts, we used a Geographic Information System (GIS) to overlay the GIR vision and the Specific Plan (Figures 2 and 3) on a series of maps produced by the City of San José depicting existing land uses and sensitive habitats in Coyote Valley.[5] After consolidating the different land uses and habitat types illustrated on these maps into four major "biomes" – agricultural land, pasture land, wetlands, and built space – we were able to calculate the number of acres in each biome allocated to development by each proposal. These acreage figures were then converted into global bioproductive space by using appropriate equivalence factors.[6] Table 3 displays the results.

As shown in Table 3, the direct ecological footprint estimate for the Specific Plan, as currently configured, is 5,899 acres, or .22 acres per household for 26,302 households. The direct ecological footprint estimate for GIR is 5,086, or .20 acres per household for 25,000 households.

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[4] In terms of direct impacts, the most common biomes used in footprint analysis are agricultural land, pasture land, forest land, wetlands, built space, and marine ecosystems.
[5] Those maps can be found at: http://www.sanjoseca.gov/coyotevalley/maps.html.
[6] Equivalence factors were taken from Venetoulis and Talberth (2005).

Thus, largely as a result of impacting fewer acres of cropland and pastureland, GIR results in a direct ecological footprint roughly 17% smaller than the footprint generated by the Specific Plan.

B. Indirect footprint acres – carbon sequestration land.

The ecological footprint also accounts for the amount of global bioproductive space needed to assimilate wastes. In terms of this application of S2, there are two major waste products to consider: carbon dioxide emissions and stormwater runoff. Based on the expected magnitude of the waste stream, S2 provides an estimate of global carbon sequestration land and stormwater runoff land needed for assimilation.

S2's estimates of carbon sequestration land demanded by a particular development take into account carbon dioxide emissions generated by traffic and by residential energy use. Calculating emissions generated by traffic necessitates assumptions about how vehicle miles traveled (VMT) differ under each scenario. A brief discussion of how VMT can be expected to differ under the Specific Plan and GIR and what that means in terms of carbon sequestration land follows.

(1) Carbon sequestration land based on differences in vehicle miles traveled (VMT).

A key benefit of developments designed in accordance with smart growth standards is reduced travel distances for residents, decreased household resources spent on transportation, and more time available for leisure. Vehicle miles traveled (VMT) is the most common indicator used to evaluate the impacts of policy and planning alternatives from a transportation perspective. VMT is exceedingly complex to predict, with a range of variables as diverse as vehicle ownership, transit provision, urban design, land use mixes and personal preferences incorporated into statistical models. Such detailed information is not yet available for Coyote Valley. Nonetheless, we generate preliminary VMT estimates based in part on the "4D" methodology developed by Criterion Planners, and in part on the Urban Emissions Model (URBEMIS) developed by Jones & Stokes Associates, Inc.

The 4D methodology converts incremental differences in urban characteristics (density, diversity, design and destinations) into changes in VMT. Criterion Planners determined the coefficients used in the conversions by consulting metropolitan studies across the United States and by incorporating the findings into tailored software packages. Users of the methodology include the Environmental Protection Agency as well as city and county governments (Criterion Planners 2005).

Density is the first variable within the 4D methodology. In calculating the density of a developed area, open spaces utilized for travel purposes are included while others, particularly on the periphery, are excluded. Accommodating a projected 80,000 residents and 50,000 jobs, the Specific Plan calls for 2,766 developed acres, while GIR calls for 2,372 developed acres. The precise formula for density is:

Measured Density = Percent Change in [(Population + Employment) per Square Mile]

Applying this formula, we find that GIR results in a density over 26% higher than the Specific Plan – 31,000 jobs and residents per square mile versus the Specific Plan's 24,600. That increase in density results in an overall VMT reduction of 1.31% in Coyote Valley, typical of denser development in which people have to travel shorter distances between home, employment, and retail locations (MSI 2).

The second D in the 4D methodology is diversity, addressing the mix of jobs and housing in a given planning area. Balance between jobs and housing in an area increases opportunities for people to live and to work in the same area—thereby reducing VMT. Calculation of the diversity variable depends on the boundaries of the areas chosen. Differences between the Specific Plan and GIR become apparent when the area is broken down into smaller components; Coyote Valley-wide, the jobs and housing balances between the two plans are similar. At the suggestion of Criterion Planners and to ensure comparability, we have divided each plan roughly into quadrants.

Diversity is calculated as:

> Percent Change in:
> {1 - [ABS(b * population - employment) / (b * population + employment)]}
> *where*: b = regional employment / regional population

Overall, GIR results in a better balance of jobs and housing at the neighborhood level. Its diversity factor is nearly 7% higher than the alternative—.55 in GIR as opposed to .51 in Specific Plan. That margin translates into a roughly .34 % decrease in VMT, achieved through implementation of GIR's more community-balanced vision (MSI 3).

The third D, design, is a composite index of three other variables: sidewalk completeness, street density, and route directness. Sidewalk completeness refers to the proportion of roadsides with paved sidewalks; street density to the amount of road length per square mile of development; and route directness, the ratio of distances 'as the crow flies' to distances in driving routes.[7] These three variables interact to create a more or less hospitable pedestrian environment; the former would result in decreased VMT for a given planning area. Design is calculated through a percent change in the overall Design Index:

> The Design Index =
> 0.0195 * street network density + 1.18 * sidewalk completeness + 3.63 * route directness.

In Coyote Valley, we first assume that both the Specific Plan and GIR will have 100% sidewalk completeness. GIR's street density is around 30% higher, with more than 94 miles of paved road across 2,400 urbanized acres; the Specific Plan includes 91 miles of road across 3,100 acres. GIR's walking routes tend to be more direct than the Specific Plan, with pedestrians needing to walk 28% further than the crow flies to reach their destination, and pedestrians in the Specific Plan walking 44% further. This difference is largely due to Monterey Highway and the parkway's presence requiring Specific Plan pedestrians to access overpasses and underpasses.

[7] Route directness is based on a sample of 20 routes per plan.

Overall, GIR boasts an approximate 11% design advantage over Specific Plan, resulting in a small VMT reduction of about .44% (MSI 4).

The fourth D, destinations, is the only variable that accounts for factors external to the development. Specifically, this variable measures the accessibility of regional jobs to Coyote Valley. For the purposes of this analysis, 'destinations' would provide an opportunity to evaluate the impact of improved regional transit provision in GIR versus the Specific Plan. GIR's plan to link the Coyote Valley rapid transit system to San José light rail could potentially reduce travel times to jobs in San José. Following the 4D methodology, such a reduction would also reduce VMT. Due to the reality that even a dramatic decrease would be unlikely to significantly affect 'destinations', since few jobs in San José are accessible by transit, and only about 3% of commuters in Santa Clara County use transit, we have not at present attempted to predict by how much the light rail link might shorten commuting times. Thus while Greenbelt Alliance's more integrated rapid transit provision would likely help to reduce VMT in Coyote Valley, we have not yet quantified by how much it might do so.

Those factors that we have quantified through the 4D methodology add up to a 2.1% decrease in VMT in Coyote Valley if GIR is adopted instead of the Specific Plan. 4D is intended to indicate how differing land use plans might produce different VMT, but it cannot account for the full range of human, physical, political, and economic factors that ultimately determine automobile usage. In this regard, the fact that at least three out of four of the Ds suggest lower VMT in GIR speaks positively for that plan. In addition, other non-design related factors, for which 4D does not account, could also impact the difference in VMT that would result from the two plans.

In addition to the 4D model, we have employed a second analysis tool. Developed by Jones & Stokes Associates, Inc., the URBEMIS (Urban Emissions Model) software package estimates emissions associated with California land development projects. URBEMIS allows calculation of Coyote Valley VMT differentials for the mix and density of housing types, along with two key elements omitted by the 4D model: level of transit provision and transit demand management (TDM).

URBEMIS estimates the absolute levels of impact of a development, consolidating large amounts of academic research to produce a single figure for VMT. Because URBEMIS compiles extensive quantitative data, its inputs and outcomes are not quite as transparent as the 4D methodology. However, URBEMIS provides a valuable alternative, taking into account a wider range of variables— including some that are explicitly absent from 4D. In particular, URBEMIS accounts for the possibility of shifting personal habits through both design and policy, whereas 4D does not (ARB 2002).

According to URBEMIS modeling of Coyote Valley's housing type variables, unmitigated VMT figures for the two plans demonstrate that GIR results in nearly 4% less VMT than does the Specific Plan. The provision of slightly less housing units in GIR (25,000 versus 26,302) gives GIR a slight advantage due to the fact URBEMIS generates VMT from the number of trips per housing unit. However, that factor does not account for the entire gap. When supplementary, mitigating policies to lessen VMT are incorporated, the VMT gap between plans increases dramatically. We assume that the provision of rapid transit will be equal between the two plans.

Supplementary bus service, however, is omitted from Specific Plan's documentation, while GIR contains suggested routes and service levels. GIR also includes a number of TDM policies, including pricing of parking, free transit passes, and bike parking facilities. To date the Specific Plan has made no mention of such policies. The mitigated VMT figures for the two plans, accounting for TDM policies, result in GIR achieving a 12% reduction in VMT as compared to Specific Plan (MSI 5).

Therefore, we may consider the outputs of the 4D and URBEMIS analysis tools to form the estimated upper (12%) and lower (2.1%) bounds of VMT variances between GIR and the Specific Plan, with GIR resulting in less VMT by all measures.

Taking the range of values calculated through the 4D and URBEMIS analysis tools, it is possible to estimate the difference in ecological footprint resulting from variance in VMT carbon emissions. Based on per capita Bay Area VMT trends, the Specific Plan would result in about 730,000,000 VMT annually, which translates into a total carbon sequestration land footprint of 189,972 acres (MSI 6). GIR, on the other hand, would produce between 642,400,000 and 714,670,000 annual VMT, and a resulting carbon sequestration footprint of between 167,175 and 185,982 global acres.

In addition to the carbon footprint savings revealed through 4D and URBEMIS analysis, two qualitative aspects of Specific Plan and GIR suggest significant VMT differences resulting from implementation of the two plans. One of these relates to GIR's foodbelt concept. Rather than a traditional greenbelt, GIR includes a fully functioning agricultural area as an urban buffer for Coyote Valley. The urban community would secure a stable agricultural land base, create new markets for local goods via local schools and businesses, and reduce farmers' operational costs by providing recycled water and compost. This localized food system would result in further VMT reductions by replacing food that would otherwise travel long distances to Coyote Valley, as well as the consumer travel to access those products elsewhere. Also, as mentioned earlier, GIR makes a stronger commitment to public transit accessibility than does the Specific Plan—putting forth policy measures to further reduce VMT and increase environmental sustainability in Coyote Valley.

(2) Carbon sequestration land based on differences in residential energy use.

Aspects of Coyote Valley's environmental and economic sustainability may be gauged by the amount of energy needed to support new development. To project residential energy, we applied a formula in which average gas and electricity consumption by unit type is applied to the total number of dwellings in a given area. In this case, the two aggregate study areas are defined by the Specific Plan and GIR.

Based on this analysis, residential energy consumption varies significantly under the two approaches. Specific Plan residents would consume about 371,800 MM British Thermal Units (MMBTUs) per year, whereas GIR residents would use 291,324. That amounts to an average difference of 15.7 MMBTUs per household, as opposed to 11.65, annually—over 25% less in GIR (MSI 7). The higher density in GIR's community building blocks contributes to this outcome, as building types with a higher proportion of common walls tend to use less energy.

As with differences in VMT, the expected difference in residential energy consumption translates into a difference in the carbon sequestration land footprint (MSI 8). We estimate annual carbon dioxide emissions to be 8,234 metric tons in the Specific Plan while only 5,808 in GIR. The resulting carbon sequestration footprint difference between the Specific Plan and GIR is significant: 233,899 global acres versus 164,983, respectively.

B. Indirect footprint acres – stormwater runoff land.

New residential developments use significant quantities of water for consumptive purposes and landscaping, and discharge polluted water in the form of effluent, grey water, and stormwater runoff. While there is no widely endorsed method for footprinting water consumption[8], one method is to calculate the energy required to supply clean water to the facility, and transform that into a CO_2 footprint. For wastewater, a method analogous to the CO_2 footprinting method calculates the wetland area needed to purify effluent, stormwater runoff, and grey water generated by the facility. For example, federal guidelines for constructed wetlands to mitigate stormwater runoff suggest a size equivalent to 2% of the impervious surface area drained by a proposed development (Schueler 1992).

Because both the Specific Plan and the GIR vision are in a preliminary state, we do not have the data needed to estimate the energy footprint of water consumption, nor the wetland area needed to filter effluents. We can, however, project the stormwater runoff land based on the amount of impervious surface created by each of the development options.[9] For the Specific Plan, the amount of impervious surface is expected to be 1,293 acres, based on information provided by the City of San José. For GIR, that figure is 996 acres. Taking the 2% figure as a rough approximation for the amount of wetlands needed to filter stormwater runoff from these impervious surfaces yields wetlands demands of 24.5 and 19.9 acres, respectively.

The final step in calculating the stormwater footprint is to translate these figures into global acres. Wetlands are some of the most productive biomes on the planet. As such, the equivalency factor for converting wetlands into global acres is quite high at 6.02, meaning that wetlands are over 6 times more productive than the average acre of bioproductive space on the planet. Multiplying this factor by our wetlands acreages yields stormwater runoff land demands of 147 acres with the Specific Plan and 120 acres – or 18% less – for GIR.

Given this, and as shown in Table 4, we estimate the total indirect (carbon sequestration and stormwater runoff land) footprint for the Specific Plan to be 424,018 acres, or 16.12 per household. Due to the variance in 4D and URBEMIS VMT bounds, the total indirect footprint for GIR would be between 332,278 and 351,085 total acres, or 13.29-14.04 per household.

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[8] There are studies which calculate water footprints, but those refer to acre feet of water and not global acres as is the standard for ecological footprinting.

[9] Total impervious area calculations include the major land use categories of residential, commercial, industrial, retail, and mixed use; roads are not included.

C. Total footprint acres.

By using the S2 methods discussed above and in Appendix 2, we estimate the total footprint associated with the Specific Plan to be 429,917 acres of global bioproductive space, with the largest component by far being carbon sequestration lands. Our footprint estimate for GIR is 356,171 or 17% less. On a per capita basis, the Specific Plan's footprint is 16.12 global acres per household while GIR's is 14.24. Thus, we can say that by promoting density, diversity, and design factors that reduce vehicle miles traveled and by converting fewer acres of biologically productive land to impervious surface, GIR's ecological footprint per household will be at least 17% less than that of the Specific Plan. The 17% figure is a lower bound since it is based on the more conservative 2.1% VMT reduction figure. The footprint reduction would be considerably more if we used the upper bound figure of 12% VMT reduction.

IV. Economic Sustainability

The second major component of our S2 analysis is to compare the Specific Plan and GIR vision in terms of economic sustainability. Here, we consider three separate measures: (a) economic costs associated with lost farmland; (b) damage associated with carbon dioxide emissions, and (c) export of income needed to pay for oil from afar.

A. Economic costs of lost farmland.

The loss of productive farmland to urban and suburban encroachment is a pressing environmental and food security concern in California and throughout the United States. According to the American Farmland Trust, every day we lose more than 3,000 acres of productive farmland to urban sprawl. More than 75 percent of our fruits and vegetables are produced near urban areas, directly in the path of development. Each year, we lose an area of productive farmland the size of Delaware.[10] Loss of this essential form of natural capital deprives future generations of the ability to grow food and fiber or reap the multiple benefits of open space. In California, agricultural land loss on a county by county basis is tracked by the Division of Land Resource Protection. Between 1984 and 2004, Santa Clara County lost 33,288 acres of agricultural land to development, or 1,664 acres per year (CDC 2005a). A Coyote Valley development would significantly increase this total. The economic costs of lost cropland, pasture, vineyards, and orchards is a critical issue from the standpoint of economic sustainability and should be addressed in a rigorous manner as the EIR process continues.

Economists distinguish between two major types of economic costs associated with lost farmland – market and non-market. Market costs are the forgone revenues associated with annual food or fiber production. These costs are further subdivided into direct costs and indirect costs, where direct costs represent the value of lost agricultural production from each acre converted and indirect costs represent the secondary economic costs incurred by businesses that provide infrastructure and services in support of such production. Direct costs are capitalized into per acre land values reported by agencies such as the U.S. Department of Agriculture in their

[10] See http://www.partnershipsforchange.cc/planningeduc0148.asp

periodic Census of Agriculture reports. Indirect costs are estimated by the product of standard industry multipliers available on a statewide or county basis times this acreage (Nef 1996).

Non-market costs include the loss of open space, scenery, wildlife habitat, traditional lifestyles, and local food security as well as ecosystem services such as flood control, water filtration, and pollination. Such costs are referred to as "non-market" because they are not reflected in the market prices developers pay for agricultural lands. However, there are techniques for estimating such costs. These include: (a) actual market transactions by governments or private non-profits to preserve agricultural land as open space; (b) related market transactions such as land or housing price differentials that reflect the premium home owners are willing to pay to live near protected agricultural land, and (c) social science research methods such as contingent valuation surveys that explore people's willingness to pay to protect agricultural land in hypothetical market situations (Loomis et al. 2000).

Both the Specific Plan and GIR will incur market costs by converting existing cropland, orchards, or pastureland to non-agricultural use. Based on a preliminary geographic information system (GIS) analysis by Haskins (2005), the Specific Plan will convert approximately 2,537 acres while GIR will convert approximately 2,174 acres or 14% less. In Santa Clara County, the 2002 Census of Agriculture reports a mean agricultural land value of $2,887 per acre, or $3,122 in 2005 dollars (USDA 2002). If we use this average, the direct market cost in terms of lost agricultural income would be $7,895,144 each year under the Specific Plan and $6,787,228 under the GIR vision. Using the statewide agriculture multiplier provided by the Minnesota Implan Group (2002), this direct loss of annual agricultural income translates into an additional loss to businesses that provide infrastructure or support services on the order of $12,316,425 each year for the Specific Plan and $10,588,075 for the GIR vision.[11]

Here, due to the preliminary nature of our analysis, we base our estimates for non-market costs on actual market transactions for conservation easements or outright purchases of land for conservation purposes. Ideally, cost estimated would be calibrated using this method in conjunction with a hedonic pricing study to quantify the actual market premiums nearby homeowners are paying to live near Coyote Valley's open spaces, or an original contingent valuation survey of nearby residents (Loomis et al. 2000).

Easement costs reflect the difference between the current market value of developed land and its value in permanent agricultural use. Of course, easement costs vary significantly depending on the proximity of the agricultural parcel to urban centers or amenities such as coastlines, the relative productivity of the parcel, types of crops, immanency of development, and other factors. Machado et al. (2003) developed an econometric model to account for these factors. Their model predicted a total easement value of $113 million for 31,000 acres of farmland in the Bay Area bioregion, or an average of $3,650 per acre. In addition to this model, actual market data is available for easement transactions from the California Department of Conservation (CDC). According to the latest tabulations, the average per acre easement value for agricultural lands in California is $6,482 (CDC 2005b). If we assume that average easement values in Coyote Valley fall within the range bounded by Machado et al. (2003) and CDC, we can take the midpoint as a rough approximation of the non-market costs associated with lost agricultural land in Coyote

[11] These are preliminary estimates using average agricultural land values for the whole county.

Valley.[12] Applying a midpoint value of $5,066, we can then estimate non-market costs of $12,852,442 per year for the Specific Plan and $11,013,484 for GIR.

Taken together, we estimate the market and non-market costs of lost farmland in Coyote Valley to be $33,064,011 under the Specific Plan and $28,388,787 – or 14% less – for GIR. These results are summarized in Table 5.

B. Carbon dioxide emissions damage.

There is now widespread scientific consensus that anthropogenic carbon dioxide emissions are contributing to global warming and increasing the risk of killer heat waves and droughts, raging wildfires, collapsing ecosystems, tropical disease epidemics, devastating storms and inundated coastlines. Of course, these disastrous outcomes come at a very steep price. Given this, and given the ongoing urgency of adopting effective but efficient climate policy at the global level, there has been a profusion of studies over the past 15 years to estimate the expected value of both market and non-market damages caused by carbon emissions on a per ton basis. Of particular importance are two recent meta- analyses completed by Clarkson and Deyes (2002) and Tol (2005).

Clarkson and Deyes (2002) limited their review to eight of the most sophisticated published models and, after calibration, concluded that using a marginal damage figure of approximately $119 USD per ton is a pragmatic approach given the current range of uncertainties. Tol (2005) evaluated and calibrated 103 estimates published in 28 separate studies and reported a mean of $93 per ton. To be conservative, we use Tol's value.

Any development in Coyote Valley will increase carbon dioxide emissions from both vehicles and residential energy use. The Specific Plan and GIR differ, however, in the amount of such emissions and, consequently, in the amount of annual carbon dioxide damage. In terms of vehicle miles traveled, we previously estimated that the Specific Plan would generate 730 million VMT annually and GIR would generate between 642 and 715 depending upon whether VMT is reduced by 2.1% (the high VMT scenario) or 12% (the low VMT scenario). By incorporating local fuel efficiency data and standard conversion factors, we estimate that VMT under the Specific Plan would generate 340,667 tons of carbon dioxide annually and under GIR would generate between 299,787 and 333,513 tons. In terms of residential energy consumption, we previously found that the Specific Plan could be expected to generate 8,234 metric tons of carbon dioxide each year while GIR would generate roughly 5,808 metric tons. In terms of short tons, these figures are 9,076 and 6,402.

Combining emissions generated by VMT as well as residential energy use, we can expect the Specific Plan to generate 349,852 short tons of carbon dioxide each year and GIR between 306,189 and 339,915 tons. Applying the Tol (2005) figure, we estimate the social costs of carbon emissions under the Specific Plan to be $32,536,236 and under GIR to range between $28,475,577 and $31,612,095 or between 3 and 13% less depending on the VMT scenario chosen.

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[12] Since proximity to urban encroachment and immanency of development are two key factors driving up easement value, it is reasonable to expect that Coyote Valley's agricultural lands would exceed the Bay Area average.

C. Export of income for oil purchases.

Throughout the United States there is growing concern over the degree to which our communities are dependent upon imports of energy, manufactured goods, food, and services from abroad or from distant regions within the country. As communities become highly dependent on distant places, they also become highly vulnerable to supply disruptions. Moreover, money spent on imports is not recycled locally and, thus, deprives communities of the multiple beneficial effects generated by purchases from local establishments. In response to these concerns, economists are increasingly engaged in “leakage” studies which assess just how much local income is exported and how to keep more of that income in the local economy.

One major leakage is money spent on gasoline made from imported oil. Urban planning – by increasing or decreasing VMT – indirectly determines the magnitude of this cost. Since we have already estimated VMT for the Specific Plan and GIR, we can approximate these costs for Coyote Valley. To do this, we take VMT figures and translate them into annual gallons of gasoline consumed under each scenario using local fuel efficiency data provided by the Environmental Protection Agency. Using California Energy Commission (CEC) data, these figures are converted into raw expenditures on gasoline, then to expenditures on oil, using an appropriate gas to oil conversion factor. Again using CEC data, we estimate the share of these expenditures exported. Our results indicate that gasoline expenditures under the Specific Plan will result in $35,965,243 of income exported, while expenditures under the GIR vision will result in $31,649,413 to $35,209,972 depending on whether the low or high VMT scenario occurs. A detailed methodology is included in Appendix 2 (MSI 9).

D. Total environmental deficit.

All tolled, we can think of the costs of lost farmland, carbon dioxide damages, and the export of capital needed to pay for oil imports as an environmental deficit passed on to future generations in the form of lost ecosystem services and lost economic capital available for productive investments in the local economy. The total environmental deficit associated with the Specific Plan and GIR is displayed in Table 6. As shown in Table 6, we estimate the total environmental deficit of the Specific Plan to be $101,565,490 per year, and the environmental deficit of GIR to be $95,210,854, or roughly 7% less using the conservative figures for VMT reduction discussed earlier.

Therefore, by preserving more productive agricultural land, reducing carbon dioxide emissions damage, and exporting fewer dollars out of the local economy to pay for imported oil, the GIR vision will cost at least $6.4 million less each year than the Specific Plan in terms of externalized economic costs to future generations.

V. <u>Social Sustainability</u>

In terms of social sustainability, we selected two measures of equity: equity in the distribution of housing types and equity in access to open space. The relationship between equity and sustainability has been well documented. Stated simply, a more equitable community is more stable and more cohesive. In contrast, an inequitable community – e.g., one dominated by exclusionary housing patterns or one where the poor are exposed to a disproportionate share of toxic pollutants – suffers from a number of social pathologies and economic inefficiencies that undermines its ability to sustain its quality of life over the long run. Thus, equity is a necessary component of sustainability (Daly 1990; Templet 1994).

Exclusionary housing patterns are a quintessential example of social inequity. Whether they evolve through conscious planning and zoning decisions or by market fiat, exclusionary housing patterns exclude affordable housing from the most desirable portions of an urban area. An exclusionary housing pattern segregates a city into regions of high-cost housing near good schools, jobs, parks, open space, arts and cultural events, and other municipal amenities, and low- cost housing in areas nearly devoid of these quality of life elements. As noted by Clingermayer (2004) "[t]hose excluded are virtually always poor and quite often non-white." Exclusionary housing patterns adversely impact a local economy in a number of ways:

- Segregated housing erodes a community's social capital – the social links and networks which help to create a cohesive, productive society (Putnam 1998).

- Tourism depends on the image and substance of a city or region as diverse, multi-cultural, equitable, and tolerant. As noted by Berry (2002) "[t]he reality – or even the public perception – of communities rent by polarizing differences, visible poverty and homelessness, souring crime and an impoverished public realm raises strong barriers to the influx of investors and key workers."

- Valuable service workers such as police officers, bus drivers, sales persons, nurses, and teachers are forced to live far away from jobs and community attractions. This spatial separation increases their cost of living, diminishes their quality of life, and creates labor shortages that undermine regional economic efficiency (Berry 2002; EPS 2002).

To insure that future development does not promote exclusionary housing patterns, some index of equality in the distribution of new housing units should be used. S2 contains such a measure. It is a housing variant of the popular "GINI" coefficient, a figure used to gauge the extent to which a nation's wealth is concentrated in the hands of a few. The GINI coefficient divides a nation's population into income quintiles, then calculates the share of wealth owned by all persons in each quintile and compares that with an ideal distribution where each quintile owns 20%. The GINI measures the degree of deviation from this ideal distribution. A GINI close to 1 indicates severe concentration of wealth, while a GINI close to 0 indicates almost perfect equality.

In a similar vein, S2's housing GINI measures the deviation of a proposed distribution in the number of housing units affordable to each income quintile from an ideal distribution in which the same number of units are made available to each quintile. In this way, the housing GINI measures the degree to which a proposed housing development is exclusionary (largely catering to just one or two income strata) or inclusionary (catering to a balanced mix of incomes). To calculate the housing GINI, we would need to estimate how many units under the Specific Plan and GIR will be affordable to each quintile. Since development plans are still in their preliminary stage, this complete analysis is not possible at this time.

In lieu of this, we can use the proposed distribution of housing units by density type as a proxy under the assumption that housing prices will vary with density – i.e. units sold in areas where the density is 100 units per acre will be less expensive than those selling in areas where the density is 25 units per acre or less. Tables 7 and 8 provide a breakdown of units by density class under GIR and the Specific Plan. To approximate GINI with this data, we use a simple metric known as the "Index of Dissimilarity" or ID. The ID represents the sum of the absolute value of differences between the proportion of housing units in each density class and the "ideal" distribution based on 1/8 shares (since there are 8 density classes listed here), all divided by two.

Tables 7 and 8 summarize the results. Using the density classes under GIR as a basis for comparison, we estimate the Index of Dissimilarity (ID) for the Specific Plan to be .312 and the ID for the GIR vision to be .220. Thus the GIR vision represents a 30% improvement in the equitable distribution of housing types as compared with the distribution envisioned by the Specific Plan. This is because GIR does a better job of distributing housing units amongst all eight density classes while the Specific Plan is skewed towards lower densities and, presumably, less affordable housing. In fact, over 57% of the units proposed under the Specific Plan fall into the bottom three density classes.

Another dimension of equity involves access to environmental and cultural amenities, which are often concentrated in wealthier neighborhoods and neglected in poorer communities. In a land use planning framework, physical accessibility (as opposed to economic or cultural) is one measure that can be quantified with relative ease. Physical accessibility measures how well people can reach key features such as jobs, transit, retail, and open space. For example, Sustainable Seattle takes as one of its key indicators of sustainability the amount of residential acreage within a certain distance of open space. Based on analysis of the preliminary Specific Plan and GIR maps, we estimated that 205 acres of purely residential area in the Specific Plan would be further than 1/8 mile from open space. In GIR only 112 acres, or 7% less, would be further than 1/3 mile from open space. Coupled with its better mix of affordable housing, GIR is more likely to provide equitable access to open space to a broader range of socioeconomic groups.

Although not yet fully measurable for this comparison, access to transit is another aspect of social equity in which GIR is likely to exceed the Specific Plan. GIR's incorporation of multiple public transit options suggests that low-income residents would be more likely able to commute to work without the expense of a car.

VI. Conclusion and Future Refinements

In this analysis, we compare two preliminary development scenarios for Coyote Valley using six quantitative measures of environmental, economic, and social sustainability taken from RP's Scenarios for Sustainability (S2) toolkit. These included the ecological footprint, the economic costs of lost farmland, carbon dioxide damage costs, export of income needed to pay for imported oil, a measure of equity in the distribution of housing types, and a measure of equitable access to open space.

Under each measure, the *Getting it Right* (GIR) vision advanced by the Greenbelt Alliance is superior to the City of San José Specific Plan. These differences initially suggest that GIR would preserve more open space, discourage unnecessary trips by automobile, foster energy conservation, and create a more livable local and regional environment than would the City's plan. By promoting a more compact urban form, a better mix of jobs and residences, and fewer vehicle miles traveled, and by converting fewer acres of biologically productive land to impervious surface, GIR's ecological footprint will be at least 17% smaller than that of the Specific Plan. By preserving more productive agricultural land, reducing carbon dioxide emissions damage, and exporting fewer dollars out of the local economy to pay for imported oil relative to the Specific Plan, the GIR vision will cost at least $6.4 million less each year in terms of externalized economic costs to future generations. GIR represents a 30% improvement in the equitable distribution of housing types as compared with the distribution envisioned by the Specific Plan. In addition, GIR would allow 7% more families to have easy access to open space, thereby mitigating the tendency for open space to be clustered near high income areas alone.

With the City of San José Specific Plan still under development and subject to change, and with a large amount of information still to emerge from the Environmental Impact Report (EIR) process, an updated assessment will likely be needed to insure that the findings presented here hold true. For example, more refined GIS analyses will yield better estimates needed for calculating both the direct and indirect footprints. More precise information on the configuration of the development proposals will improve the VMT analysis and the analyses based on VMT differentials. Better housing type distribution data coupled with affordability data from the local market will improve the housing GINI calculations.

This report is intended as an exploratory analysis at the pre-EIR stage before these data are made available. As such, it highlights important differences between the two plans, with significant implications for the sustainability of Coyote Valley's development and the entire Bay Area region. These nuances may become even more apparent as the EIR process unfolds over the coming months.

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Appendix 1: Tables and Figures

Table 1
Selected Excerpts from Development Alternatives

Sustainability Domain	*Getting it Right*	San José Specific Plan
Environment	Integrate development with the natural environment in a manner that preserves ecosystem function and protects the biological diversity and productivity of Coyote Valley.	Secure South Coyote Valley as a permanent greenbelt and create a rich system of parks, trails, and recreation areas.
Economics	Promote long term economic stability and profitability.	Maximize efficient land usage and be financially feasible for private development.
Social	Provide broad and equitable access to meaningful work, affordable housing, community services, and an attractive and healthy living environment.	Make 20 percent of all units affordable housing.
Social	Create a distinct and identifiable community that nurtures pride of place among those who live and work there.	Create an urban, pedestrian and transit oriented community with a mixture of housing densities, supportive businesses and services and campus industrial uses.

Table 2
Comparison of Selected Elements

Element	*Getting it Right*	Specific Plan
Minimum assumptions	80,000 Residents 25,000 Housing units 50,000 jobs	80,000 Residents 26,302 Housing units 50,000 jobs
Residential density	28.5 units per acre	18 units per acre
Developed area (inc. urban parks)	2,400 acres	3,100 acres
Average Employment Floor to Area Ratio[*****]	1	.55
Circulation system	Grid-based	Parkway with underlying neighborhood grids
Main hydrological feature	Existing streams	Artificial lake
Land use pattern	Multiple neighborhood centers	Single center
Regional transit links	Caltrain and other rapid transit	Caltrain only
Greenbelt agricultural policies	Food belt	No specific policies

Table 3
Direct Footprint Results

Biome	*Getting it Right* (global acres)	Specific Plan (global acres)
Agricultural land	3,654	4,142
Pasture land	1,205	1,520
Wetlands	169	157
Built space	58	81
Total:	5,086	5,899
Total per household:	.20	.22

[*****] A ratio of the gross floor area of a building or study area to the total area of the site.

Table 4
Indirect Footprint Results

Biome	*Getting it Right* (global acres)	Specific Plan (global acres)
Carbon sequestration land (vehicles miles traveled)	167,175 -185,982	189,972
Carbon sequestration land (household energy use)	164,983	233,899
Stormwater runoff land	120	147
Total:	332,278-351,085	424,018
Total per household:	13.29-14.04	16.12

Table 5
Economic Costs of Lost Farmland in Coyote Valley

Cost Component	Annual Costs *Getting it Right*	Annual Costs Specific Plan
Market value of lost farmland	$6,787,228	$7,895,144
Secondary costs incurred by support businesses	$10,588,075	$12,316,425
Non-market costs	$11,013,484	$12,852,442
Total:	$28,388,787	$33,064,011

Table 6
Annual Environmental Deficit

Deficit Component	Annual Deficit *Getting it Right*	Annual Deficit Specific Plan
Market value of lost farmland	$6,787,228	$7,895,144
Secondary costs incurred by agricultural support businesses	$10,588,075	$12,316,425
Non-market costs of lost farmland	$11,013,484	$12,852,442
Carbon dioxide emissions damage	$31,612,095	$32,536,236
Export of capital to pay for oil imports	$35,209,972	$35,965,243
Total environmental deficit:	$95,210,854	$101,565,490
Environmental deficit per household:	$3,808	$3,862

Table 7
Index of Dissimilarity or "Housing GINI" for GIR

Density class	GIR Distribution	% by class GIR (x)	% by class Equality (y)	Abs (x-y)
10 units or less per acre	1,000	0.040	0.125	0.085
11-20 units per acre	2,500	0.100	0.125	0.025
21-25 units per acre	6,250	0.250	0.125	0.125
26-30 units per acre	3,500	0.140	0.125	0.015
31-35 units per acre	3,250	0.130	0.125	0.005
36-45 units per acre	5,000	0.200	0.125	0.075
46-75 units per acre	2,500	0.100	0.125	0.025
75 units or greater per acre	1,000	0.040	0.125	0.085
Total:	25,000	1.0	1.0	0.440
			Total/2(ID):	0.220

Table 8
Index of Dissimilarity or "Housing GINI" for the Specific Plan

Density class	Specific Plan Distribution	% by class GIR (x)	% by class Equality (y)	Abs (x-y)
10 units or less per acre	2003	0.076	0.125	0.049
11-20 units per acre	5057	0.192	0.125	0.067
21-25 units per acre	7269	0.276	0.125	0.151
26-30 units per acre	2382	0.091	0.125	0.034
31-35 units per acre	279	0.011	0.125	0.114
36-45 units per acre	5746	0.218	0.125	0.093
46-75 units per acre	2988	0.114	0.125	0.011
75 units or greater per acre	578	0.022	0.125	0.103
Total:	26302	1.000	1.0	0.624
			Total/2 (ID):	0.312

Figure 1
Coyote Valley Base Map

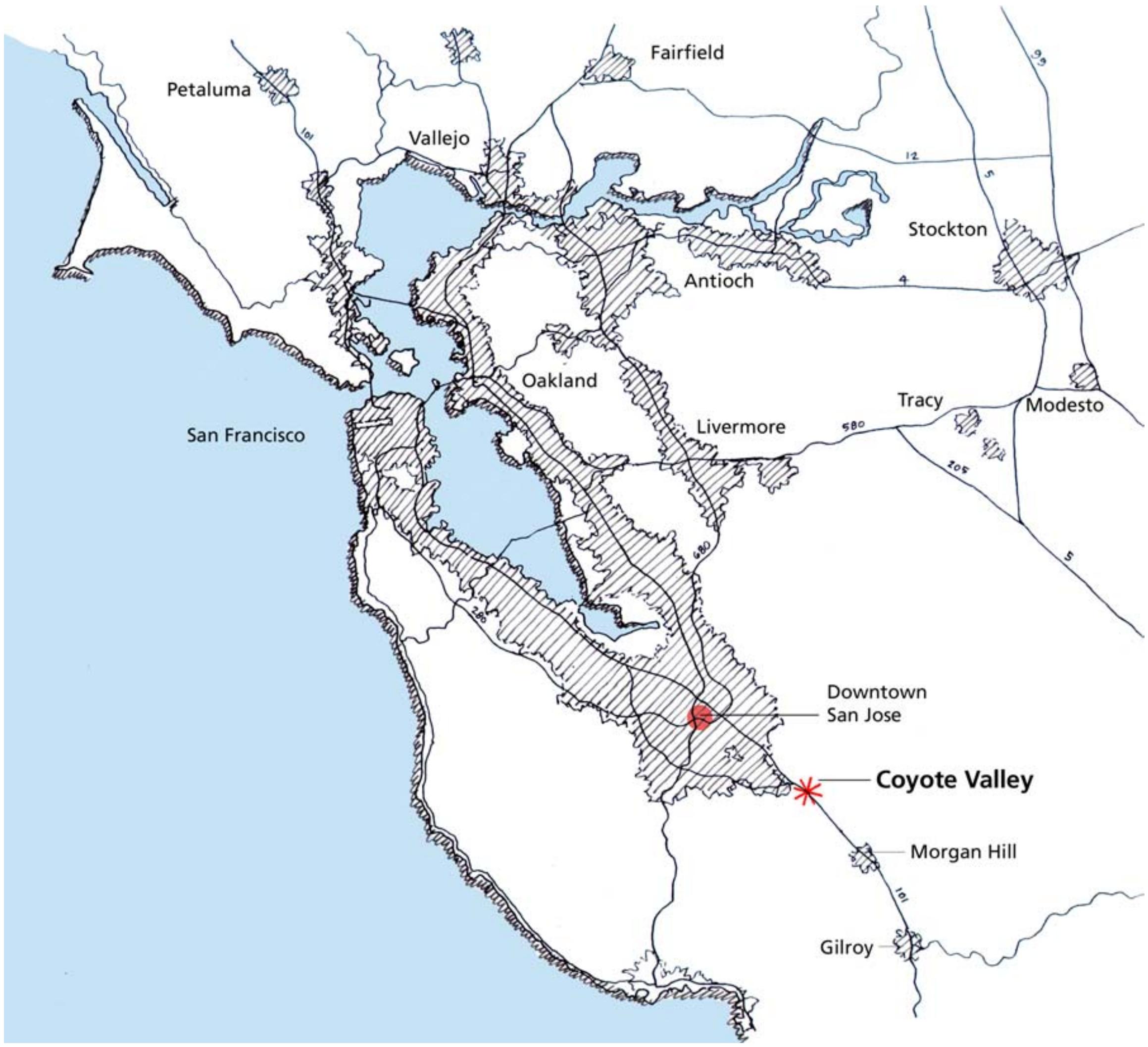
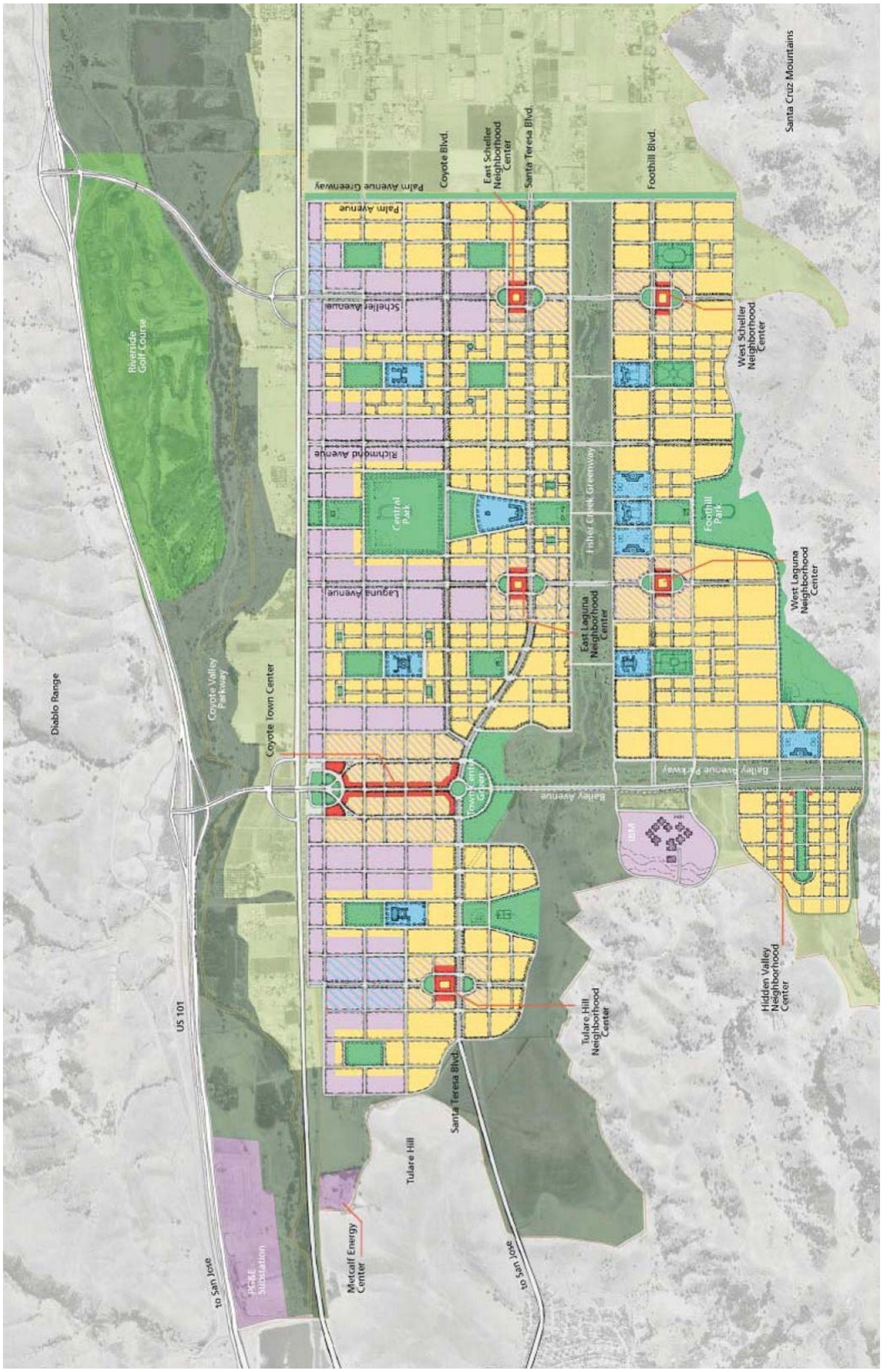


Figure 2
City of San José Specific Plan Conceptual Map

Figure 3
Getting it Right Vision Conceptual Map



Appendix 2: Methods & Sources of Information

MSI 1: Global Acre Conversions

The common unit used to compare areas with different biological productivity is called a global acre. A global acre is a measure equivalent to one acre with world-average productivity. To calculate a global acre of impact, acres directly impacted are multiplied by the following equivalency factors:

Biome	Equivalence Factors
Agricultural land developed	2.18
Pasture land developed	2.42
Wetlands developed	2.06
Built space	0.50

MSI 2: Density

To extrapolate the impact of higher density on vehicle miles traveled (VMT), the 26% density increase achieved through implementation of GIR's vision is multiplied by a -.05 VMT density elasticity coefficient. Elasticity is a measure of the percentage change that occurs in a dependent variable, such as VMT, resulting from a percentage change in an influential variable, such as density. For example, if vehicle trips decrease by 0.05% for each 1% increase in density, then vehicle trips are said to have an elasticity of -.05 with respect to density. The elasticity rate used is based on analysis of over forty studies done by Criterion Planners. Taken as a group, the studies indicate how changes in land-use characteristics, such as density, relate to changes in travel generation as measured by vehicle trips and vehicle miles of travel (Criterion Planners 2005).

VMT baseline travel forecasts are based on the Association of Bay Area Governments' 2003 series of demographic / economic / land use forecasts, and MTC interpolations for 2006 (ABAG 2002, MTC 2005). The projected growth rate is extended out to 2050, and Coyote's proportional share of Bay Area travel is applied.

MSI 3: Diversity

The impact of higher diversity on vehicle miles traveled (VMT) is calculated by multiplying the 7% community diversity increase by a -.05 VMT diversity elasticity coefficient (see Density methodology, above).

MSI 4: Design

The coefficients and definitions utilized in calculating the design index are as follows (Criterion Planners 2005):

Street network density = length of street in miles/area of neighborhood in square miles
    0.0195 = coefficient applied to street network density, expressing the relative weighting of this variable relative to the other variables in the Design Index formula;

Sidewalk completeness = total sidewalk centerline distance/total street centerline distance
    1.18 = coefficient applied to sidewalk completeness, expressing the relative weighting of this variable relative to the other variables in the Design Index formula;

Route directness = average airline distance to center/average road distance to center
    3.63 = coefficient applied to route directness, expressing the relative weighting of this variable relative to other variables in the Design Index formula;

The impact of design on vehicle miles traveled (VMT) is calculated by multiplying the 11% change in the design index by a -0.05 VMT design elasticity coefficient (see Density methodology, above).

MSI 5: URBEMIS

URBEMIS calculates VMT in two main steps (JSA 2003). First, URBEMIS turns land use data into trips and VMT by applying average trip generation rates to different land use types. For example, an average single family housing unit generates 9.57 trips per day. Second, the program reduces the resulting figures by applying mitigation factors based on policy changes. These include mix of uses, local serving retail, pedestrian environment, transit provision and TDM (ARB 2002).

MSI 6: Ecological footprint of vehicle miles traveled

In order to calculate the annual carbon footprint of VMT in a given area, daily VMT is first annualized. The annualized amounts are then divided by the average miles per gallon of vehicles in the United States according to the Energy Information Administration, multiplied by the amount of carbon dioxide (CO_2) emitted per gallon, and divided by the number of pounds per metric ton. Carbon is then converted to land area using standard conversion factors for tons of carbon absorption per hectare, percent of carbon not absorbed by oceans, global hectares acres per hectare, and hectares per acre.

MSI 7: Residential Energy Footprints

Energy use footprints are based on local consumption of electricity and natural gas. The data source for the amount of energy consumed is based on numbers found in the *Final Report of the California Statewide Residential Appliance Saturation Study Volume 2,* completed by Kema-Xenergy, Itron, and Roperasw in June 2004 (CEC 2004). Specifically, the electricity data in Table 2-5, along with the natural gas data found in Table 2-21 for single family and multi-family homes, was applied to the data found in the Specific Plan and GIR.

Fossil-fuel based electricity generation is converted to carbon emissions using conversion factors developed by Lawrence Berkeley National Lab based on PG&E's mix of sources in 1999. This was described by a scientist as a conservative estimate because sources have become more numerous and further flung as energy provision is deregulated in the state. Carbon is then converted to land area using standard conversion factors for tons of carbon absorption per hectare, percent of carbon not absorbed by oceans, global hectares acres per hectare, and hectares per acre.
Natural gas consumption is converted to carbon emissions using emissions factors developed by the Bay Area Alliance. This is then converted to area using the same method as fossil-fuel based electricity.

MSI 8: Income exports for oil purchases

Income exports for oil purchases begin with VMT figures described above for the Specific Plan and the GIR low and high scenarios. Assuming U.S. average fuel efficiency for cars and light duty trucks of 21 mpg according to the EPA, we estimate gallons of gas consumed, then translate these figures into barrels of oil using standard conversion factors. Money spent on energy imports is calculated using estimates for imports from foreign origins (36%) and Alaska (21%). We then apply a price of $36.40 price per barrel of oil based on 2004 data.

MSI 9: Housing GINI

$$ID = .5\sum_{1}^{n}\left|X_i - Y_i\right|$$

Where n is the number of classes, X the percentage of units falling into class i, and Y the percentage based on equal shares. As with GINI, an ID close to 1 indicates a skewed distribution while an ID close to 0 indicates an equitable distribution.