

Picturing Poverty: Developing Best Practices in Poverty Research and Map Making

A Thesis Presented to the Faculty of Architecture and Planning
COLUMBIA UNIVERSITY

In Partial Fulfillment
of the Requirements for the Degree
Master of Science in Urban Planning

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May 2018

Abstract

This study investigates the dynamics of poverty by examining the historical construction of poverty definitions and measures in the United States. In addition, the paper explores how the definitions work to influence the measurements through an analysis of past and contemporary research on poverty and impoverished groups. The study also investigates how the definitions and measurements affect decision making through maps as communication tools by considering the recent Los Angeles General Plan Elements. Subsequently, the research breaks down the design of maps to quantify the gaps in information by using both Monmonier's and Tufte's guidelines in graphic design and map making best practice. The paper further examines the toolkits that are available to planners to improve definitions, measurements, and maps of poverty. The study concludes by offering planning recommendations to advance best practices for studying and displaying information about poverty.

Keywords: poverty, maps, GIS, individual correlation, ecological correlation, graphic design, cartography

Acknowledgements

This section is dedicated to thanking both my advisor, Leah Meisterlin, and my reader, Douglas Woodward, who have provided much constructive feedback throughout the process. This thesis is also representative of the guidance that previous teachers and professors have given me along the way. Such teachers include my high school mathematics teacher, Mr. Joel Vaca, and my two high school English teachers, Mrs. Riley McDonald-Vaca and Ms. Claudia Pilon. I also want to thank two professors from my undergraduate university that have inspired me and reminded me to stay critical about visual culture, Professors Elizabeth Aguilera and Kelema Moses. I also want to thank History Professor Kent McGaughy for giving me some of the tools necessary to investigate topics archaeologically. And lastly, I want to thank my friends and family who have supported me throughout this entire effort.

This study is also dedicated to vulnerable communities in Los Angeles who are often over-generalized or under-estimated through archaic characteristics and estimations. It is of the utmost importance, given the political times, that poverty and the groups within its social constructs can see a better future through improved tools of analysis. It is with great humility that I hope this study will influence those new tools.

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Chapter 1

Introduction

Poverty is an issue that the planning field must consider when implementing facilities, services, and policy. In the United States context, there has been one measure that has traditionally been used to quantify poverty in study areas. Traditionally, that measure has been the 40 percent of a population within a census tract under the federal poverty level. However, more recent research has scrutinized the use and results of the measure, in that it lacks geographic, social, and economic context. Nonetheless, this and other tools based on the 40 percent measure are used by planning departments to make decisions for and communicate with various stakeholders. These measures based on fuzzy logic are solidified by quantitative methods and Geographic Information System (GIS) tools, which makes revising the measures of poverty difficult. Such that, the numerical and simulated geographical results denote certainty and fact when the definitions and methods may be to the contrary.

This paper seeks to better understand the way that poverty has been defined and used within the planning context, not just as a method of categorizing groups of people. That is, this research also considers the use of poverty to identify the location of groups through quantitative methods and maps. By investigating how the elements and approaches that define and locate poverty have changed urban planners can have a more nuanced meaning and methodological approach to understand poverty as it transforms over time. In that endeavor, planners can better communicate and identify poverty as it relates to its distinctions between states, cities, and communities. Having a more nuanced conceptualization and operationalization of poverty can

provide a framework for planners to better communicate and reflect the conditions of impoverished groups within given boundaries.

Current research on the historical changes of the meaning of poverty has been lacking, however, there is extensive research on the varied definitions of poverty. For example, that of the urban and rural poor (Orshanky, 1963, 1965a; 1965b), the poor (Jargowsky, 2003), the underclass (Auletta, 1982; Ricketts and Mincy, 1990; Jargowsky, 2003), and the ghetto poor (Jargowsky and Yang, 2006). The distinct definitions of poverty can influence what groups are included in the operationalization methods meant to identify and locate areas of poverty through statistics or cartographic methods. Furthermore, the communities that are being affected by the changes in economic structures will not have their experiences reflected in the results of either statistics or maps. That is, the definitions take longer to change than the economic structures, although they are thought to change in lock-step. Moreover, research is also lacking on the dichotomy between the fuzziness of the definitions of poverty and the rigidity and clearly bounded traits of poverty maps. Such that, the fuzziness of the definitions conflict with solidity of the maps, of which their antinomy creates issues for planners seeking to reflect communities in or make decisions about poverty.

Another aspect of having a nuanced conceptualization and operationalization of poverty involves communication through applications of graphic design. That is, graphic design guidelines have long been established and used to make images readable, clear, and concise (Monmonier, 1996; Tufte, 1999). However, there is also a lack of research that combines graphic design and cartographic guidelines for better correspondence between image/map maker and image/map user. A miscommunication between makers and users of images/maps can also lead

to the fuzziness of poverty maps. Therefore, the fuzziness of the poverty map amplifies as the fuzziness of the definitions of poverty are understood differently by makers and users.

For this study, the choice of Los Angeles was undertaken as a case study because of the region's growing population (graph 5 in appendix), the area's growing median income (graph 6 in appendix), and the increasing costs to consumers (Bureau of Labor Statistics, 2018). That is, the socio-economic trends and constraints in the area introduced an opportunity to investigate how poverty was being conceptualized, operationalized, and communicated by the planning department. Also, Los Angeles Department of City Planning recently updated three of its six elements of the general plan which provided the study with a prospect for a historical comparison among the definitions, tools, and results of poverty measures. The research then utilized the case study of Los Angeles in conjunction with past literature about poverty and planning, as well as graphic design and mapping best practice.

Therefore, Los Angeles as a case study can show the similarities and differences in the definitions, measurements, and maps of poverty across scales and time. Los Angeles will be investigated through the frameworks of the definitions of poverty, as well as the graphic design and cartographic guidelines of map making for decision making and communication. Los Angeles will be investigated through the frameworks of the definitions of poverty, as well as the graphic design and cartographic guidelines of map making for decision making and communication.

The Los Angeles Case Study

The city of Los Angeles launched the first of three chapters of their general plan in 2013. The document is state mandated for all cities in California to prepare for their future development. Although, the general plan does not consider poverty as an element, the three chapters help to understand how poverty is conceptualized, defined, and operationalized within the framework of the general plan. In addition, the three chapters of the general plan include maps that also apply to the framework of the past definitions of poverty. Therefore, the question emerges: “What are the impacts, and the planning implications, of poverty maps as decision making and communication tools in Los Angeles?”

After reviewing Los Angeles city reports and planning documents on measurements that investigated poverty within varying definitions and contexts (Los Angeles Department of city Planning 2015, 2016; Los Angeles Department of city Planning and Raimi + Associates 2013), when compared to the academic research that provided frameworks for the definition of poverty (Jargowsky, 2003; Jargowsky and Yang, 2006; Jargowsky, 2009; Sessoms and Wolch, 2008; Orshanky, 1963, 1965a; 1965b), the investigation raised questions about the fuzzy definitions used in planning products that reflect concreteness. Moreover, the concreteness of the results in planning documents is contradictory to the ground conditions, as mentioned by (Sessoms and Wolch, 2008). That is, considering that Los Angeles is a diverse city, one should expect its poverty and its approach to identifying and locating poverty to be as diverse as its citizens. One common method of exploring poverty is through a 40 percent of census tract population living below the federal poverty level measure (Sessoms and Wolch, 2008). Another combines the previous method with American normative indexes of social ills for scoring purposes - such as unemployment, low percentage of high school graduates, and high age dependency ratios

(Ricketts and Mincy, 1990). The two methods have been criticized in previous research for over-generalizing social and built environments that are "increasingly heterogeneous" in form and landscape (Jargowsky, 2003; Sessoms and Wolch, 2008). Therefore, there is a need for an analysis of Los Angeles city plans that concern the fuzziness of the definitions of poverty, in conjunction with the use of poverty maps within municipal documents.

An investigation is made in two parts for this research: First, to delve into the history and definition of the measurement of poverty in the United States. Second, to identify the gaps in graphic design and cartographic guidelines of poverty maps found in Los Angeles city planning documents. The analysis will consider the following questions: How has the definition of poverty changed over time? What are the graphic design guidelines and what can they tell us about the operationalizing of poverty through maps? What are the cartographic guidelines and what can they tell us about communication between the map maker and user? What are the implications of graphic design and map making best practice to planning? To explore these questions, an investigation on the methods of measuring, visualizing, and informing about poverty will serve as a grounding for this study.

Background

The planning research has previously considered the impacts of the definitions or maps that concern poverty as objects of analysis. However, there is a lack of research that concerns the areas of their junction. The topic that this paper considers is at that area of junction, where social constructs of the definitions of poverty meet the map making process. In the confluence of definition construction and map creation, when concerning poverty, the issues arise as facilities, services, or policy is implemented. Such that, the definitions help to create a framework for the

maps to consider, which then the maps aim to spatialize and locate the groups that fall into those frameworks. This paper also considers the fuzziness of the definitions used by the planning field, of which Los Angeles Department of City Planning is used as a case study, that is then validated through tools that imply definiteness.

The implications for planning come from the information and actions derived by the confluence of the fuzzy definitions and seemingly concrete operational tools found in planning documentation and practice. That is, the definitions and operational tools can continue the perpetual cycle of mismanaging or misaddressing poverty-stricken groups and areas. Moreover, this study highlights the nature of numerical analysis and their limitations to show that such operationalization tools are just as susceptible to error as socially constructed definitions. Central to this paper, is exploring the gap in using best practices in graphic design and map making when planning departments seek to address poverty. Such that, finding fuzzy of definitions, improving map making process, and establishing graphic and cartographic best practice guidelines become vital parts of the planner's toolkit. Thus, the implications for planning involve improving the planning practice's processes in defining poverty, creating its maps, and establishing a graphic design and map making best practice.

Literature Review

Definitions of Poverty

Early conceptualization of poverty involved people who were categorized as the "other," that is, those who were not within the constructs of what was perceived to be American: young, males with a family, white, and working. As mentioned by Orshansky (1963),

It is another thing to realize that some seem destined to poverty almost from birth - by their color or by the economic status or occupation of their parents. It has become a truism that, in good times and in bad, certain groups lag behind in the long-term upswing of our economy. Prominent among these are the aged, the families headed by a woman, and, minority groups- particularly the Negro. Jobs ask more and pay more from the outset, and the unskilled worker cannot hope to better himself much... (p. 3)

The people found in those categories were thought pre-determined to be impoverished because of color or class. To pursue policies that would cater to those who were in poverty was difficult as it would entail civic duties but also because poverty was a fuzzy phenomenon to measure. Moreover, poverty's grounding for considering certain groups as impoverished over others was fuzzy as well.

Nevertheless, the 40 percent of a population under the federal poverty line measure was established by the Social Security Administration in August 1969. Established despite the creator's admission of it being a "crude" (Orshansky, 1963, p. 3) and "arbitrary" index (Orshansky, 1965a, p. 4). Orshansky (1963), in *Children of the Poor*, mentions that using the incomes below the taxable amount places 1 in 4 American children in poverty (p. 9). The author also stated that various estimates during her time place "the number of persons of all ages with inadequate income have varied from 1 in every 5 to nearly 1 in 3," (Orshansky, 1963, p. 9). From this, we can see how the definitions of poverty change by both group (adults or children) and by income estimates (incomes before taxes or after taxes).

Orshansky (1963) is also wary of the fact that some measures that identify families as poor will be "unquestioningly acknowledged" (p. 9). Yet, other families that would be on the edge of poverty would not be counted. This adds to the fuzziness of poverty and allows some

researchers to be flexible in both their definitions of poverty and the people they include in their measurements. Orshansky (1965a) reinforces the fuzziness of poverty as she calls her measure subjective as the notion of “how much is enough to live...in a society that equates economic well-being with earnings” is entirely dependent on factors of socio-political will and power (p. 5). Furthermore, the development of the Social Security Index for poverty in 1965, helped to establish “minimum money income required to support an average family of given composition at the lowest level consistent with the standards of living prevailing” in the United States (Orshansky, 1965b, p. 8), despite the fuzziness of the definition of poverty. Yet, again she mentions that the “standard used to define poverty is admittedly arbitrary,” (Orshansky, 1965b, p. 3). For example, she states that the 40 percent measure “is not designed to be applied directly to an individual family with a specific problem. Nor even as a screening device can it be expected to stand unchallenged as an exact count of the poor in absolute numbers” (Orshansky, 1965b, p. 8). Rather, the author contends that it will approximately describe “incidence of poverty” among separate population groups that creates “targets for action” (Orshansky, 1965b, p. 8). However, over time the measure has been used to the contrary and the definitions of poverty, rather than providing targets for action, have been used as spatial traits and groups to avoid.

Years later the index provided some academics a standard for which to classify and reinforce the idea that poverty has always been an issue for those deemed “a burden to themselves and the public” of course, carrying with them racial and class issues. For instance, Auletta (1982, p. 25) defines poverty differently than Orshansky (1963, 1965a; 1965b) and distinguishes between the poor and the underclass. That is, Auletta's (1982) underclass is comprised of “high-school dropouts, drug addicts, the welfare dependent, and offenders” (Stoesz

et al., 1989, p. 7). Moreover, there are salient definitions that cross between the poor and underclass. Such that, welfare is used both by the poor and underclass which makes the distinction fuzzy. Auletta (1982) adds, “though relatively few in number, they have become a considerable burden to themselves and the public—as long-term recipients of welfare, and as the source of much violent crime and drug addiction.... There is nothing new about such a social class,” (p. 25). Ricketts and Mincy (1990) provide a discourse where the poor is distinct from that of the underclass as well,

Conceptual definitions of the underclass characterize the group by behaviors that are at variance with mainstream American norms. In fact, the underclass is distinguished from the poor by the increasing coincidence of socially dysfunctional behaviors among a diverse population living in inner city communities. (p. 137).

Although, the distinction from that of the underclass and the poor were becoming a part the academic literature, the fuzziness of poverty itself continued in other studies.

In further investigations, we see a change in language for those in the class of poverty into that of the underclass. Still, the issue and terms are conceptually fuzzy, and the underclass and the poor are overlapped in analysis and policy. Nevertheless, there is still research done to account for group size, composition, and growth as evidenced by Ricketts and Mincy (1990): “Despite this debate and the somewhat fuzzy status of the concept, researchers have begun to resolve the difficult issues of the size, composition, and growth of the underclass” (p. 137).

Furthermore, for some researchers the underclass is separate from the poor, although, the term is based on “impoverished individuals.” The unclear boundary between the underclass and the poor adds to the fuzziness of the definition of poverty.

The definition becomes fuzzy as it is sometimes combined by other researchers who call those in the underclass, the “ghetto poor”: “Over time, the term [underclass] has fallen out of favor; (Wilson 1996), for example - whose work did much to call attention to these issues - decided to drop the term "underclass" in favor of the less politically charged term ‘ghetto poor’,“ (Jargowsky and Yang, 2006). The fuzziness of the term “poverty” advances as some researchers point to individuals that may leave the areas of poverty, leaving only the poor (Jargowsky, 2009). That is, the “selective out-migration”, as mentioned by Jargowsky (2009), makes the definition of poverty spatial and intrinsic to certain individuals, rather than poverty being an economic and civic issue, as mentioned by Orshansky (1965a).

More recent research has brought forth more fluid conceptualizations of those in poverty, that is, things like health access for sexual minorities (Alencar Albuquerque et al., 2016) and racial/ethnic individuals who are also a part of the disabled community (Peterson-Besse et al., 2014). However, research on poverty has yet to include cases where economic and civic policy is addressing the needs of those groups. This adds to the fuzziness of poverty because both the terms of “poverty” and “underclass” are shaped by a scope of “normality,” (Auletta, 1982; Ricketts and Mincy, 1990). Meaning, that certain groups would not be counted in any measure that only considers parts of a “normal” world. Brown (1974) sees this subjection to the “normal” world as a submission to the culture and morality of the bourgeois in America, where individuals are assessed by their “hard work, faith in one’s superiors, and rule-following” (p. 53). Therefore, a comparison between the measures that consider “high-school dropouts, drug addicts, the welfare dependent, and offenders” (Stoesz et al., 1989) to Brown (1974) serve to be narrow definitions of impoverished individuals. The definitions are narrow because rather than poverty being based on economic or civic problems (Orshansky, 1965a), poverty is abstracted to the

behavior of individuals and groups; those behaviors based on ideals of the social order (Brown, 1974). Therefore, statistics serve to prescribe behavioral activity of groups rather than describe information of areas.

Quantitative Identification of Poverty

The fuzziness of the concept of poverty can then be abstracted by researchers who look at things like race or economic class, a statistical object (height, income, eye color, race), to account for statistics of an area (rates or means). That is, those objects would provide individual correlations rather than ecological correlations (Robinson, 1950). Yet, those correlations are used interchangeably in research on poverty to account for individual (Auletta, 1982) and area statistics (Jargowsky, 2009). Such a difference can lead to misreading or counter-inductive reasoning of groups. Where, individual correlations and ecological correlations can decrease, or in the worst case, switch from positive to negative correlation (Robinson 1950). For instance, Robinson (1950) mentions cases where the correlations decrease but still matched logical reasoning for the time, "the individual correlation between color and illiteracy is .203, while the ecological correlation is .946" (p. 339). Another case is where the correlations switch from positive to negative and defy reason for the time in history, "the individual correlation for Table 3 [foreign birth and illiteracy] is .118. However, the ecological correlation between foreign birth and illiteracy, shown in Figure 3, is - .619!" (Robinson, 1950, p. 339). Sessoms and Wolch (2008) provide a case study that shows when qualitative information contradicts quantitative measures about the underclass, "Not surprisingly, these types of communities share low homeownership rates, crowded housing, and high rent burdens, but they are not necessarily characterized by social pathologies or specific economic problems associated with the underclass

debate” (p. 82). That is, the definitions and the quantitative identification of poverty, the underclass, the poor, the ghetto poor, and the like are fuzzy. Furthermore, using quantitative methods that attempt to locate and count those individuals or groups that fall within the definitions of poverty will add a sense of solidity and reasonableness. However, careful investigation of the definitions and methods used for contextualizing poverty shows both their fuzziness and subjectivity. An analysis into best practices within planning, GIS, and graphic design can help achieve a more nuanced conceptualization and operationalization of poverty.

Best Practices of Mapping Poverty

Producers of knowledge, GIS practitioners, and cartographic theorists have made arguments about knowledge being revisable, as well as having GIS operations and maps to include biases to learn from mistakes. In particular, Morgan (2017) contends that best practice within the planning context should be like that of business, “in order to produce equally superior results, or to avoid the same mistakes” (p. 79). Morgan (2017) also states that for those in the public sector best practice should mean “promoting more consistent and better practices, and ensuring their information needs and statutory or administrative requirements are met” (p. 79). Yet, when professional norms implemented into agency- and State-sponsored best practice, those information needs and requirements, can result in the same mistakes as best practices are not easily revisable. Those mistakes are exacerbated by tools like GIS that are viewed as “value-neutral and bias-free” (Miller, 1995, p. 100). That is, when analyzing the spatiality of poverty GIS can serve to solidify its fuzziness in terms of definitions and operationalization methods.

However, Miller (1995) contends rather than “excluding imperfect data, we should utilize it in ways that acknowledge the biases it contains, while attempting to relate those biases to the

alternative viewpoints of those who created or collected the data” (p. 100). Moore (2013) views best practice as contextualized with bias, although conceived as the best ways of “designing, planning, and building...new knowledge and innovation” (p. 2371). That is, “the notion of ‘best practice’ decontextualises forms, ideas and processes from the cultural conditions that give rise to it. Moreover, the unquestioned acceptance of conventions and principles of ‘best practice’ obscures the processes of normalisation and typification that enable it” (Moore, 2013, p. 2371). Altshuler (1969) finds case studies that highlight planners using best practice for the improvement of the city. However, Altshuler (1969) finds that 1950s planners in the Twin Cities of Minneapolis and St. Paul fell back on studies or knowledge that reinforced the State corruption or evaded the issue in question. The author, concerning the inequality of black and white community revitalization programs in the planning process, goes as far as to say that “the promises of making these areas better will not be fulfilled if these games continue” (Altshuler 1969, p. 35). That is, when best practice is normalized through the adoption by agencies and State departments, it can also make fuzzy definitions and measures of displacement and poverty seem solid with hard evidence. Subsequently, best practice involving graphic design involves the same issues when combined with map making. That is, communicating these conditions of social differentiation, contingencies in statistical operation and modeling, and the correlative distinctiveness of aggregation and scale presents another problem in graphic design and cartography.

Currently, Monmonier (1996) and Tufte (1999) provide a guideline toolkit for best practice in cartographic representation of statistically based studies and graphic design production of numerical illustrations. Monmonier (1996) argues for caution when using maps, as they may have the “ability to distort and mislead,” however, it “should not detract from an

appreciation of the map's power to explore and explain geographic facts" (p. 159). Still, Monmonier (1996) provides a framework for cartographic best practice for framing topics and arguments, as well as for using scale, color, data matching symbols and hue. Tufte (1999) argues for a "vocabulary of graphics" that provides a visual representation of the data. Meaning, that the image must stay consistent with the numerical operation and representation to avoid distortion (p. 11). The two authors' guidelines will be elaborated in the methodology portion of the study. The guidelines will help to identify the gaps in the maps that are relevant to the study. The guidelines will also offer material for discussion of poverty within the framework of this study, as it relates to the fuzziness and solidity within the definitions and methods of describing, locating, and targeting areas of concentrated poverty.

Chapter 2

Methodology

Data Collection

The study considered academic journals, articles, and book material on the subject of planning, poverty maps, and Los Angeles for grounding on theory, gathering the recently State-mandated reports by the Los Angeles Department of City Planning, and selecting maps from within the Los Angeles Department of City Planning reports that measure and contextualize poverty. Planning documents were analyzed by delving into the communication efforts, design, and context of poverty maps to understand how the measures on the maps are read as a visual language, explore the patterns of communication efforts, and investigate the intersection of poverty maps, design, and mapmaking. A set of interviews were conducted with individual

planners that are a part of the mapmaking and decision-making process in the context of Los Angeles.

Research Design

The methodology considers the following sources:

Type of Source	Number	Name
Reports	4	Health Atlas (2013) Plan for a Healthy Los Angeles (2015) Housing Element 2013-2021 (2013) Mobility Plan 2035 (2013)
Maps	20	Health Atlas (2013): Maps 12-115 Health Plan of the city of Los Angeles (2015): Same maps as Health Atlas Housing Element 2013-2021 (2013): Maps Es.1-3.1 Mobility Plan 2035 (2013): No maps relevant
Community Plan Documents	3	South Los Angeles Community Plan (2016) Southeast Los Angeles Community Plan (2016) West Lake Community Plan (2016)
Presentations	4	Housing Needs Assessment (June 2012) Production Subcommittee (July 2012) Special Needs Subcommittee (July 2012)
Public Hearing Audio	1	LA Housing Element 07-27-13
Interviews	3	Subjects Unnamed for Privacy

The maps were analyzed using the guideline toolkit consisting of the arguments around mapmaking and design by Tufte (1999) and Monmonier (1996). A rubric in the form of a matrix will detail the criteria of the guideline toolkit, each matrix looking at the structures of mapmaking and design by Monmonier (1996) and the display of quantitative information by Tufte (1999). To evaluate the maps, the researcher used the guidelines of Tufte (1999) and Monmonier (1996) to create a criterion of the categories that relate to the types of data that were integrated into the map. The criteria of the categories provide the study with a standard by which to measure the quality of the maps, as they pertain to graphic design and mapping best practice.

The researcher developed 3 matrices for Monmonier's guideline and comparison: (1) the first matrix shows each map in the study and a cell is given the value of "1" if the data in the map must belong to a category of graphic illustration. If the data does not belong to a category, the cell is left blank; (2) The second matrix details how the data in the map is displayed, where each cell with a value of "1" corresponds to the category the map is utilizing to display information; (3) the third matrix compares the two previous matrices and gives the matching results, that is, where values of "1" match. The same process and development of categorization is done for the 3 matrices on the guidelines of Tufte (1999). The categories of the Monmonier guidelines matrix are: Single Sequence, Part Spectral Scale (SS, PSS) meant to describe scaled intensity or impact, although it's hard to read as a gradual increase in intensity; Complex, Full Spectral Scale (C, FSS) that shows the variability in the data (great for weather maps); Single Sequence, Single-Hue Scale (SS, SHS) indicates gradual increases or impact of a variable or value; Double-Ended, Multiple-Hue Scale (DE, MHS) illustrates gradual increase or decrease from an average; and Complex, Multiple-Hue Scale (C, MHS) gradual increase of variability of data (usually for complex weather pattern maps).

The use of each category, Monmonier (1996) argues, is: (SS, PSS) for logical ordering of high and low data; (C, FSS) for weather and relational data that gives of a feeling like hot or cold; (SS, SHS) for gradual increases; (DE, MHS) for logical and Boolean data such as differentiating between negative and positive data, and true or false data; and (C, MHS) for similar weather data, although it might be hard for map users to read (Monmonier, 1996, p. 150-156). As for the Tufte guideline matrix, the categories are: Text and Graphic Uniformity, which keeps ensures that the text and the graphic provided tell the same information; Numeric Increase Consistency, in that, the numbers increase by the same amount to avoid graphic distortion;

Numeric and Graphic Proportionality, such that, the increases in scale of the data matches the gradual increases in the saturation of the color; and Explanation of Data, where any graphic information shown is communicated to the reader to avoid confusion or distortion (Tufte, 1999). A separate count of the types of data utilized by the maps was created, that is, discrete data such as Percentage, Logical, and Interval. Another count of the types of maps used was created, that is, Topographical, Choropleth, and Dot Density.

Additionally, the total scores for every map by category are shown in Monmonier Guideline Categories (graph 1) and Tufte Guideline Categories (graph 3). Monmonier Guideline in Practice (graph 2) and Tufte Guideline in Practice (graph 4) show the score of each map overall. The difference between the sets of graphs 1 & 3 and graphs 2 & 4 is that the categories chart takes note of the sum of scores for every map by each category. The context given from the categories in graphs 1 & 3 is then how the poverty maps scored overall in relation to a certain category and map making best practice. Some categories were not used by the maps and those categories were not considered, leaving some categories with a score of zero indicated by a dashed line. The maximum possible score for each category used by the maps is indicated by the dashed line, whereas the scores for the maps are shown by a solid line. That chosen chart, is a radial chart which helps to show both overall performance through the size of a shape generated max scores and actual scores. Therefore, a smaller solid line shape illustrates lower map making performance overall. Graph 2 then shows then shows how each map performed individually across all categories. The maximum is represented by the dashed line. Thus, a solid that is closer to the dashed line denotes a better performing map across all categories. Also, the closer the solid line shape is to the dashed line shape, the better performing the maps were overall.

The 3 community plan documents are consulted to see if poverty maps or the issue of poverty arises in the documentation that was left out in any of the three General Plan elements. The community plan documents are from the following community districts: South Central Los Angeles, Southeast Los Angeles, and Westlake. The first two community districts are community districts characterized as “areas with concentrated poverty.” The last community district of Westlake is a community district that is experiencing new housing development. 3 Housing Element presentations were analyzed to see how the poverty maps or poverty were contextualized by the city. 1 public hearing audio was used contextualize the use, purpose, and role the poverty maps played within the Housing Element plan.

Lastly, 3 interviews with Los Angeles-based planners were conducted, the interviews consisting of a question-and-answer session, along with some clarification of the initial findings from the planning documents. The interviews were held by the researcher with planners to gain an understanding of the usage of the definitions of and the creation of poverty maps, as well as their implementation into the public sphere. That is, the interviews are used to give context about impacts of poverty maps within the planning practice. Six questions were formulized by the researcher to contextualize communication efforts through mapping practices used by planners. The six questions can be found in the appendix.

The research design is used to compare the maps from the documents to the graphic design and cartographic guidelines established by Monmonier (1996) and Tufte (1999). In doing so, the research design will allow the researcher to discuss the how the definitions of poverty, quantitative identification of poverty, and best practices and mapping of poverty coalesce in the planning documents. In addition, the research design allows the researcher to examine the poverty maps to identify gaps within the definitions, design issues, exclusion or inclusion of

data, and their distinctive nature between them. This is important because the study is focused on the relationships between fuzzy definitions of poverty and perceived value-neutral and bias-free tools used to represent solid target areas for services and programs, as expounded in the literature review.

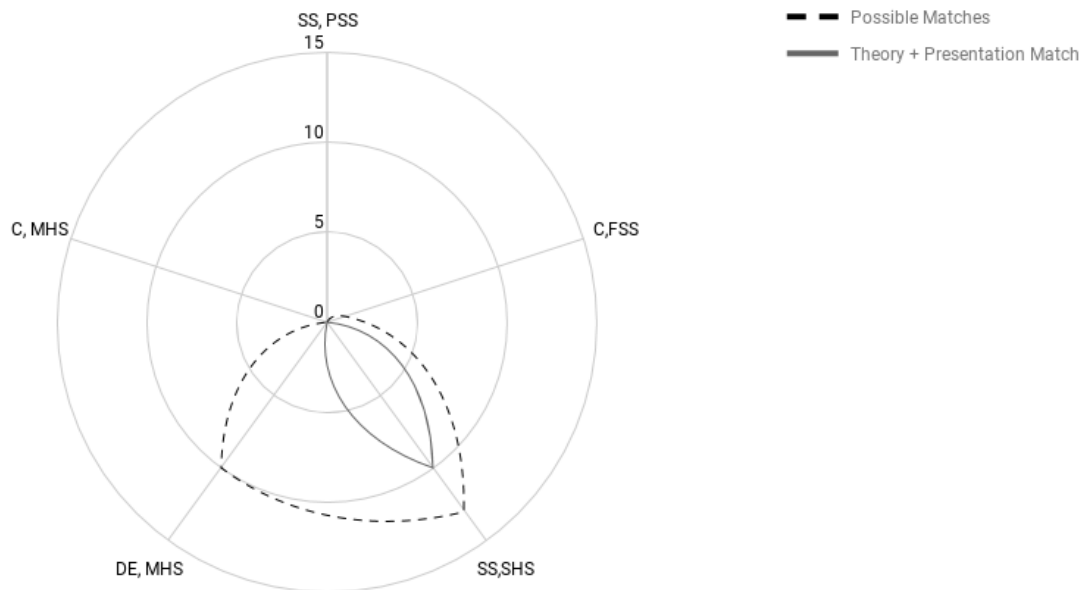
Findings

Guideline Findings: Monmonier

Evaluation: Monmonier	Possible Matches	Theory + Presentation Match	Percent Match
SS, PSS	0	0	0.0%
C, FSS	1	0	0.0%
SS, SHS	13	10	76.9%
DE, MHS	10	0	0.0%
C, MHS	0	0	0.0%
Theory + Presentation Match	24	10	41.7%

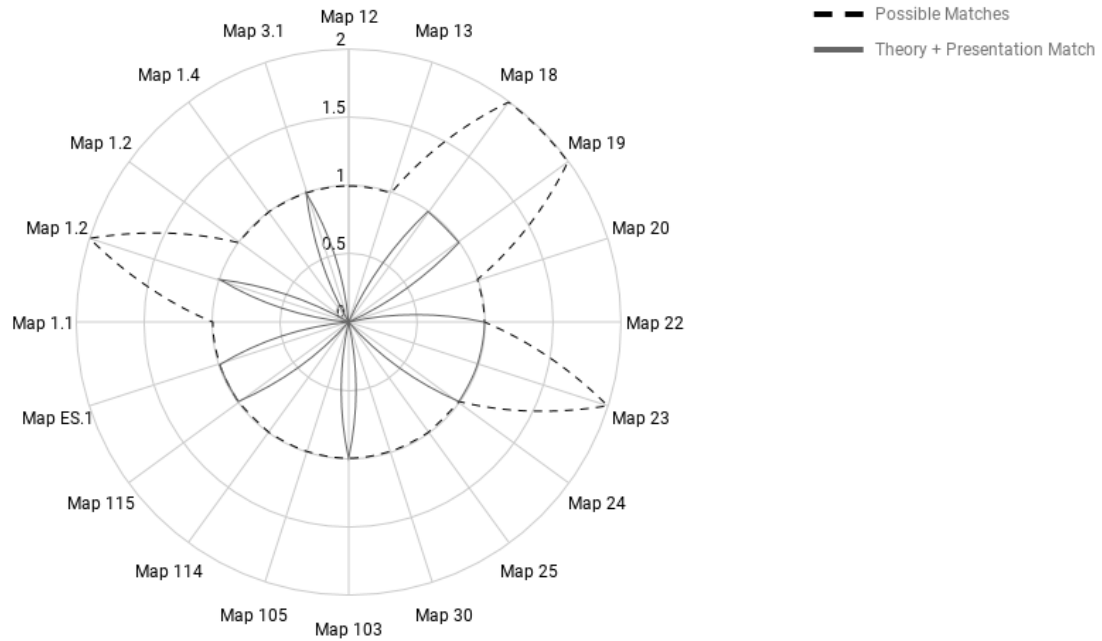
Table 1

Poverty Maps + Monmonier Guideline Categories



Graph 1

Poverty Maps: Monmonier Guideline in Practice



Graph 2

The categories were counted for each map, and values of “1” were allocated to the categories that Monmonier’s guidelines would place the maps in according to the underlying data structure. The maps were then evaluated by the researcher and each map was assigned a category value of “1” or “0”, according to the presentation of the map. Later, Monmonier’s guideline and the presentation evaluation matrices were then compared using a comparison matrix to understand where the maps matched and did not match Monmonier’s recommendations for a given category. There were 24 matches possible as some maps counted for more than one category, which only 10 out of 24 matched Monmonier’s guidelines for best practice. The category with the most matches was Single Sequence, Single-Hue Scale (SS, SHS). Yet, it only it was

used with 76.9 percent accuracy, that is, 10 out of 13 maps used the scale in accordance with best practice.

The results of graph 1 show a smaller solid line shape compared to the dashed line shape, indicating that the maps scored low across most categories. However, the Single Sequence, Single-Hue Scale (SS, SHS) category shows it was the highest scored. That is, 10 out 13 maps matched the guideline by Monmonier for using SS, SHS appropriately. This means that, in terms of graphic design and quantitative communication, the map making process must consider an appropriate use case of the scale, color, and saturation used. This finding reinforces Monmonier's and Tufte's notion of skill gaps in graphic design and quantitative methods that can lead to distorted maps and data. Moreover, the maps relied on one type of scale, SS, SHS but when considering Monmonier's guidelines on map making and graphic design, all five categories should have been used according to the data of each map. That is, one of the categories was applicable to at least one map. Furthermore, although the maps depended on SS, MHS, they only scored 76.9 percent accuracy in best practice use with SS, SHS. The overall scores for each map were similarly low scoring.

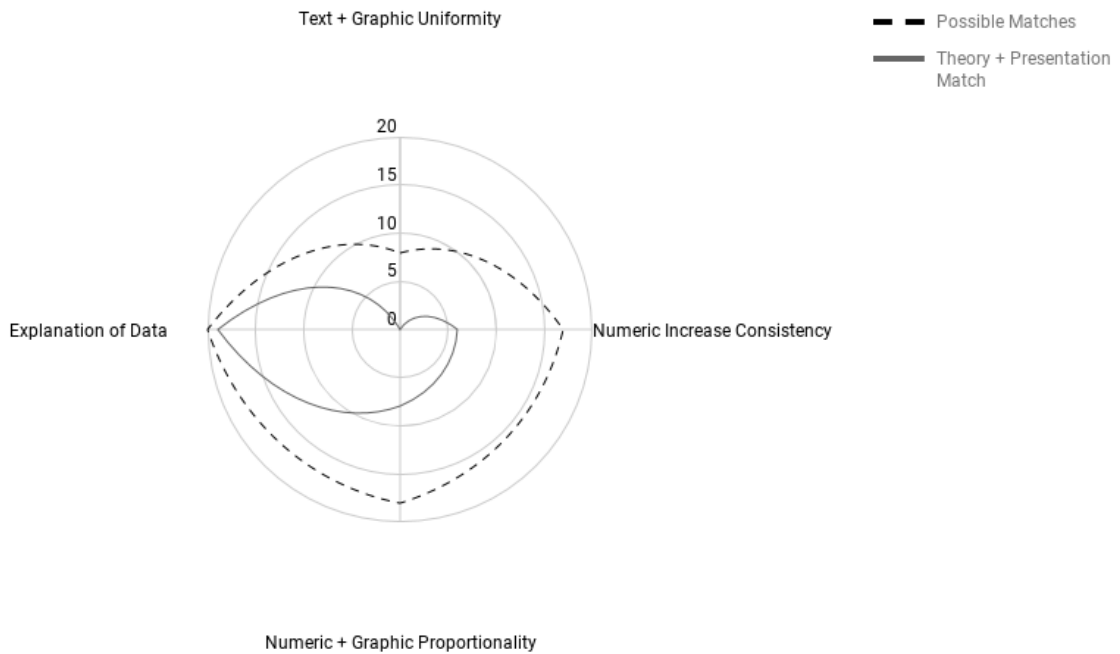
As for graph 2, it shows Monmonier's possible matches for the individual maps in practice, where some maps should have considered using at least one of the scales, but some failed to use any scale appropriately. In fact, as mentioned above only 41.7 percent of the maps used their categories in accordance with Monmonier's guideline for best practice in map making and graphic design. What follows are the scores for the Tufte analysis.

Guideline Findings: Tufte

Evaluation: Tufte	Possible Matches	Theory + Presentation Match	Percent Match
Text + Graphic Uniformity	8	0	0.0%
Numeric Increase Consistency	17	6	35.3%
Numeric + Graphic Proportionality	18	8	44.4%
Explanation of Data	20	19	95.0%
Theory + Presentation Match	63	33	52.4%

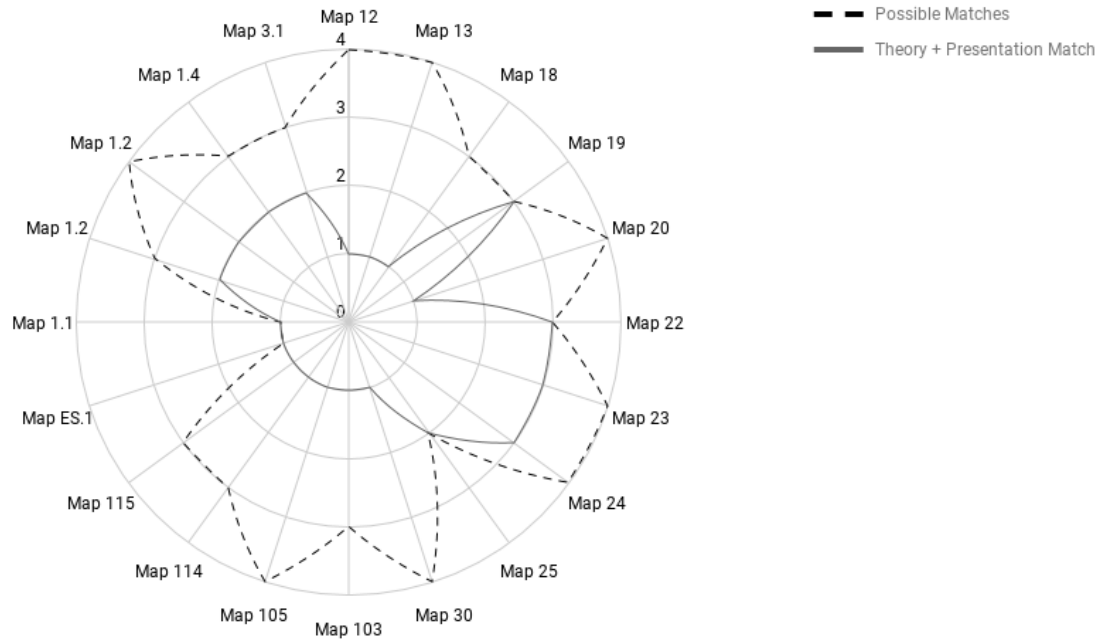
Table 2

Poverty Maps + Tufte Guideline Categories



Graph 3

Poverty Maps: Tufte Guideline in Practice



Graph 4

The maps were evaluated by the researcher and each map was assigned a category according to the presentation of the map. Later, Tufte’s guidelines and the presentation evaluation matrices were then assessed using a comparison matrix to understand where the maps matched and did not match Tufte’s guidelines. There were 63 best practice matches possible, as some maps counted for more than one category. The category with the best practice accuracy was Explanation of Data, accounting for 95 percent, or 19 out of 20 matches. The category with the second most matches was Numeric and Graphic Proportionality with 44.4 percent best practice accuracy, or 8 out of 18 matches.

Graph 3 follows the same logic as graph 1, however, it considers Tufte’s guideline where there was a total of 20 possible best practice matches. The solid line shape is slightly smaller

than the dashed line shape, meaning that the best practice performance across all categories for the poverty maps was low. However, the maps' best performing attribute was their explanation of data, where the map readers were mostly informed about the graphic content. The lowest performing category for the maps was text and graphic uniformity, where the information given to readers in the legend or in the planning document did not match or was left out of any sort of graphic representation. The research showed that the information about averages (i.e., income, poverty rates, unemployment rates, etc.) was given to readers but was not represented on the map. That is, either the legends or the planning documents referred to averages in relation to the map, but the graphic representation of the map did not indicate the averages in any sense. In fact, most averages were buried within arbitrary scales. The scores for each map were then indicative of the map making and quantitative data representation skills gap or naivety.

Graph 4 also shows a smaller solid line shape than the dashed line shape, indicating the low performance of each map meeting Tufte's guideline for best practice. Each map had one possible best practice match for each category, amounting to four total best practice matches. According to the study, the percentage of total best practice matches was 52.4 percent, or 33 out of 63. Although these categories stem from only two graphic design and map making professionals, they serve as a starting point in evaluating the effectiveness of poverty maps.

In sum, the indexical categories help the research to assess the success of the Los Angeles poverty maps as decision making and communication tools. The graphs provided a visual context of both the gaps in best practice categories and which maps were specifically lacking in active information dissemination. Furthermore, an investigation of the planning documents as they define and contextualize poverty (and as they interact with the framework of poverty maps)

offers this research an opportunity to examine how graphic design and map making best practices are linked to planning policy, concepts, and operationalization methods.

Text and Graphic Analysis

The inclusion of the maps in a given document formulates how poverty is perceived and addressed, that is, as a health, housing, or transportation issue. A link is developed between how poverty is defined in the text and how it is operationalized through maps in for location-based analysis. As the literature review suggests, the definitions of poverty may be studied in conjunction with maps to account for fuzziness and solidity, respectively. All the maps can be found in the appendix section of the study.

In the context of the *Health Atlas*, poverty is presented with the lens of public health. The document mentions that both “hardship” and “lack of education” attainment are associated with worse health outcomes (Los Angeles Department of city Planning and Raimi + Associates 2013). That is, the maps within the document informs readers about poverty as an economic and socio-political issue. The definitions then serve as a starting point for readers to frame and interpret poverty as groups to be avoided. Subsequently, such framing leads to readers developing a notion of poverty and spatiality, such that, not only are groups to be avoided but spaces or places as well. For decision and policy makers, such framing of poverty can lead to policy overlaps of the poor with the underclass, as mentioned by Ricketts and Mincy (1990). The maps then serve as platforms for intervention or action, of which might be misplaced or exaggerated. Other factors are given to contextualize poverty within the document, such as race and spatial factors: 70 percent of Non-White and Hispanic residents comprising the low-income areas of South Los Angeles and place near Downtown Los Angeles, while only representing 15 percent of high-

income areas like Bel-Air-Beverly Crest and Brentwood-Pacific Palisades, 10 percent of adults reporting to have eaten five servings of fruits and vegetables a day, 60 percent of residents in South Los Angeles paying more than 30 percent of the income (rent-burdened), 20 homicides per 100,000 residents in South Los Angeles and West Adams-Baldwin-Hills-Leimert, and 50 percent of adults having a high school diploma in Boyle Heights, South Los Angeles, and Arleta-Pacoima (Los Angeles Department of city Planning and Raimi + Associates, 2013). The document then serves to inform the map of the racial groups, the areas, the nutritional characteristics, income brackets, criminal activity, and education backgrounds to consider as communities in poverty. Meaning, that the planning document overlaps the poor and the underclass, which in turn creates overlaps in the visual language of the map when such definitions are considered in the map making process. Health policy that comes out of the communication of these studies in planning documents and maps to city stakeholders, as indicated by Monmonier (1996) and Moore (2013), then create a perpetual cycle of over- or under-generalization of groups in poverty.

However, the document does provide an in-depth analysis of the various factors that contribute to low-health outcomes. Although, low-health outcomes make no distinction between the factors that contribute to the outcomes of the poor and those that contribute to the underclass. Subsequently, the spatial and policy implication of the study remains vague and generalized as to who the analysis is claiming to investigate. That is, for some policy makers poverty, within the scope of hardship and health, might mean tougher on high crime areas, high quality foods in food deserts, better school programs, or even better land-use allocation. These factors go on to contribute to a varied perception of poverty dependent on the audience, or in our case decision-

makers, who then are able to highlight issues they see as important for the Plan for a Healthy Los Angeles (2015).

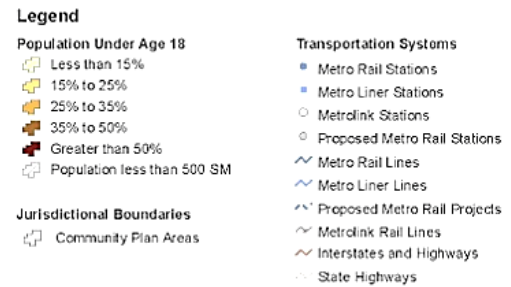
As for the Housing Element, the document presents poverty as a housing and economic issue, where specially designated areas are targeted for intervention as “special needs populations” (Los Angeles Department of city Planning, 2013). These “special needs” groups are defined within the document and the Housing Element presentation as. Such that, poverty is not defined within the presentations explicitly. However, groups that would be associated with being in danger of becoming impoverished are included within the scope of the public presentation. Also, the maps on housing production used in the presentation were not the same maps used in the Housing Element. The inconsistency with the use of maps in the presentation and the Housing Element does raise questions about what information the presenters were emphasizing; as opposed to the information that the mapmakers in the Housing Element document were illustrating. Both the Housing Element and the presentation on housing production mention that equity is a part of the goal of housing clearly: “to better link housing with employment, services, and transit” (Los Angeles Department of city Planning, 2012a). Therefore, in the context of the poverty maps produced for the Housing Element document, housing is viewed in the context of accessibility to points of employment, services, bus, and rail. That is, in conjunction with income, age dependency, and other abstractions found in the Housing Element, poverty is still ambiguous. That is, poverty in the context of housing depends on the group and their location in relation to a lack of a certain service or resource. This is opposed to Orshansky (1965b) who mentions that poverty, at its core, is an economic and civic issue.

For the Mobility Plan 2035 document, the maps offered were mostly topographical and displayed transportation networks. The search for the words like “poverty” and “impoverished”

yielding no results, and “low-income” yielding one result serves to make the issues of poverty implicit at best. That is, most talk about under-served areas related to terms like “health” and “access” which implied impoverished areas but did not define them as a target group within the document. Subsequently, the term poverty within the transportation aspect remains fuzzy, and to a greater extent than poverty as defined in the Health and Housing element. The maps can therefore be read as transportation network maps with implied equity, as mostly “special needs” groups were defined in the document; such as accessibility of the disabled and improved location for “low-income” groups. Neither of which are representative of poverty as defined in the Health and Housing elements. For example, the disabled are not mentioned within the Health Atlas as an impoverished group and low-income numbers often show two figures when compared from the document and maps. Furthermore, the low-income number used for the Health Atlas is \$22,050, the maps show the figure as \$22,113 (see figures 3 and 4 below). Both numbers are based on a family of four using 2010 U.S. Census ACS 5-year data. The cartographic affect of the fuzzy logic of implicitly including “special needs” and “low-income” groups is that such “improvised” communities may then be said to either not solidly exist with the city. As for the “low-income” group itself, the variability of the income statistic can arbitrarily place areas within the purview of an intervention or target area. Interestingly, the Department of Regional Planning for the Los Angeles County’s Affordable Housing Programs for 2016 lists neither number within any of its categories. In fact, the figure for an extremely low-income family for four is \$26,050 (HCD, 2016). The figure is \$4,000 above the estimate used in the Health Element of the general plan, further increasing the chance of an area being misinterpreted as a targetable area for intervention. As for the Housing Element, the word equity is mentioned, however, it is measured in the document by the amount of federal, state, and regional funding made available for specific

transportation improvements in the city. That is, equity is measured through the inequality of money allocated for certain transportation projects over others. Moreover, not having figures that estimate the actual cost to make transportation more equitable can obscure the actual impact the services are making in the city.

As for the results of the maps section (all the maps can be found in the appendix of this paper), they were largely unexpected as far as the information in the legend not being symbolized or illustrated in the graphics of the maps. Tufte (1999) mentions that information of the map should be clearly labeled and important events in the data should be detailed in the graphic to avoid ambiguity of the information. However, Map 12 mentions both city and state averages of 26 and 24 percent of age dependent populations without calling attention to either figure symbolically or graphically (see figure 1).



2010 population data compiled from U.S. Census American FactFinder website. For the City and County, the population under age 18 was 26% and 24%, respectively. Blocks include areas with a population density greater than 500 persons per square mile (SM).

Data Sources: Population Data, 2010 U.S. Census; Community Plan Areas, 2012 City of Los Angeles Department of City Planning; Metro Rail and Liner Routes and Stations, 2012 Metro; Metrolink Lines, 2008 Los Angeles County Urban Research; Metrolink Stations, 2012 Raimi + Associates; Proposed Metro Rail Routes and Stations, 2012 Raimi + Associates; Interstates and Highways, 2008 Tele Atlas North America, Inc.; World Terrain Base, 2009 ESRI.

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Figure 1

To make the information in the text correspond with the symbols and coloration on the map, using a bifurcating scale between 24 to 26 percent with two contrasting colors, would give the reader symbolic and graphic information that matched with the text. In this case, the two contrasting colors would let the reader know about what areas are below and above the city and state averages. While, also informing them of the areas with relatively low and high percentages of the population with age dependency. The reading of the current coloration only shows the gradual increases as they relate to the percentages of age dependency, and the increases are thus less impactful. Monmonier (1996) reinforces this notion by noting that some map readers “may

not easily and consistently distinguish colors or organize them into an ordered sequence” (p. 22). Monmonier (1996) continues by using evenly spaced shifts in tones, for example, white to light grey to black. Using these shifts in tones, or saturation, makes decoding the map easier as “darker means more and lighter means less” (Monmonier, 1996, p. 22).

Map 13 switches the emphasis of the coloration towards census blocks with percentages of populations over age 65. That is, it is a mirror image of the Map 12, where the younger are emphasized. Therefore, the map maker could combine both maps by using two colors with differing, equally spaced tones to show where more of each category (old and young) are present. They could also split the two colors by using a white tone that highlights the city average of the population over the age of 65 (10 percent), and the two contrasting colors with differing tones could illustrate the census blocks in the city that are above and below the average. Otherwise, the text information of the city average is lost within the map on the 10 to 15 percent scale. Also, using the same tone but differing colors does not help to emphasize certain areas over others without the use of the scales in the legend.

Map 18 uses the Hardship Index based on a scale from 0-100. The average is mentioned in the text here as well, yet, the areas that meet the average of 48 are not depicted on the map symbolically or graphically. The scale of the score 47.65 to 61.03 holds and hides the average of 48. Using the mapmaking and graphic design guidelines of Monmonier (1996) and Tufte (1999), Map 18 does not match the variance or structure of the data, nor does the map make the average percentage stand out. Neither does the map consider evenly spaced variation in color to match variation between low, middle, and high scored Community Plan Areas. The lack of variation of the map coloration makes it seem to the reader that there are only two colors, low and high. For the non-specialist, and some decision and policy makers, the map can serve as an impetus to

implement programs that may not be fit for some areas. For instance, Westlake is within the same color gradient as the areas of Watts, which is contradictory to the recent history of gentrification and investment of Westlake (Clifford, 2017), as well as community disinvestment and militarized police presence in Watts (Jennings n.d., 2018). That is, the map's lack of color variation, along with the indices of aggregation, makes it difficult to perceive the distinguishing of the histories of the area and the present-day issues.

Map 19's use of color variation is on the census tract level as opposed to the aggregated Community Plan Area. The same five color variations are used as in Map 18 to indicate high and low scores. For Map 19 the legend changes and details the relative high and low scores on the given scale. Map 18 only lists the scale, and the map user is left with ambiguous information. Still, the in the Health Atlas it mentions that the average of the Hardship Index is 40.6. Yet, no symbol or graphic of the average of 40.6 appears anywhere on legend nor does it appear as text on the legend. However, the legend is also very complicated as it includes the Hardship Index Score, the scores percentile, and the specified color gradients. Tufte (1999) and Monmonier (1996) note that in order to distinguish data, spatial or not, choosing the right colors that contrast each other is essential. That is, the color gradient allows for distinguishing characteristics and therefore using two contrasting colors, such as red and blue, that is bifurcated by white can serve to inform the reader of the areas with low scores, the average, and high scores. For Map 19, the discoloration used can confuse the reader of how to read the map and the information on the legend. Meaning, the discoloration bifurcates the other colors on the map, while the average (the numerical point of divergence) is lost somewhere between the light orange and semi-dark orange. This issue can also cause problems for decision and policy makers as they might

interpret the map as seeing discoloration as unaffected areas. Yet, an area's score may lie anywhere between 0 and 30.

Map 20 inverts the significance of the coloration gradient, that is, the darker colors are meant to represent low incomes. The map is then meant to highlight the prioritized low-income census tracts. The reasoning behind the design choice seems to come from an effort to combine both the city and state averages into a middle value and color gradient, along with an effort to highlight the areas that are above the self-sufficiency standard for a family of four. The legend details the median household income for the city of Los Angeles to be \$50,028, the State estimate to be \$61,632, and the self-sufficiency standard (developed by Center for Community Economic Development) to be \$70,247. The city and state median household income estimates are represented in the legend in the middle of the scale. The scales are not equally spaced by coloration as each scale increases its range of values by various factors. For example, the scale of \$22,113 to \$50,028 increase by a factor of about \$31,000, where \$50,028 to \$61,632 increases by a factor just above \$11,000. The different factors of the change give each scale a numerical weight that the color change does not represent. That is, the numerical change is not proportional to the color change.

Furthermore, the census tracts that are above the self-sufficiency standard are represented by the discolored, almost white orange. Utilizing two contrasting colors with the city and state average to split the brightness of the color on the map, the discolored proportion of the graphic and value could make this map highlight all three areas that are difficult to identify within the map's graphics: the average, areas with above the average, and the areas below. Also, as Orshansky (1965b) mentions, the thresholds can be ambiguous as some families or individuals would be more susceptible to poverty if they are only \$100 away for the federal poverty line. For

Map 20, one can consider the census tracts that are just above the self-sufficiency standard as okay when they are living just above the cutoff. However, how close is too close to the standard? Had the map accounted for a larger difference, say \$2,000 higher than the standard, the new estimate depicted by discolored orange would have given the areas the connotation of “sufficiently above the standard” rather than “just on the edge.” The grouping of census tracts that are just above the Federal Poverty Level of \$22,050 also presents the same problem. Lastly, the scale from \$50,028 to \$61,632 captures most of South and South East Los Angeles, where the map indicates that those census tracts are satisfactory. Meaning, the census tracts are just outside of poverty and approaching the state median household income estimate.

Map 22 inverts the significance of colorization of Map 20. That is, the census tracts with less unemployment are discolored and the census tracts with more unemployment are increasing saturations of orange. The map does not include the people who have stopped looking for work in its measurement, which may account for a low-percentage of workers considered unemployed. That is, the cut-off point that leads to the highest percentage of unemployed workers is 15 percent. The map also does not mention the average or state or national average to help the user gauge the map. However, the gradual increase in percentage by factors of 5 percent does match the readability of the increasing saturation of orange. What is interesting about this map is that there are areas within South and South East Los Angeles that have census tracts with coloration that is on the scale of “Less than 5 percent.” Meaning, that if one were to look at Map 20 and 22 combined, the image of the two areas of South Los Angeles would be that there are census tracts (in the solid boxes) with low- to very low-incomes but have low to very low unemployment (see figure 2).

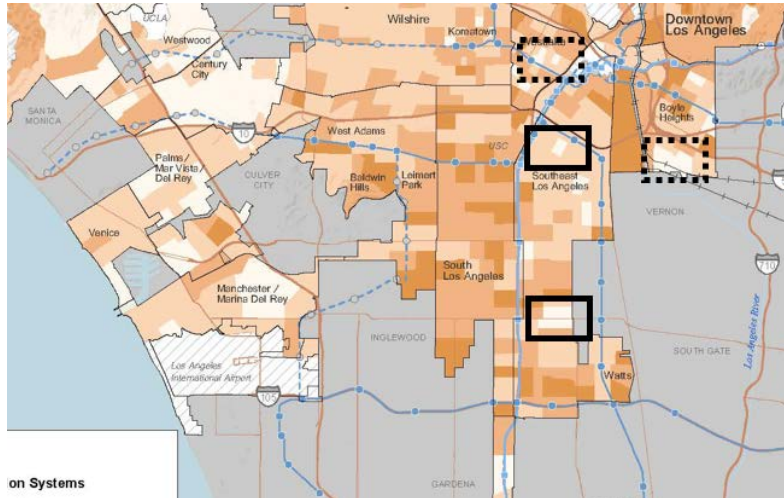


Figure 2

Therefore, a policy solely based on land-use reallocation, new transportation designations, and implementation of open spaces and walkable streets cannot address the issue of people working but still not earning enough household income to live above the poverty level. The same issue appears in the areas of Westlake and Boyle Heights (in the dotted boxes, see figure 2).

Map 23 increases the scale of coloration as the scale of percentages increases. The map uses the 40 percent of the population below the Federal Poverty Level measure, developed by Orshansky (1965b), to illustrate areas of importance. An interesting area is around the upper end of South Los Angeles. That is, these areas in upper Southeast Los Angeles detailed in Map 20 identify areas with median incomes between \$22,113 to \$50,028 and \$50,028 to \$61,632, which are above the Federal Poverty Level. Lastly, the Health Atlas mentions that the Federal Poverty Level is \$22,050, yet, the map notes that the Federal Poverty Level is \$22,113 (see figures 3 and 4). This discrepancy puts into question whether the data is guiding the analysis, or the analysis is guiding the data (overfitting).

Legend

Population Below the Poverty Level

- ☐ Less than 10%
- ☐ 10% to 20%
- ☐ 20% to 30%
- ☐ 30% to 40%
- ☐ Greater than 40%
- ☐ Population less than 500 per SM

Jurisdictional Boundaries

- ☐ Community Plan Areas

Transportation Systems

- Metro Rail Stations
- Metro Liner Stations
- Metrolink Stations
- Proposed Metro Rail Stations
- ~ Metro Rail Lines
- ~ Metro Liner Lines
- ~ Metrolink Rail Lines
- ~ Proposed Metro Rail Projects
- ~ Interstates and Highways
- ~ State Highways

2010 poverty data compiled from the U.S. Census American FactFinder website. For a family of four, the Federal Poverty Level was \$22,113. Extreme poverty neighborhoods are defined as those Census tracts with 40% or more living in poverty, per the Brookings Institute "The Re-Emergence of Concentrated Poverty" paper. Tracts include areas with a population density greater than 500 persons per square mile (SM).

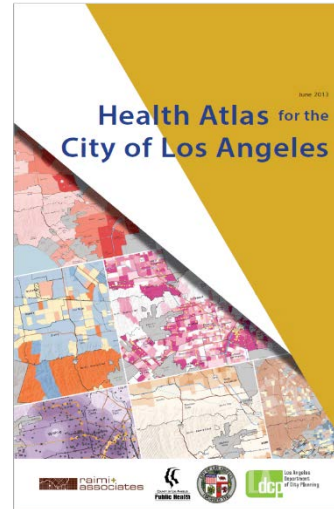
Data Sources: Poverty Data, 2010 U.S. Census; Community Plan Areas, 2012 City of Los Angeles Department of City Planning; Metro Rail and Liner Routes and Stations, 2012 Metro; Metrolink Lines, 2006 Los Angeles County Urban Research; Metrolink Stations, 2012 Raimi + Associates; Proposed Metro Rail Routes and Stations, 2012 Raimi + Associates; Interstates and Highways, 2008 Tele Atlas North America, Inc.; World Terrain Base, 2009 ESRI.

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Figure 3



The FPL for a family of four was \$22,050 in 2010.

Figure 4: Page 27

Map 24 mentions that the Federal Poverty Level is \$22,113, however, the (Los Angeles Department of City Planning and Raimi + Associates 2013) references the Federal Poverty Level as \$22,050. The 200 percent increase on the map reflects the \$22,113 measure (\$44,226), where the *Health Atlas* reflects the \$22,050 measure (\$44,100). Again, the discrepancies in measure can allow some census tracts to be just within or outside of the threshold. As for the 200 percent measure, the map shows that South and South East Los Angeles have census tracts with 50 percent to 65 percent of their populations living below the \$44,226 threshold. An issue would lie in the mismatch of census tracts with median household incomes between \$50,028 to \$61,632 on Map 20 and the same census tracts where 50 to 65 percent of its population are estimated to be

living below \$44,226. Such is the case of upper South East Los Angeles, calling into question the definition of poverty as it has been mismatched through estimation (\$44,100 in the *Health Atlas* and \$44,226 in the map) and range (\$50,028 to \$61, 632).

Map 25 uses the 40 percent measure to distinguish between areas of extreme poverty and those without. The Federal Poverty Level used in the map is also \$22,113, although, the level detailed in the plan is \$22,050. The map illustrates the upper South East of Los Angeles as having several census tracts with 40 percent of their population living below the Federal Poverty Level. However, if compared to Map 22, the same area has census tracts with unemployment rates of less than 5 percent to 10 percent. This mismatch of a reading of poverty in the areas occurs because of the unemployment measurement not counting the people who have stopped looking for work. That is, those who have been out of work for so long and have given up, because of the stigma and psychological toll of looking for work for a long-period of time, are simply not counted in the workforce estimates (Konieczka, 2015). For the mapmaker in this instance, the data has defined the issue before they were able to map it. That is, the data has chosen who to count as unemployed and thus it would be conflicting with other maps and measures that consider other factors such as income or the poverty rate. This further makes vague what an actionable target area would be as some measures highlight advantages as relative high employment and incomes. While, other measures show disadvantages like high poverty rates for the same area.

For Map 30, the data is representing the percentage of the population that is aged 25 and over, without a high school degree, and have incomes below the Federal Poverty Level for a family of four (\$22,050) in 2010. The data is three dimensional, as it tries to capture a group of people within three criteria, which would indicate a small percentage of the population as the

groups would continue to be mutually exclusive and collectively exhaustive. Meaning, that the more characteristics one finds in a group, the smaller the group will become. The map itself accounts for 4 ranges: Less than 5 percent, 5 to 10 percent, 10, to 15 percent, and over 15 percent. The Health Atlas documentation does not specify the average or highest percentages in Los Angeles or the state. However, the map does have the city average poverty rate for the population age 25 and over without a high school degree, 27 percent; while, the state average was 23 percent. As far as design, the map coloration does account for the gradual increase of percentage by 5 percent. Yet, no indication is given as which Federal Poverty Level Estimate was used in Map 30, that is, \$22,050 or \$22,113. This map has well-ranged estimates but ambiguous basis of poverty rates.

Map 103 shows the percentage of housing units with more than one person per room. The highest-level percentage is not mentioned in the Health Atlas nor in the map. Although, a cutoff point is made at the 25 percent level, where percentages above 25 percent are aggregated to indicate the same level of overcrowding. The areas of South and Southeast Los Angeles have census tracts that mostly fall between the 5 to 10 percent scale and the 10 to 25 percent scale. The increase in scale do not follow a gradual order, that is, the first scale to second scale increases 2.5 percent, second to third scale increases by 5 percent, the third to fourth scale increases by 15 percent, while the last scale aggregates percentage values greater than 25 percent. This makes reading the map difficult as the gradual color increases do not follow the same pattern as the increases of the data.

Map 105 does clarify that most people in Los Angeles (53 percent) pay 30 percent of monthly income on housing costs in the legend. However, that 53 percent is lost in the scaling of the percentages. That is, the percentage is lost between the second (47 to 53.7 percent) and third

scale (53.7 to 60.5 percent). Meaning, that the map distinguishes between the population that pays more than 30 percent on housing costs in text, yet, the graphics on the map do not. The map could serve to reinforce or show which census tracts are above or below the city threshold. Which appears to be an effort as the 53.7 percent is chosen to bifurcate the second and third scales, however, the map and ranges fail to account for the average value. As discussed for Map 19, to make the distinction clearer for the reader using two contrasting colors (say yellow and purple with white in the middle) to indicate the average, which would be the value of 53 percent. However, the map shows that forgoing such design choices, leads the map user to view the map as census tracts with increasing weight through color saturation, rather than a map informing about the difference in census tracts above and below the city average.

Map 114 changes the color scheme from that of white to dark orange to that of yellow to orange to brown. This seems to borrow from Monmonier (1996), where he makes the case of using such colors to differentiate from various randomly assorted polygons. However, the map is not clear of what its intended purpose is in relation to the data. Especially, given a potential map reader's confusion of whether dark orange (which is brighter) is supposed to communicate a larger value than dark brown (which is darker). Without the legend, the coloration does not help to distinguish among the values. Again, an arbitrary scaling factor appears in the legend where the increases in value do not match the increases in coloration or intensity.

Map 115 does make this distinction to inform the reader of the census tracts in the top quintile. The map also uses varying saturation to indicate variation within the top quintile census tracts. However, the amount of scales included in the variation obfuscates the variability of the top quintile census tracts. Furthermore, Monmonier (1996) and Tufte (1999) recommend using about 5 to 6 scales of color variation so that the magnitude of change of values is reflected in the

magnitude of change in color. Map 115 uses a total of 8 scales of color, along with changes in percentage that increases by about 1 to 2.2 to 3.3 basis points. Such irregular order and small changes in the percentages make Map 115 no more different than Map 114, to the point they are essentially the same map. Looking at the areas of South and Southeast Los Angeles exemplifies that argument that both Map 114 and 115 only distinguish between areas with high vulnerabilities, and those without.

Overall, Map ES.1 of the Housing element does serve to make a distinction between the two types of access. However, as indicated by Tufte (1999), if the text makes a distinction then the map should reflect that distinction. A gradual increase in the saturation can denote the level of access not just the distinction made between rail and bus stops. Therefore, using two opposing colors can help to avoid confusion by the readers of the map.

Map 1.1 is straight forward and uses a bright pinkish red to highlight the low-income areas. The mapmaker also used cross hatching to show the underlying census blocks. They take the advice of Tufte (1999) and Monmonier (1996) by explaining thoroughly what the polygons in the map represent as well as what it means to be a low-moderate income area.

Map 1.2 informs readers about the new permits from construction. Interestingly, from the July 27, 2013 public hearing audio, this map on housing and previous literature on the types of income were the topic of conversation. That is, the public hearing audio featured several residents that noted affordability as the main issue of housing and homelessness. One resident mentioned that in her area new development of affordable housing is aimed at people making \$30,000 a year, 50 percent of the area median income. This is despite, she mentions, that her local Area Median Income being around \$19,000. She continues that the new housing and affordability measures are not catered for current residents, specifically the middle class and

poor, and mentions that “Los Angeles is not just for the wealthy” (Los Angeles Department of city Planning n.d.). Another resident noted how sustainable practices and design should also be give more designation by the city rather the fast, profit driven development (Los Angeles Department of city Planning n.d.).

Map 1.2 (Low-Rated Areas) shows range and scale of housing code violations by census block in Los Angeles. Interestingly, when comparing Map 1.2 (Low-Rated Areas) and Map 1.2 (Permits for New Construction) with Map 115 (Community Health and Equity Index – Areas in Top Quintile) in the Health Atlas, most new permits have been approved just outside of the most impoverished areas in the city: South and Southeast Los Angeles. That is, most approved housing is focused in the downtown center of the city. From the July 27, 2013 audio a resident mentions that the population she belongs to, that of the elderly and disabled, has seen her costs of living and city expenditures rise (Los Angeles Department of city Planning n.d.). She asks what the city is doing to protect the population through either housing or services. It would appear, through the public hearing audio, that this map served its purpose of communicating where the concentration of new housing was to be prioritized.

Map 1.4 serves to highlight the areas with at-risk housing units, and the design is simplistic. The use of red dots is used to highlight points of interest, as well as giving the effect of clustering. Considering Map 115 (Community Health and Equity Index – Areas in the Top Quintile), the areas with a concentration in at-risk housing units fall within the top quintile of impoverished areas as well.

Map 3.1 is straight forward, in that it highlights the areas with at-risk housing units. Although, the design for this map is erratic as the use of yellow dots illustrate specific target areas. Also, they grow to indicate larger quantities of new housing development, and they

simultaneously indicate the relative position to points of transit. The clustering effect of the yellow dots does show the reader what areas will be experiencing the most housing development, but this completely takes over the underlying layer of transportation location. Utilizing transparent dots would leave the transportation information intact within the map, and the two contrasting colors of yellow and blue would draw the reader in to explore the document. In addition, the focus of development is set in the center of downtown Los Angeles. Although, there is the presence of new housing development clusters detailed in Watts, parts of Westlake, and Boyle Heights as well.

In sum, the maps all held some form of distortion either in terms of text, numeric values, or graphics. The guideline evaluations at the beginning of the section serve to highlight those distortions in relation to established best practice for data visualization and cartography. It is important to note that Monmonier (1996) and Tufte (1999) make the case that such distortions are not a matter of malice but perhaps a condition of a naiveite in both graphic design and cartography guidelines. However, as well established as those guidelines may be the interviews help to consider the quality and structure of data playing a part in the distortions as well.

The interviews were profound in that they highlight both strengths and weakness that planners face when defining and operationalizing poverty. For instance, Interview Subject 1 noted that data collection funding and strategies were needed to properly define and assess poverty within cities. They equated current poverty estimations with “statistical manipulation.” Interview Subject 2 talked about maps as propositions, in that maps themselves where a visual language asking different questions each time one is made. They helped to reinforce the work of Monmonier (1996), Tufte (1999), and Dodge et al. (2009) concerning the relation of graphics

and semiotics. Interview Subject 2 also mentioned the need for open-source software for public engagement but recognized the limitations in terms of steep learning curves and dependency on other private software. Interview Subject 3 mentioned briefly the issues of standardization of practices in certain city departments not allowing revivability of methods. Such findings, of all three subjects, showed a will by practitioners to question current planning practices. However, the city department for want of developing a “best practice” results in a stifling in experimentation with design and data. Funding is also an issue, where practitioners want to study certain populations as they relate to social outcomes. However, those studies are often halted by unsecured funding sources, and therefore terms like poverty, groups that live within its constructs, and the tools meant to communicate their confluence are left unclear and widespread.

The Housing Element presentations shows difference in the definition of poverty in presentations from that of the poverty in the Health Atlas, Housing Element, and Mobility Plan; that is, poverty as a characteristic of groups. That is, the presentations solidly define the groups of within poverty while the maps rely on the ambiguous and subjective terms like “age dependency”, “below Federal Poverty Level”, and “At-Risk Housing.” Moreover, the presentations all layout the goals and objectives. However, the July 27th, 2012 public hearing audio reflected the communities reading of the maps as city driven proliferation of luxury housing. This means that the elements in the general plan failed to communicate its definition of poverty as it relates to housing initiatives through programs for “special needs” groups, areas of concentrated poverty, and the like. Perhaps, the poverty maps themselves failed to inform readers about the impact on city policy in poverty reduction policies. Maybe, it was a combination of the two. This miscommunication about the information in the report and in the maps to the public

serves as a planning practice example of the vagueness of poverty, its implementation as a part of a map, and how it relates to the map users themselves.

Summary of Data Used: Data and Maps

Types of Data	Percent
Percentages	60%
Logical	20%
Interval	20%

Table 3

Types of Maps	Percentage
Topographical	10%
Choropleth	75%
Dot Density	15%

Table 4

The investigation shows that 60 percent of the data, or 12 maps out of 20 maps, use information about percentages. 75 percent of the maps, or 15 out of 20 maps, are choropleth maps. This is despite the research in the literature review showing that choropleth maps are the least reliable form of maps.

The summary data and categorical findings proved to be useful in contextualizing where the guidelines met the practice of map making. Having this information allowed the researcher to further interpret the interviews, content of the documents, and the how the maps worked as visual language devices. For instance, 75 percent of the maps studied were choropleth maps. Interestingly, according to Dodge et al. (2009), 60 percent of all maps published in leading health journals between 2000 and 2004 were choropleth maps, “despite their limitations for analysis of health distributions.” There for it is not surprising to see that the Health element utilized a health analysis comprised mostly, 75 percent, of choropleth maps with respect to both health and poverty.

As far as the evaluation of the maps based on Monmonier’s guidelines, the percentage of total matches was 41.7 percent, or 10 out 24. This wasn’t as unexpected as the results of the interviews reflected the literature, that is, they both showed the growing necessity of graphic

design skills as they relate to data and map making. The issues raised by Monmonier (1996) on cartographic design was exemplified by the fact that the most matches was Single Sequence, Single-Hue Scale (SS, SHS). Yet, it only accounted for 76.9 percent, or 10 out of 13, matches. That is, most of the maps relied on a single approach to displaying information where only 10 were properly matched.

The evaluation of the maps based on Tufte's guidelines was just as fruitful. Such that, the percentage of total matches was 52.4 percent, or 33 out 63. This result was expected given the initial review of the maps and their numeric growth inconsistencies, as well as text and graphic uniformity. Meaning that an average or other numeric descriptor was mentioned in the legend or ambiguously part of the scale, yet, not shown explicitly on the map. The category with the most matches was Explanation of Data, accounting for 95 percent, or 19 out of 20, matches. This was the least surprising, as the text was rich in detail. However, the maps were missing some of the detail mentioned in the legend or in the reports themselves. The category with the second most matches was Numeric and Graphic Proportionality with 44.4 percent or 8 out of 18 matches. As noted in the map section of the discussion, the researcher pointed out the issues with several maps having their ranges grow asymmetrically to the illustrated color variation. Case in point, only 8 matched with Tufte's guidelines.

Chapter 3

Discussion

Using Los Angeles city planning documents as a contemporary example, poverty continues to be fuzzily defined and operationalized. The use of perceived value-neutral and bias-free tools like GIS can make the definitions and operationalization of poverty seem more concrete. Although, in actuality graphic design and cartographic guidelines show that images and GIS can reflect the fuzziness inherent in the definitions and data used to make products like maps. The public hearing audio suggests that the experiences of those that are living within the bounds of poverty in Los Angeles are not currently represented in either the figures used in the planning documents or the definitions or data in the maps. Therefore, the planning documents can offer a skewed meaning of poverty in a fast-changing economy. As for the maps, the use of the choropleth maps reflects either a naivety of best practice for mapmaking, as 75 percent of the maps that described poverty were choropleth maps. This is despite literature that is critical of choropleth maps as decision making tools on account of their issues with accuracy. Such criticism is mentioned within the literature review through the work of Monmonier (1996) and Dodge et al. (2009). However, there is also literature that should be consulted that was out of the scope of the study. For instance, *Thinking about maps* by Rob Kitchin, Chris Perkins, and Martin Dodge (2009), as well as *Rethinking maps and identity: choropleth, clines, and biopolitics* by Jeremy Crampton (2009) show how maps have been used for authoritative and creative purposes, used as languages or propositions of certain arguments about power structures in society, or (in the case of the choropleth map) used for socio-political segregation (Dodge et al., 2009). Unfortunately, best practices have not yet addressed the issues present in the definitions of poverty or within the tools that represent those definitions through images. However, there is

some literature that can serve as a guide toward a new best practice when concerning fuzzy issues like that of poverty.

As discussed in the literature review, Monmonier (1996) and Tufte (1999) are just two examples that can show that the fuzziness of definitions transfers to other products, however concrete they may seem. Also, that fuzziness is operationalizable by using guidelines that identify the gaps between text and image, as well as the gaps between colorization and logic. Nonetheless, the use of maps (within the planning context) was intended to identify target locations for services and facilities for various groups within a population. Subsequently, a lack of best practices that rely on contemporary graphic design and cartographic guidelines has led to products that highlight both the fuzziness of the definitions and the fuzziness of their communication as products of knowledge. The implications for communities is that planning departments are under- or over-estimating areas that are experiencing poverty, attributing negative traits to groups that are not representative of those groups, and allocating programs, services, and facilities that are not useful for certain communities.

Implementing target areas is the last part of the planning process, yet it is dependent upon the structures of the initial analysis: the who and the what of the targets. The interview portion of the study suggests that more funding and better data quality will lead to better targeting of areas and groups within poverty. However, the study shows that funding and data quality are only a part of the improvement of addressing poverty. That is, asking the right questions about the systemic issues of the socio-economic composition within cities is vital to forming a more accurate representation of poverty. In fact, the definitions can frame the results of the analysis. For example, the Housing element considers some “special needs” groups that imply groups within poverty. However, those groups are left out of the Health and Mobility element.

Thereafter, the elements use of figures and maps to quantify and spatialize those groups do not corroborate with each other. As poverty is explicitly defined differently or implicitly attributed to groups, the targeting of those impoverished groups remains fuzzy; just as the figures and definitions themselves.

The role of the planner in this context is utilize the historic definitions and operationalization methods as a grounding to improve contemporary approaches for measuring and identifying poverty. In that endeavor, the planner can also use established graphic design and cartographic guidelines to find the biases or imperfect data to advance a nuanced representation of poverty within cities. In addition, the cartographic guidelines allow the planner to find and experiment with maps that better serve the fuzzy logic and spatiality of the socio-political economy.

Conclusion: Planning Implications

The documents, map, and interview sections indicate that poverty exists as a fuzzy term. The definitions and measurements used within planning reports and products do not help communities see themselves or their experiences in those studies. What follows are some planning implications that will help to clarify the fuzziness of poverty, which in turn can lead to more accurate map making practices and representation of on-the-ground situations. The implications will help to answer the subsequent research questions as they relate to the planning practice: How can the definitions of poverty be improved? How can the definitions influence the measurements? Can the measurements be less fuzzy? How can poverty maps be more representative of on-the-ground situations? What tools are available for the planner to use and test the fuzziness of poverty maps?

Firstly, defining poverty must involve in-situ interviews and research about those we consider to be impoverished. That is, planners must recognize the hierarchical structures within the socio-economic system that influence the fuzzy vertical structures of poverty; as evidenced by the work of Sessoms and Wolch (2008), and more recent research such as Peterson-Besse et al. (2014) and Alencar Albuquerque et al. (2016). Furthermore, recognizing the biases in previous definitions of poverty can drive better research by helping to eliminate archaic terminology and views of impoverished groups. In addition, identifying biases of past definitions can help planners to detect biases held by contemporary definitions. In a broad picture, planners can help to construct a historical account of definitions of poverty from which to compare to present-day definitions. This knowledge building approach will in turn help the definitions and the fuzziness of poverty to evolve over time, as Orshansky (1963, 1965a; 1965b) had done throughout her work in terms of measurements.

Secondly, universalizing a measure that considers changes in poverty within cities, states, and the country through time will help provide measurements as they change with the economy. Together with better definitions of poverty, the measurements can build better estimations as they both evolve in unison; later affecting the graphic design and cartographic practice. Therefore, a feedback loop can incur, where the definitions will check the measurements, and vice-versa. Further, having a grasp on the limitations of numerical operationalization can also help planners to lower the deceptiveness and counter-inductive results, as mentioned by Robinson (1950). Likewise, understanding the differences between individual and ecological correlations can help to clear the fuzziness of poverty as they are attributed to indivisible statistical objects of individuals and group statistical objects within areas. As mentioned by Seife (2010), some red flags can appear when numbers come from unclear definitions as well as using

the “proofiness” of numerical operationalization as a defense of a hypothesis rather than as evidence for an event under study (p. 12). That is, “failure to recognize the inherent limitations of a measurement can be extremely dangerous, because it can potentially create an authentic-sounding number that is in fact far removed from the realm of truth” (Seife, 2010, p. 26). Therefore, through the careful analysis of both the definitions and measurements we engender a new conceptualization of poverty that can lead toward a best practice of measure, not just relying on the descriptions and outputs.

Thirdly, the outputs from maps can also be analyzed and not just taken *prima facie*, as mentioned by Dodge et al. (2009). That is, looking at maps as a proposition can help planners to recognize true and false maps of poverty. Moreover, the use of certain maps for statistical knowledge building and decision making can be ruled out, such as the choropleth map. Such that, the choropleth map is particularly susceptible to the ecological fallacy and modifiable areal unit problem which makes it “a weak form of spatial analysis” (Dodge et al., 2009, p. 29).

Lastly, combining the graphic design and cartographic guidelines through a quantifiable method, such as in this study through comparison matrices, can help to both identify the areas where maps lack clarity as well as noting which maps are the least useable. There are other guidelines established by other authors that can be incorporated into the analysis. However, having a core ground in both fields of communicative design can help to develop a best practice for the production of poverty maps by planners. Such analytical tools can help the planner to identify the areas where communication about poverty is fuzzy, but it is important to take such tools as benchmarks toward a best practice. That is, the planner must analyze the imperfect maps as well as the more accurate maps asking questions to map makers and users about what the maps say about things like poverty. This adds a third layer to the feedback loop previously

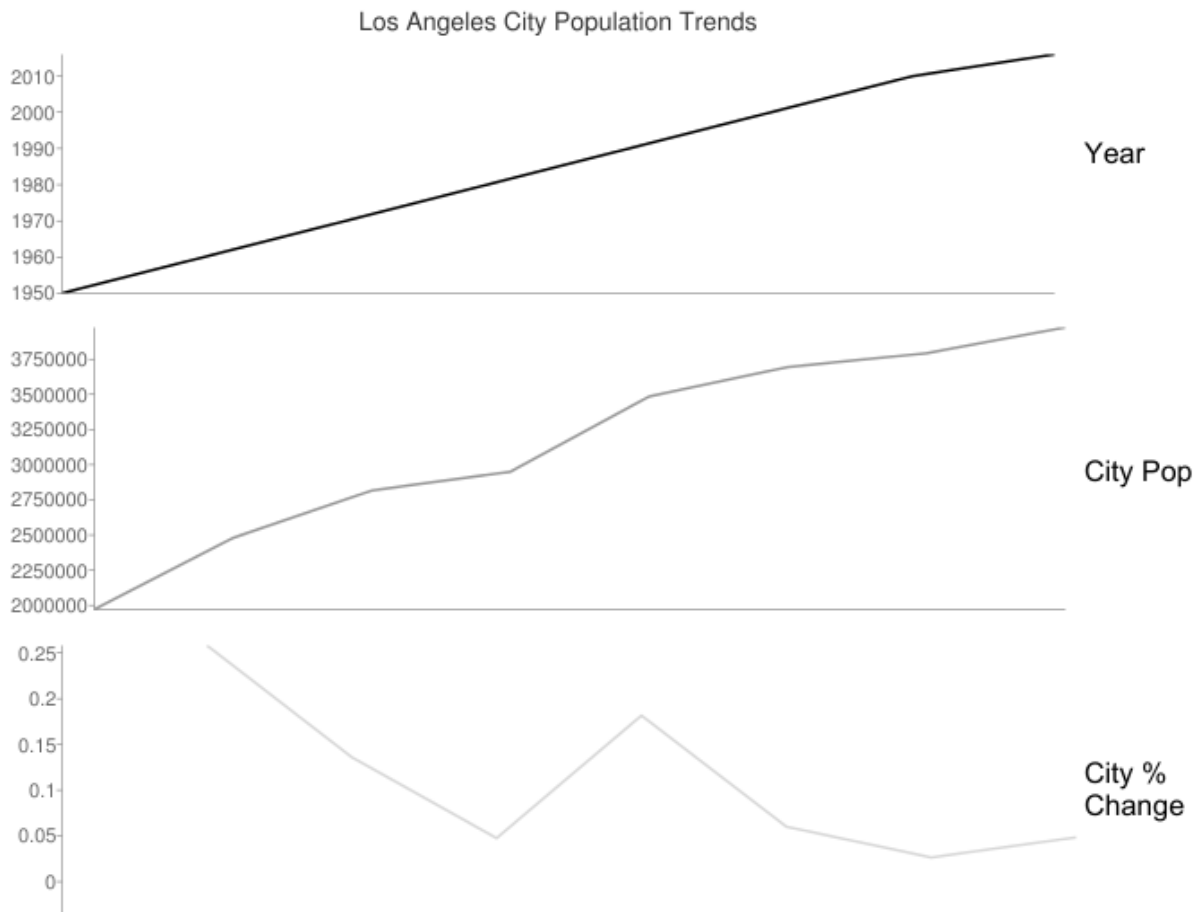
mentioned, that is the definitions influence the framework of the measurements of poverty. Additionally, maps would influence the definitions and the measurements. In this loop the planner can assess which definitions are clear and within the purview of maps. As well as, which measurements are appropriate for particular maps, and what limitations both methods encounter when used as decision making and communication tools.

This research uses the case study of Los Angeles to understand whether definitions of poverty have changed, the measurements of poverty have improved, and how the graphic design and cartographic guidelines are used to communicate to communities through explicit and implicit poverty maps. The study shows that although the technologies used to analyze poverty have evolved in the planning field, the conceptualization and operationalization have yet to change. New and modifiable knowledge building tools must become available to the planner to better study and describe poverty. This means that the community-based planner and economic development planner must embrace the historic, graphic design, and cartographic side of planning. However, it does not mean that the planner must create a new branch of planning practice, it requires a critical synthesis of the tools that are already available to the planner. Nonetheless, this is only the first step in addressing the fuzziness of poverty within contemporary planning practices that would lead to better decision making and communication tools.

Appendix

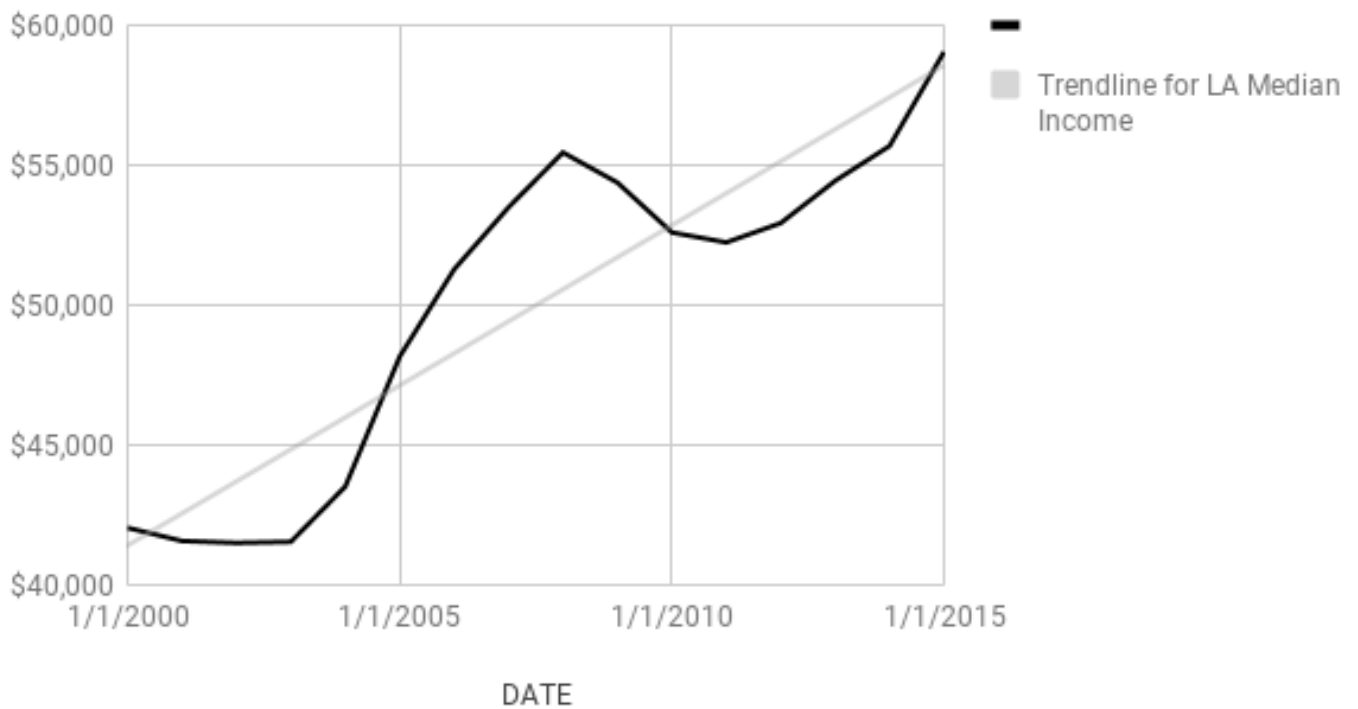
Interview Questions

1. Who are poverty maps produced for, decision-makers or communities within the boundaries of a concentrated poverty area?
2. Why is it important to consider poverty maps for community stakeholders?
3. How can poverty maps be improved?
4. Are there any new methodologies that you are aware of that you are wanting to implement?
5. What is the biggest obstacle in providing improvements?
6. On issues of planning for a city, where would you rank poverty from 1 to 5



Graph 5 | Source: U.S. Census Bureau
(Decennial Census: 2000 to 2010, ACS 5-year: 2016)

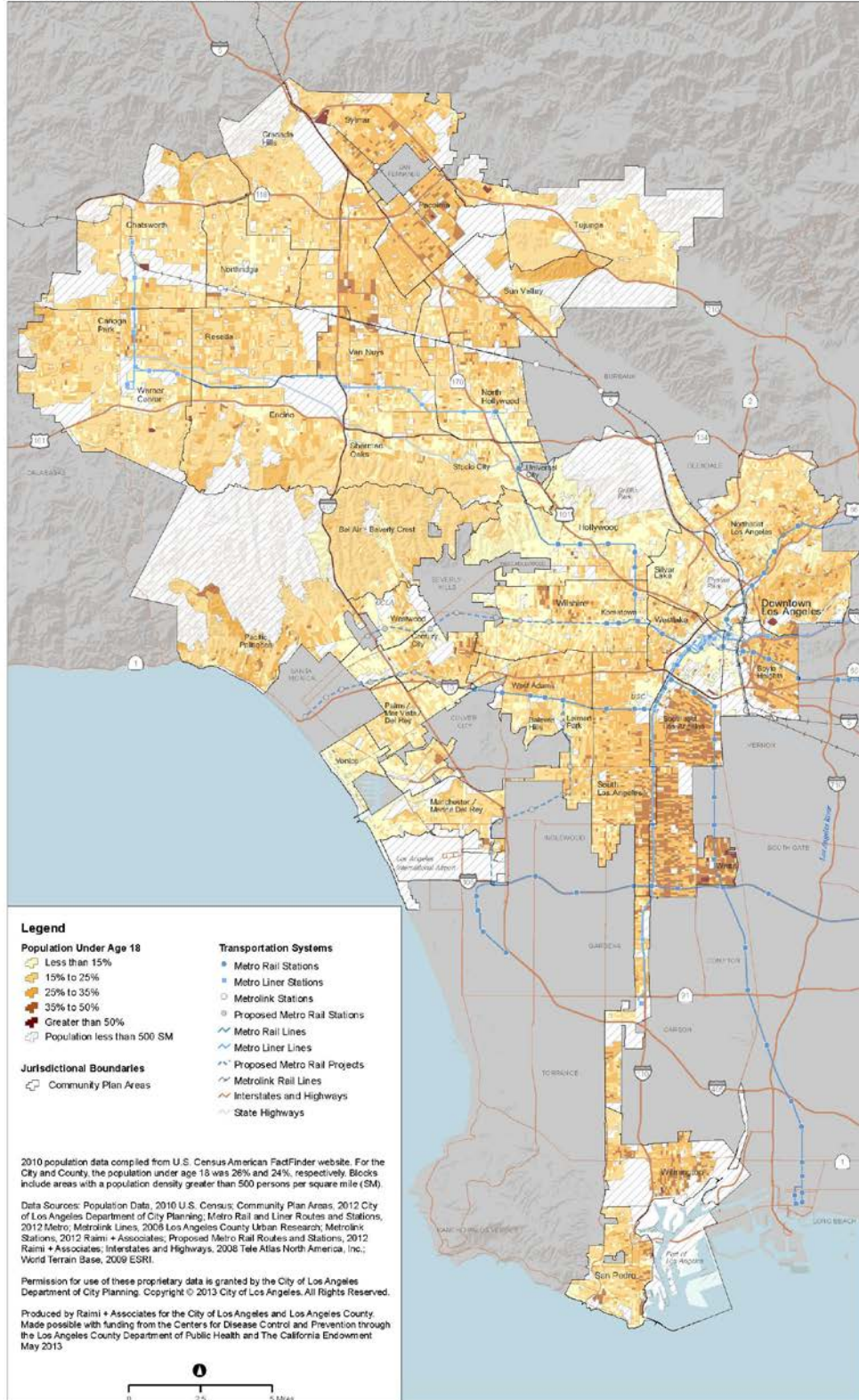
Median Household Income for Los Angeles County



Graph 6 | Source: U.S. Census Bureau
(ACS 5-year: 2000 to 2016)

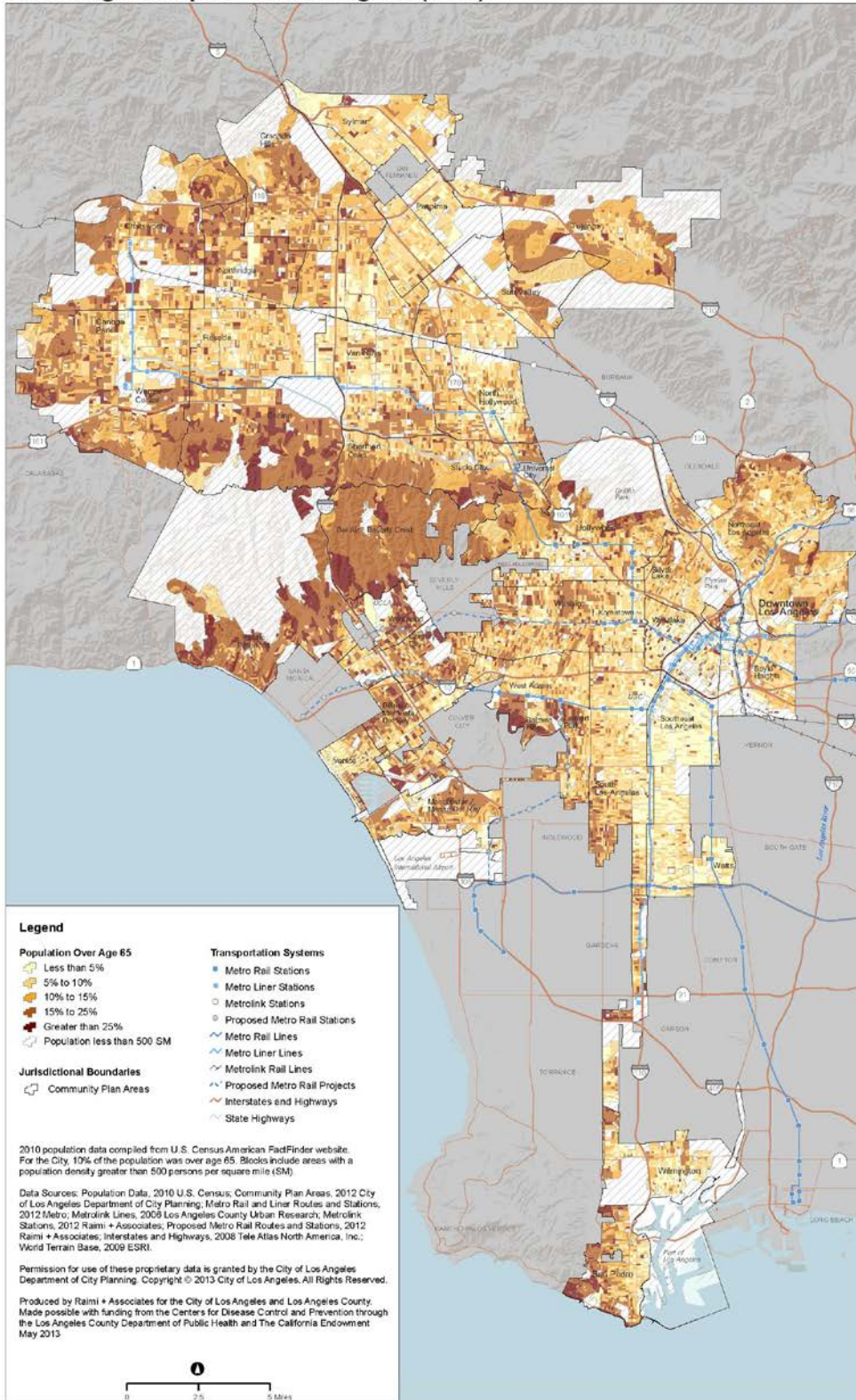
Maps: Health Atlas and Health Element of the General Plan (located below)

Map 12
Percentage of Population Under Age 18 (2010)

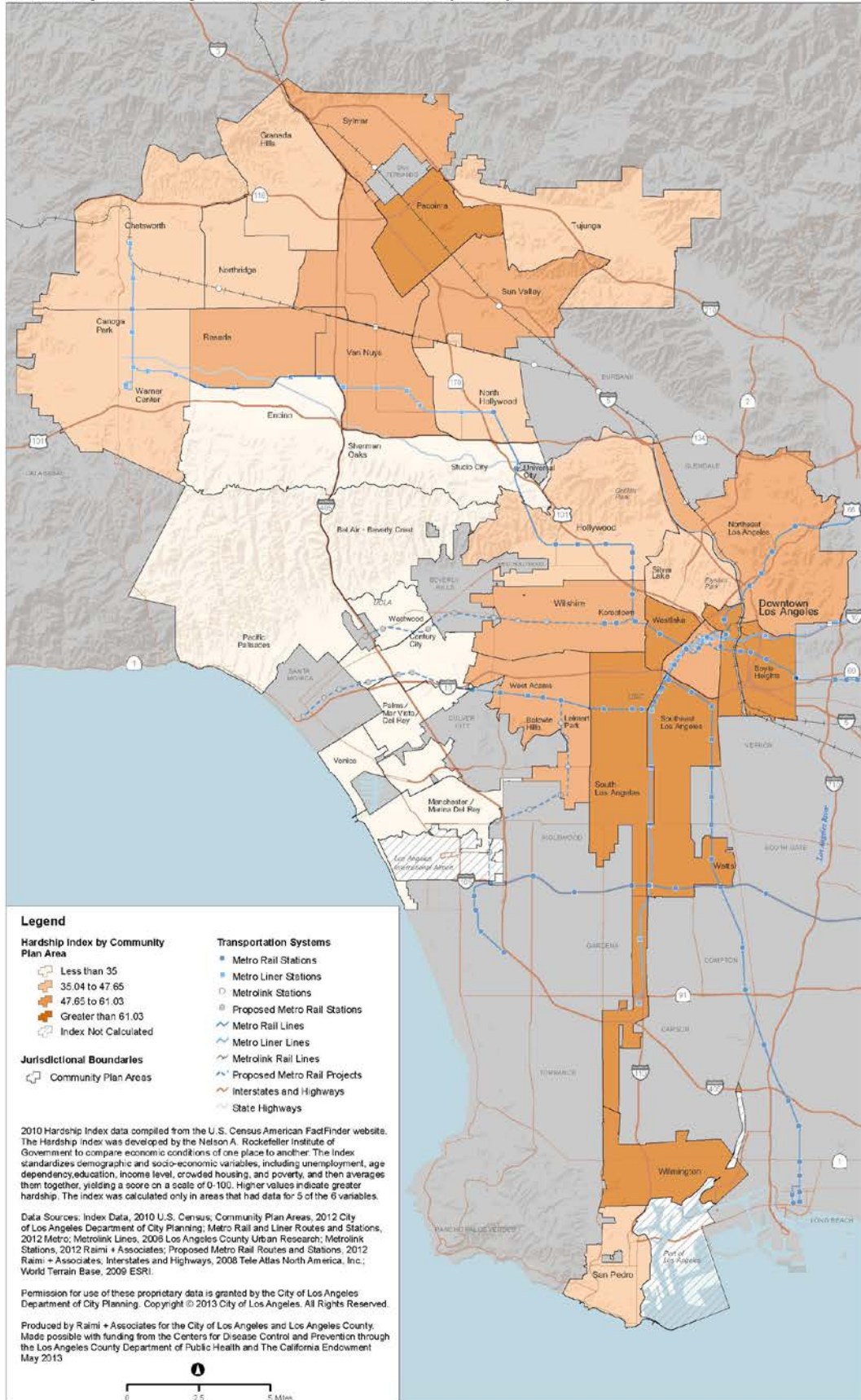


Map 13

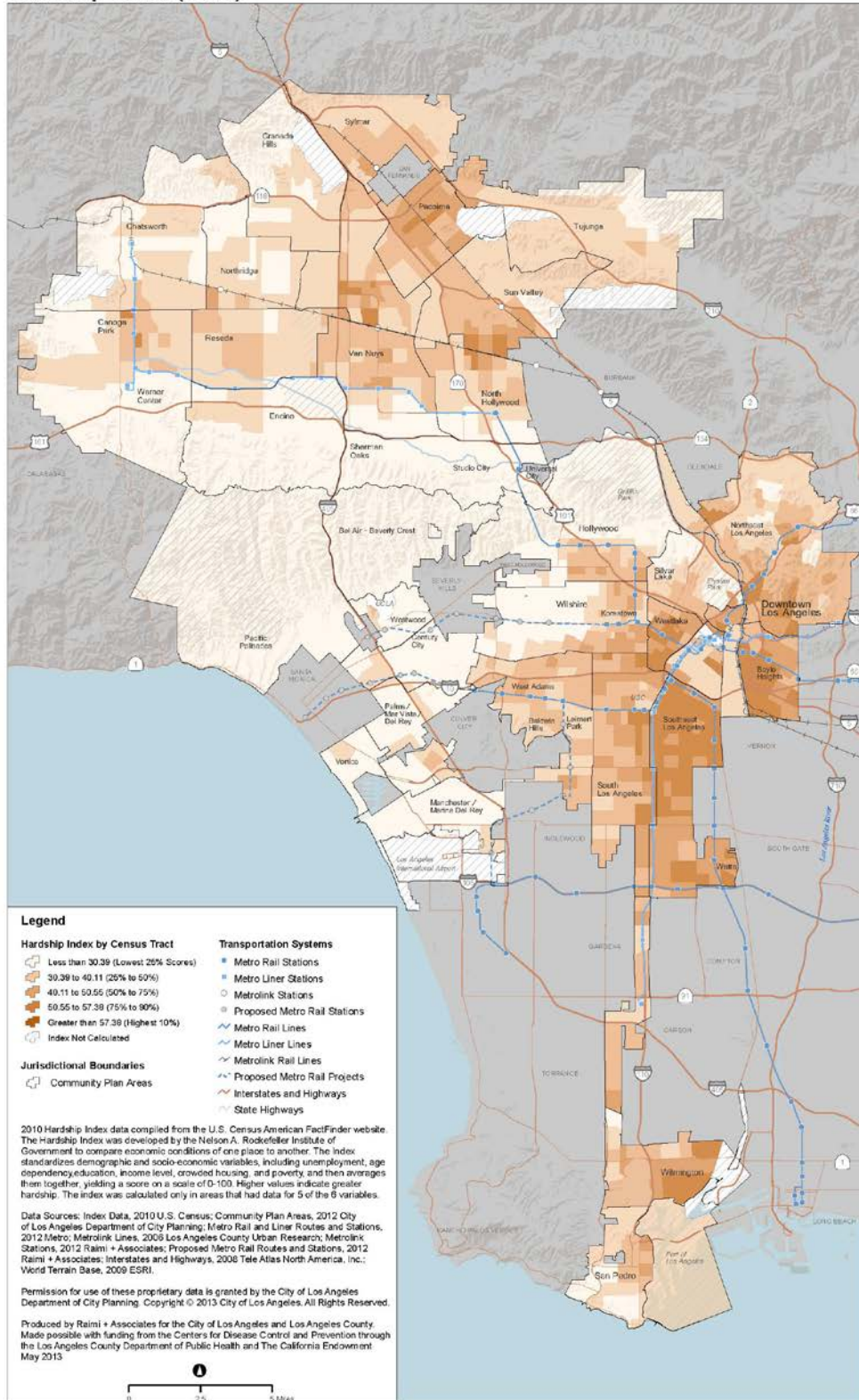
Percentage of Population Over Age 65 (2010)



Map 18
Hardship Index by Community Plan Area (2010)

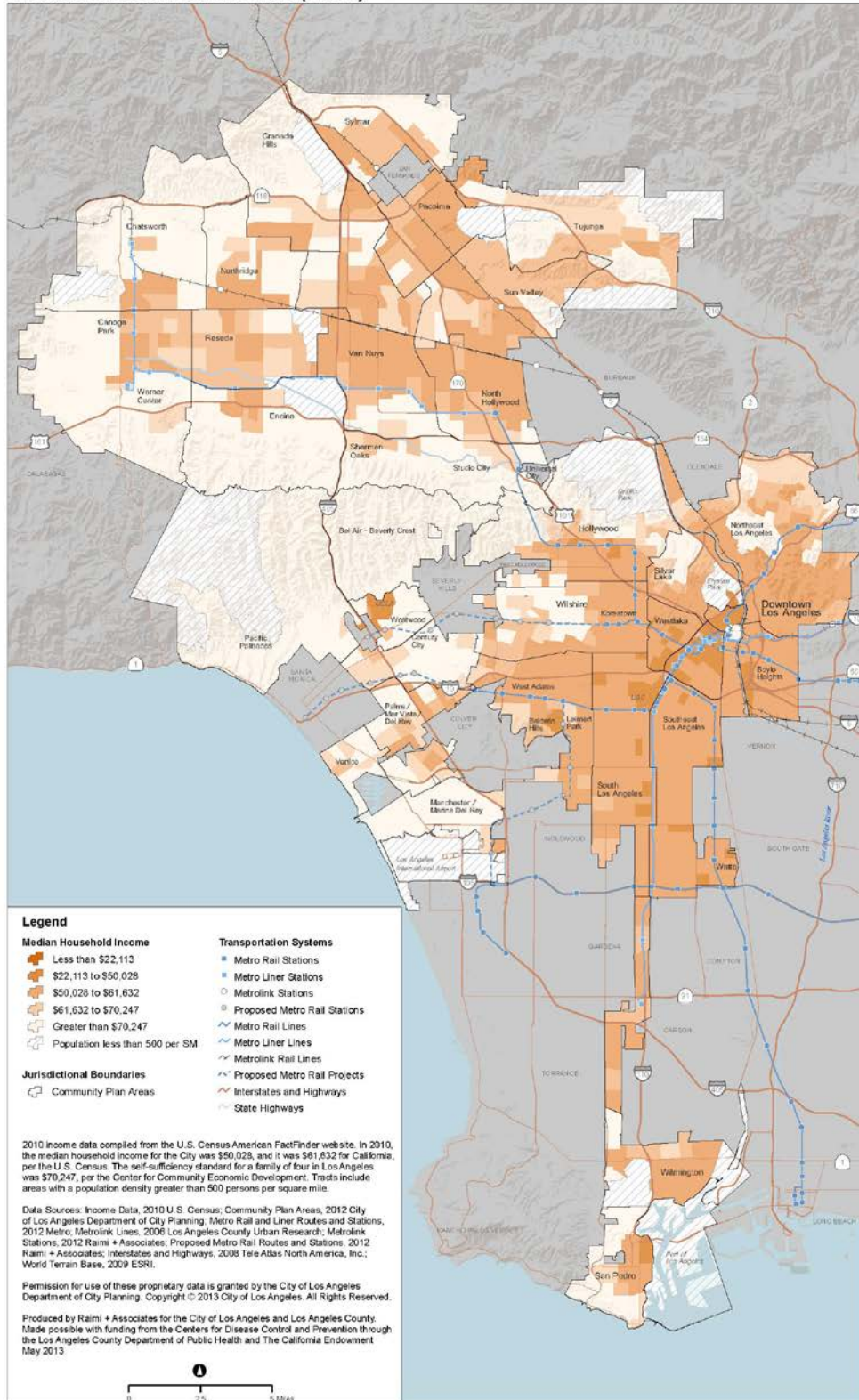


Map 19
Hardship Index (2010)



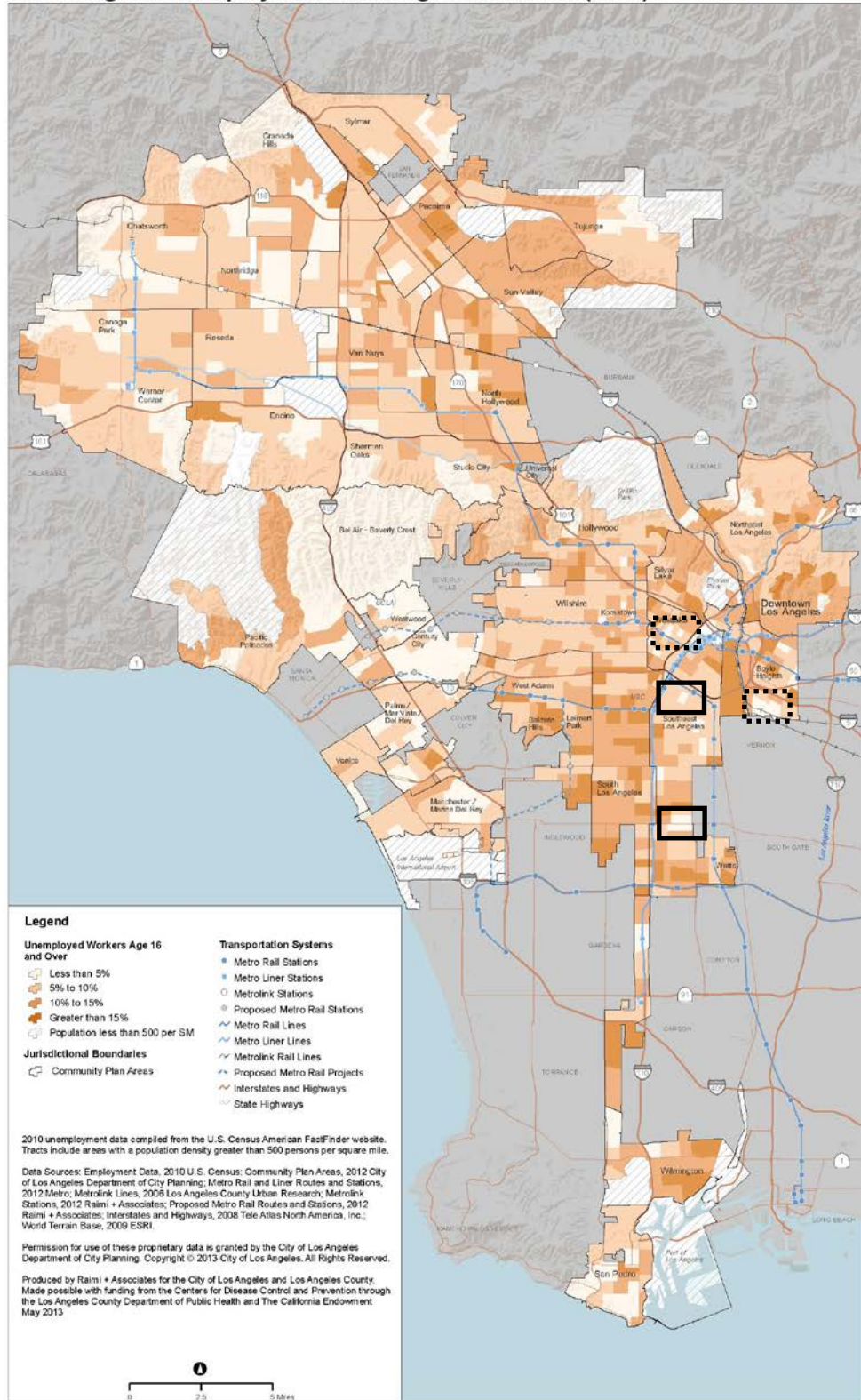
Map 20

Median Household Income (2010)



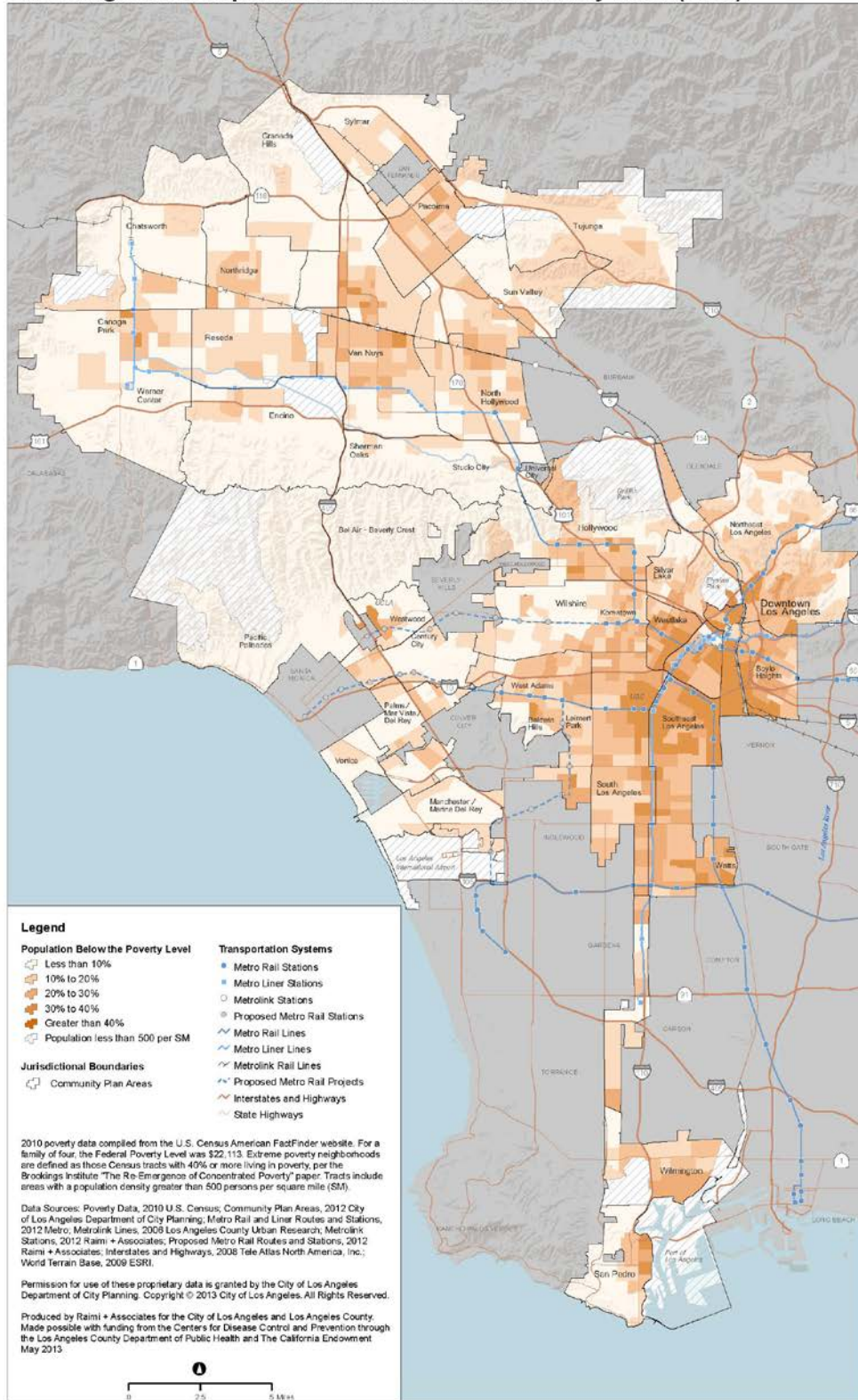
Map 22

Percentage of Unemployed Workers Age 16 and Over (2010)



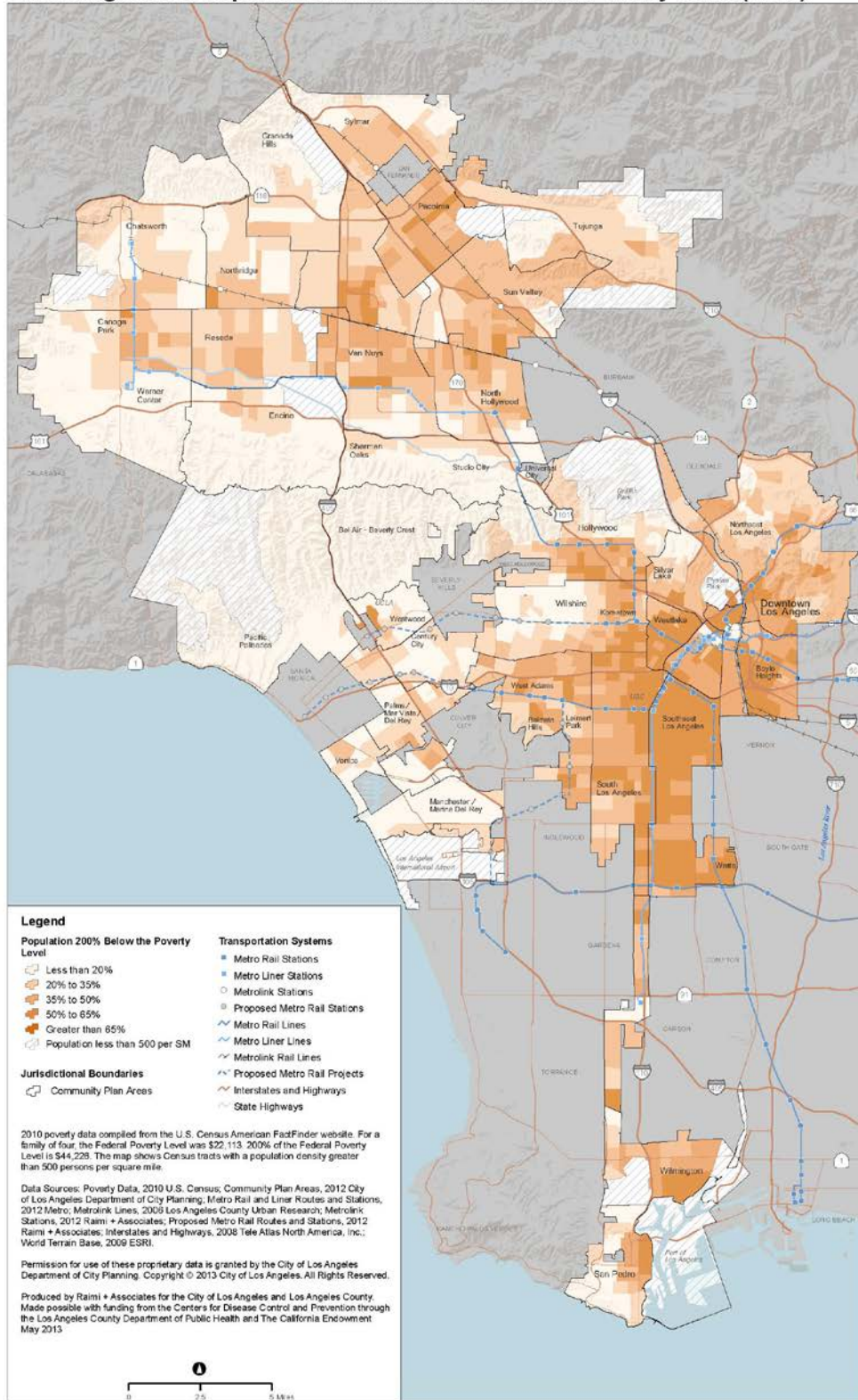
Map 23

Percentage of the Population Below the Federal Poverty Level (2010)

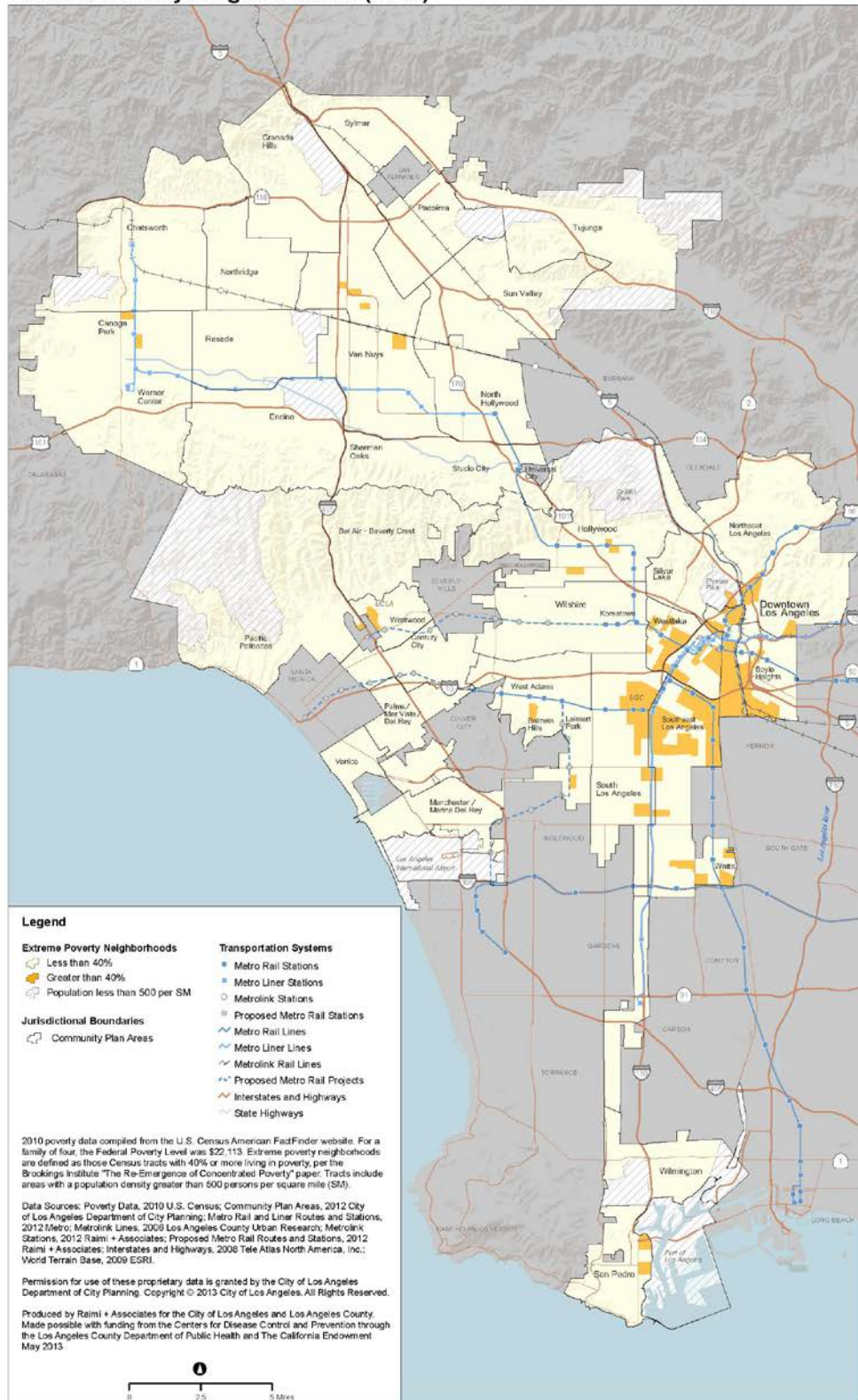


Map 24

Percentage of the Population 200% Below the Federal Poverty Level (2010)

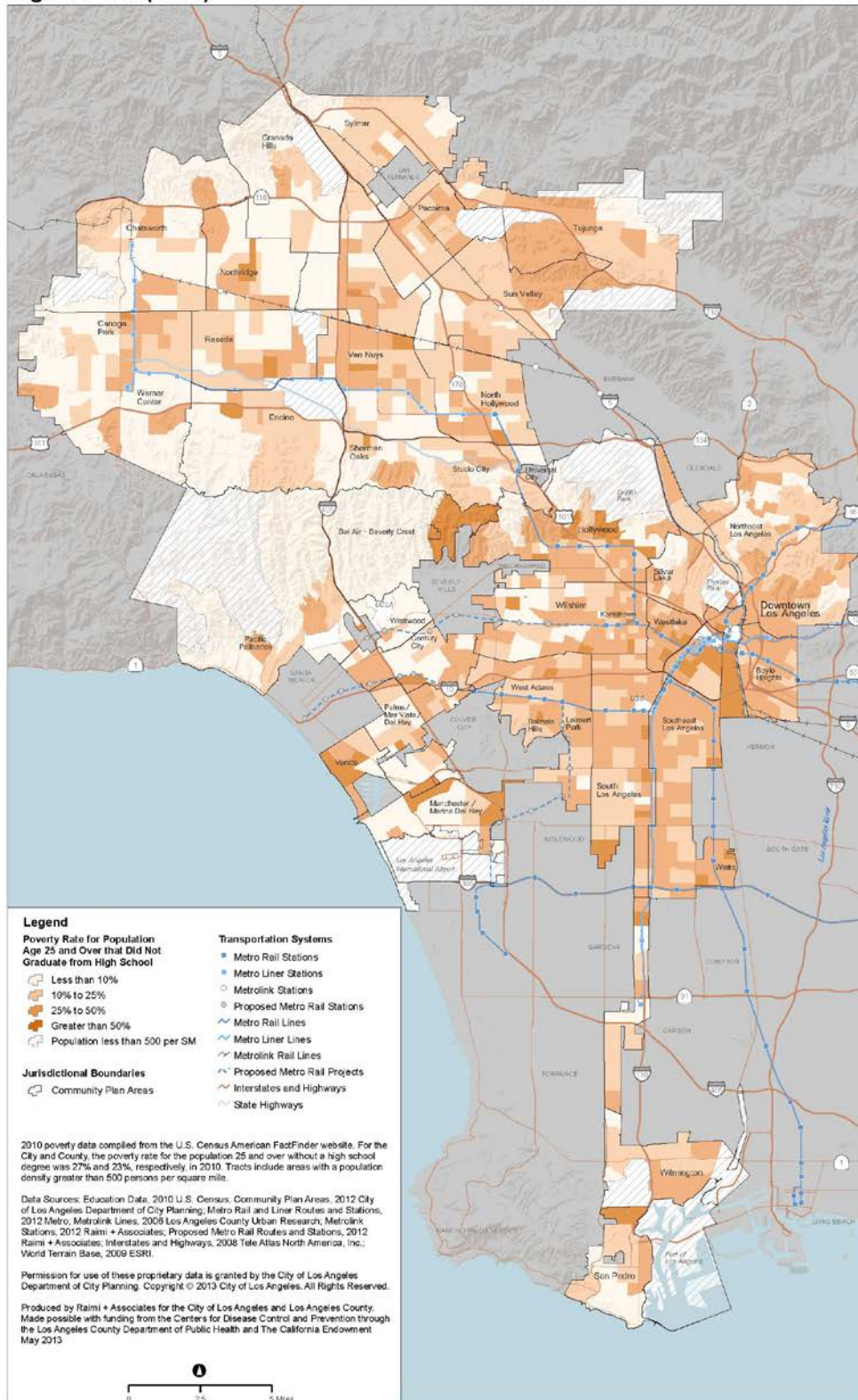


Map 25
Extreme Poverty Neighborhoods (2010)



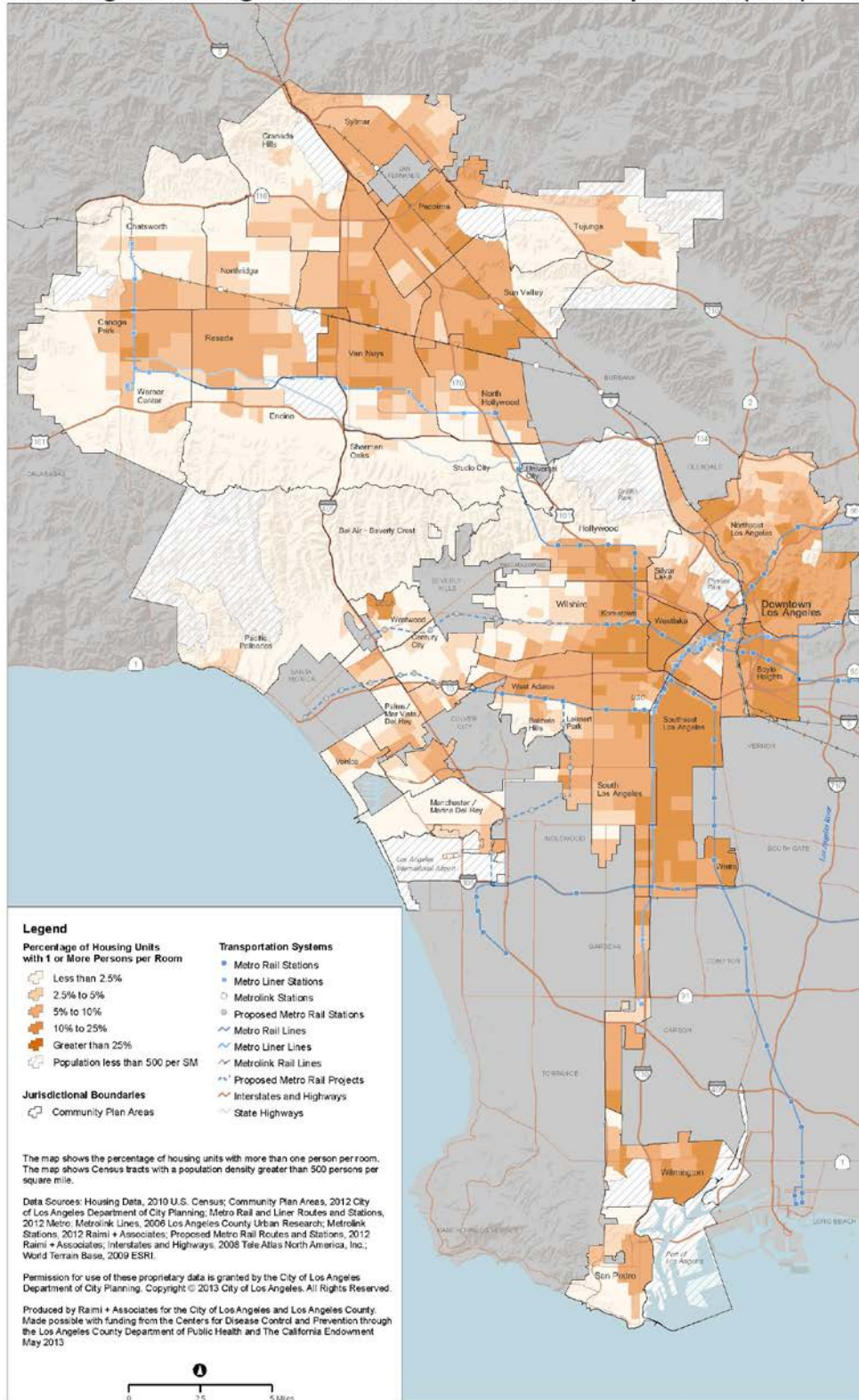
Map 30

Poverty Rate for the Population Age 25 and Over that Did Not Graduate from High School (2010)

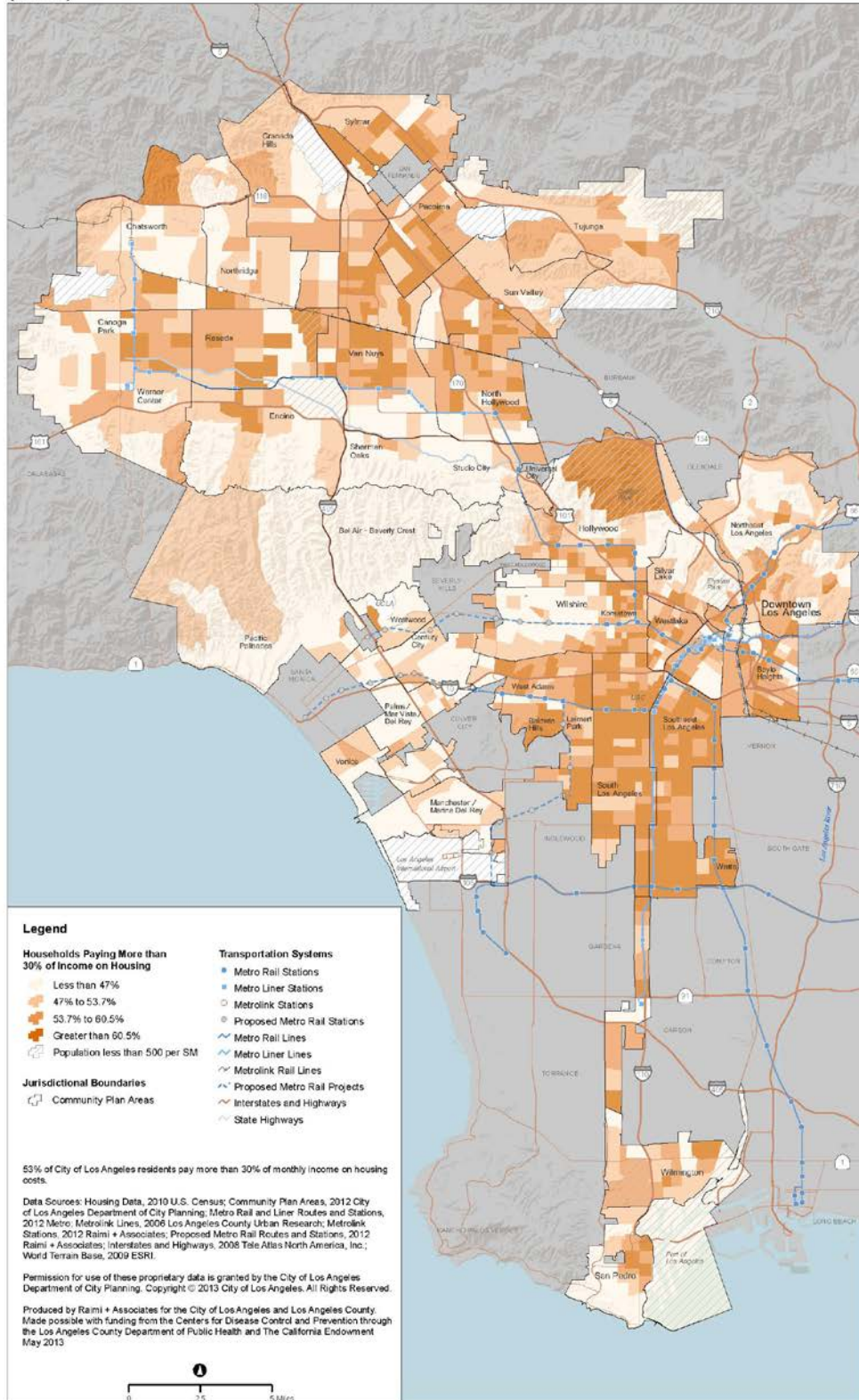


Map 103

Percentage of Housing Units with 1 or More than Persons per Room (2010)

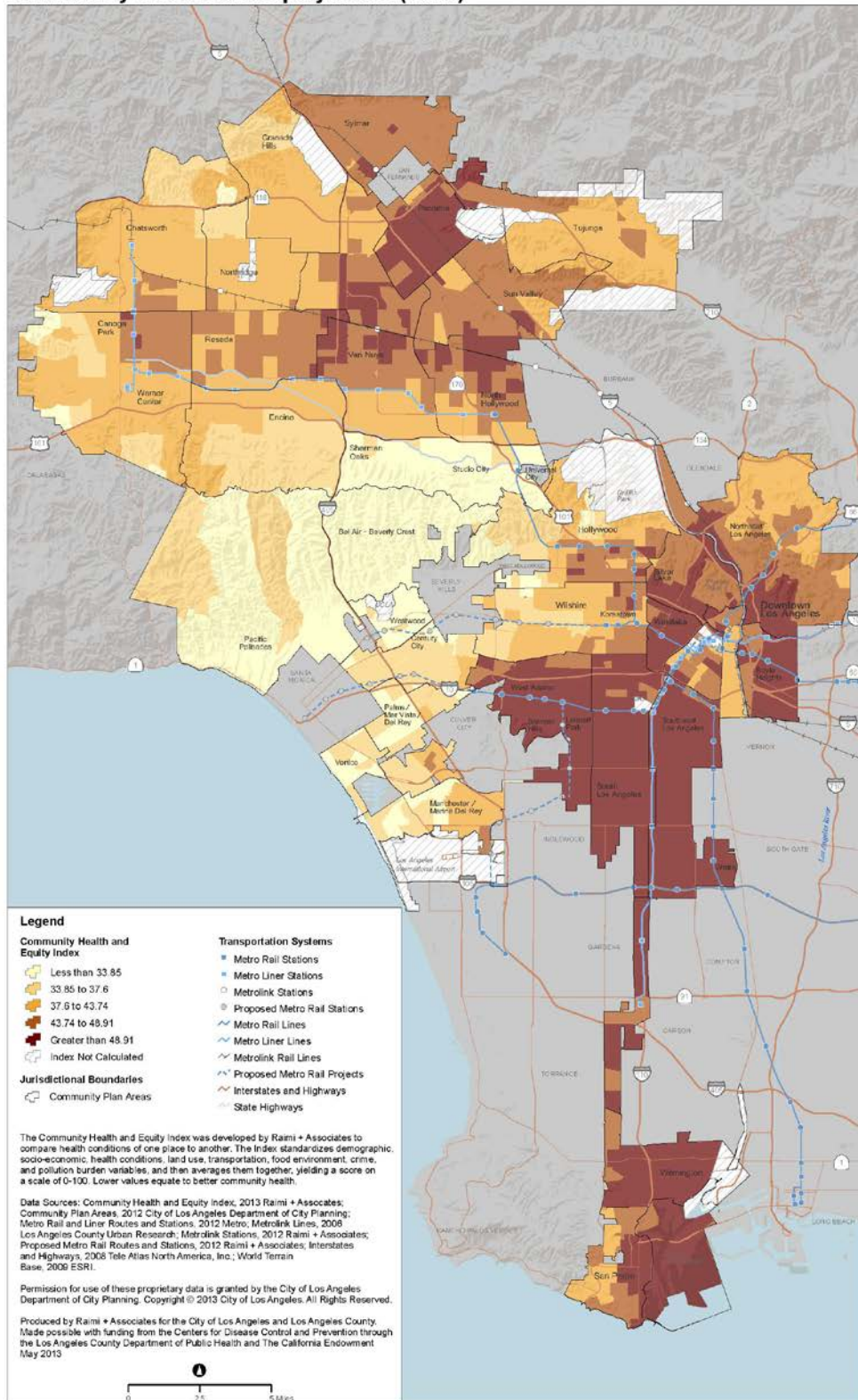


Map 105
Percentage of Households Paying More than 30% of Income on Housing Costs
(2010)

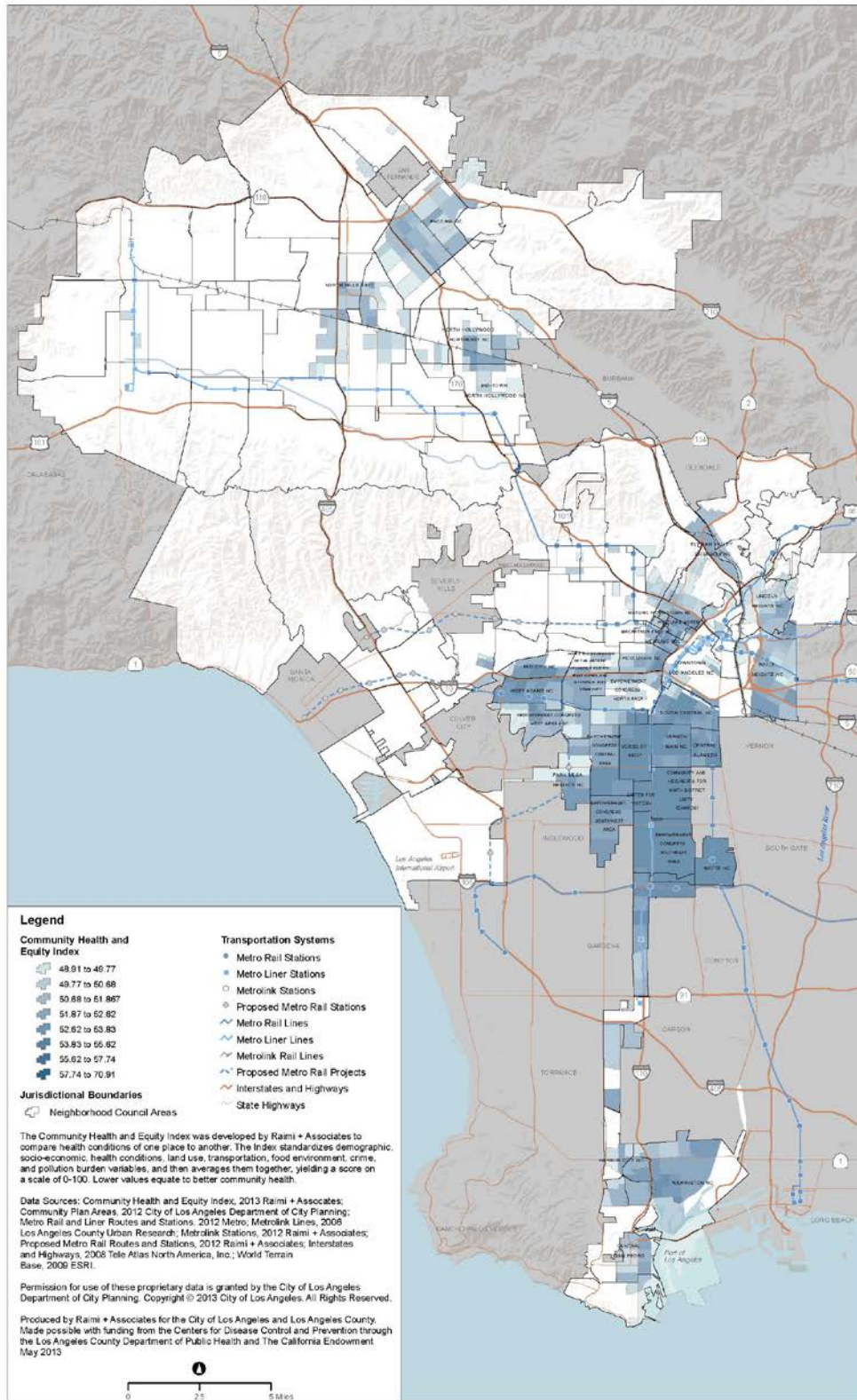


Map 114

Community Health and Equity Index (2013)

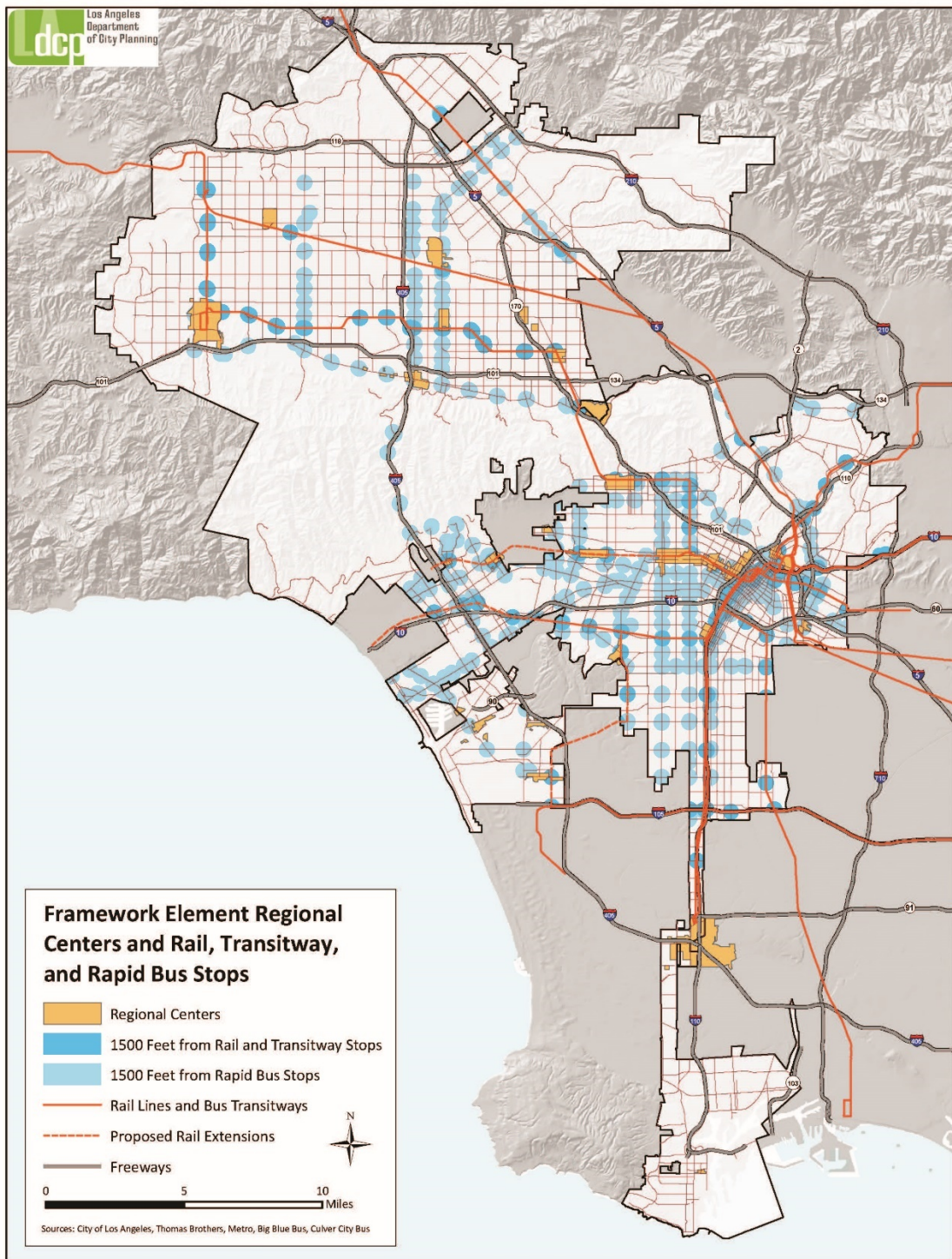


Community Health and Equity Index - Areas in the Top Quintile (2013)

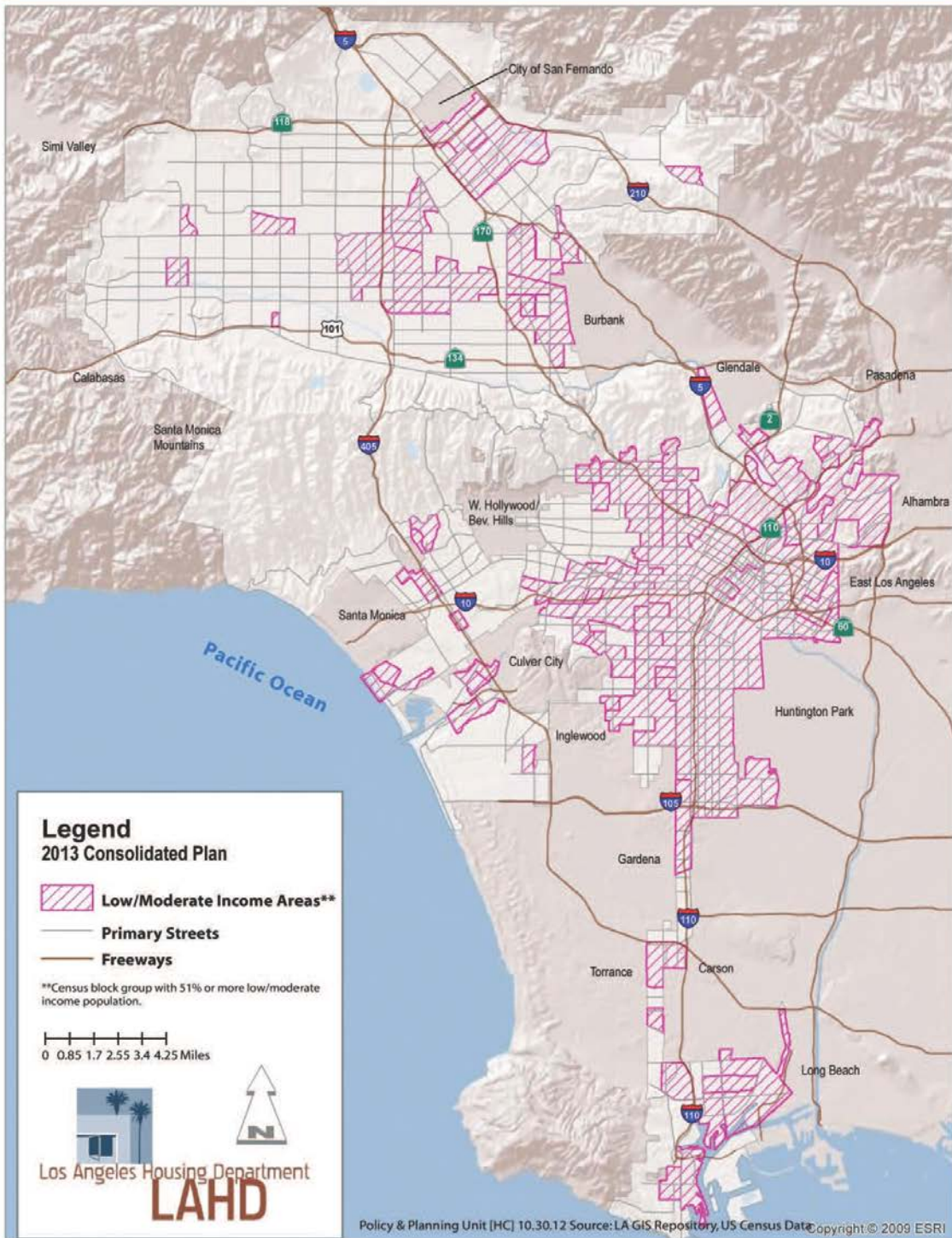


Map ES.1

General Plan Framework Element Adopted Regional Centers and Rail, Transitway and Rapid Bus Stops



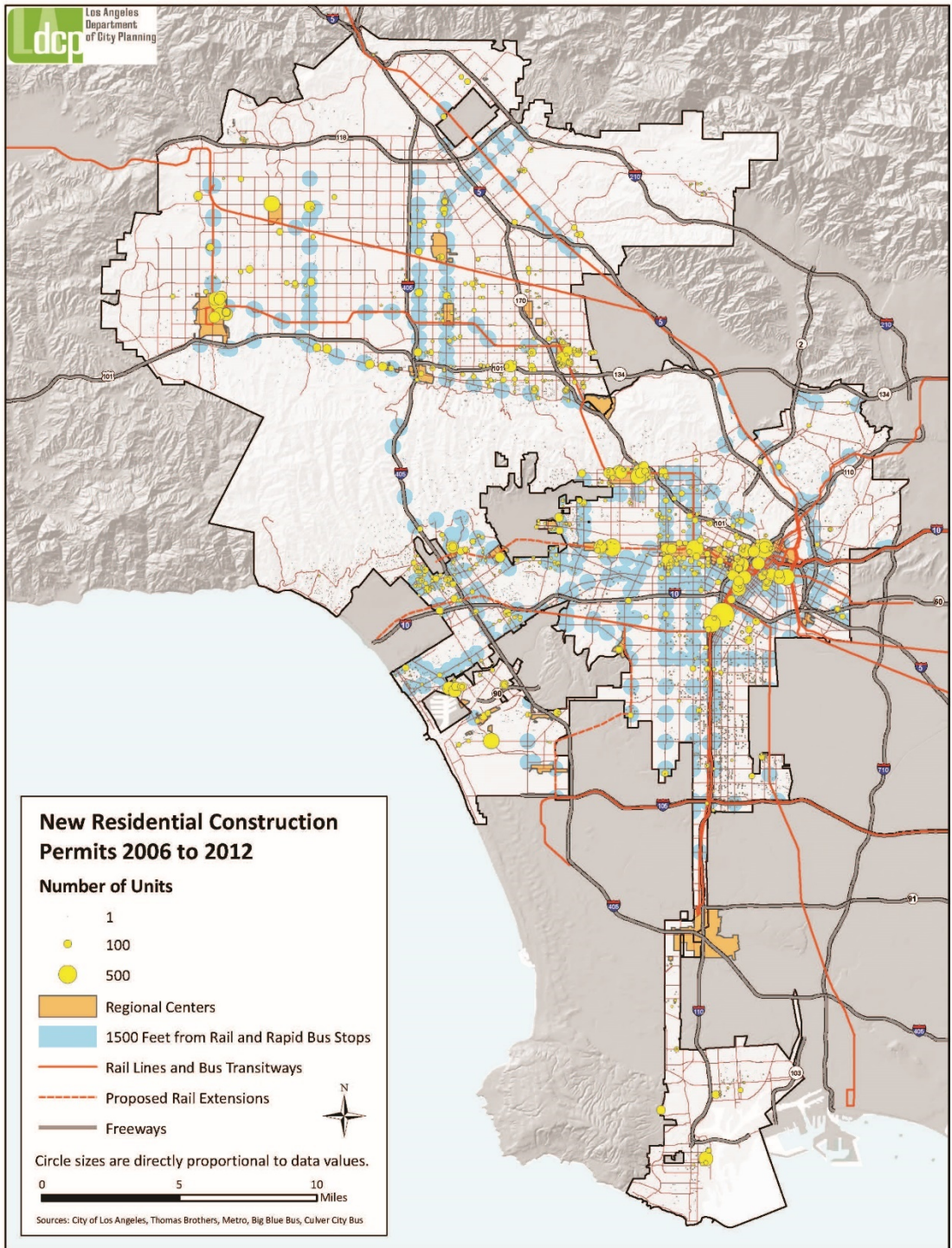
Map 1.1
 City of Los Angeles: Low/Moderate Income Areas



Los Angeles Department of City Planning

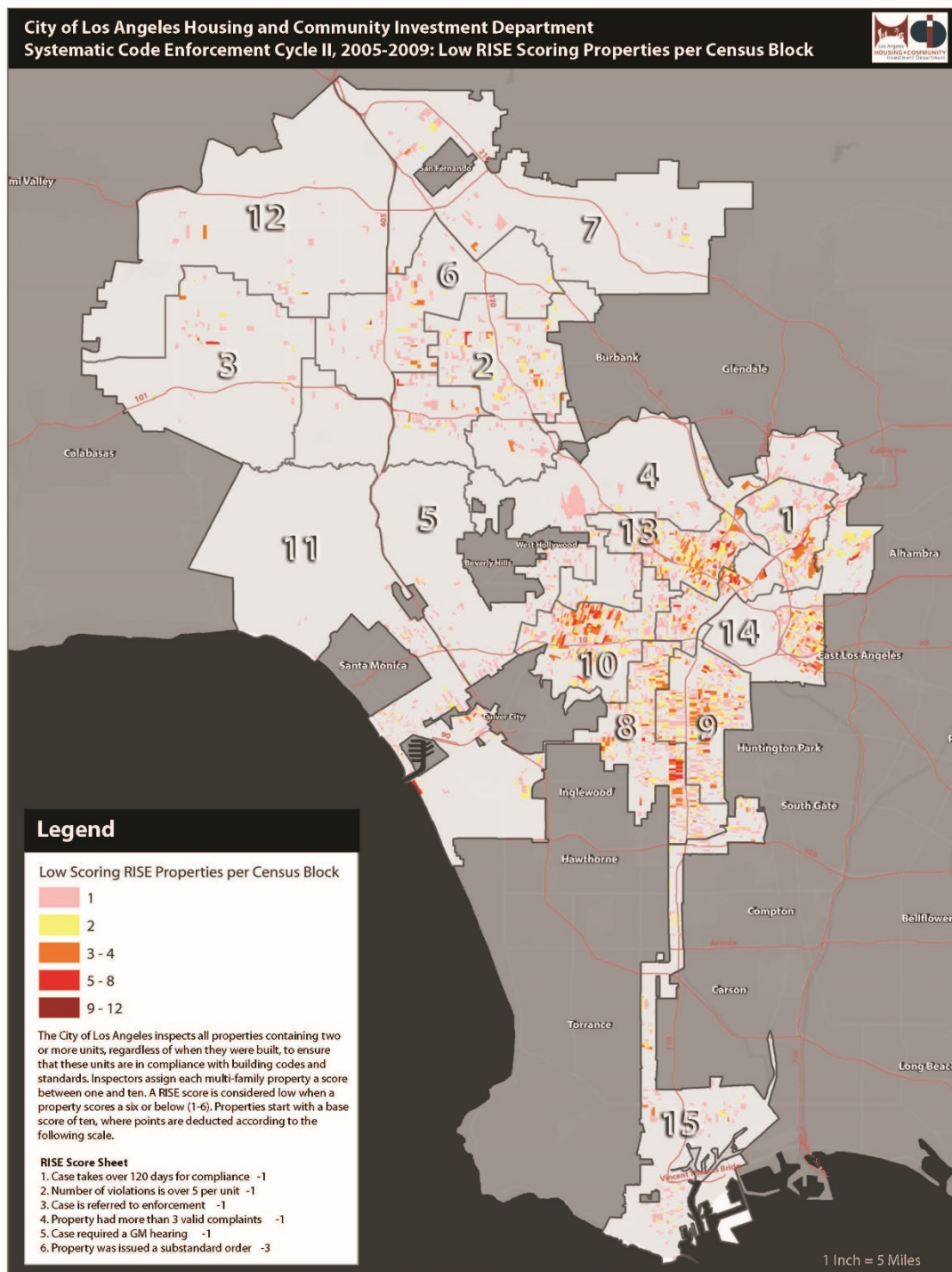
Adopted December 3, 2013 1-15

Map 1.2
Permits for New Construction 2006-2012



Map 1.2

Reliable Information System Evaluation (RISE) – Low Rated Properties by Census Block

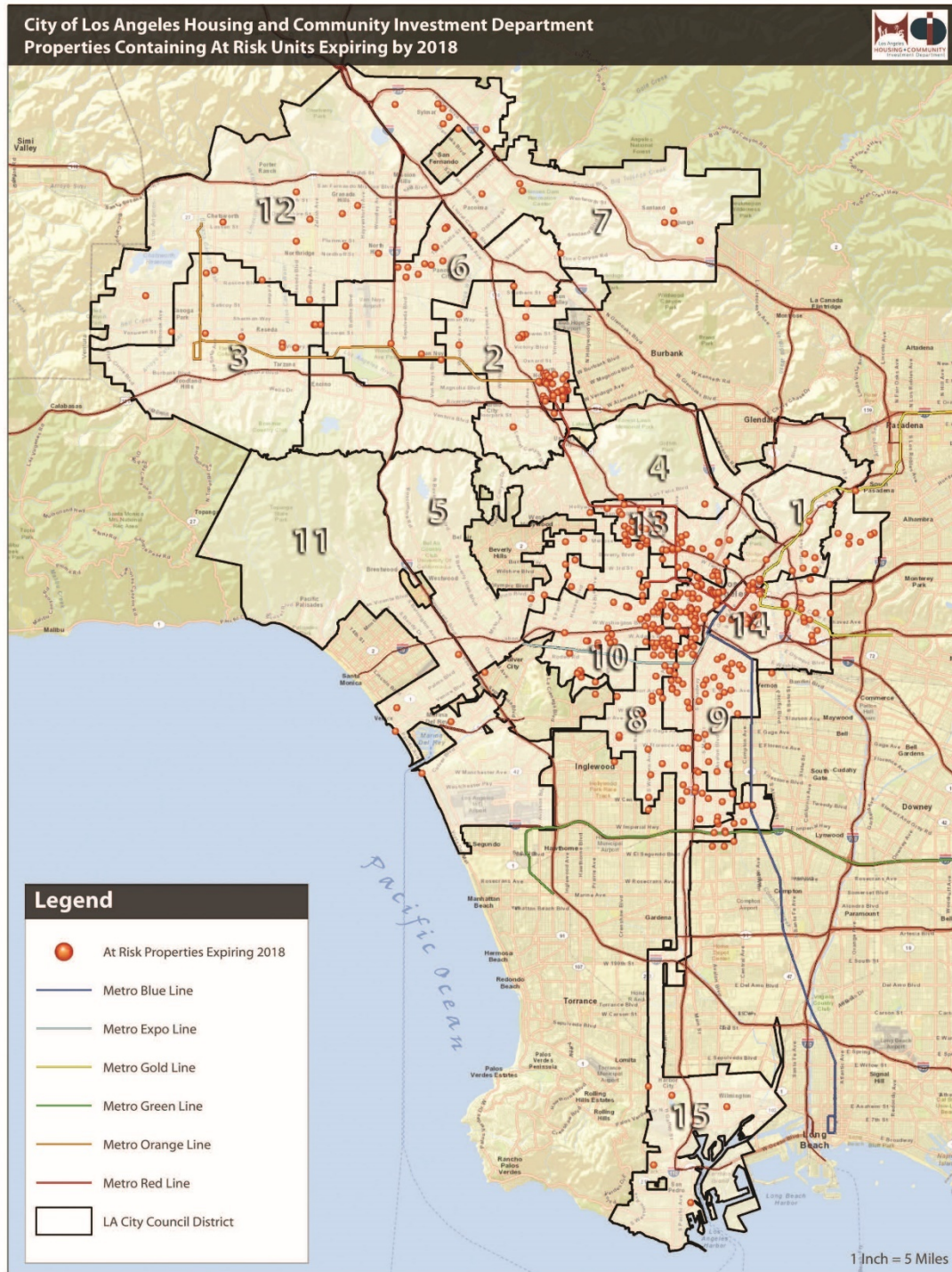


Policy & Planning Unit [HC] 07.2013 Sources: LA City GIS Repository, LA Housing + Community Investment Department

1-42 Adopted December 3, 2013

Los Angeles Department of City Planning

Map 1.4
 Properties Containing At-Risk Units Expiring by 2018

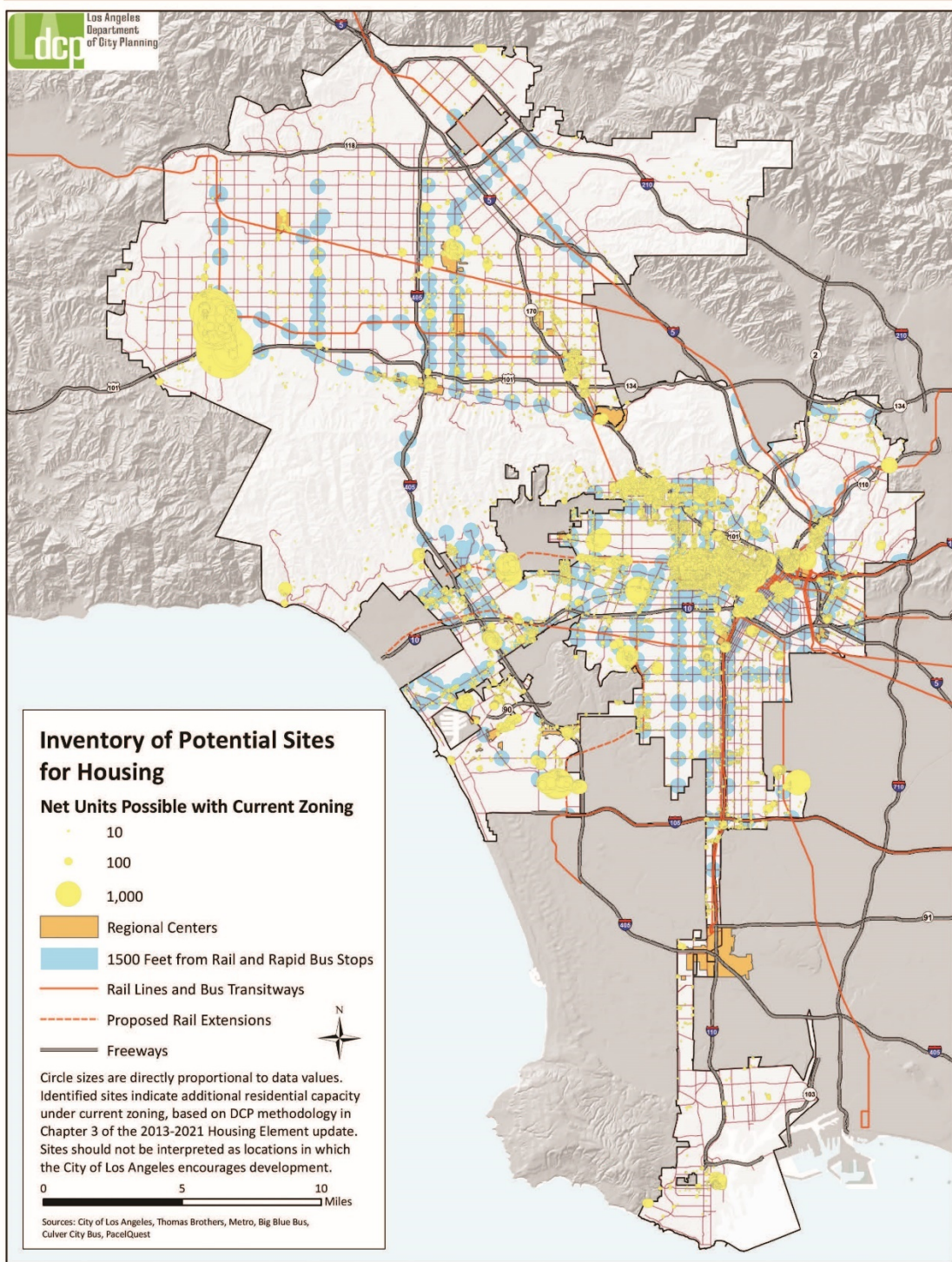


Policy & Planning Unit [HC] 06.2013 Sources: LA City GIS Repository, LA Housing + Community Investment Department

1-68 Adopted December 3, 2013

Los Angeles Department of City Planning

Map 3.1
Inventory of Potential Sites for Housing



Monmonier Guidelines	SS, PSS	C,FSS	SS,SHS	DE, MHS	C, MHS	Possible Matches
Health Atlas (2013)						
Map 12					1	1
Map 13					1	1
Map 18			1	1		2
Map 19			1	1		2
Map 20					1	1
Map 22			1			1
Map 23			1	1		2
Map 24			1			1
Map 25					1	1
Map 30					1	1
Map 103			1			1
Map 105					1	1
Map 114			1			1
Map 115			1			1
Housing Element (2013)						0
Map ES.1			1			1
Map 1.1		1				1
Map 1.2			1	1		2
Map 1.2			1			1
Map 1.4			1			1
Map 3.1			1			1
Possible Matches	0	1	13	10	0	24

Monmonier Guidelines vs.. Maps	SS, PSS	C,FSS	SS,SHS	DE, MHS	C, MHS/DD, SC	Map Presentation
Health Atlas (2013)						
Map 12	1					1
Map 13	1					1
Map 18			1			1
Map 19			1			1
Map 20			1			1
Map 22			1			1
Map 23			1			1
Map 24			1			1
Map 25			1			1
Map 30			1			1
Map 103			1			1
Map 105			1			1
Map 114	1					1
Map 115			1			1
Housing Element (2013)						0
Map ES.1			1	1		2
Map 1.1					1	1
Map 1.2			1		1	2
Map 1.2	1					1
Map 1.4					1	1
Map 3.1			1		1	2
Map Presentation	4	0	14	1	4	23

Evaluation: Monmonier	SS, PSS	C,FSS	SS,SHS	DE, MHS	C, MHS	Theory + Presentation Match
Health Atlas (2013)						
Map 12	0	0	0	0	0	0
Map 13	0	0	0	0	0	0
Map 18	0	0	1	0	0	1
Map 19	0	0	1	0	0	1
Map 20	0	0	0	0	0	0
Map 22	0	0	1	0	0	1
Map 23	0	0	1	0	0	1
Map 24	0	0	1	0	0	1
Map 25	0	0	0	0	0	0
Map 30	0	0	0	0	0	0
Map 103	0	0	1	0	0	1
Map 105	0	0	0	0	0	0
Map 114	0	0	0	0	0	0
Map 115	0	0	1	0	0	1
Housing Element (2013)	0	0	0	0	0	0
Map ES.1	0	0	1	0	0	1
Map 1.1	0	0	0	0	0	0
Map 1.2	0	0	1	0	0	1
Map 1.2	0	0	0	0	0	0
Map 1.4	0	0	0	0	0	0
Map 3.1	0	0	1	0	0	1
Theory + Presentation Match	0	0	10	0	0	10

Here is the diagram used for the matrices methodology for each guideline. The final evaluation matrix was used to produce graphs 1 through 4 in the sections above. Monmonier's guidelines are used here.

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