Appendix C

Sustainable Communities Strategy Documentation and Related Information

Appendix Contents

Sustainable Communities Strategy Documentation and Related Information

This appendix includes documentation in support of the Sustainable Communities Strategy (SCS) pursuant to Senate Bill 375 (Steinberg, 2008) (SB 375). This appendix includes a matrix that outlines the requirements in SB 375 and where the Regional Plan addresses the requirements, either in specific chapters of the Regional Plan or in specified appendices (Table C.4). The resource mapping prepared by SANDAG is based on the best practically available scientific information regarding resource areas and farmland. The source data includes: (1) 1995 data for the eastern two-thirds of the County, which cover the entire region and use the Holland classification system (Holland 1996; Oberbauer et al., 2008); (2) 2012 data which cover much of the western one-third of the region and use a classification system of groups, alliances, and associations based on the National Vegetation Classification Standard and the California Manual of Vegetation (Sproul et al., 2011; Sawyer et al., 2009); and (3) Department of Conservation Farmland Mapping and Monitoring Program data, 2010.

This appendix includes the following figures to support the SCS:

- Figure C.1: Housing Near High Frequency Transit
- Figure C.2: 2020 Land Use[1]
- Figure C.3: 2035 Land Use[2]
- Figure C.4: San Diego Region Wetlands
- Figure C.5: San Diego Region Important Agricultural Lands
- Figure C.6: San Diego Regional Habitat Preserved Lands
- Figure C.7: San Diego Region Generalized Vegetation
- Figure C.8: Potential Aggregate Supply Sites
- Figure C.9: 2020 Employment and Housing Density
- Figure C.10: 2035 Employment and Housing Density
- Figure C.11: 2035 Potential Transit Priority Project Areas

Appendix C also contains links to two SANDAG Board of Directors reports that support the development of the transportation network selected for San Diego Forward: The Regional Plan:

- August 15, 2014 – Draft Revenue Constrained Transportation Scenarios[3]
- September 12, 2014 – Preferred Revenue Constrained Transportation Scenario[4]

The Technical Methodology to estimate greenhouse gas emissions submitted to the California Air Resources Board (ARB) on June 7, 2013, as well as ARB's acknowledgment of receiving this methodology also are included in Appendix C, Attachment 1.

- June 7, 2013 – Correspondence from SANDAG to ARB regarding Technical Methodology to estimate greenhouse gas emissions from the San Diego Association of Governments Sustainable Communities Strategy.
- August 12, 2013 – Correspondence from ARB to SANDAG regarding Technical Methodology to estimate greenhouse gas emissions.

SB 375 Greenhouse Gas Reduction Targets set by the California Air Resources Board and Results of Greenhouse Gas Emissions Reductions

The path toward living more sustainably is clear: focus housing and job growth in urbanized areas where there is existing and planned transportation infrastructure, protect sensitive habitat and open space, invest in a transportation network that provides people with transportation options that reduce greenhouse gas emissions, and implement the plan through incentives and collaboration.

As part of its mandate under SB 375, in 2010 the California Air Resources Board (ARB) set specific targets for reducing greenhouse gas emissions for cars and light trucks for each of the state's regions from a 2005 base year. The greenhouse gas targets set for the San Diego region call for a 7 percent per capita reduction by 2020, and a 13 percent per capita reduction by 2035. The SCS will result in a 15 percent reduction in emissions by 2020, and a 21 percent reduction by 2035 – far more than what the state mandates require – as shown in Table C.1. The greenhouse gas reductions for the final Regional Plan were calculated using the ARB model EMFAC 2014 v. 1.0.7 and adjustment factors provided by ARB to account for differences in emission rates between EMFAC 2007 (used to set the targets) and this latest version of the emissions model (EMFAC 2014 v.1.0.7). The per capita greenhouse gas reductions for 2020 and 2035 have changed from the draft Regional Plan to the final Regional Plan by 3 percentage points. The ARB adjustment factor for SANDAG reduces the per capita results for both 2020 and 2035 by 2 percentage points. For example, before the ARB adjustment, per capita reductions for 2020 were 17 percent, and after applying the adjustment, the reductions become 15 percent. The additional 1 percentage point difference for 2020 and 2035 is due to final travel demand model runs, which also use EMFAC 2014 v.1.0.7 to estimate greenhouse gas emissions. Attachment 2 describes the off-model greenhouse gas reduction methodology that supplements the SANDAG Activity Based Model calculations as well as the ARB adjustment referenced above.

Table C.1
SB 375 Greenhouse Gas Reduction Targets and Regional Plan Greenhouse Gas Emissions Reductions Results

	2020	2035
ARB Targets	7 percent	13 percent
Greenhouse Gas Emissions Reductions	15 percent	21 percent

Note: Average weekday per capita carbon dioxide reductions for cars and light trucks from 2005.

Source: ARB and SANDAG

Breakdown of the Regional Plan's SCS Components that Contribute to SB 375 Per Capita Greenhouse Gas Reductions

Several components and strategies contribute toward SB 375 per capita greenhouse gas reductions from passenger vehicles. Approximately half of the reductions would result from the Regional Plan's investments in transit projects and their operations, managed lanes, active transportation projects, and TDM measures that support teleworking (i.e., working from home or telecommuting). About one-quarter of the reductions are estimated from changing land use and population characteristics, while another quarter are projected from increases in the cost of driving (auto operating costs).

Housing Goals

Figure C.1 and Table C.2 show that the number of homes located within one half-mile of high frequency public transit services will increase from 35 percent in 2012 to 63 percent in 2050 (for population this increase is 35 percent to 61 percent). This increase is due to new transit services, detailed in Appendix A: Transportation Projects, Costs, and Phasing, and to growth being primarily concentrated in the urbanized areas.

Figure C.1

Housing Near High Frequency Public Transit

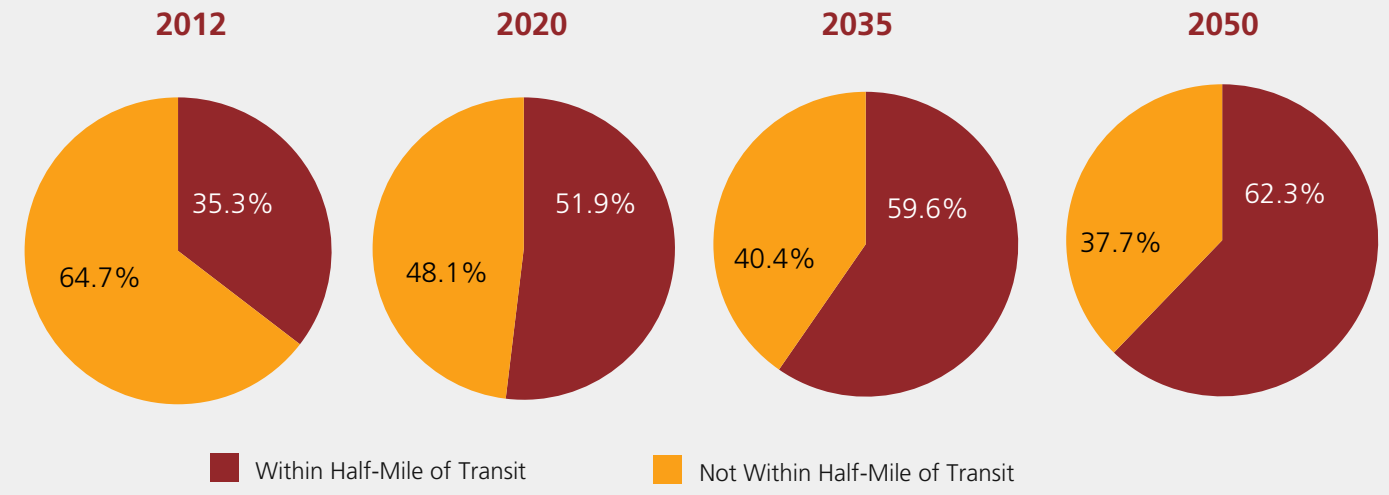

Table C.2

Housing Near High Frequency Public Transit

	2012		2020		2035		2050	
	Numeric	Percent	Numeric	Percent	Numeric	Percent	Numeric	Percent
Within Half Mile of Transit	412,050	35.3%	648,622	51.9%	831,837	59.6%	929,785	62.3%
Not Within Half Mile of Transit	753,768	64.7%	601,062	48.1%	562,946	40.4%	562,150	37.7%
Total	1,165,818	100.0%	1,249,684	100.0%	394,783	100.0%	1,491,935	100.0%

Table C.3 shows that the projected increase in new housing capacity is generally higher for areas with densities above 20 dwelling units per acre. The increases reflect extensive work by local jurisdictions to update general and specific plans to accommodate future growth and development in the urbanized areas of the region where existing and planned public transit is located.

Table C.3

Series 13 Regional Growth Forecast Estimated Housing Capacity by Jurisdiction and Subregion

	Dwelling Units Per Acre				
	0 to 10	10 to 20	20 to 30	30+	Total
City of San Diego	46,446	11,328	49,508	84,747	192,029
Unincorporated	40,625	11,330	4,621	5,794	62,370
North County Coastal	7,526	2,734	1,654	3,140	15,054
Carlsbad	4,106	1,507	-	-	5,613
Del Mar	(28)*	44	-	-	16
Encinitas	1,204	764	741	-	2,709
Oceanside	2,170	398	403	3,140	6,111
Solana Beach	74	21	510	-	605
North County Inland	16,484	1,635	1,077	12,622	31,818
Escondido	6,194	745	133	3,923	10,995
Poway	900	17	35	452	1,404
San Marcos	8,468	(112)*	187	395	8,938
Vista	922	985	722	7,852	10,481
East County	3,014	1,555	1,457	19,702	25,728
El Cajon	(283)*	763	566	10,633	11,679
La Mesa	759	188	215	7,055	8,217
Lemon Grove	201	168	180	1,372	1,921
Santee	2,337	436	496	642	3,911
South Bay	21,166	597	2,856	43,424	68,043
Chula Vista	20,356	441	1,561	10,070	32,428
Coronado	61	2	94	24	181
Imperial Beach	6	62	341	1,431	1,840
National City	743	92	860	31,899	33,594
Total	135,261	29,179	61,173	169,429	395,042

* Negative capacity is a result of redevelopment to either a different density range or to commercial land.

Table C.4

SANDAG Sustainable Communities Strategy Documentation

Subject Area		Addressed
SCS Requirement	**CGC Section 65080(b)(2)(B)** Each metropolitan planning organization shall prepare a sustainable communities strategy subject to the requirements of Part 450 of Title 23 of and Part 93 of Title 40 of the Code of Federal Regulations, including the requirement to utilize the most recent planning assumptions considering local general plans and other factors. The sustainable communities strategy shall:	See Regional Plan Chapters 2 and 5. Also see Appendices C (SCS Documentation and Related Information), J (Regional Growth Forecast), L (Regional Housing Needs Assessment Plan), and S (Monitoring Performance)
Land Use	**CGC Section 65080(b)(2)(B)(i)** identify the general location of uses, residential densities, and building intensities within the region;	See Regional Plan Chapter 2 and Appendices C (SCS Documentation and Related Information Figures C-2 and C-3), and J (Regional Growth Forecast)
Housing Goals	**CGC Section 65080(b)(2)(B)(vi)** consider the state housing goals specified in Sections 65580 and 65581;	See Regional Plan Chapter 2 and Appendices C (SCS Documentation and Related Information), L (Regional Housing Needs Assessment Plan), and U.13 (Housing: Providing Homes for all Residents)

Table C.4 (continued)
SANDAG Sustainable Communities Strategy Documentation

Subject Area		Addressed
	CGC Section 65080(b)(2)(B)(ii) identify areas within the region sufficient to house all the population of the region, including all economic segments of the population, over the course of the planning period of the regional transportation plan taking into account net migration into the region, population growth, household formation and employment growth;	See Regional Plan Chapter 2 and Appendices J (Regional Growth Forecast), L (Regional Housing Needs Assessment Plan), and U.13 (Housing: Providing Homes for all Residents)
	CGC Section 65080(b)(2)(B)(iii) identify areas within the region sufficient to house an eight-year projection of the regional housing need for the region pursuant to Section 65584;	See Regional Plan Chapter 2 and Appendices L (Regional Housing Needs Assessment Plan), and U.13 (Housing: Providing Homes for all Residents)
Natural Resources	**CGC Section 65080(b)(2)(B)(v)** gather and consider the best practically available scientific information regarding resource areas and farmland in the region as defined in subdivisions (a) and (b) of Section 65080.01;	See Regional Plan Chapter 2 and Appendix C figures titled: • Figure C.4 San Diego Region Wetlands • Figure C.5 San Diego Region Important Agricultural Lands • Figure C.6 San Diego Region Habitat Conservation Lands • Figure C.7 San Diego Region Generalized Vegetation

Table C.4 (continued)

SANDAG Sustainable Communities Strategy Documentation

Subject Area		Addressed
Transportation Network	**CGC Section 65080(b)(2)(B)(iv)** identify a transportation network to service the transportation needs of the region;	See Regional Plan Chapter 2 and Appendix A (Transportation Projects, Costs, and Phasing)
Meeting Greenhouse Gas Reduction Targets	**CGC Section 65080(b)(2)(B)(vii)** set forth a forecasted development pattern for the region, which, when integrated with the transportation network and other transportation measures and policies, will reduce the greenhouse gas emissions from automobiles and light trucks to achieve, if there is a feasible way to do so, the greenhouse gas emission reduction targets approved by the state board;	See Regional Plan Chapter 2 and Appendices C (SCS Documentation and Related Information), J (Regional Growth Forecast), and T (SANDAG Travel Demand Model and Forecasting Documentation)
Meeting Federal Air Quality Requirements	**CGC Section 65080(b)(2)(B)(viii)** allow the regional transportation plan to comply with Section 176 of the federal Clean Air Act (42 U.S.C. §7506).	See Appendix B (Air Quality Planning and Transportation Conformity), Appendix J (Regional Growth Forecast), Appendix T (SANDAG Travel Demand Model and Forecasting Documentation)
Informational Meetings	**CGC Section 65080(b)(2)(E)** The metropolitan planning organization shall conduct at least two informational meetings in each county within the region for members of the board of supervisors and city councils on the sustainable communities strategy and alternative planning strategy, if any. Only one informational meeting is needed in each county if it is attended by representatives of the county board of supervisors and city councils that represent a majority of the cities representing a majority of the population in the incorporated areas of that county.	See Regional Plan Chapter 2 and Appendix F (Public Involvement Program)

Table C.4 (continued)

SANDAG Sustainable Communities Strategy Documentation

Subject Area		Addressed
Public Participation Plan	**CGC Section 65080(b)(2)(F)** Each metropolitan planning organization shall adopt a public participation plan, for development of the sustainable communities strategy and an alternative planning strategy, if any, that includes all of the following:	See Regional Plan Chapter 2 and Appendix F (Public Involvement Program)
Public Participation Plan – outreach	**CGC Section 65080(b)(2)(F)(i)** Outreach efforts to encourage the active participation of a broad range of stakeholder groups in the planning process, consistent with the agency's adopted Federal Public Participation Plan, including, but not limited to, affordable housing advocates, transportation advocates, neighborhood and community groups, environmental advocates, home builder representatives, broad-based business organizations, landowners, commercial property interests, and homeowner associations.	See Appendix F (Public Involvement Program)
Public Participation Plan – consultation	**CGC Section 65080(b)(2)(F)(ii)** Consultation with congestion management agencies, transportation agencies, and transportation commissions.	See Appendix F (Public Involvement Program)
Public Participation Plan - workshops	**CGC Section 65080(b)(2)(F)(iii)** Three workshops throughout the region to provide the public with the information and tools necessary to provide a clear understanding of the issues and policy choices. Each workshop, to the extent practicable, shall include urban simulation computer modeling to create visual representations of the SCS and the alternative planning strategy.	See Appendix F (Public Involvement Program)
Public Participation Plan – SCS public review	**CGC Section 65080(b)(2)(F)(iv)** Preparation and circulation of a draft SCS and an alternative planning strategy, if one is prepared, not less than 55 days before adoption of a final regional transportation plan.	See Appendix F (Public Involvement Program)

Table C.4 (continued)

SANDAG Sustainable Communities Strategy Documentation

Subject Area		Addressed
Public Participation Plan – public hearings	**CGC Section 65080(b)(2)(F)(v)** At least three public hearings on the draft sustainable communities strategy in the regional transportation plan and alternative planning strategy, if one is prepared. If the metropolitan transportation organization consists of a single county, at least two public hearings shall be held. To the maximum extent feasible, the hearings shall be in different parts of the region to maximize the opportunity for participation by members of the public throughout the region.	See Appendix F (Public Involvement Program)
Public Participation Plan – public notice	**CGC Section 65080(b)(2)(F)(vi)** A process for enabling members of the public to provide a single request to receive notices, information, and updates.	See Appendix F (Public Involvement Program)
Consultation with Local Agency Formation Commission	**CGC Section 65080(b)(2)(G)** In preparing a sustainable communities strategy, the metropolitan planning organization shall consider spheres of influence that have been adopted by the local agency formation commissions within its region.	See Regional Plan Chapter 2 and Appendix I (Consultation with the Local Agency Formation Commission)
ARB Greenhouse Gas Reduction Targets for San Diego Region	**CGC Section 65080(b)(2)(H)** Prior to adopting a sustainable communities strategy, the metropolitan planning organization shall quantify the reduction in greenhouse gas emissions projected to be achieved by the sustainable communities strategy and set forth the difference, if any, between the amount of that reduction and the target for the region established by the state board.	See Regional Plan Chapter 2 and Appendix C (SCS Documentation and Related Information, Table C.1)

Table C.4 (continued)

SANDAG Sustainable Communities Strategy Documentation

Subject Area		Addressed
Consideration of Financial Incentives for Cities and Counties with Resource Areas or Farmlands	**CGC Section 65080(b)(4)(C)** The metropolitan planning organization or county transportation agency, whichever entity is appropriate, shall consider financial incentives for cities and counties that have resource areas or farmland, as defined in Section 65080.01, for the purposes of, for example, transportation investments for the preservation and safety of the city street or county road system and farm-to-market and interconnectivity transportation needs. The metropolitan planning organization or county transportation agency, whichever entity is appropriate, shall also consider financial assistance for counties to address countywide service responsibilities in counties that contribute towards the greenhouse gas emission reduction targets by implementing policies for growth to occur within their cities.	See Regional Plan Chapter 2 and Chapter 5

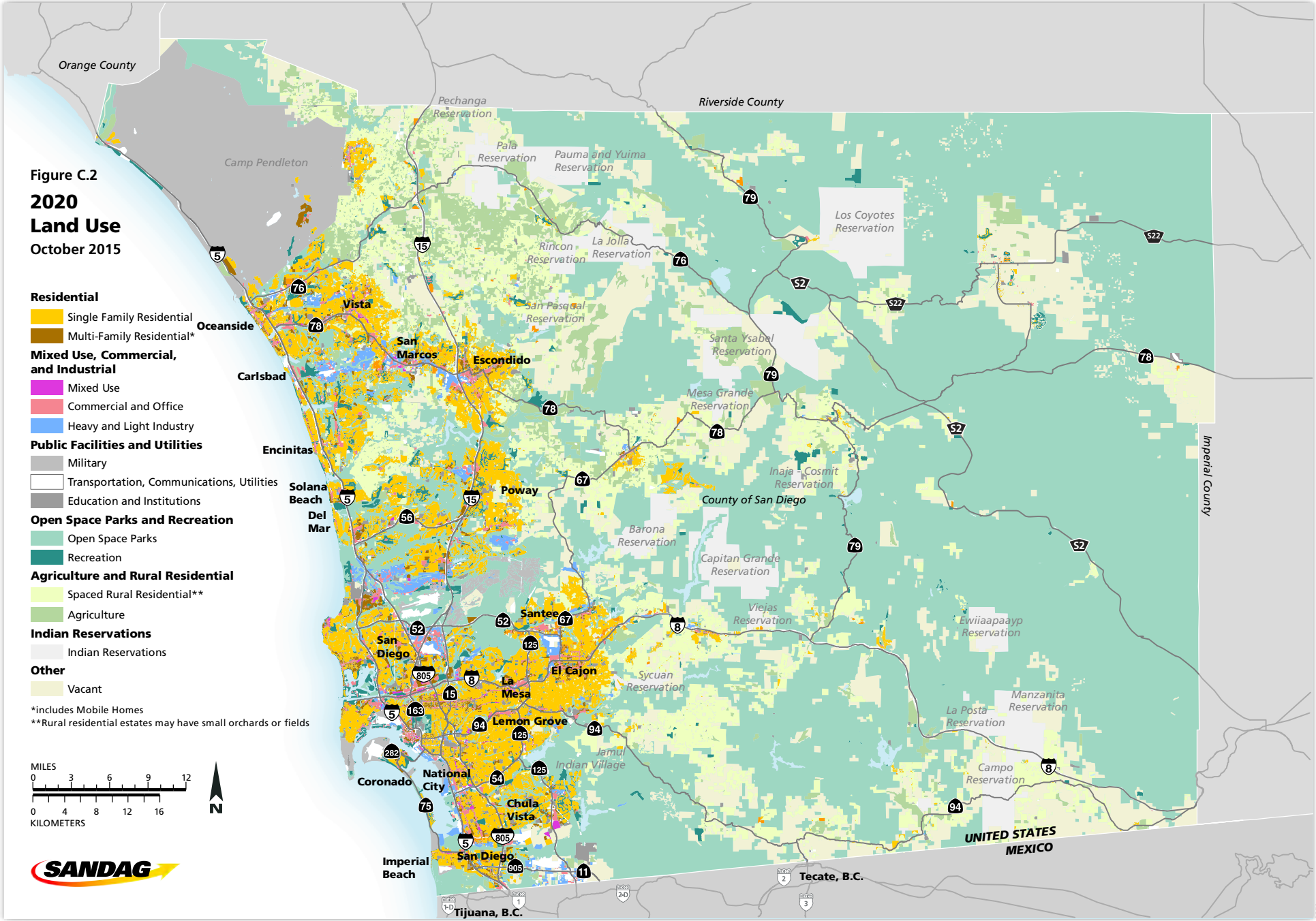
Figure C.2
2020
Land Use
October 2015
Residential
Single Family Residential
Multi-Family Residential*
Mixed Use, Commercial, and Industrial
Mixed Use
Commercial and Office
Heavy and Light Industry
Public Facilities and Utilities
Military
Transportation, Communications, Utilities
Education and Institutions
Open Space Parks and Recreation
Open Space Parks
Recreation
Agriculture and Rural Residential
Spaced Rural Residential**
Agriculture
Indian Reservations
Indian Reservations
Other
Vacant
*includes Mobile Homes
**Rural residential estates may have small orchards or fields
MILES
0 3 6 9 12
0 4 8 12 16
KILOMETERS
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SANDAG
Orange County
Riverside County
Imperial County
Camp Pendleton
Pechanga Reservation
Pala Reservation
Pauma and Yuima Reservation
Rincon Reservation
La Jolla Reservation
Los Coyotes Reservation
San Pasqual Reservation
Santa Ysabel Reservation
Mesa Grande Reservation
Inaja - Cosmit Reservation
County of San Diego
Barona Reservation
Capitan Grande Reservation
Viejas Reservation
Ewiiaapaayp Reservation
Sycuan Reservation
Manzanita Reservation
La Posta Reservation
Jamul Indian Village
Campo Reservation
Oceanside
Vista
San Marcos
Escondido
Carlsbad
Encinitas
Solana Beach
Del Mar
Poway
Santee
El Cajon
La Mesa
Lemon Grove
National City
Chula Vista
Coronado
Imperial Beach
San Diego
Tijuana, B.C.
Tecate, B.C.
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MEXICO
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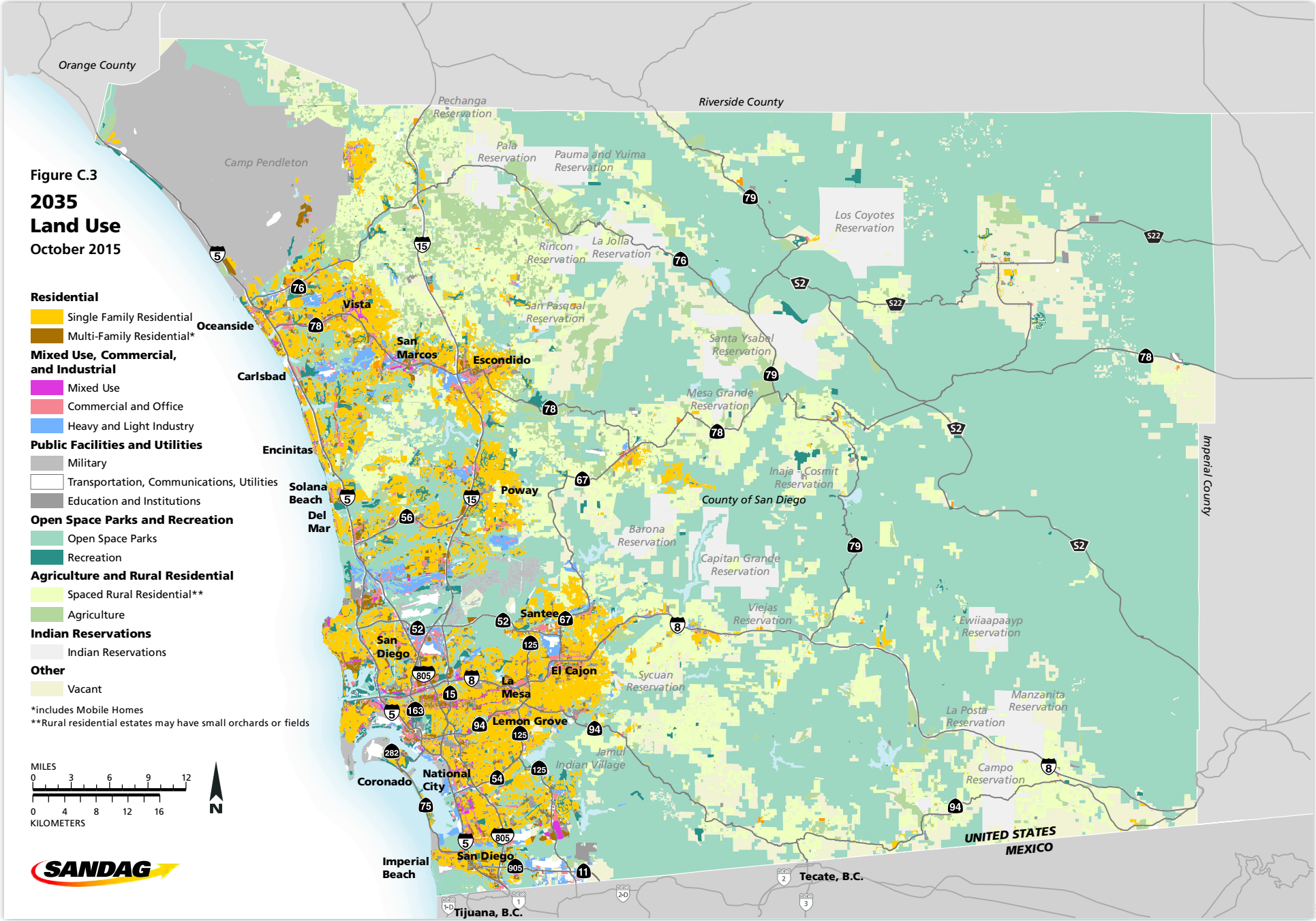
Figure C.3
2035
Land Use
October 2015
Residential
Single Family Residential
Multi-Family Residential*
Mixed Use, Commercial, and Industrial
Mixed Use
Commercial and Office
Heavy and Light Industry
Public Facilities and Utilities
Military
Transportation, Communications, Utilities
Education and Institutions
Open Space Parks and Recreation
Open Space Parks
Recreation
Agriculture and Rural Residential
Spaced Rural Residential**
Agriculture
Indian Reservations
Indian Reservations
Other
Vacant
*includes Mobile Homes
**Rural residential estates may have small orchards or fields
MILES
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Orange County
Riverside County
Imperial County
Camp Pendleton
Pechanga Reservation
Pala Reservation
Pauma and Yuima Reservation
Rincon Reservation
La Jolla Reservation
Los Coyotes Reservation
San Pasqual Reservation
Santa Ysabel Reservation
Mesa Grande Reservation
Inaja - Cosmit Reservation
Barona Reservation
Capitan Grande Reservation
Viejas Reservation
Ewiiaapaayp Reservation
Sycuan Reservation
Manzanita Reservation
La Posta Reservation
Campo Reservation
Jamul Indian Village
County of San Diego
Oceanside
Vista
Carlsbad
San Marcos
Escondido
Encinitas
Solana Beach
Del Mar
Poway
Santee
El Cajon
La Mesa
Lemon Grove
National City
Coronado
Imperial Beach
San Diego
Tijuana, B.C.
Tecate, B.C.
UNITED STATES
MEXICO

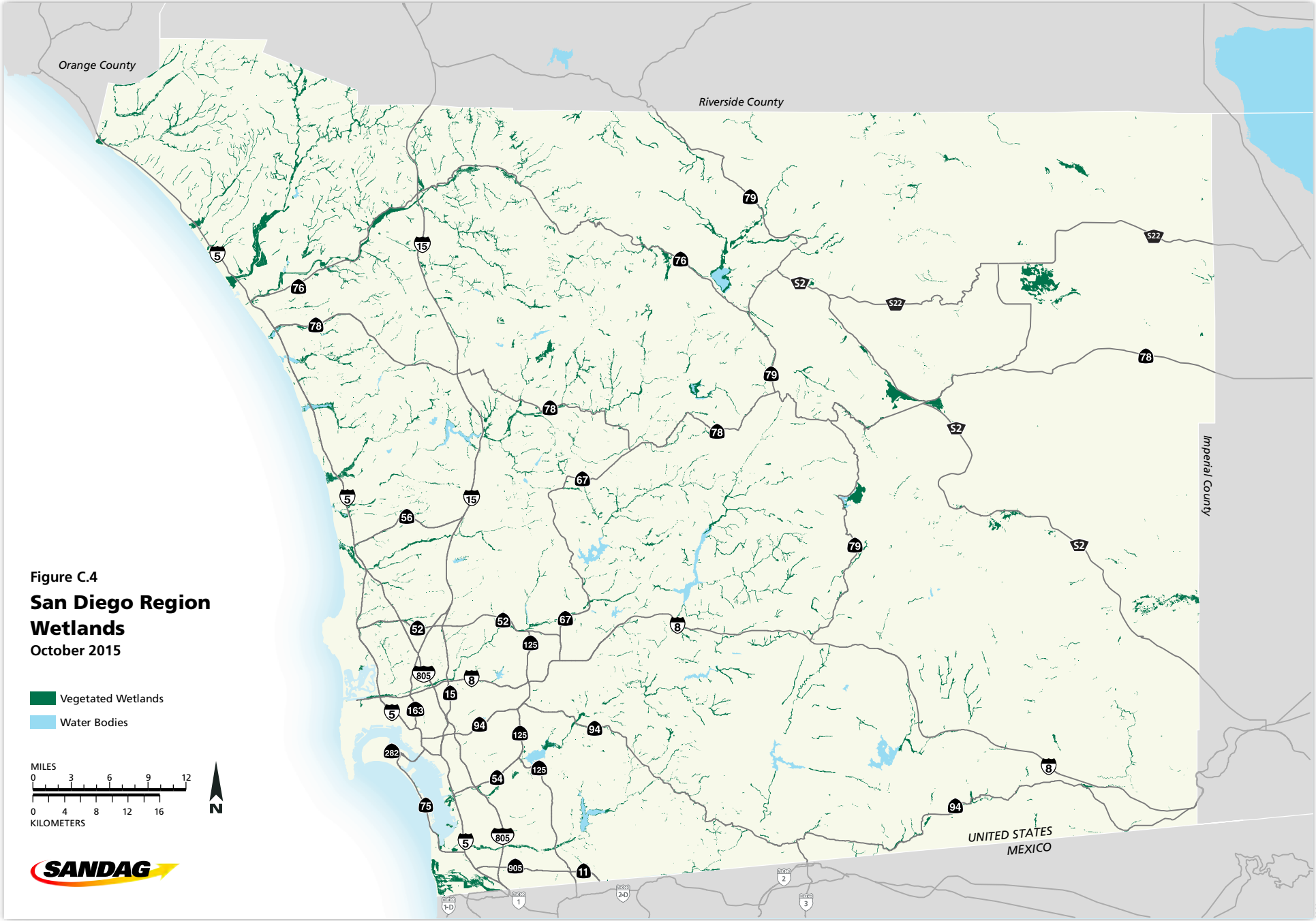


Figure C.4

San Diego Region Wetlands

October 2015

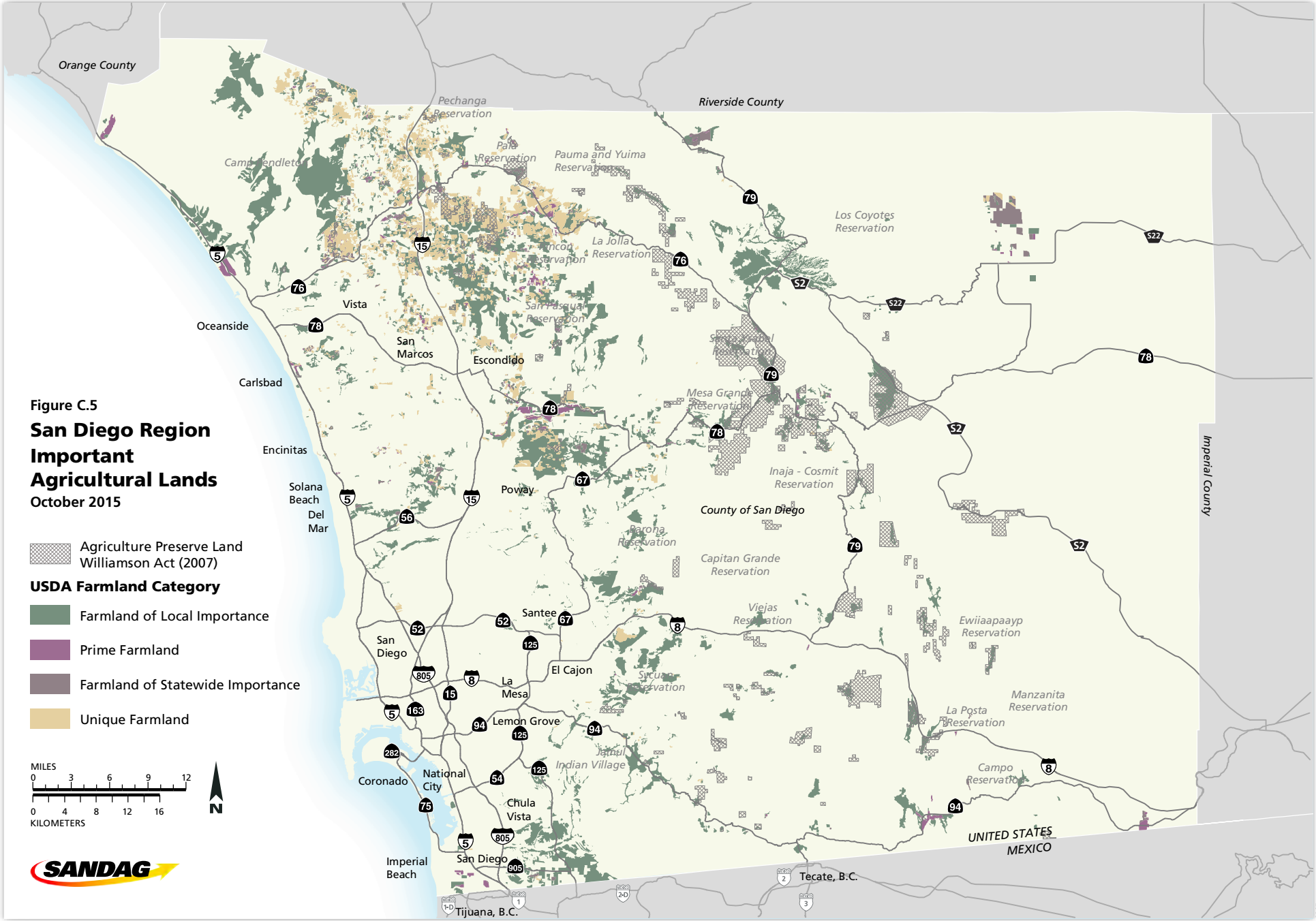
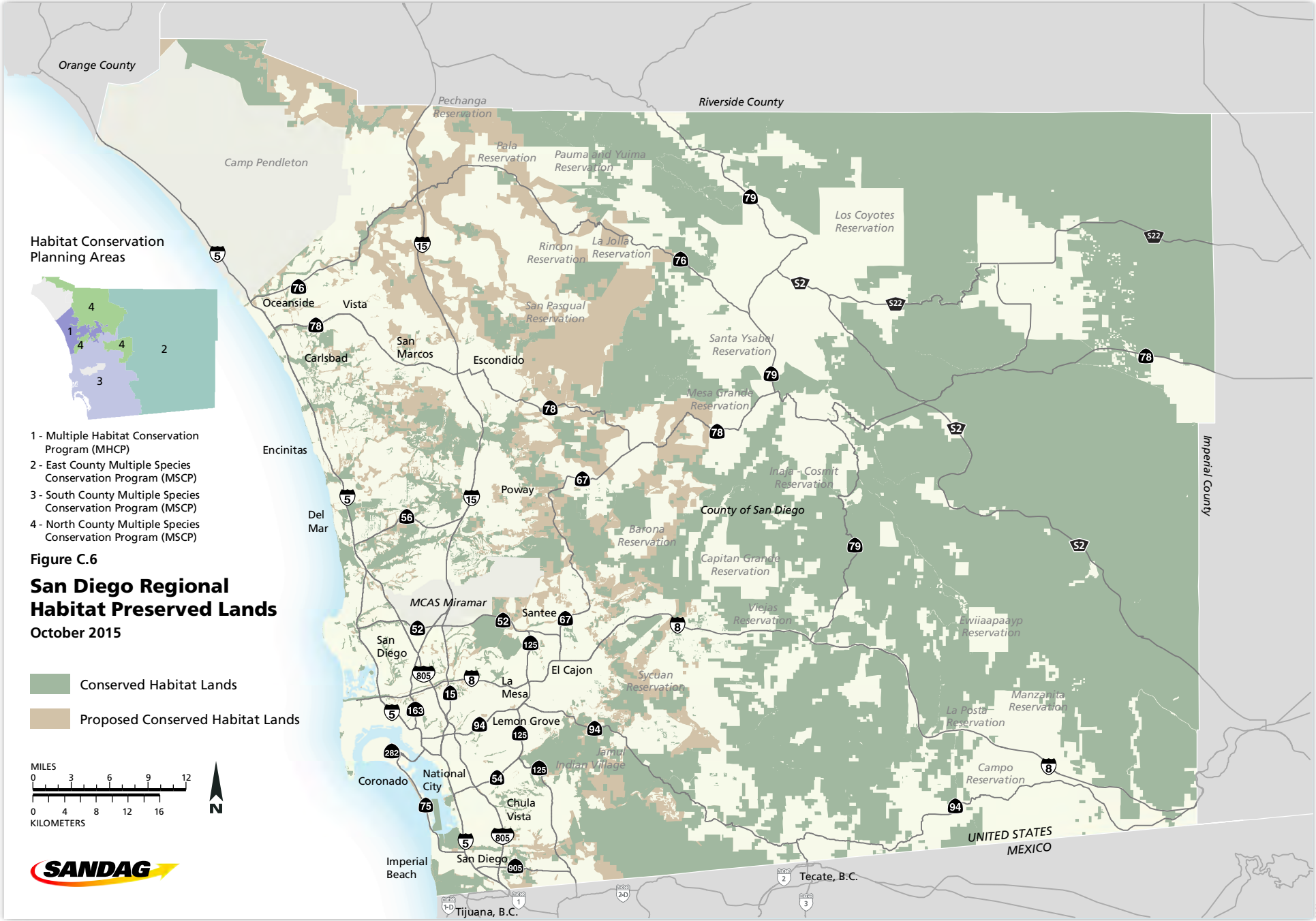


Figure C.5
San Diego Region Important Agricultural Lands
October 2015
Agriculture Preserve Land Williamson Act (2007)
USDA Farmland Category
Farmland of Local Importance
Prime Farmland
Farmland of Statewide Importance
Unique Farmland
MILES
0 3 6 9 12
0 4 8 12 16
KILOMETERS
N
SANDAG
Orange County
Riverside County
Imperial County
Pechanga Reservation
Pala Reservation
Pauma and Yuima Reservation
Los Coyotes Reservation
La Jolla Reservation
San Pasqual Reservation
Mesa Grande Reservation
Inaja - Cosmit Reservation
County of San Diego
Barona Reservation
Capitan Grande Reservation
Viejas Reservation
Ewiiaapaayp Reservation
Sycuan Reservation
La Posta Reservation
Manzanita Reservation
Campo Reservation
Jamul Indian Village
Oceanside
Vista
San Marcos
Escondido
Carlsbad
Encinitas
Solana Beach
Del Mar
Poway
Santee
El Cajon
La Mesa
Lemon Grove
National City
Chula Vista
Coronado
Imperial Beach
San Diego
UNITED STATES
MEXICO
Tecate, B.C.
Tijuana, B.C.


Habitat Conservation Planning Areas
1 - Multiple Habitat Conservation Program (MHCP)
2 - East County Multiple Species Conservation Program (MSCP)
3 - South County Multiple Species Conservation Program (MSCP)
4 - North County Multiple Species Conservation Program (MSCP)
Figure C.6
San Diego Regional Habitat Preserved Lands
October 2015
Conserved Habitat Lands
Proposed Conserved Habitat Lands
MILES
0 3 6 9 12
0 4 8 12 16
KILOMETERS
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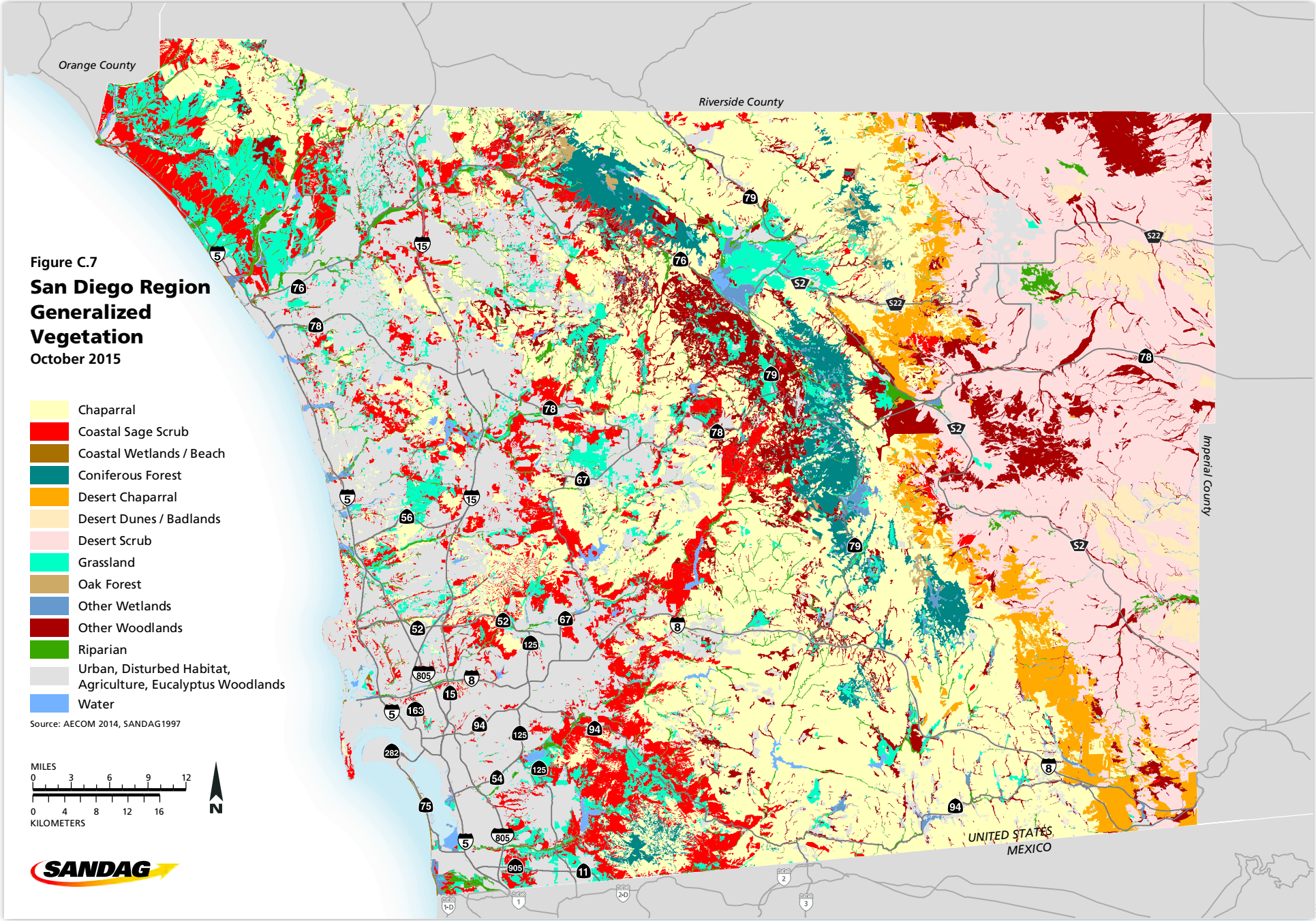
SANDAG
Orange County
Riverside County
Imperial County
County of San Diego
UNITED STATES
MEXICO
Camp Pendleton
MCAS Miramar
Pechanga Reservation
Pala Reservation
Pauma and Yuima Reservation
Rincon Reservation
La Jolla Reservation
Los Coyotes Reservation
San Pasqual Reservation
Santa Ysabel Reservation
Mesa Grande Reservation
Inaja - Cosmit Reservation
Barona Reservation
Capitan Grande Reservation
Viejas Reservation
Ewiiaapaayp Reservation
Sycuan Reservation
La Posta Reservation
Manzanita Reservation
Campo Reservation
Jamul Indian Village
Oceanside
Vista
Carlsbad
San Marcos
Escondido
Encinitas
Poway
Del Mar
Santee
El Cajon
La Mesa
Lemon Grove
National City
Chula Vista
Coronado
Imperial Beach
San Diego
Tijuana, B.C.
Tecate, B.C.


Orange County
Riverside County
Imperial County
UNITED STATES
MEXICO
Figure C.7
San Diego Region Generalized Vegetation
October 2015
Chaparral
Coastal Sage Scrub
Coastal Wetlands / Beach
Coniferous Forest
Desert Chaparral
Desert Dunes / Badlands
Desert Scrub
Grassland
Oak Forest
Other Wetlands
Other Woodlands
Riparian
Urban, Disturbed Habitat, Agriculture, Eucalyptus Woodlands
Water
Source: AECOM 2014, SANDAG1997
MILES
0 3 6 9 12
0 4 8 12 16
KILOMETERS
N
SANDAG

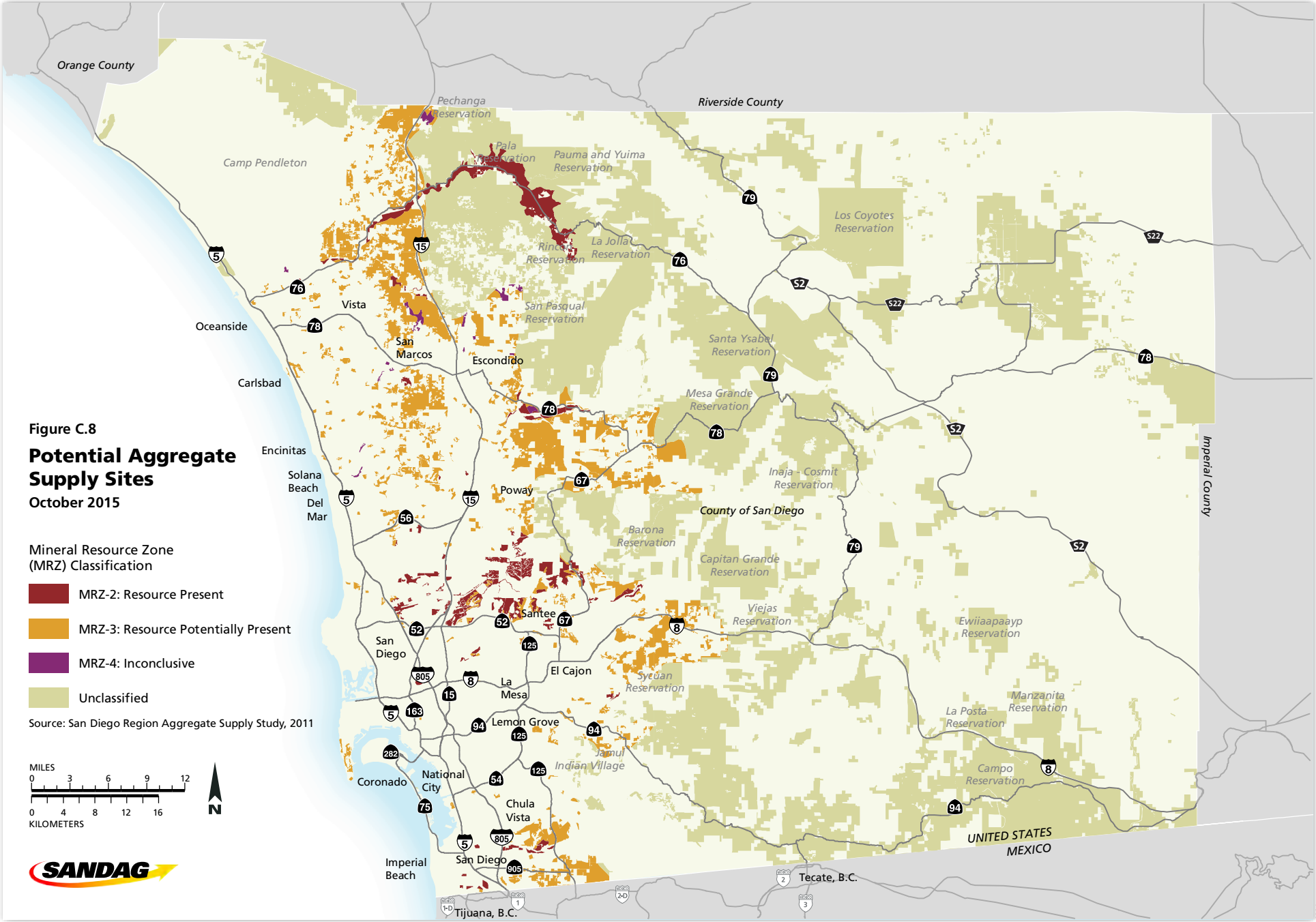


Figure C.8
Potential Aggregate Supply Sites
October 2015
Mineral Resource Zone (MRZ) Classification
MRZ-2: Resource Present
MRZ-3: Resource Potentially Present
MRZ-4: Inconclusive
Unclassified
Source: San Diego Region Aggregate Supply Study, 2011
MILES
0 3 6 9 12
0 4 8 12 16
KILOMETERS
N
SANDAG
Orange County
Riverside County
Imperial County
Camp Pendleton
Pechanga Reservation
Pala Reservation
Pauma and Yuima Reservation
Los Coyotes Reservation
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Manzanita Reservation
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Jamul Indian Village
Oceanside
Vista
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Encinitas
Solana Beach
Del Mar
Poway
Santee
El Cajon
La Mesa
Lemon Grove
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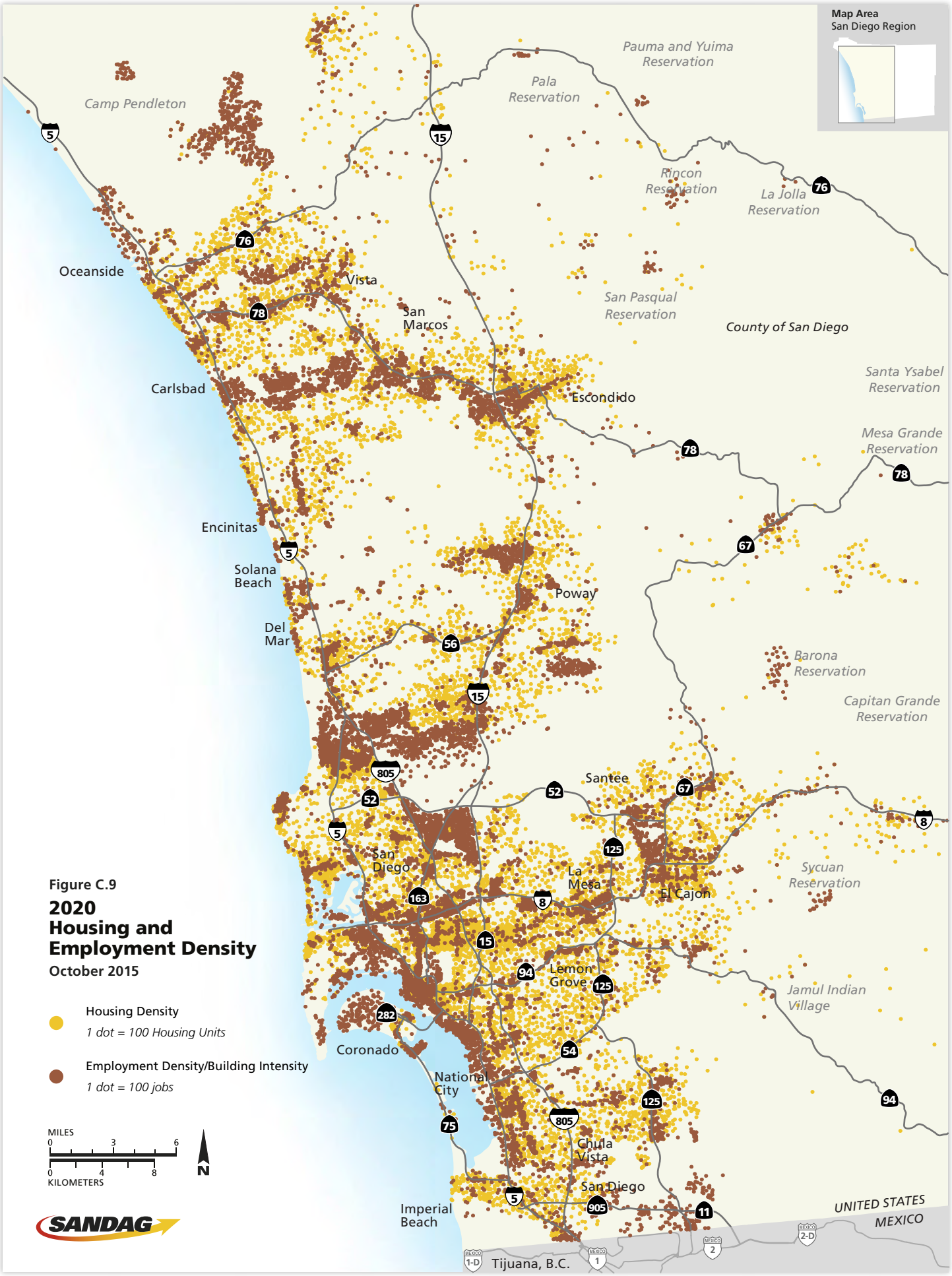
National City
Chula Vista
Imperial Beach
Tijuana, B.C.
Tecate, B.C.
UNITED STATES
MEXICO
2994


Map Area
San Diego Region
Pauma and Yuima Reservation
Pala Reservation
Camp Pendleton
Rincon Reservation
La Jolla Reservation
Oceanside
Vista
San Marcos
San Pasqual Reservation
County of San Diego
Carlsbad
Escondido
Santa Ysabel Reservation
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Encinitas
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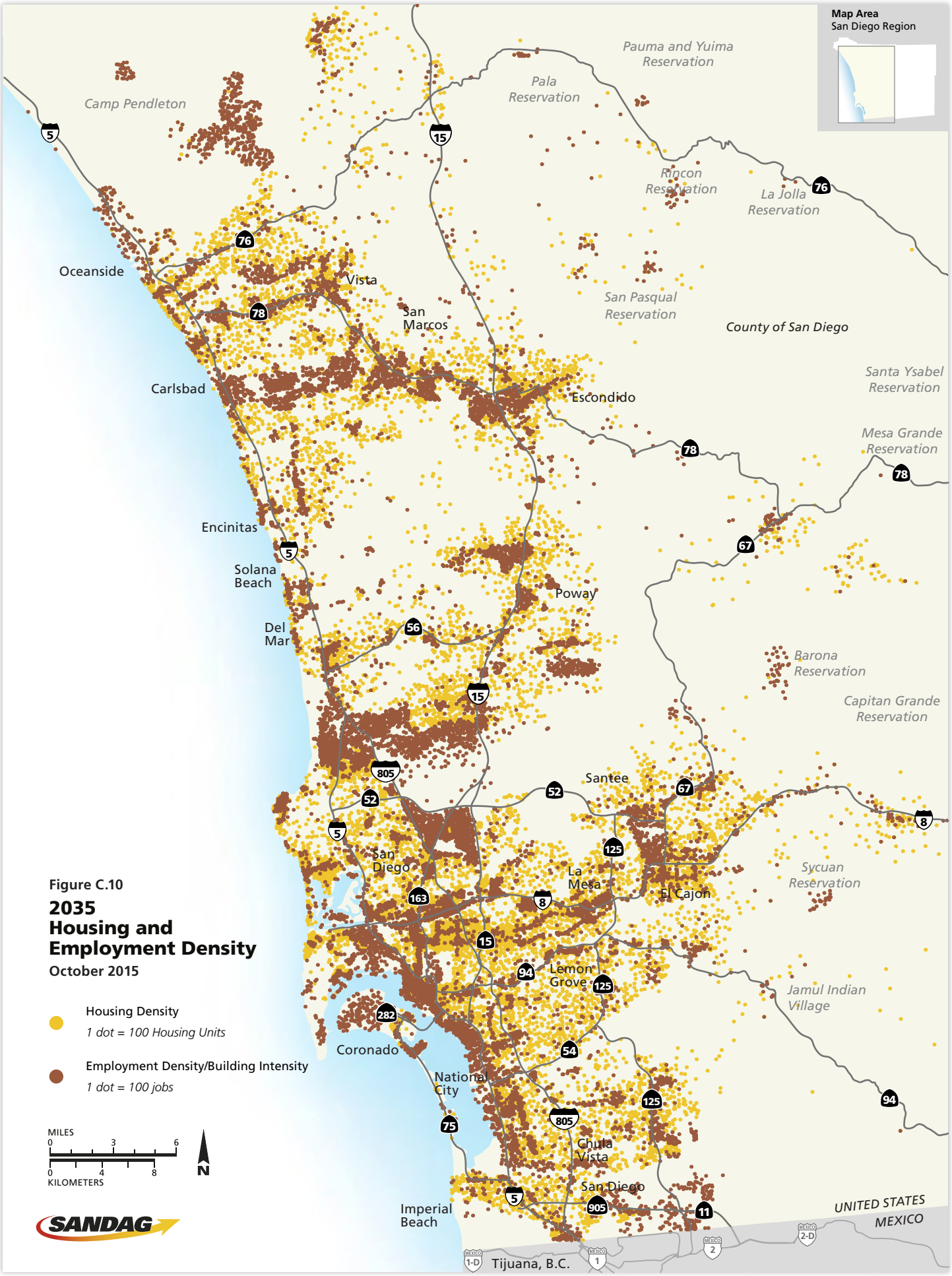
Capitan Grande Reservation
Santee
Sycuan Reservation
San Diego
La Mesa
El Cajon
Lemon Grove
Jamul Indian Village
Coronado
National City
Chula Vista
Imperial Beach
San Diego
UNITED STATES
MEXICO
Tijuana, B.C.
Figure C.9
2020
Housing and
Employment Density
October 2015
Housing Density
1 dot = 100 Housing Units
Employment Density/Building Intensity
1 dot = 100 jobs
MILES
0 3 6
0 4 8
KILOMETERS
N
SANDAG


Map Area
San Diego Region
Pauma and Yuima Reservation
Pala Reservation
Camp Pendleton
Rincon Reservation
La Jolla Reservation
Oceanside
Vista
San Marcos
San Pasqual Reservation
County of San Diego
Carlsbad
Escondido
Santa Ysabel Reservation
Mesa Grande Reservation
Encinitas
Solana Beach
Poway
Del Mar
Barona Reservation
Capitan Grande Reservation
Santee
Sycuan Reservation
San Diego
La Mesa
El Cajon
Lemon Grove
Jamul Indian Village
Coronado
National City
Chula Vista
Imperial Beach
Tijuana, B.C.
UNITED STATES
MEXICO
Figure C.10
2035
Housing and
Employment Density
October 2015
Housing Density
1 dot = 100 Housing Units
Employment Density/Building Intensity
1 dot = 100 jobs
MILES
0 3 6
0 4 8
KILOMETERS
N
SANDAG

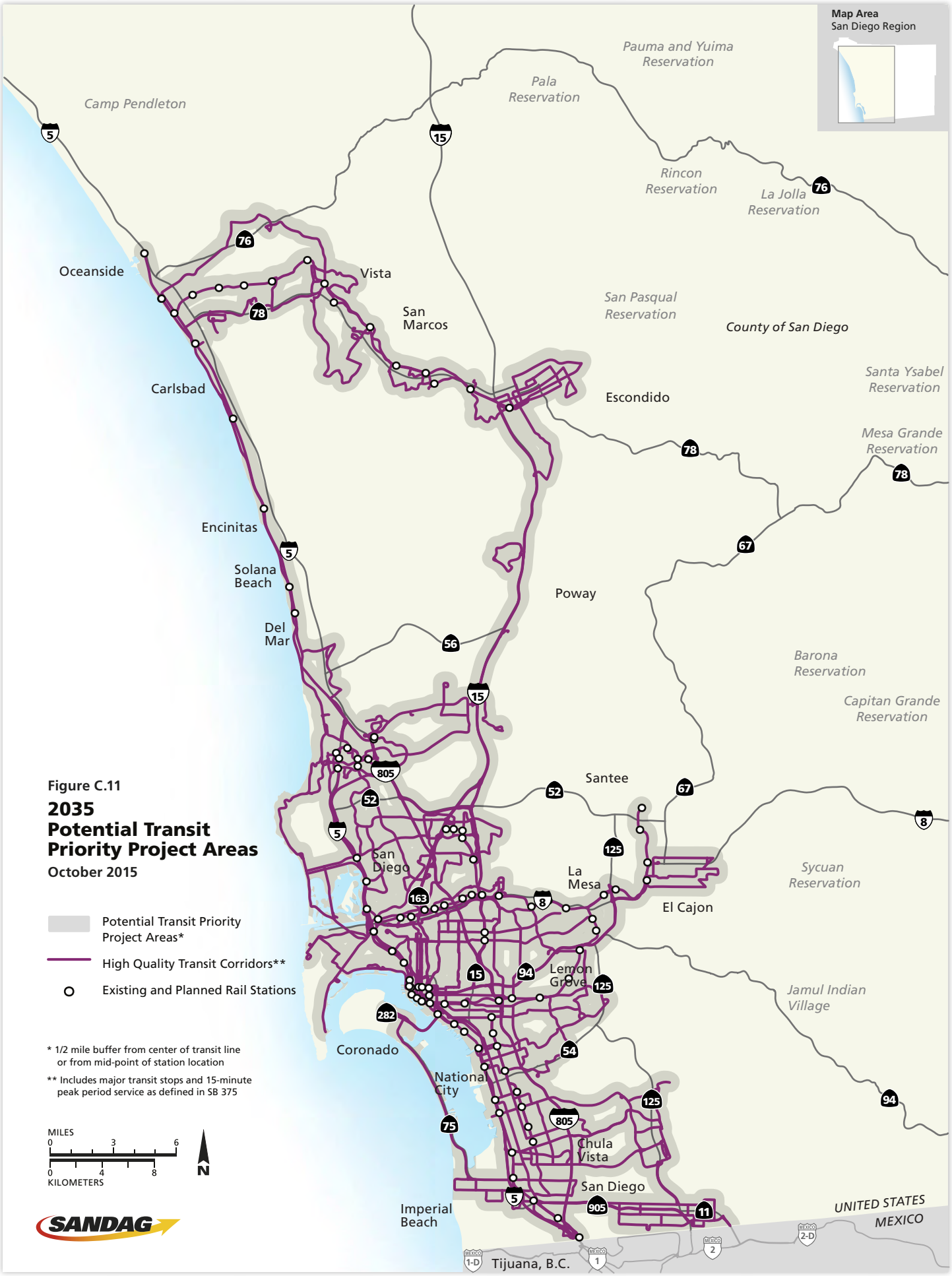


Figure C.11

2035 Potential Transit Priority Project Areas

October 2015

Endnotes

[1] Consistent with SB 375, this map identifies the general location of uses, residential densities, and building intensities in 2020. (Government Code Section 65080(b)(2)(B)(i)).

[2] Consistent with SB 375, this map identifies the general location of uses, residential densities, and building intensities in 2035. (Government Code Section 65080(b)(2)(B)(i)).

[3] http://www.sandag.org/index.asp?meetingID=3957&fuseaction=meetings.detail

[4] http://www.sandag.org/index.asp?meetingID=3851&fuseaction=meetings.detail

401 B Street, Suite 800
San Diego, CA 92101-4231
(619) 699-1900
Fax (619) 699-1905
www.sandag.org

June 7, 2013

File Number 3100000

Mr. Richard Corey
Executive Officer
California Air Resources Board
1001 I Street
Sacramento, CA 95814

Dear Mr. Corey:

SUBJECT: Technical Methodology to Estimate Greenhouse Gas Emissions from the San Diego Association of Governments Sustainable Communities Strategy

California Government Code 65080(b)(2)(I)(i) requires each Metropolitan Planning Organization to submit a description to the state board of the technical methodology it intends to use to estimate the greenhouse gas emissions from its sustainable communities strategy and, if appropriate, its alternative planning strategy. The enclosed document outlines the planning and modeling methodology the San Diego Association of Governments (SANDAG) intends to use to estimate the greenhouse gas emissions from its sustainable communities strategy and alternative planning strategy, if necessary. I am pleased to inform you the upcoming SANDAG Regional Plan will use an open, activity-based model that will be fully integrated with our new Production Exchange, Consumption, and Allocation System (PECAS) land use and economic model. This advancement will allow for a more detailed review of the interaction between land use and transportation in this plan.

Sincerely,

Gary L. Gallegos

GARY L. GALLEGOS
Executive Director

GGA/CDA/bga

Attachment: Technical Methodology to Estimate Greenhouse Gas Emissions

This report outlines key San Diego Forward: The Regional Plan (Regional Plan) planning efforts and inputs, including a description of its transportation and land use modeling platform. The Regional Plan serves as the San Diego Association of Governments (SANDAG) long-range planning document for the San Diego region, and it also functions as the Regional Transportation Plan and its Sustainable Communities Strategy (2050 RTP/SCS), which will comply with state and federal regulations including California Senate Bill 375 (Steinberg, 2008) and federal air quality conformity.

The Regional Plan brings together the updates of the SANDAG Regional Comprehensive Plan, the long-range blueprint planning document, and the 2050 RTP/SCS. A unified document provides San Diego residents a more accessible document that includes an overall vision for the region with a concrete implementation program. SANDAG anticipates the Regional Plan and its Environmental Impact Report (EIR) will be adopted by the Board of Directors in summer 2015.

What's New in the Regional Plan

The Regional Plan will continue to build on the planning and implementation progress since the adoption of the 2050 RTP/SCS in October 2011. The list below highlights some of the planning work that has been taking place in the San Diego region since 2011:

- An early action program to advance design and construction of projects included in the Regional Bicycle Plan
- A strategy to implement a broader Active Transportation Program that would include Safe Routes to School and Safe Routes to Transit
- Evaluation of alternative land use and transportation scenarios to further reduce projected Greenhouse Gas (GHG) emission levels
- Completion of a new transportation, land use, and economic modeling framework including an Activity-Based Transportation Model and Production Exchange, Consumption, and Allocation System (PECAS)
- Testing public health analytical tools for potential future planning work
- Development of a Regional Transit Oriented Development strategy to foster a greater level of development that supports investments in public transit
- Development of a Regional Complete Streets Policy for use at the regional and local level

In addition to the planning work, SANDAG and its partners are implementing the 2050 RTP/SCS, including the delivery of the following projects:

- SuperLoop Bus Service connecting the University of California San Diego and the adjacent major employment and housing centers of the North University area
- Expansion of the Bayshore Bikeway in Chula Vista
- New Bus Rapid Transit Stations and Managed Lanes along the Interstate 15 corridor

- Completion of the State Route 905 connecting the Otay Mesa International Port of Entry to the Interstate 5 and Interstate 805 corridors
- Double tracking of the COASTER and Amtrak LOSSAN corridor through northern San Diego County, including improved pedestrian crossings and tidal lagoon enhancements
- Completion of eight Smart Growth Incentive Program Capital Projects, including the Lemon Grove Main Street Promenade which will provide pedestrian enhancements to integrate planned mixed-use development at an existing light rail station

San Diego Forward: The Regional Plan Work Plan

On February 22, 2013, the SANDAG Board of Directors reviewed the work program for the Regional Plan. The work program provides the overall framework and schedule to develop and adopt the Regional Plan in 2015. Highlights of the work plan include the following activities:

- Engage in public outreach and involvement
- Establish the Regional Plan vision, goals, and policy objectives
- Prepare the 2050 Regional Growth Forecast update (Series 13)
- Refine and develop policy areas
- Incorporate recommendations from more detailed planning studies
- Develop Sustainable Community Strategies (SCS) and Alternative Planning Strategy (if needed)
- Update revenue and cost projections for projects, programs, and services
- Update regional arterial system (as needed)
- Update airport multimodal and rail planning
- Update transportation project evaluation criteria
- Update performance measures for the Regional Plan
- Develop financially unconstrained multimodal transportation scenario
- Develop revenue constrained alternative transportation scenarios and select preferred scenario
- Perform air quality conformity analysis
- Produce draft Regional Plan
- Prepare draft EIR
- Address feedback from public comment period

- Adopt final Regional Plan and certify final EIR
- Air quality conformity determination by United States Department of Transportation
- Air Resources Board (ARB) determination on the adopted SCS

Public Involvement Plan

The Public Involvement Plan (PIP) is intended to support the development of the Regional Plan, creating a variety of opportunities for individuals, organizations, agencies, and other stakeholders to provide meaningful input. The PIP was created based on input obtained throughout the fall of 2012 from the SANDAG Board of Directors, Policy Advisory Committees, working groups, surveys, and a public workshop held in October 2012. The PIP was drafted using the guidelines provided by the agency's overall Public Participation Plan, which sets the foundation for specific public outreach approaches. The PIP describes efforts that SANDAG will undertake to secure input on: developing sustainability and land use goals; priorities for transportation projects, programs, and services; transportation networks; infrastructure recommendations; funding alternatives; policies and programs; performance measures; GHG emissions targets; and other related issues.

Implementation of this PIP will accomplish the following:

- Provide a road map to ensure that all interested stakeholders are given the chance to participate in the process
- Reach beyond traditional methods to encourage participation from a wide variety of members of the public
- Communicate the importance of the plan and the opportunities to participate in the process
- Educate the public about SANDAG and its role in the region
- Establish the new Regional Plan as a critical policy document helping to balance our future housing, jobs, land use, transportation, health, social equity, economic, and environmental sustainability needs

This PIP is intended to be a living document. Because of the fluid nature of public participation, this plan may be updated at major milestones and adjusted in response to issues and circumstances that arise throughout the planning process.

Series 13: 2050 Regional Growth Forecast

The Series 13 Regional Growth Forecast serves as the foundation for the Regional Plan and other planning documents (e.g., water, general plans) across the region. SANDAG denotes forecasts by a sequential series number. The forecast under development is known as the Series 13: 2050 Regional Growth Forecast. The forecast used in the 2050 RTP/SCS, adopted in October 2011, was the Series 12: 2050 Regional Growth Forecast.

The regional forecast is developed by SANDAG with input from expert demographers, economists, developers, planners, and natural resource managers. These experts review economic and

demographic assumptions about fertility, migration, inflation, and other indicators. In addition to the traditional expert panel review SANDAG conducts, SANDAG also has reviewed the forecast with key stakeholders across the region, including transportation, land use, and economic development advocates.

SANDAG uses its Demographic and Economic Forecasting Model (DEFM) to develop the regional forecast. The DEFM was first developed to support the Series 4 forecast in the late 1970's. The DEFM uses a standard cohort-survival modeling technique along with econometric tools to estimate future growth. The DEFM has a proven track record of accuracy; since Series 4 (1977), on average, it has been within 4 percent of observed population growth.

The DEFM results will feed the sub-regional allocation models to develop city and neighborhood level forecasts. The Series 13 sub-regional forecast will use a new tool called PECAS. This model offers several enhancements beyond the sub-regional forecasting models used in prior forecasts by introducing economic conditions and return on investment calculations into the projections of development, redevelopment, and infill. In addition to new data sources, PECAS continues to rely upon the land use plans, policies, and zoning ordinances of the 18 cities, the County of San Diego, and other land use authorities. To ensure that local plans and policies are accurately reflected in the subregional forecast, the local jurisdictions and member agencies complete a review of its land use inputs (including general plans, planned land use, and housing capacity) via an online review tool.

Once the sub-regional forecast is complete, the detailed demographic forecast is produced. The Program for Age, Sex, and Ethnicity Forecast (PASEF) is a demographic model designed to forecast detailed demographic characteristics at a neighborhood level. PASEF projects population for 18 five-year age groups (0-4, 5-9,...,80-84, and 85+) broken down by gender and ethnicity for the region and smaller geographies.

A more detailed description of the land use forecasting models is included below in the *Modeling the Regional Plan* section of this report.

Evaluation Criteria and Performance Measure Development and Implementation

Project evaluation criteria is one element of a multistep process used to develop the revenue constrained multimodal transportation network for the Regional Plan. Evaluation criteria have been used in previous transportation plans including in the 2050 RTP/SCS. Project prioritization along with other factors such as funding availability, project readiness, and overall network connectivity are considered when developing the proposed transportation network alternatives.

In past transportation plans, SANDAG also has utilized performance measures to evaluate the performance of proposed revenue constrained transportation networks. The performance measures from the 2050 RTP/SCS included metrics to evaluate safety, multimodal mobility and reliability, goods movement, social equity, environmental impacts, and the relationship between land use and transportation. Performance measures are used to compare the proposed network alternatives and serve as a tool to select the preferred revenue constrained network scenario.

SANDAG is currently analyzing both the evaluation criteria and performance measures to incorporate best practices being used in the transportation planning field. Revisions for evaluation criteria are intended to simplify and standardize the criteria across different modal categories.

Performance measure revisions will assess the effectiveness of existing measures and consider new components including public health factors. Consultant assistance has been retained to research the best practices of other Metropolitan Planning Organizations (MPO) and various transportation research institutions and to develop refinements of the evaluation criteria and performance measures. The revised transportation project evaluation criteria and the updated performance measures will be presented to the SANDAG Board of Directors in fall 2013 for approval.

Land Use and Transportation Scenarios

The development of alternative land use and transportation scenarios, including the evaluation of potential pricing and parking strategies, is proposed to test strategies that could result in further reductions of GHG emissions beyond those forecasted in the 2050 RTP/SCS. The Series 13 sub-regional forecast will provide the baseline scenario against which alternative scenarios are compared.

Initial work on defining the scenario assumptions will begin in spring 2013, and scenario testing will begin in summer 2013. Through this planning process, various scenarios will be prepared, tested, and analyzed by early 2014, so results can inform the development of revenue-constrained transportation network scenarios.

A consultant team is assisting SANDAG in developing inputs and assumptions to assess the alternative land use and transportation scenarios. The scenarios will be measured against indicators, tested for performance, and refined throughout 2013. Sketch planning and travel demand models will be used in this planning effort.

Modeling the Regional Plan

SANDAG will use an integrated land use, economic, and transportation modeling system to estimate the GHG in the Regional Plan. Over the past five years, SANDAG has developed a new PECAS, Population Synthesizer (PopSyn), Activity-Based Model (ABM), Commercial Travel Model (CTM), and updated its Heavy-Duty Truck Model (HDTM).

The integrated system includes: (1) DEFM; (2) PECAS in conjunction with Urban Development Model (UDM); (3) detailed demographic forecast (PASEF and PopSyn); (4) the ABM and CTM; and (5) the latest Emission Factors (EMFAC) model from ARB (currently EMFAC 2011). Depending on model sensitivity to certain transportation policies, SANDAG will consider using off-model factors (or ARB defined Policies and Practices) as recommended by the Regional Targets Advisory Committee (RTAC). The Regional Plan model will have a base year of 2012.

The first model component, DEFM, is an econometric forecasting model with a demographic module. DEFM produces an annual forecast of the size and structure of the region's economy and a demographic forecast consistent with that future economy. For the economic forecast, DEFM relates historical changes in the region's economy to historical changes in the United States' economy using input-output and econometric methodologies. The demographic module uses a cohort survival model to forecast population by age, gender, and ethnicity. DEFM produces a wealth of data about the region's future economic and demographic characteristics. Among the more important elements are the size and composition of the population, employment by industry sector,

household and personal income, housing units by structure type, vacancy status and persons per household, labor force, and school enrollment.

Next, PECAS offers several improvements over more traditional spatial interaction "gravity" models. PECAS attempts to account for variation in the cost and quality of goods and services, as well as individual tastes and preferences. By integrating spatial characteristics (travel distances, land availability) and the economic system (prices, income), PECAS can evaluate a wider range of socio-economic impacts resulting from land use and transportation policies. PECAS is able to model the effects of land use and transportation policies on the wages, rents, productivity, and overall benefit to industrial and socio-economic groups.

PECAS has two component modules: the Activity Allocation (AA) Module and Space Development (SD) Module. The AA Module models the areas in which households and firms locate and who buys what from whom. Households located in one submarket interact with businesses throughout the region by both providing labor and purchasing goods and services. Businesses exchange their products with other businesses located throughout the region and use household labor as part of their production process. The SD Module models the actions of real estate developers who provide space (land use and floor space) in which households and firms can locate, responding to demand from households and businesses in AA for space in certain areas. These modules are run in one-year steps, with SD following AA. As a final step in the PECAS process, zonal control targets for housing and jobs are allocated to the parcel level with the UDM.

The third model component includes PASEF and the PopSyn. PASEF is a demographic model designed to forecast detailed demographic characteristics at a neighborhood level. The detailed demographic forecast comes directly from DEFM, but requires aggregating the single year of age detail into the five-year age groups used in PASEF, and an adjustment for special populations. The model projects population for 18 five-year age groups (0-4, 5-9,...,80-84, and 85+) broken down by gender and ethnicity for the region and smaller geographies. PASEF produces population controls used by the PopSyn.

The PopSyn generates a synthetic population for the region. This synthetic population represents the individual travelers that the ABM will simulate. For each simulation year, a full population is synthesized to match the forecasted socio-economic and housing characteristics of each part of the region at the zonal level. These forecasts, a key ABM input, come from the land use models described above. Synthesis works by replicating a sample of Census or American Community Survey Public Use Microdata Sample records (each containing complete household and individual characteristics) and placing them around the region in such a way that the forecasted characteristics of each zone are matched.

The fourth model component, the ABM, forecasts travel activity. The ABM simulates individual and household transportation decisions that compose their daily travel itinerary. People travel for activities such as work, school, shopping, healthcare, and recreation, and the ABM attempts to predict whether, where, when, and how this travel occurs. The ABM addresses both household-level and person-level travel choices including intra-household interactions between household members. It also offers sensitivity to demographic and socio-economic changes by the enhanced and flexible population synthesis procedures as well as by the fine level of model segmentation.

The ABM operates at fine temporal and spatial resolution: a half hour temporal resolution for the tour generation, mode choice, and trip generation. These 30-minute intervals are aggregated into five time-of-day periods for auto, transit, and non-motorized assignment. The ABM takes advantage of the Master Geographic Reference Area (MGRA) zone system, which is the most disaggregate zonal system currently in use in any travel demand model in the United States. The SANDAG current MGRA system consists of 23,000 zones (Series 13 version), which are roughly equivalent to Census block groups. To avoid computational burden, SANDAG relies on a 4,900 Transportation Analysis Zone (TAZ) system for the auto assignment step, but performs transit calculations at the more detailed MGRA level.

While the ABM addresses personal travel, the CTM addresses travel made in the region for non-personal reasons. Commercial travel is defined as heavy-duty truck trips with both origin and destination in San Diego County; professional service vehicle trips such as trips generated by plumbers, gardeners, and electricians; light-duty freight trips such as trips generated by trash trucks, light construction trucks, food delivery vehicle operators; postal and package couriers (such as FedEx and UPS); and at-work business trips generated by company employees.

The CTM is a disaggregate tour-based model used to forecast "local" intra-region commercial travel. The model starts with aggregate tour generation by industry type followed by disaggregate simulation of the tour attributes such as mode, purpose, exact start time, stop purposes, stop locations, and stop durations. The trip list produced by the CTM is transformed into trip tables by vehicle class for assignment with the ABM person trip tables. This model construct allows for more realistic commercial movements over trip-based models since commercial movements tend to have complex tours with a large number of stops.

An external HDTM addresses external to internal, internal to external, and external to external truck trips for San Diego County. The model is based on disaggregated Freight Analysis Framework forecast data. External trucks by commodity are allocated to TAZs based on employment types. Both the CTM and HDTM external model work on the same TAZ system as the ABM.

At the end of the modeling system is the EMFAC model, which takes vehicle miles traveled (VMT) by vehicle class and fuel type, and VMT speed distributions by vehicle class, post processed from the ABM/Commercial Vehicle Model, and calculates the GHG emissions for the SCS.

SANDAG strives to stay in the forefront of forecasting technology by subjecting its efforts to peer review and presenting the methodology at relevant meetings and conferences.

Active Transportation Enhancements

The Active Transportation Model component enhances the ABM to provide greater sensitivity and broader capabilities to address Active Transportation projects and policies and inform the SANDAG policy development and future decision-making. These enhancements include a complete representation of bike and pedestrian networks, and associated attributes such as facility type, distance, and grade; a new Bike-Route Choice Model; and revised and recalibrated trip and tour mode choices in ABM.

The first phase of the Active Transportation Model development is a seven-month project that is anticipated be completed in the second half of 2013. In this phase, a Bike-Route Choice Model will

be borrowed from San Francisco County and will be calibrated and validated with San Diego local bike count datasets. In cooperation with the County of San Diego and San Diego State University, SANDAG has installed 28 permanent bicycle count stations around the region to continuously monitor bicycle and pedestrian activity on key regional corridors.

A bike travel behavior survey will be conducted in future phases to estimate a San Diego Bike-Route Choice Model. With these enhancements, the integrated ABM and Active Transportation model can be used to assess the impact of bike and pedestrian investments on bike ridership and pedestrian volume changes, diversion of ridership on parallel facilities, mode share changes, VMT reductions, and GHG emission reductions. The Active Transportation Model will produce a set of non-motorized travel related Regional Transportation Plan (RTP) performance measures.

Emissions Modeling

The latest version of EMFAC (currently EMFAC 2011) will be used to calculate the GHG emissions for the Regional Plan based on the transportation model outputs. The transportation model post processes highway and transit assignment information to create EMFAC input files containing vehicle trips by vehicle class and fuel type, VMT by vehicle class and fuel type, and VMT speed distributions by vehicle class and hour. The current version of EMFAC projects the following GHG pollutants: carbon dioxide, carbon monoxide, nitrous oxides, total hydrocarbons, and methane.

Feedback in the Regional Travel Demand Model

A noteworthy feature of the forecasting process is the feedback of information from one model to another. For example, regionwide projections of economic activity from the DEFM are used in the AA Module of PECAS, and then AA Module results are used for the SD Module of PECAS. Similarly, data from AA are major inputs to the transportation model, and then transportation model data are used in subsequent AA calculations. A key feature of the modeling system is the central role that land use and transportation policies play in determining future travel patterns and the associated location of people, houses, and jobs.

Off-Model Techniques to Measure GHG

While the impacts of certain policy scenarios cannot be measured in the Travel Demand Model, SANDAG may use these policy scenarios to meet its GHG targets established by ARB. In these instances, SANDAG will rely on off-model techniques based on academic literature reviews, collaboration with other MPOs, and consultation with ARB's Policies and Practices Guidelines. Any off-model techniques used will be fully documented and justified in the final RTP, SCS, and/or model documentation.

RTP Consistency with RTAC Target Setting Process

SANDAG anticipates using the methodology described in this report to calculate GHG emissions for the Regional Plan and its SCS as well as the current GHG target setting process as outlined by the RTAC and any subsequent updates by ARB. SANDAG may revise the methodology to be used in the regional plan in consultation with ARB if updated software (e.g., EMFAC 2013) or a more accurate methodology becomes available during the target-setting revision process.

Addressing GHG Emissions after 2035 in the Regional Plan

SANDAG will use the modeling methodology outlined in this document to calculate GHG emission for 2020 and 2035 for the SCS as required by California Government Code 65080. SANDAG will perform an analysis of GHG emissions through 2050. As the Regional Plan is being developed, SANDAG will work with the appropriate federal and state agencies to ensure its 2050 methodology is consistent with best practices and conforms to all applicable state and federal regulations.

Air Resources Board

Mary D. Nichols, Chairman
1001 I Street • P.O. Box 2815
Sacramento, California 95812 • www.arb.ca.gov

Matthew Rodriquez
Secretary for
Environmental Protection

Edmund G. Brown Jr.
Governor

August 12, 2013

Mr. Gary Gallegos
Executive Director
San Diego Association of Governments
401 B Street, Suite 800
San Diego, California 92101-4231

Dear Mr. Gallegos:

Thank you for submitting the San Diego Association of Governments' (SANDAG) proposed technical methodology for quantifying the greenhouse gas emissions resulting from the regional Sustainable Communities Strategy (SCS) currently being developed as part of the next regional transportation plan scheduled to be adopted in 2015. Your letter dated June 7, 2013 satisfies the requirement in Government Code section 65080(b)(2)(J)(i) that each Metropolitan Planning Organization submit to Air Resources Board (ARB) a description of the technical methodology that it will use, prior to beginning the region's public process to develop a strategy for meeting SB 375 targets.

We look forward to continuing our collaboration with SANDAG as you begin to prepare the San Diego region's second SCS. We appreciate the fact that SANDAG is undertaking a significant effort to develop new and updated modeling tools, including an Activity Based Model, which will be used in the planning process for the 2015 SCS.

If you have any questions, please contact Ms. Lynn Terry, Deputy Executive Officer, at (916) 322-2739.

Sincerely,

Richard W. Corey
Executive Officer

cc: Ms. Lynn Terry
Deputy Executive Officer

The energy challenge facing California is real. Every Californian needs to take immediate action to reduce energy consumption. For a list of simple ways you can reduce demand and cut your energy costs, see our website: http://www.arb.ca.gov.

SANDAG Off-Model Greenhouse Gas Reduction Methodology

To forecast the outcomes of the transportation network included in the Regional Plan, SANDAG uses the Activity Based Model (ABM) to estimate performance measures. However, some strategies including carshare, vanpool programs, carpool programs, plug-in electric vehicle (PEV) charging stations, managed lane automation, and transit managed lane automation are not captured fully by the SANDAG ABM or the California Air Resources Board (ARB) Emissions Factor model. These off-model strategies are included to account for their additional reductions of greenhouse gas emissions. This attachment documents both the methodology and explanation of benefits from these off-model strategies.

Carshare

Carshare is one aspect of shared mobility highlighted in San Diego Forward: The Regional Plan. Carshare can provide first mile/last mile connections to transit or fill gaps in the region's transit services by providing an efficient transportation alternative for commute and non-commute trips. A carshare service provides members with access to a vehicle for short-term use, such as Car2Go and Zipcar. Shared vehicles are distributed across a network of locations (or specified service area) within urban communities. Members can access the vehicles at any time with a reservation and are charged by time or by mile. Carshare provides some of the benefits of a personal vehicle without the costs associated with owning one. The SANDAG Transportation Demand Management (TDM) program seeks to incentivize and expand the reach of carshare to employment centers and urban communities that are not currently served by this mobility option and that the private market may be hesitant to enter in order to complement and improve access to regional transit services.

Methodology and calculations

A minimum level of density and supporting land use is required to initiate and sustain most carshare services. The following methodology pertains exclusively to investments in carshare, the shared mobility service type with the greatest amount of history and data available, and for which SANDAG is taking credit for under SB 375 in terms of reduced greenhouse gas emissions. Past research on traditional (or round-trip) carshare models[1] has demonstrated that between 10 percent[2] and 13 percent[3] of the eligible population is expected to join a carshare service. In the San Diego region, the eligible population is defined as anyone age 18 or older, the current minimum age requirement for a carshare membership. Additionally, a residential density threshold was established for each milestone year to determine which portions of the San Diego region are most suited for carshare investment through 2050. In 2020, the assumed minimum residential density is 69 persons per acre or higher and in 2035 and 2050 the assumed minimum residential density is 55 persons per acre or higher.[4] In line with past research coupled with the recent introduction of one-way[5] and peer-to-peer[6] carshare in the San Diego region, a conservative proportion of the region's eligible population living in communities that meet these residential density thresholds was considered to estimate the adoption of carshare in the region over time:

- 2020 – 15% of the eligible population, or approximately 52,791 people
- 2035 – 20% of the eligible population, or approximately 146,914 people
- 2050 – 25% of the eligible population, or approximately 227,615 people

The daily VMT reduction for each milestone year is calculated by multiplying the estimated number of carshare members by seven miles (the average daily VMT reduction per carshare member[7]).

SB 375 emissions reduced by milestone year were calculated by multiplying the average daily VMT reduction for each milestone year by the derived CO_2 emission factor of 0.9484 lbs / mile for 2020, 0.9408 lbs / mi for 2035, and 0.9407 lbs / mi for 2050.[8]

Table 1
Carshare VMT and CO_2 Reduction Results

	2020	2035	2050
Daily VMT Reduction	369,536	1,028,398	1,593,305
SB 375 Emissions (lbs)	350,474	967,506	1,498,870

Vanpools

The Regional Vanpool Program is currently offered by SANDAG. Vanpools have been shown to reduce greenhouse gas emissions since only one (albeit larger) vehicle is required to transport the same number of people that would normally take 7 to 15 single-occupant vehicles to transport. Based on historic trends the program is assumed to grow 13 percent by 2020 (approximately 811 vanpools), 62 percent by 2035 (approximately 1,163 vanpools), and 110 percent by 2050 (approximately 1,512 vanpools). Future growth assumptions are based on restructuring the current $400 monthly subsidy program to encourage the formation of larger vanpools and sustain program participation, policy changes that reduce barriers to entry, improved program administration, and targeted marketing to key employment industries and underserved populations.

Methodology and calculations

Growth of the Regional Vanpool Program is tied to the assumption of a slight increase in the monthly subsidy over time and available funding for program administration. Eighty percent of all vans are assumed to carry up to eight passengers, and 20 percent of all vans are assumed to carry up to ten passengers.

Average daily VMT reduction calculation for each milestone year:

(Proportion of eight-passenger vans x Number of projected vanpools in the milestone year x Number of total passengers excluding the driver x Average round-trip vanpool commute distance) + (Proportion of ten-passenger vans x Number of projected vanpools in the milestone year x Number of total passengers excluding the driver x Average round-trip vanpool commute miles)

SB375 emissions reduced by milestone year were calculated by multiplying the average daily VMT reduction for each milestone year by the derived CO_2 emission factor of 0.9484 lbs / mile for 2020, 0.9408 lbs / mi for 2035, and 0.9407 lbs / mi for 2050.

Table 2
Vanpool VMT and CO_2 Reduction Results

	2020	2035	2050
Daily VMT Reduction	678,339	972,797	1,264,438
SB 375 Emissions (lbs)	643,349	915,197	1,189,495

Carpools

SANDAG evaluated the investment in a carpool incentive program to promote the use of fewer vehicles to transport the same number of people to and from work. A carpool incentive was pilot tested with select employers in 2012. Based on lessons learned from the pilot, a formal carpool incentive program is expected to launch in the summer of 2016. The proposed program would incentivize the formation of 17,582 new carpools between now and 2050. Based upon anticipated budget and staffing levels, an incentive of $30 per month per carpooler for three continuous months at a budget of $100,000 per year[9] would reasonably accommodate up to 488 new carpools annually. [10]

Methodology and calculations

Following the initial three-month incentive period, assumed carpool program retention rates per carpool are 90 percent after one year, 50 percent after two years, 25 percent after three years, and 0 percent after four years.[11] It is assumed that approximately 1,293 new carpools carrying 2,716 carpoolers would exist in 2020, 2035, and 2050 based on these retention rates. Carpool size is assumed to be 2.1, and daily VMT per capita is assumed to be 26 miles.[12]

Average daily VMT reduction calculation for each milestone year:

Total number of carpools x Average carpool size (excluding the driver) x Average round-trip commute miles

SB 375 emissions reduced by milestone year were calculated by multiplying the average daily VMT reduction for each milestone year by the derived emission factor of 0.9484 lbs / mile for 2020, 0.9408 lbs / mile for 2035, and 0.9407 lbs / mile for 2050.

Table 3
Carpool VMT and CO_2 Reduction Results

	2020	2035	2050
Daily VMT Reduction	36,986	36,986	36,986
SB 375 Emissions (lbs)	35,078	34,796	34,793

Plug-In Electric Vehicles (PEV) Charging Stations

The State of California has a goal to have 1.5 million zero emissions vehicles (ZEVs) operating in California by 2025. ZEVs include both Plug-in Electric Vehicles (PEVs) and fuel cell electric vehicles. To achieve additional greenhouse gas reductions beyond the state goals, a larger network of electric vehicle charging stations (EVCS) is needed to extend the electric range of plug-in hybrid electric vehicles. SANDAG will establish a Regional Charger Program by setting aside approximately $30 million of Congestion Management and Air Quality (CMAQ) Improvement Program funds expected between 2020 and 2050 (approximately $1 million annually) to fund an incentive program for the installation of publicly available EVCS. According to the Electric Power Research Institute (EPRI), one EVCS is needed for every five PEVs, with a breakdown of 75 percent Level 1 EVCS (which adds 2-5 miles of range per hour of charging) and 25 percent Level 2 EVCS (which adds 10-20 miles of range per hour of charging). Increasing the number of publicly available EVCS would reduce greenhouse gas emissions by extending the electric range of plug-in hybrid electric vehicles that would replace gasoline-powered internal combustion engines. The calculations and expected emissions reductions attributed to the Regional Charger Program are shown here.

Methodology and calculations

By 2025, the state's target is for 15.4 percent of new car sales to be ZEVs; of this, 9 percent would be Plug-in Electric Vehicles (PEVs). SANDAG assumes that after 2025, these percentages for annual sales remain constant, but overall ZEV fleet continues to grow due to vehicle turnover. Currently, plug-in hybrids drive 30 percent of their miles in electric mode and the remainder in gasoline mode. The build-out of a robust charger network would increase this percentage to 41 percent. The 11 percent increase in electric miles from plug-in hybrid vehicles results in the additional greenhouse gas reductions summarized below. The funding for the program would provide incentives for the installation of publicly available EVCS throughout the region. The program currently assumes incentive levels of $250 per Level 1 EVCS and $2,100 per Level 2 EVCS, and would add 6,065 EVCS by 2020, 35,697 EVCS by 2035, and 43,376 EVCS by 2050.

Table 4
Plug-In Hybrid Electric Vehicles and Added e VMT

	2020	2035	2050	
Number of Plug-in Hybrid Vehicles	34,326	182,484	220,882	
Daily VMT per vehicle	21.83	20.48	19.90	
Total Daily VMT	749,259	3,737,510	4,394,701	
eVMT (30%)	224,778	1,121,253	1,318,410	
eVMT with Program (41%)	307,196	1,532,379	1,801,827	
Added eVMT (11%)	82,418	411,126	483,417	
Emission Factor - per mile reduced	0.9484	0.9408	0.9407	lb/mi
CO_2 reduced	78,167	386,783	454,765	lbs CO_2

Table 5
PEV Charging Stations and CO_2 Reduction Results

	2020	2035	2050
SB 375 Emissions (lbs)	78,167	386,783	454,765

Managed Lane Automation

In 2050, assuming vehicle automation technology becomes available to vehicles accessing managed lane facilities, the managed lane facilities will have 80 percent higher capacity to handle these zero emission vehicles.

Methodology and calculations

SANDAG conducted a model run with 80 percent increased capacity on the managed lane system. Using output from the model run, SANDAG calculated total managed lane (ML) VMT for the SB 375 vehicle classes. To account for all ML vehicles operating as zero emission vehicles, the VMT from ML was removed from the EMFAC inputs. Using the ML VMT modified EMFAC file, an emissions profile was created. The off-model calculation reflects the CO_2 emission differences between the Regional Plan preferred scenario and the automated managed lane scenario.

Table 6

Regional Plan and Managed Lane Automated Scenario CO_2 Emissions

	2050
2050 Regional Plan CO_2 Emissions (SB 375)	82,215,442 lbs / day
Automated ML Scenario CO_2 Emissions	77,896,235 lbs / day
Emissions Difference	(4,319,207) lbs / day

Table 7

Managed Lane Automation and CO_2 Reduction Results

	2020	2035	2050
SB 375 Emissions (lbs)	–	–	4,319,207

Transit Managed Lane Automation Programs

In 2050, assuming vehicle automation technology becomes available to transit vehicles, the automated transit vehicles would result in lower operating costs that would potentially allow for more frequent service on certain routes and lower fares.

Methodology and calculations

SANDAG conducted a model run with increased transit operations on well utilized transit routes. Using output from the transit operations model run, SANDAG calculated total greenhouse gas emissions for the SB 375 vehicle classes. The off-model calculation reflects the CO_2 emission differences between the 2050 Regional Plan preferred scenario and the automated transit scenario.

Table 8

Regional Plan and Automated Transit Scenario CO_2 Emissions

	2050
2050 Regional Plan CO_2 Emissions (SB 375)	82,215,442 lbs / day
Automated Transit Scenario CO_2 Emissions	81,282,787 lbs / day
Emissions Difference	(932,655) lbs / day

Table 9

Transit Managed Lane Automation and CO_2 Reduction Results

	2020	2035	2050
SB 375 Emissions (lbs)	–	–	932,655

Summary of Off-Model Strategies

The six off-model greenhouse gas reduction measures described above are projected to reduce daily vehicle miles traveled (VMT) by nearly 3 million miles by 2050, which translates to a daily CO_2 emissions reduction of 4,214 tons per day by 2050 (or approximately 2 lbs. per person) as shown in Table 10.

Table 10
Summary of Off-Model Strategies (CO_2 lbs / day)

	2020	2035	2050
Carshare	(350,474)	(967,506)	(1,498,870)
Vanpools	(643,349)	(915,197)	(1,189,495)
Carpools	(35,078)	(34,796)	(34,793)
Plug-in Electric Vehicle Charging Stations	(78,167)	(386,783)	(454,765)
Managed Lane Automation	–	–	(4,319,207)
Transit Automation	–	–	(932,655)
Total SB 375 CO_2 Off-Model Adjustments	**(1,107,068)**	**(2,304,282)**	**(8,429,785)**

ARB EMFAC 2007 to EMFAC 2014 CO_2 Adjustments

On June 30, 2015, ARB staff transmitted a memorandum to Metropolitan Planning Organization (MPO) technical staff providing "guidance on how to deal with changes arising from different EMFAC versions" for the greenhouse gas quantification determinations for the second round of Sustainable Communities Strategies (SCS). According to the enclosed memorandum, in 2010, ARB established regional SB 375 greenhouse gas targets in the form of a percent reduction per capita from 2005 for passenger vehicles using the ARB Emission Factor model, EMFAC 2007. Since the time when targets were set using EMFAC 2007, ARB has released two subsequent versions, EMFAC 2011 and EMFAC 2014. ARB has updated the carbon dioxide (CO_2) emission rates in EMFAC 2011 and EMFAC 2014, based on recent emission testing data and updated energy consumption for air conditioning. In addition, vehicle fleet mix has been updated in EMFAC 2011 and again in EMFAC 2014 based on the latest available Department of Motor Vehicle data at the time of model development. These changes have lowered the overall CO_2 emission rates in EMFAC 2011 and EMFAC 2014 compared to EMFAC 2007.

ARB staff developed a methodology to allow MPOs to adjust the calculation of percent reduction in per capita CO_2 emissions used to meet the established targets when using either EMFAC 2011 or EMFAC 2014 for their second round RTP/SCS. This method will neutralize the changes in fleet average emission rates between the version used for the first RTP/SCS and the version used for the second RTP/SCS. The adjustment for SANDAG is +2 percent per capita reductions; that is, SANDAG has to reduce the estimated change in CO_2 by two additional percentage points. For example, before the ARB adjustment, SB 375 per capita reductions for 2020 were 17 percent, and after applying the adjustment, the reductions became 15 percent. Table 11 provides a summary of the CO_2 per capita reductions from the on-model components, from the off-model analysis of the six strategies included in this attachment, and the ARB adjustment factor.

Table 11
Summary of CO_2 Per Capita Reductions – On and Off-Model Results

	2020	2035	2050
Per Capita Reduction (On-Model Results Only)	16%	21%	23%
Per Capita Reduction (Off-Model Results Only)	1%	2%	8%
ARB Adjustment Factor	-2%	-2%	-2%
Total Per Capita Reduction	**15%**	**21%**	**29%**

Endnotes

[1] Round-trip carshare services require users to return a rented vehicle to the pick-up location (e.g., Zipcar).

[2] Zipcar. http://www.zipcar.com/business/is-it/greenbenefits. Accessed August 3, 2015.

[3] Zhou, B., Kockelman, K., and Gao, R. "Opportunities for and Impacts of Carsharing: A Survey of the Austin, Texas Market", Transportation Research Board, 2009.

[4] Residential density thresholds align with those established for the SANDAG Smart Growth Opportunity Areas. Mixed-Use Transit Corridors require a residential density minimum of 69 persons per acre while Community Center and/or Town Centers align with a residential density minimum of 55 persons per acre. Additional information on SANDAG Smart Growth Opportunity Areas can be found here: http://www.sandag.org/uploads/projectid/projectid_296_14002.pdf.

[5] A one-way carshare service allows a user to rent a vehicle at one location and end the trip at another location within the carshare service area (e.g., car2go).

[6] Peer-to-peer carshare allows vehicle owners to rent their personal cars to others for a daily or hourly rate via a website or mobile app (e.g., RelayRides). This model offers a way in which vehicle owners can maximize vehicle use in lieu of keeping it parked at a single location.

[7] The daily VMT reduction of seven miles per carshare member was established based on academic research: (1) Shaheen and Cohen, "Innovative Mobility Carsharing Outlook" (Summer 2013); (2) Cervero, Golub, and Nee, "City CarShare: Longer-Term Travel-Demand and Car Ownership Impacts", July 2006, Transportation Research Board 2007 Annual Meeting paper.

[8] Emissions rates from EMFAC 2014 v.1.0.7.

[9] Figure not inclusive of marketing and administrative costs.

[10] ($30 gift card + $2.50 activation fee per card) x 3 months x 2.1 people per carpool.

[11] Retention rates were based on case study research. In 2009 SANDAG commissioned a study to analyze rideshare incentive programs and develop an incentive program framework for the San Diego region. The study evaluated rideshare incentive programs offered by the San Bernardino Association of Governments (SANBAG) and the Riverside County Transportation Commission (RCTC) and found that 90 percent of participants continued to rideshare after participating in the program. A Transportation Research Board (TRB) study entitled "Duration of Carpool and Vanpool by Rides Clients" evaluates the San Francisco Bay Area ridesharing program and found that 50 percent of participants were still carpooling 30 months after they received assistance from the rideshare program. Research from Denver (Survey of Work Commuters in the Denver Area, DRCOG (2010)) and Virginia (Methodologies for Determining Carpooler and Vanpool Average Life Bases and the Average Fuel Economy of Commuter Vehicles, VHTRC) revealed that the average lifespan of a carpool was between 2.25 - 3.2 years.

[12] Per the SANDAG activity-based model.

From: Taylor, Jonathan@ARB [mailto:jonathan.taylor@arb.ca.gov]
Sent: Tuesday, June 30, 2015 5:24 PM
To: Daniels, Clint; 'Guoxiong Huang'; Bruce Griesenbeck (BGriesenbeck@sacog.org); David Ory; Tanisha Taylor (Taylor@sjcog.org); ehahn@Stancog.org; Matt Fell (matt.fell@mcagov.org); terri.king@co.kings.ca.us; jeff@maderactc.org; Kai Han (KHan@fresnocog.org); RBrady@tularecog.org; Vincent Liu (vliu@kerncog.org); Bhupendra Patel (BPatel@ambag.org); JWorthley@slocog.org; blasagna@bcag.org; 'Andrew Orfila'; Sean Tiedgen (stiedgen@srta.ca.gov); Norberg, Keith@TRPA
Cc: Ken Kirkey; ggarry@sacog.org; Stoll, Muggs; Huasha Liu (LIU@scag.ca.gov) (LIU@scag.ca.gov); Mike Bitner (mbitner@fresnocog.org); rball@kerncog.org; terri.king@co.kings.ca.us; patricia@maderactc.org; Marjie.Kirn@mcagov.org; nguyen@sjcog.org; Park, Rosa@DOT; BKimball@tularecog.org; cdevine@bcag.org; hadamson@ambag.org; SDevencenzi@slocog.org; pimhof@sbcag.org; dlittle@srta.ca.gov; Haven, Nick@TRPA; Kalandiyur, Nesamani@ARB; Roberts, Terry@ARB
Subject: Methodology to Adjust EMFAC Output for SB 375 Target Demonstrations

To All MPO Technical Staff,

Now that many of the MPOs are working on their second round of SCSs, and with ARB recently releasing a new version of EMFAC, we want to provide guidance on how to deal with changes arising from different EMFAC versions as you do your GHG quantification determinations for the second round of SCSs.

We request that you use the attached methodology if you will be using a different version of EMFAC for quantifying reductions from your second SCS than the EMFAC version you used for your first SCS. Our intent with this methodology is to maintain the same level of stringency for meeting the current targets even though there are emission rate changes when switching EMFAC versions. When targets are updated next year, they will probably be based on EMFAC 2014, therefore, this methodology would not be required with the new targets until a new version of EMFAC was released to supersede EMFAC 2014. Our plan is to update the methodology at that time.

Please look over this methodology and let us know if you have any questions or concerns. For general questions, please contact me by email at jonathan.taylor@arb.ca.gov or by phone at 916-445-8699. For specific technical questions on the adjustment calculations, please contact Nesamani Kalandiyur at nesamani.kalandiyur@arb.ca.gov or 916-324-0466.

I'd like to take this opportunity to thank all of you for your generous assistance and patience as ARB staff have evaluated your SCSs. I am sure you are all proud of your accomplishments in meeting the goals of SB 375, and we ARB staff look forward to continuing to work with all of you.

Best,

Jon

Jonathan Taylor, P.E.
Assistant Chief,
Air Quality Planning and Science Division
California Air Resources Board
jonathan.taylor@arb.ca.gov
Ph. 916-445-8699
FAX: 916-322-3646

Methodology to Calculate CO2 Adjustment to EMFAC Output for SB 375 Target Demonstrations

Background:

In 2010, ARB established regional SB 375 greenhouse gas (GHG) targets in the form of a percent reduction per capita from 2005 for passenger vehicles using the ARB Emission Factor model, EMFAC 2007. EMFAC is a California-specific computer model that calculates weekday emissions of air pollutants from all on-road motor vehicles including passenger cars, trucks, and buses. ARB updates the EMFAC model periodically to reflect the latest planning assumptions (such as vehicle fleet mix) and emissions estimation data and methods. Since the time when targets were set using EMFAC2007, ARB has released two subsequent versions, EMFAC2011[1] and EMFAC2014[2].

ARB has improved the carbon dioxide (CO2) emission rates in EMFAC2011 and EMFAC2014, based on recent emission testing data and updated energy consumption for air conditioning. In addition, vehicle fleet mix has been updated in EMFAC2011 and again in EMFAC2014 based on the latest available Department of Motor Vehicle data at the time of model development. These changes have lowered the overall CO2 emission rates in EMFAC2011 and EMFAC2014 compared to EMFAC2007.

Purpose:

Some metropolitan planning organizations (MPOs) used EMFAC 2007 to quantify GHG emissions reductions from their first Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS); others used EMFAC 2011. As MPOs estimate GHG emissions reductions from subsequent RTP/SCSs, they will use the latest approved version of EMFAC, but using a different model will influence their estimates and their ability to achieve SB 375 targets. The goal of this methodology is to hold each MPO to the same level of stringency in achieving their SB 375 targets regardless of the version of EMFAC used for its second RTP/SCS.

ARB staff has developed this methodology to allow MPOs to adjust the calculation of percent reduction in per capita CO2 emissions used to meet the established targets when using either EMFAC2011 or EMFAC2014 for their second RTP/SCS. This method will neutralize the changes in fleet average emission rates between the version used for the first RTP/SCS and the version used for the second RTP/SCS. The methodology adjusts for the small benefit or disbenefits resulting from the use of a different version of EMFAC by accounting for changes in emission rates, and applies an

[1] EMFAC2011 was approved by USEPA in March 2013.
[2] EMFAC2014 is under review for USEPA approval.

adjustment when quantifying the percent reduction in per capita CO2 emissions using EMFAC2011 or EMFAC2014.

Applicability:

The adjustment is applicable when the first RTP/SCS was developed using either EMFAC2007 or EMFAC2011 and the second RTP/SCS will be developed using a different version of the model (EMFAC2011 or EMFAC2014).

- Hold the 2005 baseline CO2 per capita estimated in the first RTP/SCS constant. Use both the human population and transportation activity data (VMT and speed distribution) from the first RTP/SCS to calculate the adjustment.
- Add the adjustment to the percent reduction in CO2 per capita calculated with EMFAC2011 or EMFAC2014 for the second RTP/SCS. This will allow equivalent comparison to the first RTP/SCS where emissions were established with EMFAC 2007 or EMFAC2011.

Example Adjustment Calculation (hypothetical for illustration purposes):

In this example, the first RTP/SCS was developed using EMFAC2007 and the second RTP/SCS using EMFAC2011 to calculate the CO2 per capita.

Step1: Compile the CO2 per capita numbers from the MPO's first adopted RTP/SCS using EMFAC 2007 without any off-model adjustments for calendar years (CY) 2005, 2020, and 2035 for passenger vehicles.

Calendar Year	EMFAC2007 CO2 Per capita (lbs/day)
2005	30.0
2020	28.8
2035	27.6

Step 2: Calculate the percent reductions in CO2 per capita from the 2005 base year for CY 2020 and 2035 from Step 1.

Calendar Year	EMFAC2007 Percent Reductions (%)
2020	4.0%
2035	8.0%

Step 3: Develop the input files for the EMFAC2011 model using the same activity data for CY 2020 and 2035 from the first adopted RTP/SCS (same activity data used in Step 1) and execute the model.

Step 4: Calculate the CO2 per capita for CY 2020 and 2035 using the EMFAC2011 output from Step 3; do not include Pavley I, LCFS, and ACC benefits for passenger vehicles.

Calendar Year	EMFAC2011 CO2 Per capita (lbs/day)
2020	28.2
2035	27.9

Step 5: Calculate the percent reductions in CO2 per capita for CY 2020 and 2035 calculated in Step 4 from base year 2005 established in Step 1.

Calendar Year	EMFAC2011 Percent Reductions (%)
2020	6.0%
2035	7.0%

Step 6: Calculate the difference in percent reductions between Step 5 and Step 2 (subtract Step 5 results from Step 2 results) for CY 2020 and 2035; this yields the adjustment for the respective CY.

Calendar Year	EMFAC2011 Adjustment (%)
2020	-2.0%
2035	+1.0%

Step 7: Develop the input files for the EMFAC2011 model using the activity data from the new/second RTP/SCS for CY 2020 and 2035 without any off-model adjustments and execute the model.

Step 8: Calculate the CO2 per capita for CY 2020 and 2035 using the EMFAC2011 output from Step 7; do not include Pavley I, LCFS, and ACC benefits for passenger vehicles.

Calendar Year	EMFAC2011 CO2 Per capita (lbs/day)
2020	26.4
2035	26.1

Step 9: Calculate the percent reductions in CO2 per capita for CY 2020 and 2035 calculated in Step 8 from base year 2005 established in Step 1.

Calendar Year	EMFAC2011 Percent Reductions (%)
2020	12.0%
2035	13.0%

Step 10: Add the adjustment factors from Step 6 to the percent reductions calculated for the new/second RTP/SCS (Step 9) using EMFAC 2011 for CY 2020 and 2035.

Calendar Year	Adjusted Percent Reductions (%)
2020	10.0%
2035	14.0%

Follow the same steps to adjust for use of EMFAC2007 or EMFAC2011 to EMFAC2014. Do not include any off-model adjustments during application of the EMFAC adjustment factor.