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Attachment A

Prepared for:

California Public Utilities Commission
Communications Division

Broadband Internet and Wireline Voice Competition Study in Service Territories of Small Incumbent Local Exchange Carriers

Prepared by:

Mission Consulting, LLC
555 Capitol Mall, Suite 450
Sacramento, CA 95814

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EXECUTIVE SUMMARY

In compliance with California Public Utilities Commission (CPUC) Decision (D.) 14-12-084, Staff contracted with Mission Consulting to conduct an independent study to assist the Commission in making informed decisions on:

> (A) Whether fixed broadband revenues or profits should be counted towards the California High Cost Fund-A (CHCF-A) intrastate revenue requirement; and
>
> (B) Whether Small Incumbent Local Exchange Carriers (Small ILECs) territories should be opened to wireline voice competition.

These two issues will ultimately be addressed in Phase 2 of Rulemaking (R.) 11-11-007.

In accordance with California Public Utilities (P.U.) Code Section 275.6, the CHCF-A provides Small ILECs financial supports for the delivery of safe, reliable, high-quality voice communication service and the deployment of broadband-capable networks, insofar as to provide them with a fair opportunity to achieve a reasonable rate of return on their investment. The fund helps offset the high costs of providing services in the Small ILECs' territories, which are often rural areas, sparsely populated, and face geographical barriers. The mandate set by the P.U. Code is for CHCF-A funding to be at an amount that cannot be reasonably provided by customers, after federal rate support is received, is not excessive, and is reasonably equal to the value of benefits. Currently, ten of the State's thirteen Small ILECs requested and received CHCF-A Funds (Participant Small ILECs), which amounts to approximately $40 million in 2018. The three remaining Small ILECs did not apply for nor receive CHCF-A Funds (Non-Participant Small ILECs). Both Participant and Non-Participant Small ILECs are required to serve as a Carrier of Last Resort (COLR) for wireline voice service, and to provide services at "just and reasonable" rates that are comparable to those offered by urban telephone corporations.

This study evaluates the status of Small ILEC high-quality voice and broadband-capable networks within the current regulatory, economic, and technological environment. This includes analyzing data from the CPUC, the Federal Communications Commission (FCC), and the United States Census, as well as Small ILEC responses to data request. This report is intended to reflect the status of deployment and markets for service, and identify any primary concerns the CPUC should consider when making decision on these issues.

In D. 14-12-084, the Commission made a preliminary conclusion not to impute broadband revenue pending completion of the study, because it needed more information on the broadband networks in the Small ILEC areas. The Commission's concern over imputing broadband revenue was that the resulting reduction in CHCF-A support may impede a Small ILEC's ability to provide customers with access to broadband, and therefore ordered a study to evaluate broadband build-out.

In Section 2 of the Study, Mission Consulting assesses the availability of broadband networks and the data shows CHCF-A-Participant Small ILECs have made progress building out their networks and now provide access to broadband to nearly all of their households that meet State "served" speed standard of 6 megabits per second (Mbps) downstream/1 Mbps upstream, and current Federal Communications

Commission (FCC) Connect America Fund (CAF) speed standards of 10 Mbps downstream/1 Mbps upstream. Data show that seven of the ten Participant Small ILECs provide access to between 95 and 100 percent of the households in their territories.

In contrast, the three Non-Participant Small ILECs provide similar levels of broadband access to only 14 percent of their households and no broadband service to 26 percent of their households. Furthermore, over the past four years, the majority of Small ILECs have consistently generated annual broadband revenues that exceed their broadband expenses. Based on this information, it appears that broadband revenue imputation would not hinder most Participant Small ILECs' ability to provide access to broadband in their territories, and therefore broadband revenue should be included in the intrastate revenue requirement.

In D.14-12-084, the Commission also made a preliminary finding not to open Small ILECs territories to wireline competition at that time, and noted that no request for interconnection in a Small ILEC territory had been presented or ripe for review.[1] The Commission ordered a study to explore the potential impacts of permitting wireline voice competition in Small ILEC territories, with particular attention to "universal service, reliability, safety, just and reasonable rates, deployment of broadband capable networks, deployment and maintenance of high-quality voice networks, and the economic impact on users of telecommunications services, and on the High Cost A Fund…."[2]

In Section 3 of this study, Mission Consulting evaluates the potential impact of opening Small ILEC territories to wireline voice competition and concludes that wireline voice competition is not expected to have a significant direct impact on Small ILECs and their customers because they are largely insulated by the CHCF-A program. CHCF-A ensures that all Small ILEC customers will retain just and reasonable rates in comparison to urban areas. The CHCF-A also help Small ILECs achieve a set rate of return, rendering it unlikely that competition will affect their deployment and maintenance of high-quality voice and broadband capable networks. However, because of this same commitment, Small ILECs may experience some revenue shortfall due to competition – Small ILEC customers switching to CLECs. As a result, opening Small ILEC markets to competitors may pose new challenges for the CHCF-A fund and the level of subsides, which the Commission should examine more closely before implementation.

The status of broadband deployment in Small ILEC territories will continue to evolve over time, due to additional investment, and changing state and federal standards. This study represents a snapshot in time and may need to be updated periodically to capture changes in Small ILEC broadband deployment, service speeds, and network technologies. Each Small ILEC is unique in their own geography networks and the impact of competition may vary based on the individual ILEC's circumstances.

[1] Pg 39.
[2] CPUC D.14-12-084 at 99, Conclusion of Law (CL) 41.

1 INTRODUCTION

1.1 Background

In compliance with California Public Utilities Commission (CPUC) Decision (D.) 14-12-084[3], this study reviews questions facing the California High Cost Fund-A Program (CHCF-A) to be addressed in Phase 2 of the R.11-11-007 proceeding.[4] The study consists of two parts, each focused on providing information and analysis to assist the CPUC in answering two separate questions:

- Should fixed broadband revenues or profits count towards the CHCF-A intrastate revenue requirement? (Section 2)

- Should the Small Incumbent Local Exchange Carrier[5] (Small ILEC) territories be opened to wireline voice competition? (Section 3)

The CPUC Communications Division (CD) engaged Mission Consulting, LLC to provide an independent analysis to address the CPUC's Order to Institute Rulemaking. The study included gathering and analyzing data from California's 13 Small ILECs, the CPUC, the Federal Communications Commission (FCC), the United States Census (U.S. Census), and other sources, as needed. The analysis was driven by the policy considerations demonstrated by the California Public Utilities Code (P.U. Code) and prior CPUC and FCC decisions. This study was completed in July 2018.

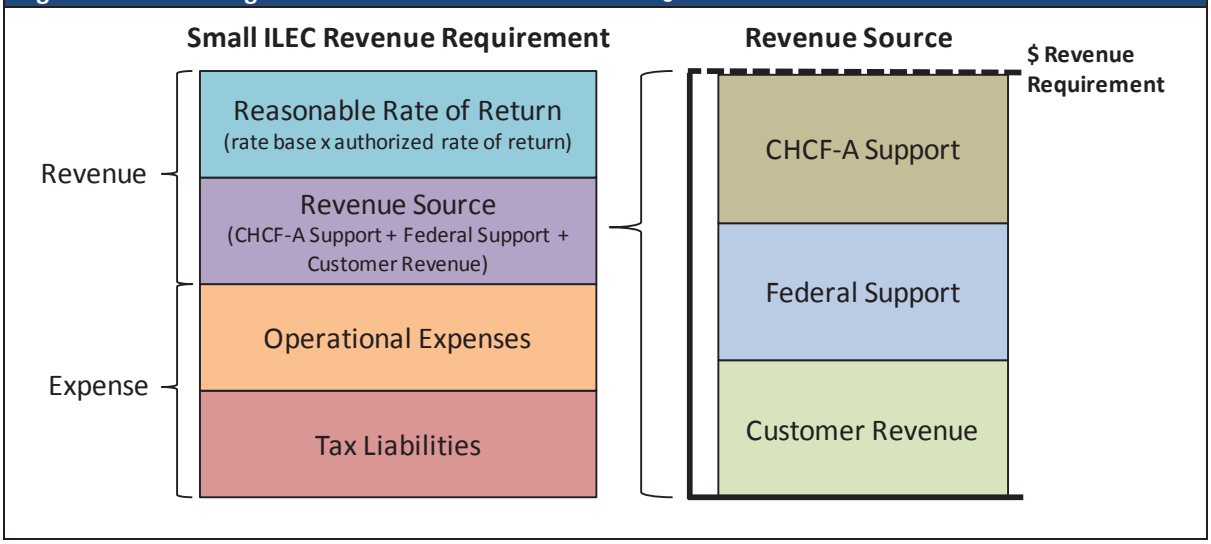
1.2 California High Cost Fund-A (CHCF-A) Program Overview

The CHCF-A, codified by P.U. Code § 275.6, financially supports Small ILECs in the delivery of safe, reliable, high-quality voice communication service and the deployment of broadband-capable networks, to provide them with a fair opportunity to achieve a reasonable rate of return on their investment.[6] As a condition of receiving CHCF-A funds, a Small ILEC is subject to rate-of-return regulation and must file a General Rate Case (GRC) application – a formal proceeding used to address recover costs of operating and maintaining a telephone corporation's plant and equipment, as well as providing the opportunity to achieve a reasonable rate of return. In the GRC proceeding, the CPUC uses this information to determine the Small ILEC's Revenue Requirement, which is the total revenue amount (revenue source plus a reasonable rate of return) needed to support the Small ILEC's expenses (operational and tax liabilities). This process also produces a Rate Design, which is the mix of customer wireline voice revenue, federal rate support[7], and CHCF-A rate support needed to achieve the Revenue Requirement. The CPUC's goal is for CHCF-A funding to be at an amount that "cannot be reasonably provided by customers, after federal

[3] CPUC D.14-12-084, http://docs.cpuc.ca.gov/publisheddocs/published/g000/m143/k638/143638287.pdf.
[4] *Id.* at 99, Conclusion of Law (CL) 41.
[5] These are also known as small independent telephone corporations. P.U. Code § 275.6(b)(6).
[6] P.U. Code § 275.6(a) and (b)(2)-(4).
[7] Small ILECs may also be eligible for federal rate support for their broadband-capable networks from the federal Connect America Fund (CAF) and Alternative to Connect America Cost Model (A-CAM) rate-of-return programs. Access to federal rate support reduces Small ILEC dependence on the CHCF-A to meet the Revenue Requirement. These programs have their own requirements separate from those of the CHCF-A.

rate support is received," is not excessive, and is reasonably equal to the value of benefits.[8] The factors outlined by P.U. Code § 275.6 are summarized in Figure 1, below.[9]

Figure 1. CHCF-A Program Framework Based on P.U. Code § 275.6



California P.U. Code § 275.6 defines the primary elements of the CHCF-A program and GRC process as follows:[10]

> *"Carrier of last resort"* means a telephone corporation that is required to fulfill all reasonable requests for service within its service territory.
>
> *"Rate base"* means the value of a telephone corporation's plant and equipment that is reasonably necessary to provide regulated voice services and access to advanced services, and upon which the telephone corporation is entitled to a fair opportunity to earn a reasonable rate of return.
>
> *"Rate design"* means the mix of end user rates, high-cost support, and other revenue sources that are targeted to provide a fair opportunity to meet the revenue requirement of the telephone corporation.
>
> *"Rate-of-return regulation"* means a regulatory structure whereby the commission establishes a telephone corporation's revenue requirement, and then fashions a rate design to provide the company a fair opportunity to meet the revenue requirement.

[8] P.U. Code § 275.6(c)(4); (c)(7); and (f).
[9] This figure is formatted to display the relationship between factors only, not the relative values of the factors. Therefore, revenue and expense proportions are not to exact scale.
[10] P.U. Code § 275.6(b) and (c). This excerpt does not include the complete language of the code section.

"Revenue requirement" means the amount that is necessary for a telephone corporation to recover its reasonable expenses and tax liabilities and earn a reasonable rate of return on its rate base.

"Small independent telephone corporations" are rural incumbent local exchange carriers subject to commission regulation.

Rate-of-return and revenue requirement amounts: "Employ rate-of-return regulation to determine a small independent telephone corporation's revenue requirement in a manner that provides revenues and earnings sufficient to allow the telephone corporation to deliver safe, reliable, high-quality voice communication service and fulfill its obligations as a carrier of last resort in its service territory, and to afford the telephone corporation a fair opportunity to earn a reasonable return on its investments, attract capital for investment on reasonable terms, and ensure the financial integrity of the telephone corporation.

Rates charged to customers: "Ensure that rates charged to customers of small independent telephone corporations are just and reasonable and are reasonably comparable to rates charged to customers of urban telephone corporations."

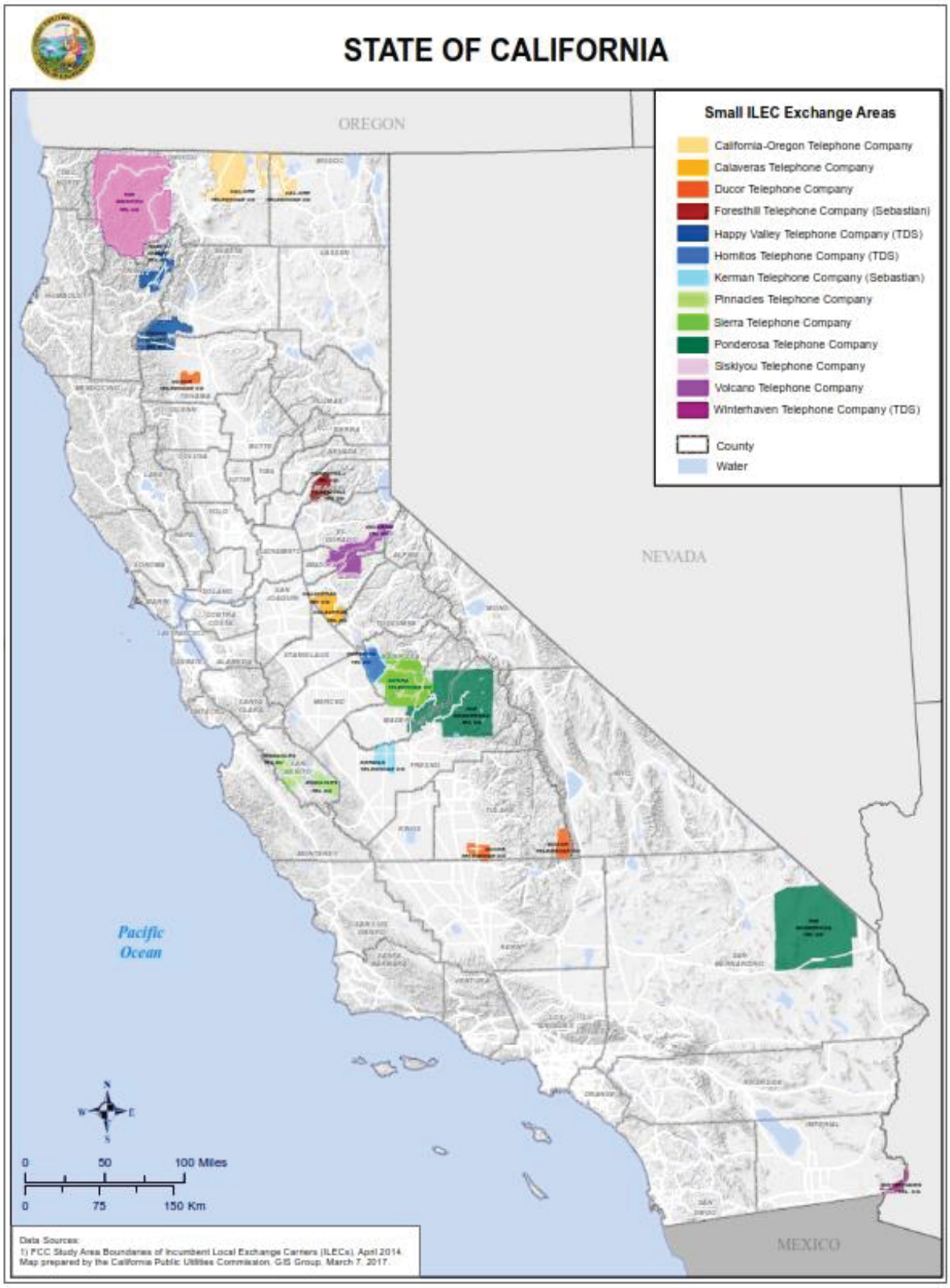
CHCF-A support levels: "Provide universal service rate support from the California High-Cost Fund-A Administrative Committee Fund to small independent telephone corporations in an amount sufficient to supply the portion of the revenue requirement that cannot reasonably be provided by the customers of each small independent telephone corporation after receipt of federal universal service rate support."

1.3 Small ILEC Territories

There are currently 13 Small ILEC territories in California. (Table 1) Also, see map of Small ILEC Exchange Areas on the next page. These territories are rural, sparsely populated, and often face geographical barriers that make the provision of high-quality wireline voice and broadband services more difficult and expensive than elsewhere. According to 2010 U.S. Census data, over 60 percent of the census blocks[11] in the Small ILEC territories had no households[12], and another 24 percent of the census blocks had fewer than 10 households. (Table 2)

[11] A census block is "[t]he smallest level of geography you can get basic demographic data for, such as total population by age, sex, and race." U.S. Census Bureau, *What are Census Blocks?* (July 2011) at www.census.gov/newsroom/blogs/random-samplings/2011/07/what-are-census-blocks.html.

[12] "A household consists of all the people who occupy a housing unit. A house, an apartment or other group of rooms, or a single room, is regarded as a housing unit when it is occupied or intended for occupancy as separate living quarters; that is, when the occupants do not live with any other persons in the structure and there is direct access from the outside or through a common hall." U.S. Census Bureau, *Subject Definitions*, at www.census.gov/programs-surveys/cps/technical-documentation/subject-definitions.html#household.


STATE OF CALIFORNIA
OREGON
NEVADA
MEXICO
Pacific Ocean
Small ILEC Exchange Areas
California-Oregon Telephone Company
Calaveras Telephone Company
Ducor Telephone Company
Foresthill Telephone Company (Sebastian)
Happy Valley Telephone Company (TDS)
Hornitos Telephone Company (TDS)
Kerman Telephone Company (Sebastian)
Pinnacles Telephone Company
Sierra Telephone Company
Ponderosa Telephone Company
Siskiyou Telephone Company
Volcano Telephone Company
Winterhaven Telephone Company (TDS)
County
Water
0 50 100 Miles
0 75 150 Km
Data Sources:
1) FCC Study Area Boundaries of Incumbent Local Exchange Carriers (ILECs), April 2014.
Map prepared by the California Public Utilities Commission, GIS Group, March 7, 2017.

Currently, 10 of the 13 Small ILECs apply for and receive CHCF-A funding (Participant Small ILECs). In recent years, the amount of CHCF-A support has increased from $33 million in 2016 to $40 million in 2018.[14] The three Small ILECs that do not apply for nor receive CHCF-A funds are Happy Valley, Hornitos, and Winterhaven (Non-Participant Small ILECs). These Small ILECs are subject to the same regulatory requirements as the participating Small ILECs, most notably, Carrier of Last Resort (COLR) obligations[15] and the rate-setting process pertaining to wireline voice services. Nevertheless, Non-Participant Small ILECs are included in this study, as they remain eligible to apply for CHCF-A funding in the future.

For the purposes of the broadband section of this study, we consider a Small ILEC and its affiliate that provides broadband services over its network as the same entity.[16]

Table 1. California Small ILECs, 2010

Small ILECs	Households[13]
1. Calaveras Telephone Company (Calaveras)	3,951
2. Cal-Ore Telephone Company (Cal-Ore)	2,203
3. Ducor Telephone Company (Ducor)	1,351
4. Foresthill Telephone Company (Foresthill)	2,679
5. Kerman Telephone Company (Kerman)	6,508
6. Pinnacles Telephone Company (Pinnacles)	125
7. The Ponderosa Telephone Company (Ponderosa)	9,648
8. Sierra Telephone Company (Sierra)	18,404
9. Siskiyou Telephone Company (Siskiyou)	4,308
10. Volcano Telephone Company (Volcano)	10,217
Participant Total	**59,394**
11. Happy Valley Telephone Company (Happy Valley)	3,317
12. Hornitos Telephone Company (Hornitos)	634
13. Winterhaven Telephone Company (Winterhaven)	1,528
Non-Participant Total	**5,479**
Small ILEC Total	**64,873**

Table 2. Small ILEC Census Blocks by Number of Households, 2010

Small ILEC	Number of Household in Census Block					
	0	1-10	11-20	21-30	31-40	40+
Calaveras	44%	25%	15%	8%	2%	6%
Cal-Ore	70%	27%	3%	0%	0%	0%
Ducor	69%	24%	4%	1%	1%	1%
Foresthill	67%	20%	6%	2%	0%	5%
Kerman	36%	38%	17%	4%	1%	3%
Pinnacles	87%	12%	1%	0%	0%	0%
Ponderosa	66%	21%	6%	3%	1%	3%
Sierra	41%	31%	9%	7%	4%	9%
Siskiyou	77%	20%	2%	1%	0%	0%
Volcano	54%	24%	8%	4%	4%	7%
Particpant Total	**63%**	**24%**	**6%**	**2%**	**1%**	**3%**
xHappy Valley	69%	22%	6%	1%	1%	2%
xHornitos	81%	14%	2%	1%	1%	1%
xWinterhaven	70%	23%	4%	1%	0%	1%
Non-Paricipant Total	**71%**	**21%**	**4%**	**1%**	**1%**	**1%**
Small ILEC Total	**65%**	**24%**	**6%**	**2%**	**1%**	**3%**

[13] Census block household figures used in his study are from the 2010 U.S. Census, the most recent data available at the census block level.

[14] CPUC-CD CHCF-A records (May 2018).

[15] P.U. Code § 275.6(d)(3) and (b)(1) "'Carrier of last resort' means a telephone corporation that is required to fulfill all reasonable requests for service within its service territory." A Carrier of Last Resort (COLR) is also defined in CPUC Decision 96-10-066, Appendix B, 1(F), as "A carrier who provides local exchange service, and stands ready to provide basic service to any customer requesting such service within a specified area. To be a COLR, the provider must meet Commission-approved qualifications."

[16] This consideration is supported by the CPUC's conclusion in D.14-12-084 that affiliate revenues are eligible to be imputed if so desired by the CPUC. (CPUC D.14-12-084 at 93, CL 3) Fixed broadband services are provided to

2 BROADBAND INTERNET IMPUTATION

2.1 Introduction

This section of the study examines the question "Should broadband revenues or profits count towards the intrastate revenue requirement?" The CPUC has authority to impute Small ILEC broadband revenues and profits when calculating CHCF-A rate support amounts, but to date, has not done so. According to D.14-12-084, the CPUC's concern over imputing broadband revenues is that a resulting reduction in CHCF-A rate support may impede a Small ILEC's ability to provide its customers with access to broadband.[17] At the same time, the CPUC has a responsibility to California ratepayers to not over-subsidize Small ILECs for broadband network expenses that are generating revenues.

To assist the CPUC in answering the question of whether to impute broadband revenues, we evaluate each Small ILEC on a number of factors related to broadband network build-out: (1) customer access to broadband; (2) broadband technology; (3) barriers to broadband build-out; and (4) broadband revenues and expenses. Taken together, these factors shed light on the extent to which broadband revenue imputation poses a threat to a Small ILEC's ability to provide access to broadband in its territory. A summary of key findings is presented in Section 2.4.

2.2 Background

In D.14-12-084, the CPUC considered arguments about whether broadband revenues or profits should count toward the calculation of a Small ILEC's Intrastate Revenue Requirement, which ultimately determines the amount of the CHCF-A subsidy needed by the Small ILEC.[18] Under P.U. Code § 275.6, CHCF-A funds can be used to subsidize a Small ILEC's reasonable investments necessary to provide for the delivery of high-quality communication services and the deployment of broadband-capable facilities.[19] Currently, the revenue and profit generated from broadband services that are provided over CHCF-A-subsidized networks are not included as a revenue source when calculating the Small ILEC Revenue Requirement and resulting Rate Design. If broadband revenues were counted toward meeting a Small ILEC's Revenue Requirement, it would effectively reduce the funds needed from the CHCF-A. (Figure 2)

The CPUC, upon concluding it has the authority to impute broadband revenues[20], sought to evaluate whether it was appropriate to do so within the greater context of the CHCF-A program's competing

customers over Small ILEC networks by the Small ILECs themselves or by their designated affiliates. In 2017, nine Small ILECs reported using affiliates. July 7, 2017, Small ILEC responses to 2017 CPUC Data Request 4, Question 1.b.

[17] The CPUC defines broadband as any internet connection that terminates at an end-user location and enables the end user to receive information from and/or send information to the internet at speeds exceeding 200 kilobits per second in at least one direction. The CPUC also distinguishes between "served" and "unserved" levels of broadband based on downstream and upstream speeds, which are discussed later in this report. http://cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/Utilities_and_Industries/Communications_-_Telecommunications_and_Broadband/Service_Provider_Information/Broadband_Mapping/About%20The%20CA%20Interactive%20Broadband%20Map%20Jan%202016.pdf.

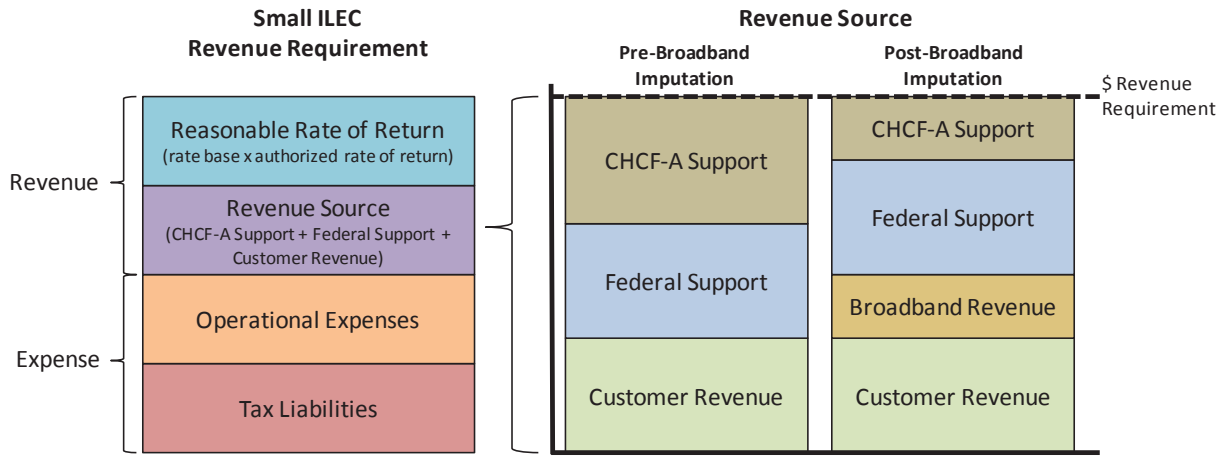
[18] CPUC D.14-12-084 at 13.

[19] *Id*. at 20; P.U. Code § 275.6(a).

[20] *Id*. at 93, CL 1.

policy objectives. Chief among these objectives are the CPUC's responsibility to ensure that CHCF-A funding supports the reasonable investments necessary for Small ILECs to deploy broadband-capable networks while ensuring the level of support is not excessive and equal to the benefits received.[21]

Figure 2. Expected Impact of Broadband Imputation on CHCF-A Support[22]



Ultimately, the CPUC determined "the circumstances [were] not yet ripe for the application of broadband revenue imputation."[23] The CPUC believed it was too soon to determine the potential effects of revenue imputation on Small ILEC broadband deployment given that investment in broadband-capable networks had only become eligible for CHCF-A funds less than two years prior. The CPUC found there were no standards in place by which it could assess the extent of broadband deployment in these rural areas.[24] As a result, the CPUC requested this study "to analyze the current extent of broadband network deployment and the speeds, latency, and other characteristics of service, as well as barriers to network deployment, and factors that affect network deployment such as population characteristics, terrain, density, and businesses, in each Small ILEC area."[25] The information resulting from this study is intended to assist the CPUC in making future determinations regarding broadband revenue imputation.

[21] CPUC D.14-12-084 at 21-23. P.U. Code § 275.6(c)(2). The CHCF-A is to support all reasonable investments necessary to deploy broadband-capable facilities. P.U. Code § 275.6(c)(7). The CHCF-A amount cannot be excessive, so as to limit the burden on contributors.

[22] This figure is formatted to display the relationship between factors only, not relative values of these factors. Therefore, revenue and expense proportions are not to exact scale.

[23] CPUC D.14-12-084 at 22.

[24] *Id*. at 23.

[25] *Id*. at 58-60, Conclusion of Law (CL) 41.

2.3 Methodology

To evaluate the status of broadband deployment across the Small ILECs, this study focuses on four areas: (1) customer access to broadband; (2) broadband technology; (3) barriers to broadband build-out; and (4) broadband revenues and expenses. The methodology for analyzing these factors is summarized below.

Customer Access to Broadband

The single most relevant measure of the status of broadband deployment in a Small ILEC is the percentage of households with access to broadband services. For each Small ILEC, we measure household access to broadband in relation to CPUC and FCC CAF standards based on maximum downstream and upstream speeds. We also analyze the presence of other fixed broadband carriers serving households within the Small ILEC territories as a means of measuring customer dependence on Small ILECs for service.

Broadband Technology

Fixed broadband service is provided over networks consisting of different technologies, each of which have different costs, physical limitations, and speed capabilities that can affect a Small ILEC's ability to meet existing and future standards. Using CPUC broadband and U.S. Census data at the census block level, we calculate the percentage of households by network technology type for each Small ILEC territory and evaluate the availability of broadband technologies deployed by other carriers in these territories.

Barriers to Broadband Build-Out

Barriers to fixed broadband build-out in rural Small ILEC territories can increase the complexity and cost of providing service. For the purposes of this analysis, we focus on three barrier types – population scarcity, service affordability, and terrain. We used CPUC broadband and U.S. Census data to identify the household density of those census blocks reported as not having access to broadband services and the average poverty rates for each Small ILEC territory. We use Small ILEC responses to a 2017 CPUC data request to evaluate barriers represented by terrain.

Broadband Revenues and Expenses

To understand the potential financial impact of broadband revenue imputation, we collected and analyzed data on Small ILEC and affiliate broadband revenues and expenses for each of the past five years. The Small ILECs provided this data in response to a 2017 CPUC data request. Because of confidentiality concerns, only a summary of statewide revenues and expenses is included in this study.

2.3.1 Data Sources

Small ILEC Responses to CPUC Data Requests

In 2017, the CPUC issued five data requests to the 13 Small ILECs, asking a range of questions related to the topics addressed by this study. Mission Consulting reviewed the data response and followed-up with the Small ILECs as appropriate. Small ILEC responses were primarily in narrative form that often did not include any citation of the supporting data sources. In addition, the Small ILECs requested that several components of their responses be deemed confidential per state code and CPUC decisions, including broadband revenue and expense data.[26] Nevertheless, these responses provided valuable information on several topic areas and allowed the Small ILECs to provide additional context for their data, concerns, and other factors influencing the provision of broadband in their territories.

FCC Study Area Boundary Data

FCC Study Area Boundary data from 2016 were used to isolate those census blocks that fall within Small ILEC territory boundaries, based on each Small ILEC's unique Study Area Code (SAC).[27] We then used the 15-digit Federal Information Processing Standards (FIPS) code for each census block as a means to match and organize the CPUC broadband and U.S. Census data, which share the same census block and tract FIPS codes. In instances in which a census block was only partially included within the Small ILEC territory, we applied the percentage of area that was within the Small ILEC territory to the other data categories to estimate the number of households and population residing within the territory. This method helps align data between census blocks and Small ILECs territories.

CPUC-Verified Data on Broadband Deployment to Consumers and Businesses

Much of the study's analysis relies on CPUC data on broadband deployment by census block. The most recent CPUC data at the start of the analysis was dated December 31, 2015. The Small ILECs originally provided this data to the FCC via their bi-annual Form 477 filings[28], which was then improved upon by the CPUC through the performance of data validation activities.[29] This data included information, by census block, on traits such as the fixed broadband provider name, downstream and upstream speeds, technology type, and customer presence.

[26] Small ILEC data request responses to CPUC Data Request 5 on November 22, 2017. Broadband customers and revenues are marked confidential under General Order 66C, P.U. Code § 583, and P.U. Code § 275.6(e).
[27] FCC, Study Area Boundary Data (December 2016) at www.fcc.gov/wireline-competition/industry-analysis-and-technology-division/general/study-area-boundary-data.
[28] FCC, Form 477 Broadband Deployment Data, (December 2016) at www.fcc.gov/general/broadband-deployment-data-fcc-form-477. The Form 477 data allowed for the identification of the census blocks that belonged to each of the 13 Small ILEC territories.
[29] CPUC, Broadband Data (December 2015) at www.cpuc.ca.gov/General.aspx?id=1197. When possible, CPUC data was chosen over FCC and provider data because the CPUC independently validated downstream speed data.

U.S. Census Data on Population, Households, Income, and Poverty

We used U.S. Census data to identify the population, household, median income, and poverty rates associated with each census block or tract within the Small ILEC territories.[30] The California Department of Finance provided the U.S. Census data files. The most recent population and household data at the census block level was dated 2010. The median income and poverty rate data was available only at the census tract level and represent the most recent estimates, dated 2016. This data allowed for the calculation of the number and percentage of households with access to different traits of broadband service.

2.3.2 Assumptions

To perform the analysis with the data available, we were required to make a number of assumptions. To the degree possible, we adopted the assumptions previously used by the CPUC in past proceedings. In other instances, we developed assumptions that we found to be the most reasonable and justifiable, and recognize the potential pros and cons associated with each, below.

1. Broadband availability to one household in a census block is considered availability for the entire census block. This assumption is made due to the lack of granular data available (e.g. address level). The Commission is considering changes to its "served" definition for the purposes of the California Advanced Service Fund proceeding (R.12-10-012). A decision is expected by the end of 2018.
2. A broadband provider's highest advertised speed is considered the speed available to consumers. This CPUC has applied this assumption in prior decisions and in its mapping of broadband availability.[31] This assumption may result in the overestimation of the speed levels available to all customers and households in a census block, especially in rural areas.[32] To mitigate this, the CPUC performs field research to validate FCC data.[33]
3. It is preferable to perform analyses of service at the most granular level that data makes available. In most instances, this is at the census block level, though some data is only available at the census tract level. The CPUC has applied this assumption in prior decisions and in its mapping of broadband availability.[34]
4. In instances in which a census block is only partially within a Small ILEC territory, the number of households within the territory was estimated by multiplying the total number of households in

[30] United States Census Bureau (U.S. Census) at www.census.gov/programs-surveys/acs/. The most recent population and household data by census block is from the 2010 Census. Census data for median income and poverty are available at the census tract level as recently as 2016. For the purposes of this study, we used the most recently published U.S. Census data available at the lowest level of granularity. This allowed us to combine and perform analysis on CPUC, FCC, and U.S. Census data at the census block and tract levels.
[31] *Id.* at 57-58.
[32] *Id.* at 3. "Aggregated and averaged market data understate the barriers to competitive market entry, and thus overstate the market choices available to individuals and businesses, particularly in rural areas."
[33] CPUC, *California Broadband Validation Methods: Round 2016*, at ftp://ftp.cpuc.ca.gov/telco/BB%20Mapping/2016/Round%202016%20Validation%20Definitions%20and%20Methodology-Revised%20Clean-RO.pdf.
[34] CPUC D.16-12-025 at 59-60.

the census block by the percentage of the census block area reported as within territory boundaries.[35] For example, a census block that contains 10 households and has 60 percent of its area located within a Small ILEC territory was assumed to have six households within the territory. We believe this assumption offered the best opportunity to accurately reflect broadband availability based on census blocks with boundaries that do not align with Small ILEC boundaries.

5. A census block or census tract segment that falls within a Small ILEC's boundaries is assumed to share the traits of the entire census block or tract when more granular data is not available. For example, if a census tract is reported as having a poverty rate of 15 percent, we assume that the segment of the census tract that falls within a Small ILEC territory also has a poverty rate of 15 percent.
6. In general, the information reported by the Small ILECs to the CPUC and FCC should be relied upon given the limitations of independent entities to perform independent validation.[36] Where CPUC-validated data was available, it was the preferred source of information used in this study.
7. Given the unique circumstances of the Small ILECs and barriers posed by population scarcity and terrain, it is not possible for the CPUC to estimate future network investment costs absent Small ILEC analysis and estimates for a specific project.
8. While the use of averages presents an overall status of broadband deployment, it may potentially conceal distinctions between individual Small ILECs and census blocks. For example, the Small ILEC Sierra Telephone Company accounts for 28 percent of all Small ILEC households statewide and its data may skew the statewide averages used in this study. As a result, the study provides the data for each Small ILEC and recommends that the CPUC refer to the data for each individual Small ILEC when making decisions.

2.3.3 Public Utilities Code, Decisions, and Other Resources

The primary CPUC P.U. Code sections and decisions used to perform this study are as follows:

- California Public Utilities Code § 275.6 (Establishing the California High Cost Fund-A program).[37]
- CPUC Decision 14-12-084, *Decision Adopting Rules and Regulations in Phase 1 of the Rulemaking for the California High Cost Fund-A Program, Order Instituting Rulemaking into the Review of the California High Cost Fund-A Program*, Rulemaking 11-11-007 (December 18, 2014).[38]

[35] This process resulted in the exclusion of approximately 5,503 households from census blocks only partially falling within Small ILEC territories, statewide, bringing the total estimated households in all 13 territories down to 64,873, based on 2010 Census data. This figure is within 3.5 percent of the 67,194 households separately reported by the Small ILECs in response to the CPUC's 2017 data requests. While the resulting figures are to be considered estimates only, there is confidence in the nature of the overall findings based on this data.
[36] CPUC D.16-12-025 at 57. The CPUC has recognized this limitation in prior decisions.
[37] P.U. Code § 275.6 at https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=P.U.Code&sectionNum=275.6.
[38] CPUC D.14-12-084 at http://docs.cpuc.ca.gov/publisheddocs/published/g000/m143/k638/143638287.pdf.

- CPUC Decision 16-12-025, *Decision Analyzing the California Telecommunications Market and Directing Staff to Continue Data Gathering, Monitoring, and Reporting on the Market*, Investigation 15-11-007 (December 1, 2016).[39]

- CPUC Decision 96-10-066, *Investigation on the Commission's Own Motion into Universal Service and to Comply with the Mandates of Assembly Bill 3643* (October 25, 1996).[40]

2.4 Analysis of Broadband Internet Imputation

2.4.1 Customer Access to Broadband Provided by Small ILECs

Arguably, the single most relevant measure of the status of broadband deployment in a Small ILEC is the percentage of households with access to broadband services. For the purposes of this study, we use CPUC broadband and U.S. Census data to identify the maximum downstream[41] and upstream[42] speeds made available to the households in each Small ILEC.[43] We then compared these speeds against three different standards, listed below, to identify the percentage of households with access to each.

- California Statutory (State) "served" speed standard (6 megabits per second (Mbps) downstream, 1 Mbps upstream)[44];
- FCC Connect America Fund (CAF) current speed standard (10 Mbps downstream/1 Mbps upstream); and
- FCC CAF proposed speed standard (25 Mbps downstream/3 Mbps upstream).

The results of this analysis show variation in levels of broadband access within and across the Small ILECs in relation to each standard. Table 3 provides a summary of each Small ILEC's ability to provide access to speeds that meet current State and FCC CAF standards, and the FCC CAF Proposed standard.[45]

[39] CPUC D.16-12-025 at http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M171/K031/171031953.pdf.
[40] CPUC D.96-10-066 at ftp://ftp2.cpuc.ca.gov/LegacyCPUCDecisionsAndResolutions/Decisions/Decisions_D9507001_to_D9905055/D9610066_19961025_R9501020.pdf.
[41] Downstream speed is defined as "Data flowing from the Internet to a computer (Surfing the net, getting E-mail, downloading a file)." CPUC, *Broadband Deployment in California* (May 2005) at Appendix C, http://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/46428_D0505013_BBReport_Appendix_C.PDF.
[42] *Id.* Upstream speed is defined as "Data flowing from your computer to the Internet (sending E-mail, uploading a file)."
[43] For households in census blocks for which the Small ILEC reported providing access to more than one speed level, only the highest reported speed was used. The speeds represent the reported maximum advertised downstream and upstream speeds to households in each census block.
[44] Assembly Bill 1665 amended P.U. Code § 281(a)(b)(1)(B) to define "unserved household" to mean a household for which no facility-based broadband provider offers broadband service at speeds of at least 6 Mbps downstream and 1 Mbps upstream. By default, State "served" standard is considered 6 Mbps downstream/1 Mbps upstream for the purpose of this study. The CPUC has not officially adopted a "served" standard.
[45] Summary Data in Table 3 represents the percentage of households that meet each standard's downstream and upstream speed requirements. As a result, this percentage is equal to lower of the percentages of households meeting the downstream and upstream speed standards for each Small ILEC, as shown in Tables 4 and 5.

Table 3. Customer Access to Broadband Standard Speeds, 2015				
Small ILEC	**State Served Status** 6 Mbps/1 Mbps	**FCC CAF Current** 10 Mbps/1 Mbps	**FCC CAF Proposed** 25 Mbps/3 Mbps	**No Access Reported**[46]
Calaveras	96%	83%	74%	4%
Cal-Ore	100%	50%	0%	0%
Ducor	81%	0%	0%	12%
Foresthill	100%	100%	78%	0%
Kerman	100%	100%	64%	0%
Pinnacles	73%	73%	0%	27%
Ponderosa	93%	93%	88%	4%
Sierra	99%	99%	1%	1%
Siskiyou	96%	96%	0%	4%
Volcano	99%	99%	6%	1%
Participant Total	**97%**	**93%**	**31%**	**2%**
Happy Valley	19%	19%	19%	18%
Hornitos	20%	20%	0%	22%
Winterhaven	0%	0%	0%	44%
Non-Participant Total	**14%**	**14%**	**12%**	**26%**
Small ILEC Total	**90%**		**29%**	**4%**

Participant Small ILECs

Participant Small ILECs provide 97 percent of their households with State "served" broadband service. Of the remaining three percent of households, one percent has access to broadband at slower speeds, and two percent of households do not currently have access to broadband. The 97 percent rate is higher than the 2016 statewide average, which according to the CPUC, is 96 percent of households (though several rural counties only achieved 60-70 percent served status).[47] The Participant Small ILEC rate is considerably higher than their Non-Participant Small ILEC counterparts (14 percent), suggesting that the CHCF-A program has been successful at supporting broadband deployment. Three Small ILECs provide State "served" broadband service to 100 percent of their households (Cal-Ore, Foresthill, and Kerman), and two others reach 99 percent of households (Sierra and Volcano). These Small ILECs have networks that are considerably built-out and appear to meet the needs of its customers and the network performance goals of the CHCF-A.

Only two Small ILECs provide less than 85 percent of their households with access to State "served" broadband service (Ducor - 81 percent and Pinnacles - 73 percent). However, most of all of the remaining households located in these two Small ILECs have no access to broadband service (Ducor -12 percent and Pinnacles – 27 percent).

If the minimum speed standard increases from 6 Mbps (State "served") to 10 Mbps (FCC CAF current) downstream, the percentage of households meeting the standard drops slightly to 93 percent, with all

[46] This figure includes only those households in census blocks for which no carrier reported providing fixed broadband service. This figure excludes any households for which internet speeds were reported but at speeds below the CPUC "served" standard.

[47] CPUC, *State of California Wireline Broadband Availability* (December 31, 2016) at ftp://ftp.cpuc.ca.gov/telco/BB%20Mapping/2017/CA%202017%20-%20Household%20Availability%20by%20County%20and%20Consortia%20-%2020171221.pdf.

of the decrease attributable to Ducor (a decrease from 81 percent to 0 percent) and Calaveras (a decrease from 96 percent to 83 percent).

At the FCC CAF proposed standard of 25 Mbps downstream and 3 Mbps upstream, only 31 percent of households would meet the standard. Four Small ILECs would drop to 0 percent and two others would provide service meeting the standard to less than 10 percent of their households, due primarily to low downstream speeds. (Table 3)

Non-Participant Small ILECs

Only 14 percent of the households in Non-Participant Small ILECs have access to State "served" broadband speeds[48]. The majority of households in these territories (60 percent) receive broadband at "unserved" levels, due to upstream speeds of less than 1 Mbps. The remaining 26 percent of households have no access to broadband service. No households in Winterhaven are considered served due to low upstream speeds, and 44 percent of its households do not have access to any broadband service. The low served rates in these Small ILECs suggest that there remains a need to invest in broadband-capable infrastructure, though the nature and cost of those investments is unknown. Happy Valley and Winterhaven have been awarded California Advanced Services Fund (CASF) grants and will begin construction of fiber optic broadband facilities at some point in the future.[49]

The percentage of households meeting the FCC CAF current standard is 14 percent, but it drops to 12 percent at the FCC CAF proposed standard. (Table 3)

Tables 4 and 5 provide detail on the downstream and upstream speeds offered to households in each Small ILEC territory.

Table 4. Customer Access to Downstream Speeds, 2015

Small ILEC	State Served Status 6 Mbps	FCC CAF Current 10 Mbps	FCC CAF Proposed 25 Mbps	No Access Reported
Calaveras	96%	83%	74%	4%
Cal-Ore	100%	50%	0%	0%
Ducor	81%	0%	0%	12%
Foresthill	100%	100%	78%	0%
Kerman	100%	100%	64%	0%
Pinnacles	73%	73%	0%	27%
Ponderosa	95%	93%	88%	4%
Sierra	99%	99%	1%	1%
Siskiyou	96%	96%	0%	4%
Volcano	99%	99%	6%	1%
Participant Total	**97%**	**93%**	**31%**	**2%**
Happy Valley	32%	32%	19%	18%
Hornitos	20%	20%	0%	22%
Winterhaven	34%	34%	0%	44%
Non-Participant Total	**31%**	**31%**	**12%**	**26%**
Small ILEC Total	**92%**	**86%**	**29%**	**4%**

[48] This rate is considerably lower than their Participant Small ILEC counterparts (97 percent) and the statewide average (96 percent).

[49] CASF grants have been awarded to Happy Valley with Resolution T-17411 and Winterhaven with Resolution T-17410.

Table 5. Customer Access to Upstream Speeds, 2015				
Small ILEC	**State Served Status** 1 Mbps	**FCC CAF Current** 1 Mbps	**FCC CAF Proposed** 3 Mbps	**No Access Reported**
Calaveras	95%	95%	82%	4%
Cal-Ore	100%	100%	50%	0%
Ducor	81%	81%	0%	12%
Foresthill	100%	100%	81%	0%
Kerman	100%	100%	64%	0%
Pinnacles	73%	73%	0%	27%
Ponderosa	93%	93%	91%	4%
Sierra	99%	99%	98%	1%
Siskiyou	96%	96%	21%	4%
Volcano	99%	99%	6%	1%
Participant Total	**97%**	**97%**	**66%**	**2%**
Happy Valley	19%	19%	19%	18%
Hornitos	20%	20%	20%	22%
Winterhaven	0%	0%	0%	44%
Non-Participant Total	**14%**	**14%**	**14%**	**26%**
Small ILEC Total	**90%**	**90%**	**61%**	**4%**

2.4.1.1 Availability of Fixed Broadband Provided by Other Carriers in Small ILECs Territories

Other Fixed Broadband Providers

The CPUC data also includes information on other fixed broadband carriers that reported providing service to customers within each Small ILEC territory. (Table 6) Evidence of consumers having access to more than one carrier and technology suggests that an analysis of broadband access need not be restricted to solely the Small ILEC. Only in very few instances did an alternative fixed broadband service carrier provide broadband access to a census block that did not have access through the Small ILEC (such Ducor and Siskiyou).[50]

[50] The presence of multiple fixed broadband providers in a Small ILEC territory does not mean that every household in that territory has access to every carrier. In addition, AT&T currently does not provide fixed broadband DSL service over Small ILEC networks. It is assumed that presence of AT&T in Table 6 is the result of AT&T providing fixed broadband service to a portion of a census block that is partially included within the Small ILEC territory. These households equal no more than one percent of households in three Small ILECs. (Table 6)

Table 6. Number of Available Fixed Broadband Carriers, 2015					
Small ILEC	Number of Carriers Available				Broadband Carriers in Service Territory
	0	1	2	3	
Calaveras	3%	73%	24%	0%	Calaveras, AT&T, Comcast
Cal-Ore	0%	100 %	0%	0%	Cal-Ore
Ducor	11%	89%	0%	0%	Ducor, AT&T
Foresthill	0%	28%	70%	2%	AT&T, Foresthill-Sebastian, Suddenlink
Kerman	0%	38%	62%	0%	Comcast, Foresthill-Sebastian
Pinnacles	27%	73%	0%	0%	Pinnacles
Ponderosa	4%	89%	7%	0%	AT&T, Comcast, Northland, Ponderosa Edge, Ponderosa Telco, Sierra
Sierra	1%	53%	46%	0%	AT&T, Northland, Ponderosa, Sierra, TDS
Siskiyou	3%	96%	0%	0%	AT&T, Northland, Siskiyou
Volcano	1%	98%	1%	0%	AT&T, Charter, Comcast, Volcano
Participant Total	**2%**	**71%**	**27%**	**0%**	
Happy Valley	18%	73%	9%	0%	AT&T, Charter, Happy Valley-TDS, Velocity
Hornitos	22%	58%	20%	0%	AT&T, Sierra Tel, Hornitos -TDS
Winterhaven	43%	41%	16%	0%	Winterhaven-TDS, Time Warner Cable
Non-Participant Total	**26%**	**62%**	**12%**	**0%**	
Small ILEC Total	**4%**	**70%**	**26%**	**0%**	

Approximately 71 percent of households in the Participant Small ILECs are dependent on the Small ILEC for access to fixed broadband service. Household dependence on the Small ILEC is 100 percent in three of the Small ILECs (Cal-Ore, Ducor, and Pinnacles) when also including those households currently with no access to broadband service. The most competition for fixed broadband services, as indicated by more than one service provider, is in Foresthill (70 percent), Kerman (62 percent), and Sierra (46 percent).

Approximately 62 percent of households in the Non-Participant Small ILECs are dependent on the Small ILEC for access to fixed broadband service. Approximately 12 percent of households in these territories have access to an alternate provider of fixed broadband, though this access does not reduce the overall percentage of households that have no providers of broadband (26 percent).

Wireless, Fixed Wireless, and Satellite Broadband

The data used for wireless and satellite broadband access is available by geographic area, not by census block, thereby restricting our analysis to that reported by the Small ILECs in response to 2017 data requests.[51] Assembly Bill 1665 states that grants from the California Advanced Service Fund's Broadband Infrastructure Grant Account shall be awarded on a technology-neutral basis, including both

[51] These limitations and the CPUC's desire for the FCC to enhance the data collected regarding wireless broadband deployment were recognized in Comments of the California Public Utilities Commission *In the Matter of: Modernizing the FCC From 477 Data Program* (WC Docket No. 11-10) (September 25, 2017). As wireless technologies improve, they may raise new questions of the purpose and necessity of fixed voice and broadband services and the role of the CHCF-A. These questions are not addressed by this study.

wireline and wireless technologies. [52] As these services continue to advance in speed and availability to rural areas, the CPUC may eventually consider these technologies as equivalents, which may affect customer access and CHCF-A fund support.

According to the Small ILECs, wireless and satellite broadband, while generally available, may be inconsistent and unreliable. Each of the Small ILECs describes wireless services in their territories as "serviceable" on main roads and towns, but otherwise "spotty, non-existent, and generally unreliable" on smaller roads and in households. In some Small ILEC territories, such as Ducor and Pinnacles, there remain areas that do not have access to wireless broadband service. Likewise, nearly all Small ILECs reported having some access to satellite broadband, though they note that access is limited by terrain, vegetation, and weather common to the areas. In addition, the Small ILECs cited the high relative costs, upload limitations, and latency issues of satellite broadband as additional barriers to customer access.[53]

2.4.2 Broadband Technology

Consumer access to more advanced broadband-capable technology and infrastructure is another indicator of a more mature broadband network. In addition to determining the speed capability of the network, technology and infrastructure are also an indicator of the future investment needed to achieve build-out in a Small ILEC territory, which has a direct impact on the need for CHCF-A funds, or CASF grants.

2.4.2.1 Overview of Technology Types

Fixed broadband service can be provided over networks consisting of different technology types, each of which have different costs, physical limitations, and speed capabilities that can affect a Small ILEC's ability to meet existing and future standards. Table 7 provides an overview of the technologies reported as being deployed within the Small ILEC territories.

Table 7. Overview of Fixed Broadband Technologies

Technology	Description[54]
Digital Subscriber Lines (xDSL)	DSL is a wireline transmission technology that transmits data faster over traditional copper telephone lines already installed to homes and businesses. DSL-based broadband provides transmission speeds ranging from several hundred Kbps to millions of bits per second (Mbps). The availability and speed of the DSL service may depend on the distance from the home or business to the closest telephone company facility. "As DSL has matured, different types of DSL technologies have been developed, and these technologies are collectively referred to as x-type DSL, or xDSL. The "x" is replaced with a letter that represents a particular type of DSL, such as ADSL (Asymmetric DSL), HDSL (High bit rate DSL), and Very high bit rate DSL (VDSL). The various types of xDSL provide different speeds, and the speed necessarily determines how each type of xDSL is used."[55]
Asymmetric Digital Subscriber Lines (ADSL)	Used primarily by residential customers, such as Internet surfers, who receive a lot of data but do not send much. ADSL typically provides faster speed in the downstream direction than the upstream

[52] Chapter 851, Statutes of 2017.
[53] Small ILEC responses to 2016 CPUC Data Request 1, Question 3. March 16, 2016.
[54] Descriptions from FCC, *Types of Broadband Connections*, at www.fcc.gov/general/types-broadband-connections. Additional descriptions included for ADSL2/2+ and VDSL.
[55] The term "xDSL" is used by the CPUC in its GIS mapping and broadband data. Description of xDSL taken from Hewlett Packard (HP), *WAN Technologies Version 5.21*, 5-3 at ftp://ftp.hp.com/pub/networking/training/WAN_technologies-with_covers.pdf.

	direction. ADSL allows faster downstream data transmission over the same line used to provide voice service, without disrupting regular telephone calls on that line.
Asymmetric Digital Subscriber Lines 2 and 2+ (ADSL 2/2+)	ADSL2 and ADSL2+ use the same cabling and exchange infrastructure as a regular ADSL connection, but software allows for higher speeds than regular ADSL. As with ADSL connections, the distance of your house from the telephone exchange and the quality of the copper wiring can have a significant effect on speed availability.
Very High data rate Digital Subscriber Line (VDSL)	VDSL also uses the same cabling and exchange infrastructure as regular ADSL and ADSL2/2+ connections, but software allows for higher speeds than the other DSL technologies. The distance limitations of VDSL are greater than other forms of ADSL.
Cable Modem, Data Over Cable Service Interface Specification 3.0 (DOCSIS 3.0)	Cable modem service enables cable operators to provide broadband using the same coaxial cables that deliver pictures and sound to your TV set. Most cable modems are external devices that have two connections: one to the cable wall outlet, the other to a computer. Subscribers can access their cable modem service by simply turning on their computers, without dialing-up an ISP. You can still watch cable TV while using it. Transmission speeds vary depending on the type of cable modem, cable network, and traffic load.
Fiber	Fiber optic technology converts electrical signals carrying data to light and sends the light through transparent glass fibers about the diameter of a human hair. Fiber transmits data at speeds far exceeding current DSL or cable modem speeds, typically by tens or even hundreds of Mbps. The actual speed you experience will vary depending on a variety of factors, such as how close to your computer the service provider brings the fiber and how the service provider configures the service, including the amount of bandwidth used. The same fiber providing your broadband can also simultaneously deliver voice (VoIP) and video services, including video-on-demand. Telecommunications providers sometimes offer fiber broadband in limited areas and have announced plans to expand their fiber networks and offer bundled voice, Internet access, and video services. Variations of the technology run the fiber all the way to the customer's home or business, to the curb outside, or to a location somewhere between the provider's facilities and the customer.
Wireless	Wireless broadband connects a home or business to the Internet using a radio link between the customer's location and the service provider's facility. Wireless broadband can be mobile or fixed. • Wireless technologies using longer-range directional equipment provide broadband service in remote or sparsely populated areas where DSL or cable modem service would be costly to provide. Speeds are generally comparable to DSL and cable modem. An external antenna is usually required. • Wireless broadband Internet access services offered over fixed networks allow consumers to access the Internet from a fixed point while stationary and often require a direct line-of-sight between the wireless transmitter and receiver. These services have been offered using both licensed spectrum and unlicensed devices. For example, thousands of small Wireless Internet Services Providers (WISPs) provide such wireless broadband at speeds of around one Mbps using unlicensed devices, often in rural areas not served by cable or wireline broadband networks. • Wireless Local Area Networks (WLANs) provide wireless broadband access over shorter distances and are often used to extend the reach of a "last-mile" wireline or fixed wireless broadband connection within a home, building, or campus environment. Wi-Fi networks use unlicensed devices and can be designed for private access within a home or business, or be used for public Internet access at "hot spots" such as restaurants, coffee shops, hotels, airports, convention centers, and city parks.
Satellite	Just as satellites orbiting the earth provide necessary links for telephone and television service, they can also provide links for broadband. Satellite broadband is another form of wireless broadband, and is also useful for serving remote or sparsely populated areas. Downstream and upstream speeds for satellite broadband depend on several factors, including the provider and service package purchased, the consumer's line of sight to the orbiting satellite, and the weather. Typically a consumer can expect to receive (download) at a speed of about 500 Kbps and send (upload) at a speed of about 80 Kbps. These speeds may be slower than DSL and cable modem, but they are about 10 times faster than the download speed with dial-up Internet access. Service can be disrupted in extreme weather conditions.

The types of broadband-capable networks used within the Small ILEC territories have important consequences on this analysis and future CHCF-A funding needs. There are characteristics unique to each technology type that affect its feasibility in certain areas as well as the level of service available to end users. (Table 8) For example, households receiving service via an ADSL network may currently meet both State and FCC CAF speed standards, but may not be able to meet the standards if they are increased beyond ADSL's technological limitations. If the FCC CAF proposed speed standard (25 Mbps downstream/3 Mbps upstream) is adopted, this may require a Small ILEC to invest in the replacement of these networks to achieve served and eligibility status, resulting in a higher rate base and increased dependence on CHCF-A funds.

Table 8. Characteristics of Different Broadband Technologies, Ascending Order

Technology	Maximum Down/Up Speed[56]	Connection	Strengths[57]	Weaknesses
Wireline				
Dial-up	56 Kbps	Phone Line	Works with existing wire and less expensive	Slow speeds
Asymmetric DSL	12/2 Mbps	Phone Line	Works with existing wire and speed does not fluctuate with traffic	Limited to within 18,000 feet (or 4,000 ft - VDSL) from central office or remote cabinet of DSL Access Multiplexer (DSLAM)
ADSL2/2+	24/4 Mbps	Phone Line		
VDSL	300/100 Mbps	Phone Line		
Cable Modem	40/10 Mbps to 500/100 Mbps	Coaxial Cable	Speed not impacted by distance	Limited rural availability, speed impacted by traffic, and upload never matches download speeds
Fiber	2000/2000 Mbps	Fiber optics	Fastest service over greater distances with the least degradation, lower maintenance, allows expansion	Expensive investment and fragile
Wireless[58]				
Satellite	400 Kbps – 100 Mbps	Wireless Satellite	Service can be provided to remote areas that make it difficult to build a fixed network	Access to service is generally less reliable than fixed broadband (e.g., geography, weather), experiences higher latency (satellite), speeds are often lower, and costs are generally higher for similar speeds.
3G	50 Kbps – 1.5 Mbps	Wireless		
4G / LTE	Up to 12 Mbps	Mobile Wireless		
WiMax	Up to 128 Mbps	Wireless		

2.4.2.2 Fixed Broadband Technology Provided by Small ILECs

Asymmetric xDSL is the technology type most commonly used by Small ILECs. Using CPUC broadband and U.S. Census data at the census block level, we calculated the percentage of households by network technology type for each Small ILEC territory. (Table 9) In census blocks for which the Small ILEC

[56] CPUC-CD speed ranges for each technology, April 2018.
[57] Iowa Communications Network, *Broadband Matters, What are the Wired Broadband Technologies?*, at https://broadbandmatters.com/what-are-wired-broadband-technologies.
[58] Iowa Communications Network, *Broadband Reference Guide: A Resource for Digital Stakeholders*, at https://broadbandmatters.com/broadband101#n31.

reported offering more than one technology type, the technology offering the highest downstream speed was used for this analysis.

Table 9. Fixed Broadband Technology Provided by Small ILEC, 2015

Small ILEC	Small ILEC Broadband Technology[59]					
	None	Asymmetric xDSL	ADSL2 ADSL2+	VDSL	Cable Modem DOCSIS 3.0	Fiber
Calaveras	4%	62%	0%	0%	0%	34%
Cal-Ore	0%	100%	0%	0%	0%	0%
Ducor	12%	88%	0%	0%	0%	0%
Foresthill	0%	19%	0%	0%	0%	81%
Kerman	0%	36%	0%	0%	0%	64%
Pinnacles	27%	73%	0%	0%	0%	0%
Ponderosa	4%	86%	0%	0%	0%	10%
Sierra	1%	99%	0%	0%	0%	0%
Siskiyou	4%	0%	75%	0%	0%	21%
Volcano	1%	0%	90%	0%	3%	6%
Participant Total	**2%**	**59%**	**21%**	**0%**	**1%**	**17%**
Happy Valley	18%	50%	12%	19%	0%	0%
Hornitos	22%	59%	19%	0%	0%	0%
Winterhaven	44%	22%	34%	0%	0%	0%
Non-Participant Total	**26%**	**43%**	**19%**	**12%**	**0%**	**0%**
Small ILEC Total	**4%**	**58%**	**21%**	**1%**	**0%**	**16%**

Participant Small ILECs

Asymmetric DSL is the primary technology by which six of the 10 Participant Small ILECs deliver broadband service. Two Small ILECs rely predominantly on ADSL2/2+ (Siskiyou - 75 percent and Volcano - 90 percent) and another two Small ILECs rely predominantly on Fiber (Foresthill - 81 percent and Kerman - 64 percent). To varying degrees, six of the 10 Participant Small ILECs have deployed fiber networks.

Non-Participant Small ILECs

Similarly, Asymmetric DSL is the primary technology by which the three Non-Participant Small ILECs provide access to broadband (43 percent of households). This is followed by ADSL2/2+ (19 percent of households) and VDSL (12 percent of households). Happy Valley is the only Small ILEC in the state to use VDSL technology.

Continued increases to State and FCC CAF speed standards may render certain forms of technology insufficient for providing service, and require additional network investments to promote state and federal policy goals. Table 10 shows the rate at which each technology type is currently achieving the broadband speeds available to households in all of Small ILEC territories. VDSL is now meeting all three standards; Cable Modems are meeting the current State and FCC CAF standards, but not the FCC CAF Proposed standard.

[59] The technologies listed represent those available to at least one household in a given census block. In a number of instances, a Small ILEC reported providing access to more than one technology in a single census block.

Table 10. Percentage of Households by Small ILEC Technology and Speed Standard, 2015			
Technology	**State Served** 6 Mbps/1 Mbps	**FCC CAF Current** 10 Mbps/1 Mbps	**FCC CAF Proposed** 25 Mbps/3 Mbps
Asymmetric xDSL	99%	91%	26%
ADSL 2/2+	100%	100%	0%
Cable Modem, DOCSIS 3.0	100%	100%	0%
Fiber	100%	100%	90%
Participant Total	**97%**	**93%**	**31%**
Asymmetric xDSL	5%	5%	0%
ADSL 2/2+	0%	0%	0%
VDSL	100%	100%	100%
Non-Participant Total	**14%**	**14%**	**12%**
Small ILEC Total	**90%**	**87%**	**29%**

Some Small ILEC broadband networks that are currently considered built-out and serving their customer base (e.g., provide access to 99-100 percent of their households), may, by virtue of the service provided and/or technology in place (e.g., ADSL), be unable to meet future service levels to meet the FCC CAF proposed speed standards (25 Mbps downstream and 3 Mbps upstream). It is likely that these diminished speeds are due to increased customer distance from facilities. This may require additional network investments of which the technology type and costs are unknown at this time.

The need for future network investments is likely to disproportionately affect those Small ILECs relying more on ADSL technology, which are the majority of Small ILECs, because it offers the lowest speeds. The nature and cost of future investments is unknown at this time given the many factors unique to the Small ILEC and its customer base.

2.4.2.3 Fixed Broadband Technology Provided by Other Carriers in Small ILEC Territories

Cable modem is the predominant technology type deployed by other carriers providing fixed broadband within Small ILEC territories. (Table 11) It is possible, though the extent is unknown, that competition for fixed broadband over Small ILEC networks is suppressed because these companies cannot currently provide wireline voice services in Small ILEC territories. Though there is no restriction for other internet service providers (ISPs) to provide service over a Small ILEC's network, none of the Small ILECs reported this occurring. CPUC fixed broadband data shows that cable is the primary competitor to Small ILECs for fixed broadband. Six ILECs are not facing much broadband competition - Foresthill (71 percent) and Kerman (59 percent) have over 50 percent of their household with option of cable broadband. The overall lack of availability of alternative fixed broadband providers in these regions suggests continued customer dependence on the Small ILEC for fixed broadband access.

Table 11. Fixed Broadband Technology Type Provided by Other Carriers, 2015					
Small ILEC Territory	Alternative Carrier Broadband Technology				
	Asymmetric xDSL	ADSL2 ADSL2+	VDSL	Cable Modem DOCSIS 1, 1.1, 2.0	Cable Modem DOCSIS 3.0
Calaveras	1%	0%	0%	0%	25%
Cal-Ore	0%	0%	0%	0%	0%
Ducor	1%	0%	0%	0%	0%
Foresthill	0%	0%	0%	0%	71%
Kerman	0%	0%	0%	0%	59%
Pinnacles	0%	0%	0%	0%	0%
Ponderosa	1%	0%	0%	0%	3%
Sierra	0%	0%	0%	0%	45%
Siskiyou	0%	0%	0%	0%	1%
Volcano	0%	1%	0%	0%	0%
Participant Total	**0%**	**0%**	**0%**	**0%**	**26%**
Happy Valley	0%	6%	0%	0%	3%
Hornitos	0%	0%	0%	0%	0%
Winterhaven	0%	0%	0%	0%	17%
Non-Participant Total	**0%**	**4%**	**0%**	**0%**	**6%**
Small ILEC Total	**0%**	**0%**	**0%**	**0%**	**24%**

2.4.3 Barriers to Broadband Build-Out

When the CPUC considered arguments in favor of imputing broadband revenues, chief among its concerns was avoiding policy that impeded the ability of a Small ILEC to deliver broadband service to its customers. Related to this analysis are the types of barriers faced by Small ILECs in building out their networks, as they drive deployment costs and reliance on CHCF-A subsidies. As shown in the previous section of the study, many Small ILECs have successfully been able to provide broadband access to over 90 percent of the households in their territories. As a result, an analysis of barriers applies most to a Small ILEC's (1) ability to deliver broadband to the segment of the customer population not currently served, and (2) ability to upgrade its network in the future to meet increased standards and service demand.

In response to a CPUC Data Request, all of the CHCF-A participating Small ILECs issued the same statement with regard to barriers:

> *"In the rural area that [Small ILEC] serves, the challenges are numerous and ongoing. The cost to install and maintain service continues to be very high. The principal challenge of services [in Small ILEC's] service territory is that customer locations are distant from one another and distant from [the Small ILEC's] central office…"*[60]

In addition, the Small ILECs noted their terrain poses a barrier to delivering service. For example, Foresthill's "highly forested and mountainous" terrain makes deployment of broadband technologies more complex and expensive. As for the three non-participating Small ILECs, each make note that, absent CASF grant support, there is no "business case" for the investment in broadband-capable networks due to high cost construction related to mountainous and sparsely populated areas in their

[60] Small ILEC responses to 2017 CPUC Data Request 5 (November 22, 2017).

territories. Furthermore, even with CASF grant support in hand, two of these three Non-Participant Small ILECs cite the costs and time related to the California Environmental Quality Act (CEQA) review process as an additional barrier to build-out.[61]

For the purposes of this analysis, we focus on three barrier types: population scarcity, service affordability, and terrain.

2.4.3.1 Population Scarcity

Population scarcity in a territory can pose a barrier to broadband services because of the high cost of building a network relative to the revenue it generates. In fact, Small ILECs cited the combination of a lack of population and high cost of construction as the primary barriers to expanding service. For the purposes of this analysis, we used CPUC broadband and U.S. Census data to identify the household density of those census blocks reported as not having access to broadband services.

As mentioned earlier in the report (Table 2), the Small ILEC territories are sparsely populated, with 63 percent of census blocks lacking a single household, 25 percent with 1-10 households, and 5 percent with only 11-20 households. Table 12 shows the population scarcity for those census blocks for which there is no broadband service available. The households that do not have access to broadband account for only 4 percent[62] of all households (2,800 households) in Small ILEC territories statewide – only half of which are in Participant Small ILEC territories. According to the data, 58 percent of households without service are in rural census blocks containing fewer than ten households, while 31 percent of households lacking service are in census blocks with between 11-40 households. Non-Participating Small ILECs have about 22 percent of households lacking service in the more populated areas with 40+ households.

Table 12. Households Without Service by Number of Households in Census Block, 2015

Small ILEC	Number of Households in Census Block					Total Households Without Service
	0-10	11-20	21-30	31-40	40+	
Calaveras	45%	43%	12%	0%	0%	175
Cal-Ore	100%	0%	0%	0%	0%	9
Ducor	78%	7%	16%	0%	0%	164
Foresthill	100%	0%	0%	0%	0%	2
Kerman	100%	0%	0%	0%	0%	1
Pinnacles	100%	0%	0%	0%	0%	34
Ponderosa	43%	18%	13%	27%	0%	416
Sierra	59%	16%	0%	25%	0%	270
Siskiyou	67%	13%	0%	20%	0%	190
Volcano	79%	21%	0%	0%	0%	119
Participant Total	**59%**	**18%**	**7%**	**16%**	**0%**	**1380**
Happy Valley	68%	26%	0%	7%	0%	603
Hornitos	57%	20%	0%	23%	0%	140
Winterhaven	32%	15%	7%	5%	41%	677
Non-Participant Total	**50%**	**20%**	**3%**	**7%**	**20%**	**1420**
Grand Total	**54%**	**19%**	**5%**	**11%**	**10%**	**2800**

[61] Small ILEC responses to 2016 CPUC Data Request 1, Question 2 (March 16, 2016).

[62] The 4 percent is derived from total number of household without service (2,800) divided by total number of household (64,873). The total number of household is from Table 1.

2.4.3.2 Service Affordability

The affordability of broadband services can also present a barrier to broadband access in rural areas that are economically challenged. In these areas, demand for services may be more sensitive to price, and a Small ILEC may generate less revenue relative to their investment in a broadband-capable network. For the purposes of this study, we analyzed U.S. Census data on census tract median income and poverty rates and compared them to statewide rates to identify relative poverty rates.[63]

According to 2016 U.S. Census data, only 3 of the 13 Small ILECs have tracts with poverty rates below the statewide average of 14.5 percent[64] (Calaveras, Foresthill, and Ponderosa). This means the 10 Small ILECs have higher incidents of low income customers. The average poverty rate for all tracts within Small ILEC territories is approximately 18 percent. The highest poverty rates among Participant Small ILECs are Ducor (29 percent), Kerman (25 percent), and Siskiyou (22 percent). Among Non-Participant Small ILECS, the highest poverty rates are in Winterhaven (25 percent) and Hornitos (20 percent). Because of the higher relative poverty rate, broadband service may be less affordable in the small ILEC service area.

Table 13. Small ILEC Average Census Tract Poverty Rate and Median Household Income, 2016

Small ILEC	Number of Tracts	Average Tract Poverty Rate	Average Tract Median Household Income
Calaveras	7	11%	$ 62,023
Cal-Ore	6	19%	$ 39,128
Ducor	8	29%	$ 37,847
Foresthill	2	14%	$ 60,576
Kerman	7	25%	$ 46,168
Pinnacles	2	18%	$ 61,984
Sierra	13	16%	$ 51,804
Ponderosa	15	14%	$ 62,153
Siskiyou	9	22%	$ 41,389
Volcano	12	15%	$ 55,007
Participant Total	**81**	**18%**	**$ 51,584**
Happy Valley	10	18%	$ 45,446
Hornitos	5	20%	$ 45,886
Winterhaven	2	25%	$ 27,292
Non-Participant Total	**17**	**19%**	**$ 43,439**
Small ILEC Total	**98**	**18%**	**$ 50,171**

[63] The question of affordability is a difficult one to evaluate given the many factors that influence it, including household income, cost of living, and cost of service. Further, there is no agreed upon standard for determining broadband affordability and there is limited data on broadband service levels, costs, and disposable income levels by Small ILEC territory. Lastly, unlike wireline voice services, fixed broadband service rates are not regulated by the CPUC as part of the CHCF-A GRC process, resulting in a wide range of service products and rates.

[64] California Budget and Policy Center, *New Census Figures Show that 1 in 5 Californians Struggle to Get By* (September 2017) at http://calbudgetcenter.org/resources/new-census-figures-show-1-5-californians-struggle-get/. The average poverty rate in California in 2016 was estimated to be 14.5 percent, though experts acknowledge that effective poverty rates in the state are often significantly higher when taking into account its higher cost of living relative to the rest of the nation.

2.4.3.3 Terrain

Difficult terrain can also pose a barrier to broadband services in Small ILEC territories that often include mountainous and heavily wooded areas, and sometimes face natural threats such as wildfires. Though many of these barriers can be physically overcome, they may result in significantly higher costs for providing broadband service. For the purposes of this study, our analysis of terrain is based on descriptions provided by the Small ILECs in response to a 2017 CPUC data request.

In their responses, the Small ILECs claim terrain is a barrier to deploying broadband internet, and several note that dependence on federal and state subsidies is required for such investments to make business sense. That being said, it should be noted that all of the CHCF-A participating Small ILECs claimed in 2017 that they provide 99-100 percent of their households with access to wireline voice networks. (Table 17) In these instances, it appears that geographical barriers are often physically surmountable, though deployment may be expensive. Furthermore, Small ILECs are not necessarily bound to provide broadband access to those households that are the most remote and difficult to reach, as COLR obligations apply to wireline voice services.

2.4.4 Broadband Revenues and Expenses

To understand the potential financial impact of broadband revenue imputation, we collected and analyzed data on Small ILEC and affiliate broadband revenues and expenses for the past five years. The Small ILECs provided this data in response to a 2017 CPUC data request.[65] These figures are provided at an aggregate level to protect the confidentiality of the individual Small ILECs. For the same reason, we do not include the revenue and expense figures for the three Non-Participant Small ILECs. Nevertheless, these figures are informative of the general trend in Small ILEC fixed broadband expenses and the revenues generated by the broadband services they support.

Small ILEC broadband revenue sources may include customer rates, affiliate revenue, and other forms of rate support. Regardless of their source, these revenues reflect a Small ILEC's ability to recover deployment and maintenance costs absent CHCF-A funds. In addition, understanding these figures can assist the CPUC in understanding the potential financial impact of imputation. Table 15 contains broadband revenue and expense figures for Participant Small ILECs, inclusive of their affiliates, for the period 2013-2016.

Table 15. Reported Annual Broadband Revenues and Expenses, 2013 - 2016

		2013	2014	2015	2016	Average
Participant Small ILEC Totals	**Revenues**	$21,455,791	$23,964,408	$25,190,501	$27,092,406	$24,425,777
	Expenses	$18,961,483	$21,382,636	$22,769,903	$24,605,620	$21,929,911
	Difference	$2,494,308	$2,581,772	$2,420,599	$2,486,786	$2,495,866

Revenues have risen by $5.6 million, or 26 percent, between 2013 and 2016**. On average, the ten Participant Small ILECs generated annual broadband revenues that exceeded their broadband expenses by nearly $2.5 million.** If this was commensurate with a rate of return on their broadband expenses, it would be 11.5 percent, led by two Small ILECs that generate returns of nearly 20 percent.

[65] Small ILEC responses to 2017 CPUC Data Request 5 November 22, 2017.

Three of the ten Participant Small ILECs do not regularly generate broadband revenues that meet or exceed expenses. (-10.2, -5.6, and -0.7 percent, over the four-year period). Small ILECs that regularly generate revenues below their expenses are likely to be more dependent on CHCF-A funds for broadband deployment. Since 2013, Participant Small ILECs have increased their annual expenditure in broadband-capable networks by 3-5 percent. Among Participant Small ILECs, expenses have risen by almost $6 million, or 30 percent, between 2013 and 2016.

2.4.5 Additional Policy Considerations

While the status of Small ILEC broadband deployment is critical to determining the appropriateness of broadband revenue imputation, the final criteria for making this determination and the process by which imputation will occur remains unclear. This section recognizes some of the issues the CPUC should consider when designing broadband imputation to achieve its policy goals.

Responding to Changing Standards and Technology

This analysis represents a snapshot in time and may need to be updated periodically to capture changes in Small ILEC broadband deployment, service speeds, network technologies, and state and federal standards. Over time, as Small ILECs continue investing in their broadband-capable networks, the percentage of households with access to broadband and improved service should increase. In contrast, any increases to state or federal standards are likely to result in a decrease to the percentage of households with access to qualifying speeds.[66] In addition, improvements to wireless broadband services may allow it to eventually challenge fixed broadband in reliability and cost. Each of these changes is likely to impact the types[67] and amounts of Small ILEC broadband investments that are considered "reasonably necessary" for the purposes of allocating CHCF-A funds. When deciding whether a Small ILEC's broadband revenues should be imputed, the CPUC should analyze updated data specific to each Small ILEC, including considerations raised by the Small ILEC territories that may have not been captured in this study.[68]

[66] As shown in Table 4, a shift from the FCC CAF current (10/1) to proposed (25/3) standard results in a decrease in households meeting the standard from 93 percent to 31 percent for Participant Small ILECs.

[67] For example, the CPUC will need to decide if it treats an investment in a technology upgrade that goes above and beyond the State "served" speed level differently than an investment to bring service to a census block that lacks broadband access.

[68] Examples include individual Small ILEC customer subscription rates, revenue and expense data, and detailed estimates of the investments needed to achieve 100 percent access to service territory households at rates that meet State standards.

Perverse Incentives and Unforeseen Consequences

The imputation of broadband revenues is expected to lead to a decrease in the amount of CHCF-A funding allocated to a Small ILEC. As a result, Small ILECs may seek ways to minimize and offset these reductions that could include changes that run counter to CPUC policy goals. These actions may include reducing or increasing revenues, increasing expenses, or keeping access and speeds levels below any identified State standard that triggers imputation. This may require the CPUC to consider different ways to ensure that non-imputed broadband revenues are being invested in the advancement of broadband access in each territory. Because fixed broadband rates are not regulated in the same way as wireline voice rates, Small ILECs have the discretion to increase broadband rates in a way that could negatively affect household access.

Alternatives Approaches to Implementing Revenue Imputation

The CPUC has some flexibility in its approach because the CPUC has yet to impute the broadband revenues of any Small ILEC, it retains flexibility in crafting its approach. Broadband revenue imputation could be done in different ways, including: (1) complete and immediate imputation upon Small ILEC achievement of certain criteria; (2) imputation that is proportional to a Small ILEC's progress in deploying broadband; and (3) phased-in imputation, in order to minimize the impact of CHCF-A reductions on each Small ILEC. In addition, the CPUC has discretion as to which factors it will include in determining whether a Small ILEC is eligible for broadband revenue imputation.

2.5 Summary of Key Findings

This section summarizes the key findings taken from the analysis section of the report for both Participant and Non- Participant Small ILECs.

Table 16. Summary of Key Data from Broadband Internet Imputation Section

Small ILEC	House-holds (HH)	Access to Broadband						Broadband Technology		Barriers to Build-Out	
		HH Access to Speed Standards			HH Without Access		Small ILEC is Sole Provider	ADSL (Lower speeds)	Fiber (Higher speeds)	No Service & Rural (<10 HH)	Average Poverty Rate
		State Served (6/1)	FCC Current (10/1)	FCC Proposed (25/3)	#	%					
Calaveras	3,951	96%	83%	74%	175	4%	73%	62%	34%	45%	11%
Cal-Ore	2,203	100%	50%	0%	9	0%	100%	100%	0%	100%	19%
Ducor	1,351	81%	0%	0%	164	12%	89%	88%	0%	78%	29%
Foresthill	2,679	100%	100%	78%	2	0%	28%	19%	81%	100%	14%
Kerman	6,508	100%	100%	64%	1	0%	38%	36%	64%	100%	25%
Pinnacles	125	73%	73%	0%	34	27%	73%	73%	0%	100%	18%
Ponderosa	9,648	93%	93%	88%	416	4%	89%	86%	10%	43%	16%
Sierra	18,404	99%	99%	1%	270	1%	53%	99%	0%	59%	14%
Siskiyou	4,308	96%	96%	0%	190	4%	96%	0%	21%	67%	22%
Volcano	10,217	99%	99%	6%	119	1%	98%	0%	6%	79%	15%
Participant Totals	**59,394**	**97%**	**93%**	**31%**	**1,380**	**2%**	**71%**	**59%**	**17%**	**59%**	**18%**
Happy Valley	3,317	19%	19%	19%	603	18%	73%	50%	0%	68%	18%
Hornitos	634	20%	20%	0%	140	22%	58%	59%	0%	57%	20%
Winterhaven	1,528	0%	0%	0%	677	44%	41%	22%	0%	32%	25%
Non-Participant Totals	**5,479**	**14%**	**14%**	**12%**	**1,420**	**26%**	**62%**	**43%**	**0%**	**50%**	**19%**
Small ILEC Totals	**64,873**	**90%**	**86%**	**29%**	**2,800**	**4%**	**70%**	**58%**	**16%**	**54%**	**18%**
Table reference	*1*	*3*	*3*	*3*	*12*	*3*	*6*	*9*	*9*	*12*	*13*

2.5.1 Participant Small ILEC Findings

2.5.1.1 Customer Access to Broadband

1. Overall, Participant Small ILECs provide 97 percent of their households with access to broadband at State"served" speeds (6 Mbps downstream/1 Mbps upstream), which exceeds the statewide average rate of 96 percent. Five of the ten Small ILECs provide 99 to 100 percent of their households with access to "served" speeds. Only three of the ten Small ILECs provide qualifying speeds to fewer than 95 percent of their households. The rates of access to broadband meeting State "served" speeds in Participant Small ILECs far exceeds that in Non-Participant Small ILECs (14 percent), suggesting that CHCF-A has been successful in supporting the deployment of broadband.

2. Of the 59,394 households in Participant Small ILEC territories, only 1,380 (or 2 percent) are reported as not having access to any broadband service. The remaining one percent of households considered "unserved" have access to broadband speeds below the state standard.

3. At higher downstream and upstream speeds, the number of households with access decreases. Approximately 93 percent of households in participating Small ILEC territories have access to broadband speeds that meet the current FCC CAF standard (10 Mbps downstream/1 Mbps upstream). However, this number drops to 31 percent of households (and 0 percent in 4 Small ILECs) when applying the proposed FCC CAF standard (25 Mbps downstream/3 Mbps upstream).

4. Most households in Small ILEC territories remain dependent on Small ILECs and their affiliates for access to fixed broadband. For 71 percent of households in Participant Small ILECs, the Small ILEC is the sole provider of fixed broadband. For five Participant Small ILECs, this figure increases to over 88 percent of households. If households lacking broadband service are included, these figures increase, reaching 100 percent of households in four of the ten territories. The primary alternative source of fixed broadband is cable, which reaches approximately 26 percent of households[69]. Though other internet service providers (ISPs) can provide service over Small ILEC networks, there are no reports that this occurs beyond the Small ILEC affiliates.

2.5.1.2 Broadband Technology

5. The majority (59 percent) of Participant Small ILEC networks rely on Asymmetric xDSL technology to deliver broadband services, followed by ADSL2/2+ (21 percent). Some Small ILECs have begun to deploy fiber networks that offer higher speeds, but it is available to only 17 percent of households. As state and federal broadband standards continue to increase, Small ILECs will be required to invest in enhancing or upgrading their services and networks. Each broadband technology has its own capabilities and constraints that affect performance and cost.

2.5.1.3 Barriers to Broadband Build-Out

6. The high rates of household access to broadband that meets State "served" and current FCC CAF standards suggest that most barriers to build-out facing Small ILECs are physically and financially surmountable. However, barriers may make it difficult to provide services to the remaining 1,380 households in Participant Small ILECs that lack access, as well as affect future efforts to improve and upgrade broadband networks. According to CPUC broadband data and Small ILEC reports, the most significant barriers are population scarcity and the high costs of construction in difficult terrain.

7. In general, broadband services are likely to be less affordable in Small ILEC territories given their higher incidence of poverty. According to U.S. Census data, poverty rates among participating Small ILECs are higher than California's statewide average (14.5 percent). Participant Small ILECs have an average poverty rate of 18 percent, with only three territories below the statewide average, and three Small ILECs with rates that top 20 percent.

[69] Table 11

2.5.1.4 Broadband Revenues and Expenses

8. On the aggregate level, Participant Small ILECs have generated annual broadband revenues that exceed their broadband expenses over the period 2013 - 2016. On average, the ten Participant Small ILECs' generated annual revenues exceeded their expenses by nearly $2.5 million. If this was commensurate with a rate of return on their broadband expenses, it would be 11.5 percent. In general, broadband revenues and expenses have steadily increased by 3-5 percent annually during this period.

2.5.2 Non-Participant Small ILEC Findings

2.5.2.1 Customer Access to Broadband

9. The networks of the three Non-Participant Small ILECs are less deployed than that of their CHCF-A-participating counterparts. Only 14 percent of households in these Small ILECs have access to broadband at State "served" and FCC CAF speeds, and 12 percent are able to meet the proposed FCC CAF standard (25 Mbps downstream/3 Mbps upstream). One Non-Participant Small ILEC does not provide any households with broadband at "served" speeds. Most of the households (60 percent) in these territories have access to broadband at "unserved" speeds, and another 26 percent of households lack access to any broadband service.

10. Most households in Non-Participant Small ILEC territories remain dependent on Small ILECs and their affiliates for access to fixed broadband. For 62 percent of households in these three Small ILECs, the Small ILEC is the sole provider of fixed broadband. This figure increases to 88 percent of households when including households lacking broadband service in these territories.

2.5.2.2 Broadband Technology

11. The majority of households (43 percent) rely on Asymmetric xDSL technology for broadband services, followed by ADSL2/2+ (19 percent) and VDSL (12 percent). None of these Small ILECs has begun to deploy fiber networks that offer higher speeds. As state and federal broadband standards continue to increase, Small ILECs are likely to be required to invest in enhancing or upgrading their networks. Each broadband technology has its own capabilities and constraints that affect their performance and cost.

2.5.2.3 Barriers to Broadband Build-Out

12. Similar to Participant Small ILECs, Non- Participant Small ILECs often face population, affordability, and terrain barriers to providing broadband access. Given the high percentage of households considered "unserved" due to slow speeds (60 percent) and no service (26 percent or 1,420 households), these barriers appear to be more significant in the absence of additional CHCF-A rate support.

13. In general, broadband services are likely to be less affordable in Non- Participant Small ILEC territories than elsewhere in the state given their higher incidence of poverty. According to Census data, poverty rates among non-participating Small ILECs (19 percent) are higher than California's statewide average (14.5 percent).

2.5.3 General Findings

14. The status of broadband deployment in Small ILEC territories will continue to evolve over time, due to additional investments and changing state and federal standards. This study represents a snapshot in time and should continue to be updated periodically at the individual Small ILEC level. Though data on customer access to broadband speeds are valuable, additional data not included in this report due to confidentiality concerns, such as subscriber rates and revenue and expense data, will also provide the CPUC with important context to help ensure it acts in accordance with its policy objectives. Operating in a complex regulatory area that straddles voice and broadband data on a shared network makes it difficult to strike a balance between being responsible stewards of the CHCF-A fund while not significantly impairing customer access to broadband in Small ILEC territories.

15. Because broadband revenues have not yet been imputed, there remain a number of questions surrounding the most effective way for the CPUC to approach the policy and process of imputing revenues. This includes the determination of what criteria and standards trigger imputation and whether imputation should be complete and immediate or phased-in over time. In addition, the CPUC will need to consider policies that ensure that Small ILECs do not have access to ways to avoid imputation or find alternative ways to recover the CHCF-A funds that stand to be lost, particularly when those activities result in poorer customer access to quality broadband services.

2.6 Conclusion

An analysis of the available data on Small ILEC broadband deployment shows that CHCF-A-Participant Small ILECs have successfully made progress building out their networks and now provide access to broadband to nearly all of their households at speeds that meet State “served” and current FCC CAF speed standards. Data show that seven of the ten Participant Small ILECs provide access to between 95 and 100 percent of the households in their territories. In contrast, the three Non-Participant Small ILECs were able to provide broadband access to only 14 percent of their households and no broadband service to 26 percent of their households. Furthermore, over the past four years, the majority of Small ILECs have shown the ability to consistently generate annual broadband revenues that exceed their broadband expenses. Based on this information, it appears that broadband revenue imputation would not hinder most Participant Small ILEC’s ability to provide access to broadband in their territories, and therefore broadband revenue should be included in the intrastate revenue requirement.

For those Small ILECs that are at or near complete broadband deployment, question of actual customer access remains - individual Small ILEC subscriber rates were not available for this study. Physical access to broadband does not necessarily equate with demand and affordability. The CPUC has discretion over how it determines which Small ILECs are ripe for imputation, how the process of imputation will be implemented, and what controls it can institute to ensure that customer access is protected and advanced.

3 WIRELINE VOICE COMPETITION

3.1 Introduction

This section of the study examines the question "Should the Small Incumbent Local Exchange Carrier (Small ILEC) territories be opened to wireline voice competition?" Federal code gives states the discretion to determine whether wireline voice competition be allowed in a given Small ILEC territory[70], though the CPUC has yet to receive any requests from Competitive Local Exchange Carriers (CLECs)[71] to provide competing wireline voice services over Small ILEC networks. According to CPUC D.14-12-084, the answer to this question is rooted in whether increased competition will provide an overall benefit to customers in a Small ILEC territory and further the aims of federal and state universal service. The CPUC ordered this study to explore the potential impacts of permitting wireline voice competition in Small ILEC territories, with particular attention to "universal service, reliability, safety, just and reasonable rates, deployment of broadband capable networks, deployment and maintenance of high-quality voice networks, and the economic impact on users of telecommunications services, and on the High Cost A Fund…."[72] A summary of key findings is presented in Section 3.5.

3.2 Background

In D.14-12-084, the CPUC visited the question of whether Small ILEC territories should be opened to wireline voice competition.[73] First was the question of whether opening these territories to competition was required by state and federal law. Upon review, the CPUC concluded that it is not mandated by federal or state law to open the Small ILEC territories to competition, interconnection, or the provision of service.[74]

Federal code gives states discretion over whether wireline voice competition should be allowed in a given Small ILEC territory.[75] As part of the Telecommunications Act of 1996, federal code sets forth a series of requirements for Small ILECs to provide other carriers, CLECs, with nondiscriminatory access to their network. This would allow a CLEC to offer competing local exchange services within the Small ILEC's service territory, and thus open the market for wireline voice services to competition.[76] However, the statute allows for a "rural exemption" under which rural telephone companies[77], including the Small

[70] CPUC D.14-12-084 at 97-99, Conclusion of Law (CL) 31, 37, and 38.
[71] A CLEC is a telephone company competing with established local telephone businesses (ILECs) to provide services in their territories. To promote competition, the Telecommunication Act of 1996 generally requires ILECs to offer CLECs access to their unbundled network elements and services at a wholesale discount.
[72] CPUC D.14-12-084 at 99, CL 41.
[73] CPUC D.14-12-084 at 32. This analysis is specific to wireline voice services, and does not apply to other voice services, such as wireless, and satellite, which are permitted to compete within a Small ILEC's territory.
[74] CPUC D.14-12-084 at 97-99, CL 31, 37, and 38.
[75] 47 U.S.C. § 251(f)(1)(A) at www.gpo.gov/fdsys/pkg/USCODE-2011-title47/html/USCODE-2011-title47-chap5-subchapII-partII-sec251.htm.
[76] *Id.* at (c). CPUC D.14-12-084 at 40.
[77] *Id.* at (f). The code refers to "rural telephone companies," which is a group that includes California's Small ILECs. According to 47 U.S.C. § 153(44), the term "rural telephone company" means a local exchange carrier operating entity to the extent that such entity - (A) provides common carrier service to any local exchange carrier study area that does not include either— (i) any incorporated place of 10,000 inhabitants or more, or any part thereof, based on the most recently available population statistics of the Bureau of the Census; or (ii) any territory, incorporated

ILECs, are exempt from the requirement to allow voice competition over its facilities until (1) the Small ILEC has received a "bona fide" request from a CLEC for interconnection, services, or network elements, and (2) the CPUC determines that the request is not unduly economically burdensome, is technically feasible, and is consistent with principles of universal service.[78] If a bona fide request is received, the Small ILECs may petition the CPUC for a "suspension or modification" of the CLEC's request.[79] The CPUC will then make a determination on whether the Small ILEC's petition is necessary and consistent with the public interest, convenience, and necessity.[80]

Between 1996 (when the law took effect) and 2014, no CLEC has submitted a bona fide request to provide wireline voice services in one of California's Small ILECs territories. As a result, the CPUC had not addressed the rural exemption set forth by the federal code.[81]

Nevertheless, the CPUC preliminarily explored the impact of competition in D.14-12-084 and received comments from parties in favor of and against opening Small ILEC territories to wireline voice competition. The primary arguments in favor of competition, made by groups representing CLECs, were that competition would lead to advances in infrastructure and increase the types of services available to customers in the Small ILEC territories.[82] The primary arguments against competition, made by the Small ILECs, was that it would undermine universal service by reducing revenue collected from Small ILEC customers, while having no impact on high expenses due to the COLR obligation imposed on Small ILECs, resulting in a shortfall in revenue that would require increased CHCF-A subsidies.[83]

The CPUC ultimately called for a study to evaluate the "potential impact" of wireline voice competition on universal service, reliability, safety, just and reasonable rates, deployment of broadband capable networks, deployment and maintenance of high-quality voice networks, end-user service costs, and the CHCF-A fund.[84] This information and analysis may assist the CPUC in evaluating a bona fide request, if and when, one is made. In the meantime, citing end-customer concerns about potential service degradation and the lack of requests for interconnection and exemption, the CPUC preliminarily concluded that was not in the public interest to open any Small ILEC territories to wireline voice competition.[85]

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or unincorporated, included in an urbanized area, as defined by the Bureau of the Census as of; (B) provides telephone exchange service, including exchange access, to fewer than 50,000 access lines; (C) provides telephone exchange service to any local exchange carrier study area with fewer than 100,000 access lines; or (D) has less than 15 percent of its access lines in communities of more than 50,000.

[78] 47 U.S.C. § 251(f)(1)(A).

[79] 47 U.S. Code § 251(f)(2).

[80] *Id*.

[81] CPUC D.14-12-084 at 43.

[82] *Id.* at 30, et. al.

[83] *Id.* at 36-38.

[84] *Id.* at 99, CL 41.

[85] *Id.* at 45.

3.2.1 Overview of Small ILEC Wireline Voice Service

The networks that provide wireline voice services to customers in Participant Small ILEC territories are effectively built-out. According to Small ILEC responses to a 2017 CPUC data request, 99 percent of households within these territories have access to wireline voice services.[86] This figure is only 72 percent among Non-Participant Small ILECs. (Table 17)

Table 17. Percentage of Households with Access to Wireline Voice, 2017

Small ILEC	Total Households	Households Without Access	Percentage of Households with Access
Calaveras	4,000	-	100%
Cal-Ore	4,476	-	100%
Ducor	1,244	-	100%
Foresthill	3,125	31	99%
Kerman	7,700	-	100%
Pinnacles	157	-	100%
Ponderosa	8,631	259	97%
Sierra	18,208	-	100%
Siskiyou	4,577	595	87%
Volcano	9,900	-	100%
Participant Total	**62,018**	**885**	**99%**
Happy Valley	2,794	671	76%
Hornitos	529	185	65%
Winterhaven	1,853	611	67%
Non-Participant Total	**5,176**	**1,467**	**72%**
Small ILEC Total	**67,194**	**2,352**	**96%**

Small ILECs have obligations as COLORs to provide wireline voice services, and the prices charged for voice service is determined in CPUC GRC proceedings.[87] Since 1996, the Small ILECs have been able to provide wireline voice services to their customers without any competition, though they are subject to increasing competition from alternative means of voice communication, such as VoIP, cable, wireless, and satellite, which are not restricted in the same way. Unlike broadband service, the CPUC find that wireless voice services are often a functional equivalent to wireline voice services, with the relevant exception of those areas in which those services are unreliable, which may be applicable to the Small ILEC territories.[88]

[86] While these are the same networks upon which a Small ILEC provides broadband services, a slightly lower percentage of households in these territories (97 percent) have access to broadband, as noted in the Broadband Imputation section of the study. The Total Households figure in Table 17 is slightly different from that cited in the Broadband section of the report because it is based on Small ILEC responses to a 2017 CPUC data request rather than U.S. Census data.

[87] P.U. Code § 275.6(d).

[88] CPUC D.16-12-025 at 37-43. Though this equivalency is not applicable in areas in which access to mobile services is unreliable, such as may be the case within rural Small ILEC territories.

3.3 Methodology

This study evaluates the potential impact of opening Small ILEC territories to wireline voice competition by addressing several factors related to universal service as identified in D.14-12-084:

1. California High Cost Fund-A (CHCF-A)
2. Just and reasonable rates for customers
3. Service reliability
4. Public safety
5. Emerging technologies
6. Deployment and maintenance of high quality voice networks
7. Deployment of broadband capable networks
8. Economic impact on users of telecommunication services

For each factor, we examine the arguments in favor and against the standard, which include those made by interested parties in prior CPUC and FCC decisions, as well as those made by Small ILECs in response to CPUC data requests in 2017. This analysis is further supported, when possible, by relevant CPUC and FCC data on Small ILEC networks, U.S. Census data, and other sources, as cited throughout the section.

3.3.1 Assumptions

1. The existing CHCF-A framework promulgated by P.U. Code § 275.6 will remain intact even if the CPUC finds that competition is permitted under 47 U.S.C. § 251(f).
2. The CLECs choosing to compete in a Small ILEC territory will primarily serve as resellers of Small ILEC wireline voice services over Small ILEC wireline facilities.
3. Because Small ILEC voice and broadband services are provided over the same network, CPUC and FCC data on network access and technology is generally applicable to voice services.

3.4 Analysis of Wireline Voice Competition

3.4.1 California High Cost Fund-A

As mentioned earlier in the report, the CHCF-A is intended to subsidize Small ILECs in the provision of high-quality voice and broadband services of comparable quality and cost to those found in urban areas. The amount of CHCF-A funds allocated to a Small ILEC is equal to that amount that cannot be reasonably provided by customers, after federal rate support is received, to meet its CPUC-determined Revenue Requirement.[89] The Revenue Requirement is determined by Rate of Return Regulation to be an amount sufficient to allow the delivery of safe, reliable, high quality voice communication service, fulfill COLR obligations, and provide a reasonable rate of return on investment, attract capital for investment on reasonable terms, and ensure Small ILEC fiscal integrity.[90]

3.4.1.1 Reduced Small ILEC Revenues due to Potentially Fewer Customers

In D.14-12-084, both the parties for and against competition shared the premise that increased competition for wireline voice services in Small ILEC territories would result in some customers leaving the Small ILEC for a CLEC competitor. Regardless of the impact on the individual customer, a potential decrease in customers is likely to result in a reduction in Small ILEC customer revenues. (Figure 3) Moreover, by virtue of CPUC regulations, Small ILECs cannot increase service rates to counteract this loss, nor can they charge CLECs more than wholesale cost for access to their unbundled network elements. At this time, the extent of the potential impact is unknown.[91]

In addition, there is concern that CLEC competition is likely to focus on those institutions that represent the highest revenues and lowest service costs within a Small ILEC territory. This tactic is often referred to as "cherry picking." [92] Beyond those institutions, which are currently provided wireline voice service by the Small ILECs, new competition may not necessarily result in substantial benefit to the general customer base. Again, the true extent of this impact remains unknown.

However, competition also open a new revenue steam for the Small ILECs. The Small ILECs can earn *Interstate* Access Revenue collected from a CLEC, which may include private network services and circuits. However, the revenue collected from these services are not included in the calculation for revenue requirement in the Small ILECs' GRCs. A GRC only accounts for *intrastate* revenue, not *interstate* revenue collected from CLECs. As a result, the Small ILEC may be collecting twice for the same service: (1) interconnection rate imposed on CLECs for using ILEC's network; and (2) increase funding support from CHCF-A.

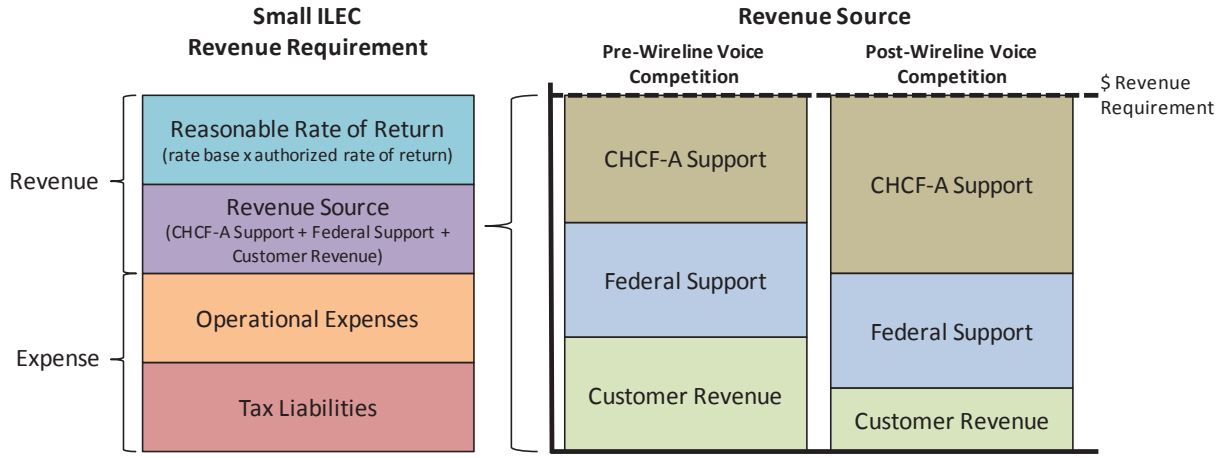
3.4.1.2 Limited Opportunities for Small ILECs to Reduce Expenses

Due to regulatory obligations, Small ILECs may have limited ability to decrease their expenses to account for the reduction in revenue. As a recipient of CHCF-A funds, Participant Small ILECs are obligated to

[89] P.U. Code § 275.6(c)(4).
[90] *Id.* at (c)(2).
[91] 47 U.S.C. 251(4) Requiring "resale at wholesale rates any telecommunications service that the carrier provides at retail to subscribers who are not telecommunications carriers."
[92] CPUC D.14-12-084 at 91, Finding of Fact (FF) 29.

serve as the Carrier of Last Resort (COLR) for customers that make a reasonable request for wireline voice services in their territory.[93] This requires a certain minimum level of network investment and maintenance regardless of the presence of a subscriber. Competitors such as CLECs, wireless, or satellite, do not share these COLR obligations. In addition, Small ILECs network and service expenses are driven by regulatory requirements, rather than competitive market forces, to meet specified minimum levels of service as a condition to qualify for CHCF-A and federal CAF funds. As noted earlier, nearly every household in each Participant Small ILEC territory already has access to basic telephone service.[94]

Figure 3. Expected Impact of Wireline Voice Competition



3.4.1.3 Increased Burden on CHCF-A to Achieve the Revenue Requirement

Small ILECs are allowed to recover their reasonable expenses and tax liabilities and earn a reasonable rate of return on their rate base (plant and equipment), which is known as *revenue requirement*. Under P.U. Code § 275.6, the CPUC established Small ILEC revenue requirement, which consists of reasonable rate of return (rate base multiplied by authorized rate of return), operating expenses, taxes, and revenue sources. Revenue sources consist of CHCF-A support, federal support and customer revenue. Assuming no increase in federal support, the burden of the decreased revenue will fall directly on the CHCF-A, resulting in an increased need for the subsidy. (Figure 3) In effect, the result of competition would be an increased cost for all ratepayers. The extent of an increased burden on the CHCF-A is unknown at this point, as it would depend on the number and type of customers that switch to CLEC service providers. The Small ILECs opposed to competition concur with this analysis of the potential impacts of competition on the CHCF-A, while proponents of competition do not appear to have offered any countervailing arguments or alternative viewpoints.[95]

[93] P.U. Code § 275.6(d)(3).

[94] Small ILEC responses to 2016 CPUC Data Request 2, Questions 2 and 3 (April 4, 2016). The only Small ILECs that did not report providing access to 100 percent of their households were Cal Ore (99.5 percent – 10 households lack access), Ponderosa (97.8 percent – 188 households lack access), and Siskiyou (87 percent – 599 households lack access).

[95] CPUC D.14-12-084 at 37-38.

3.4.2 Just and Reasonable Rates for Customers

Opening Small ILEC territories to wireline voice competition will not have an effect on rates for Small ILEC end user customers because the rate is set at a reasonable rate comparable to those in urban areas. A primary principle of universal service is for federal and state government to strive to make "quality services…available at just, reasonable, and affordable rates."[96] For rural and high cost areas, such as the Small ILEC territories, this standard is set at a level "reasonably comparable to those services provided in urban areas and that are available at rates that are reasonably comparable to rates charged for similar services in urban areas."[97] To ensure Small ILECs receiving CHCF-A funds meet this standard, the CPUC prescribes the rates that they can charge customers for voice services.[98] As a result, barring a change to the regulatory obligations of participating Small ILECs, future customers will continue to have access to "just and reasonable" rates via the Small ILEC. Note that customer rates only change when a Small ILEC's next GRC is completed.

In contrast, CLECs that would provide competing wireline voice services in Small ILEC territories are not bound by the same regulatory requirements and are free to offer services at rates below, at, or above those offered by the Small ILECs. As result, competition could create an opportunity for customers to switch to a CLEC and pay rates that are not considered just and reasonable; however, this would not impact the customer's access to the just and reasonable rates offered by the Small ILEC. Instances in which a CLEC charges lower rates than the competing Small ILEC could be beneficial to individual customers. At this point in time, there is no information on what a CLEC would charge customers in these territories.

Because voice and broadband are increasingly sold as bundled services, it is difficult to isolate the relative cost of each service type when performing an analysis on rates. The impact of competition on wireline voice rates and services cannot be done absent the consideration of broadband services. In D.16-12-025, the CPUC noted that wireline voice and broadband services are inextricably linked, as (1) VoIP is voice service over broadband, (2) nearly 92 percent of customers purchase wireline voice and broadband as a bundle[99], and (3) the services share the same infrastructure. [100] Customer decisions on bundled service are often driven by the relative cost of broadband service, not voice service, and this clouds the true impact of competition on voice services.[101]

In D.14-12-084, proponents of increased competition argued competition would lead to an increased number of service types available to customers in a Small ILEC territory, and a reduction in consumer service costs. However, there are doubts that these impacts would be significant or beneficial. First, the CLECs' network service would be limited to those of the Small ILEC because the CLECs would use Small

[96] 47 U.S.C. § 254(b)(1).
[97] *Id.* at (b)(3); Also reflected in P.U. Code § 275.6(c)(3) ("Ensure that rates charged to customers of small independent telephone corporations are just and reasonable and are reasonably comparable to rates charged to customers of urban telephone corporations.")
[98] P.U. Code § 275.5(c)(3).
[99] CPUC D.16-12-025 at 184, FF 3.
[100] *Id.* at 187, FF 14.
[101] *Id.* at FF 13.

ILEC upstream facilities. The exception would be when a CLEC chooses to overbuild the last-mile of network infrastructure (e.g., fiber to the home). However, the CPUC has found this type of investment is generally rare (only 1-2 percent statewide), and it is unlikely to occur in a Small ILEC's sparsely populated high-cost areas.[102] Consequently, the CPUC and FCC have recognized that the benefits of competition in a resale situation is minimal, and any differences in service cost exist insofar as one service provider can have more effective and efficient retail operations to attract more customers and reduce service costs, respectively.[103]

3.4.3 Service Reliability

Opening Small ILEC territories to wireline voice competition will not have an impact on service reliability, but there may be a difference in service quality. Network reliability is particularly important in Small ILEC territories because the Small ILEC is often the sole provider of wireline voice and broadband services.[104] According to a 2018 CPUC report on wireline telephone service quality, majority of Small ILECs generally meet all of the minimum standards for all five service quality measures (installation interval; installation commitments; customer trouble report; out of service repair interval; and operator answer time), which exceeded the performance of Uniform Regulatory Framework (URF) ILECs and CLECs.[105] However, because competing voice service providers will likely be relying on the same Small ILEC infrastructure as resellers, service reliability is expected to be identical. Where service quality may differ would be found in the CLEC out of service repair statistics, which are generally poorer, assuming a continuation of service quality issues found by the CPUC in 2018.[106]

3.4.4 Public Safety

Opening Small ILEC territories to wireline voice competition should not have an impact on public safety. Related to service reliability, the CPUC also has an interest in ensuring that competing CLEC service providers will provide reliable and consistent access to 9-1-1 in emergencies. Given that CLECs will use Small ILEC networks to provide voice service, the ability of a service to reach emergency service institutions and be configured in a way that promotes network redundancy and protection from natural disasters (e.g., buried lines in a fire hazard area), will be identical between competitors.

3.4.5 Emerging Technologies

VoIP and wireless are types of voice services that can potentially serve as functional and economic equivalents to traditional wireline voice, but their adoption and accessibility in rural Small ILEC territories remains unclear. The CPUC has recognized the advancement and proliferation of emerging technologies that have the potential to significantly affect the provision of voice communication and the

[102] *Id.* at 64-65.
[103] *Id.* at 63-64.
[104] Refer to Table 6 (Seventy percent of households in Small ILECs rely on Small ILECs for wireline voice and broadband service).
[105] CPUC, *California Wireline Telephone Service Quality* (May 8, 2018) , http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/Utilities_and_Industries/Communications_-_Telecommunications_and_Broadband/Service_Provider_Information/2014-2016%20ServiceQuality%20staff%20report%20May%202018.pdf
[106] *Id.*

achievement of universal service goals. In D.16-12-025, the CPUC found that other types of voice services, such as VoIP and wireless, are functional and economic equivalents to traditional wireline voice.[107] As a result, given the many potential options for providing high-quality voice services, universal service goals appear more attainable now than ever.

Perhaps most pertinent to this section of the analysis is the fact that many of these voice services are already eligible to compete in Small ILEC territories. That is, voice services provided by wireless, satellite, and internet service providers (ISPs) do not fall under the jurisdiction of 47 U.S.C. § 251 and its rural exemption, as do Small ILECs and the CLECs competing for wireline voice services.

The most significant competitor in the area of voice services in Small ILECs has been wireless technology. According to Small ILEC responses to a 2016 CPUC data request[108], nearly all customers are assumed to have some access to wireless voice service.[109] However, in Small ILECs facing rural areas and geographical barriers, wireless voice is inaccessible and unreliable, rendering it an inadequate substitute. Unfortunately, there are few details on the true extent of wireless voice services within the Small ILEC territories. The Small ILEC responses to wireless availability lacked this detail, and CPUC and FCC data on wireless service is based on geographic area rather than by census block and household access. While maps of service territories can be useful, they lack the detailed information on service reliability, costs, and household customer access.

Other voice technologies, such as VoIP, do not appear to present the same competitive challenge to wireline voice at this time. Though other ISPs are already permitted to provide service over Small ILEC networks, no Small ILECs reported an ISP using their networks beyond their own broadband affiliates. This suggests that the market for broadband services alone does not entice competition. According to the Small ILECs, the vast majority of its broadband customers continue to subscribe to voice services, despite the availability of VoIP through the Small ILEC broadband affiliate. The Small ILECs do not offer standalone broadband; however, they offer lower broadband prices when coupled with voice service.

Emerging technologies may have a potential impact on customer access to emergency services because it may route 9-1-1 calls differently. For example, both VoIP and mobile voice service 9-1-1 calls are not associated with a specific location, while landline telephone services directly link the phone number with a known physical location.

3.4.6 Deployment and Maintenance of High-quality Voice Networks

The deployment and maintenance of high-quality voice networks in Small ILEC territories does not appear directly threatened by increased CLEC competition, as these investments are primarily driven by regulatory requirements placed on the Small ILECs and the availability of CHCF-A and CAF funding in amounts that make such investments viable. However, the resulting increased burden placed on the CHCF-A because of competition may potentially affect the availability of adequate funds in the future.

[107] CPUC in D.16-12-025 at 37-43.
[108] Small ILEC responses to 2017 CPUC Data Request 2, Question 6 (April 4, 2016).
[109] Small ILEC responses to 2017 CPUC Data Request 2, Question 7 (April 4, 2016).

3.4.7 Deployment of Broadband Capable Networks

The allowance of wireline voice competition in Small ILEC territories would not necessarily have an impact on the deployment of the broadband capable networks over which voice service can be provided. Because the CHCF-A is meant to offset the gap between customer and federal revenues and the CPUC-determined revenue requirement, a decrease in customer revenues may increase reliance on the CHCF-A, but not impact the revenue requirement itself. As a result, there does not appear to be a financial or non-financial reason for Small ILECs to alter their deployment approach.

3.4.8 Economic Impact on Users of Telecommunication Services

While the CHCF-A program will insulate Small ILECs and their customers from changes in access to service and just and reasonable rates due to wireline voice competition, the burden of the anticipated increase in CHCF-A funding needed to offset reduced customer revenues will fall on statewide ratepayers. At this time, the scale of the economic impact on end users, both individually and statewide, is unknown.

3.5 Summary of Key Findings

The following represent key findings from Section 3.4 of this report.

1. Competition for wireline voice services is expected to result in some customers transferring from Small ILECs to CLECs, resulting in a decrease in Small ILEC customer revenues. This decrease will be more pronounced if CLECs engage in cherry picking the most profitable customers in each territory. Because Small ILECs will retain their COLR and rate-setting obligations, their ability to decrease expenses are limited, and the financial burden of offsetting decreased revenues is likely to fall on the CHCF-A and its ratepayers. The extent of the potential impact is unknown.
2. Opening Small ILEC territories to wireline voice competition is not expected to have an effect on rates for Small ILEC end user customers because the CHCF-A requires Small ILECs to offer rates that are just and reasonable in comparison to those in urban areas. In general, analyses of the impact of changes to wireline voice rates are difficult as these services are now commonly bundled with broadband and other services.
3. Because CLEC services are likely to be limited to those offered by the Small ILEC because of their expected reliance on Small ILEC upstream facilities, competition will not have an impact on service characteristics related to the network itself, including service reliability and public safety. However, service characteristics unique to each carrier, such as customer service quality, may be different, and CPUC data has shown that CLECs generally provide poorer customer service quality than Small ILECs.
4. VoIP and wireless are types of voice services that can potentially serve as functional and economic equivalents to traditional wireline voice, but the extent of their adoption and accessibility in rural Small ILEC territories remains unclear.
5. Competition is not expected to negatively affect the deployment and maintenance of high-quality voice and broadband-capable networks in Small ILEC territories because the CHCF-A is currently set up to help them maintain their revenue levels despite experiencing reductions to customer revenues. Though the resulting burden on the CHCF-A due to competition may potentially affect the availability of adequate funds in the future, Small ILECs should be insulated from any direct impacts in the short-term.

3.6 Conclusion

In general, the intention of the Telecommunication Act of 1996 was to promote increased competition as a mechanism to improve service offerings and decrease costs to customers. However, the Act recognized that there are certain rural high-cost areas for which the market alone would not be able to support these goals, resulting in the creation of an exemption from wireline competition for these areas. The process created by the FCC focuses on balancing competition with the goals of universal service.

Opening Small ILEC territories to wireline voice competition is not expected to have a significant direct impact on Small ILECs and their customers because they are largely insulated by the CHCF-A Program (P.U. Code § 275.6). The CHCF-A guarantees customers will retain access to just and reasonable rates in comparison to urban areas. The CHCF-A also help Small ILECs achieve a set rate of return, rendering it unlikely that competition will affect their deployment and maintenance of high-quality voice and

broadband capable networks. However, because of this same commitment, there may be demand for CHCF-A funds to offset the revenue shortfall experienced by Small ILECs whose customers transfer to CLECs. The full impact of this is unknown.

Given that the CLECs are expected to resell Small ILEC wireline voice services over the same network, the introduction of competition is not expected to have a negative impact on service reliability and public safety. Service quality, on the other hand, may be poorer for customers that transfer to a CLEC. In the meantime, other emerging technologies, such as VoIP and wireless, are increasingly able to provide an alternative access to comparable voice services. However, at this time, it remains uncertain whether these technologies provide sufficient access and reliability needed to supplant wireline voice service.

Overall, opening Small ILEC markets to competitors may pose new challenge for the CHCF-A fund and the level of subsides should be examined more closely before implementation. If and when a process is for opening the market in Small ILECs service areas is undertaken, the CPUC should considered specific proposals to implement this new direction.

Appendix 1: Acronyms

Acronym	Description
ADSL	Asymmetric DSL
CAF	Connect America Fund
CAI	Community Anchor Institutions
CASF	California Advanced Services Fund
CD	Communications Division
CEQA	California Environmental Quality Act
CHCF-A	California High Cost Fund-A
CL	Conclusion of Law
CLEC	Competitive Local Exchange Carrier
COLR	Carrier of Last Resort
CPUC	California Public Utilities Commission
D.	Decision
DOCSIS	Data Over Cable Service Interface Specification
DSL	Digital Subscriber Line
DSLAM	Digital Subscriber Line Access Multiplexer
FCC	Federal Communications Commission
FF	Finding of Fact
FIPS	Federal Information Processing Standards
G.O.	General Order
GIS	Geographic Information System
GRC	General Rate Case
ILEC	Incumbent Local Exchange Carrier
Mbps	Megabits Per Second
OOS	Out-of-Service
P.U.	Public Utilities
R.	Rulemaking
SAC	Study Area Code
T1	Transmission System 1
U.S.	United States
U.S.C.	United States Code
URF	Uniform Regulatory Framework
VDSL	Very High Data Rate Digital Subscriber Line
VoIP	Voice Over Internet Protocol
WAN	Wide Area Network
WC	Wireline Competition
WISP	Wireless Internet Service Provider
WLAN	Wireless Local Area Network

(END OF ATTACHMENT A)