WISCONSIN PUBLIC SAFETY BROADBAND PROJECT

COVERAGE NEEDS AND USER POPULATION ANALYSIS FOR FIRSTNET

September 30, 2016

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Introduction

About the Project

The Wisconsin Public Safety Broadband (WiPSB) project represents the state's efforts to prepare for the implementation of FirstNet in the state. This project includes collecting user requirements, performing user population modeling and analysis, reviewing the state's public safety communications governance structure, and performing stakeholder outreach.

This project is housed under the Wisconsin Department of Justice, Crime Information Bureau, Interoperability Unit. It is funded by the U.S. NTIA State and Local Implementation Grant Program (SLIGP).

The objective of this project is to ensure successful implementation of the Nationwide Public Safety Broadband Network (NPSBN) in the state of Wisconsin based on a comprehensive statement of stakeholder requirements.

This Document

The WiPSB State Planning Report provides a summary of Wisconsin's buildout phases submitted for FirstNet state planning purposes. It also provides a summary of network requirements as determined through an extensive and inclusive data collection process. This report documents Wisconsin's needs for FirstNet state planning purposes as of September 30, 2016.

This document reflects Wisconsin's initial recommendation to FirstNet. These recommendations may change before the State Plan is delivered, and are subject to change after additional information about FirstNet's chosen vendor becomes available.

The information included in this document will be later supplemented by a plan for tribal land when that information becomes available.

Coverage Priorities

Buildout Phases

Meaning

These buildout phases represent Wisconsin's requirement for geographic coverage by the NPSBN during each phase of buildout. These phases are designed to align with FirstNet's RFP,[1] which divides implementation of the network roughly into 1-year phases.[2] Phase One is anticipated to begin Q4 2017, Phase Two in Q4 2018, and so forth through substantial network completion in Q4 2022, or sooner.

Methodology

The specific methodology for determining each phase was determined by the Wisconsin Interoperability Council, NPSBN Subcommittee. The committee ruled that each phase should consist of entire counties to encourage adoption by Sheriff's Departments due to the challenges that come with being a home rule state. This approach also encourages adoption by other agencies when a majority of their region is

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[1] https://www.fbo.gov/index?id=33106ecc75222458a6e4405b0f66bd2e
[2] Note: FirstNet's RFP has six phases, labeled IOC (Initial Operating Capability) 1-6 that cover five years. FirstNet phase 1 and 2 are six months long. Accordingly, Wisconsin's Phase 1 is equivalent to FirstNet's IOC1 and 2, Phase 2 is equivalent to IOC 3, and so on.

covered in a specific implementation year. Counties were weighted according to two factors: by permanent resident population per US census; and seasonal population based on visitor counts to parks and landmarks and vacation housing. Counties were weighted based on these two factors and organized into a list. From this list, groups of counties were divided into five phases. Each phase was equivalent to roughly 20% of the total area of the state. Finally, noting that this approach left counties in northwestern Wisconsin for only Phase 4 and 5, the NBSPN Subcommittee made substitutions to ensure that there was a fairly even buildout throughout each region of the state. Finally, the NPSBN Subcommittee added the area encompassing two miles within all railroads in northern Wisconsin to Phase 2 due to their key interest as a target and poor incumbent cellular carrier coverage throughout the region.

Table 1: Counties and Other Entities Included in Each Phase

Phase One	Phase Two	Phase Three	Phase Four	Phase Five
Brown	Bayfield	Ashland	Barron	Adams
Crawford	Chippewa	Dodge	Calumet	Shawano
Dane	Fond du Lac	Eau Claire	Clark	Buffalo
Door	Kewaunee	Langlade	Columbia	Burnett
Douglas	Menominee	Lincoln	Dunn	Florence
Grant	Monroe	Manitowoc	Forest	Green
Kenosha	Oneida	Marinette	Iowa	Green Lake
La Crosse	Ozaukee	Oconto	Jackson	Iron
Marathon	Rock	Pierce	Jefferson	Lafayette
Milwaukee	Sauk	St. Croix	Juneau	Marquette
Outagamie	Sheboygan	Trempealeau	Polk	Pepin
Portage	Washington	Vilas	Taylor	Price
Racine	Wood	Waupaca	Vernon	Rusk
Richland	Northern Railroads			Sawyer
Walworth				Washburn
Waukesha				Waushara
Winnebago				

The table below shows the total area of each phase, both cumulatively and individually. Because the first two phases contain the most populous counties in the state (specifically, Milwaukee, Brown and Dane counties), most of the population of Wisconsin is covered within the first year of service (59.21%).

Table 2: Area and Population Covered by Phase

Phase		Phase Area	% of Total Area	Phase Population	% of total pop
Cumulative	1	12,100.58	21.57%	3,406,495	59.21%
	1-2	23,516.08	41.92%	4,363,450	75.84%
	1-2-3	34,328.62	61.20%	5,000,161	86.91%
	1-2-3-4	45,090.59	80.38%	5,480,647	95.26%
	1-2-3-4-5	56,095.96	100.00%	5,753,324	100.00%
Individual	1	12,100.58	21.57%	3,406,495	59.21%
	2	11,415.50	20.35%	956,955	16.63%
	3	10,812.54	19.28%	636,711	11.07%
	4	10,761.97	19.18%	480,486	8.35%
	5	11,005.38	19.62%	272,677	4.74%

The project team and NPSBN Subcommittee referenced the filing provided to FirstNet on September 30, 2015 in ranking counties for the purposes of sorting into coverage phases. Specifically, the subcommittee referenced seasonal housing and tourist counts in establishing its phases. Incorporating tourist and visitor counts moved, for example, Door, Langlade, Bayfield, Forest and Vilas counties into earlier phases[3] in response to periodic surge in populations in these counties.

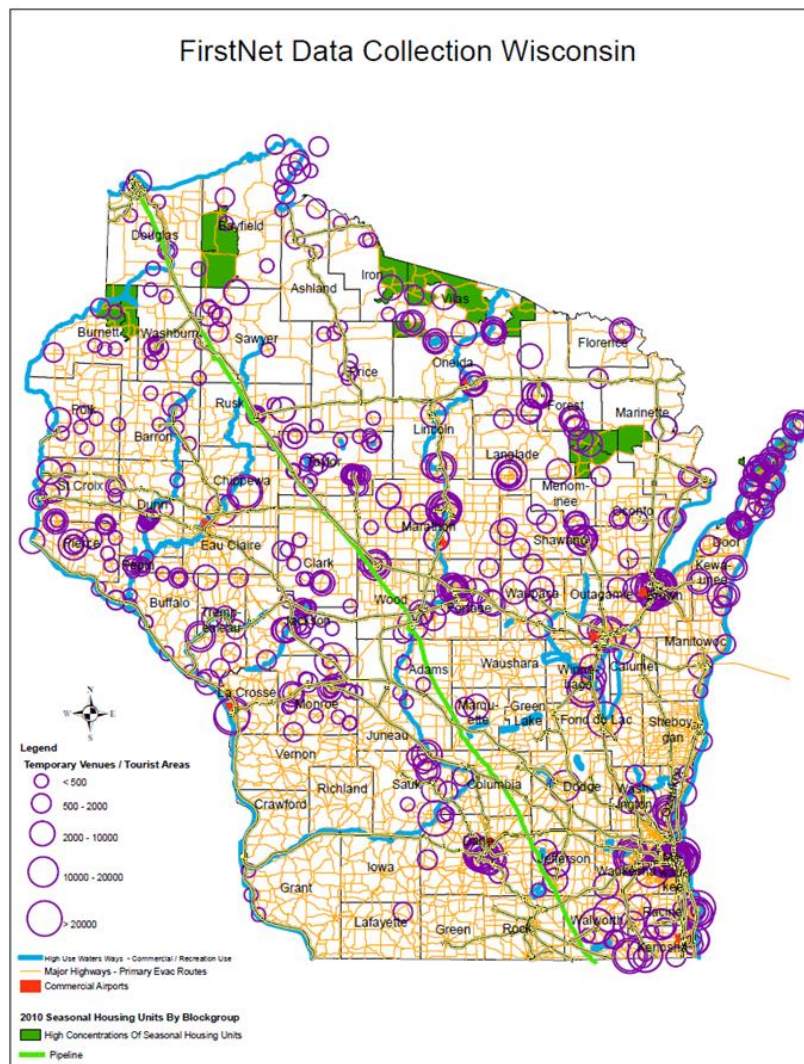[3] *See* Appendix I: Wisconsin_County_Statistics.xlsx

Figure 1: Temporary venues, seasonal housing and other selected areas of interest

This phased build-out plan was approved by the NPSBN Subcommittee on 9/21/2016 and by the Wisconsin Interoperability Council on 9/27/2016. The corresponding phased coverage maps and statistical demographics per phase are presented below. Note that in the breakdown of each county's statistics in each phase, "urban area" means the urban area included in FirstNet's RFP, which in turn takes its definition from the Rural Electrification Act of 1936:[4]

- *A city, town, or incorporated area that has a population of greater than 20,000 inhabitants*, and
- *any urbanized area contiguous and adjacent to a city or town that has a population of greater than 50,000 inhabitants*

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[4] See *First Responder Network Authority; Final Interpretations of Parts of the Middle Class Tax Relief and Job Creation Act of 2012*, https://www.federalregister.gov/documents/2015/10/20/2015-26621/first-responder-network-authority-final-interpretations-of-parts-of-the-middle-class-tax-relief-and and see also Section 601(b)(3) of the Rural Electrification Act of 1936, as amended, http://www.rd.usda.gov/files/utprea36.pdf.
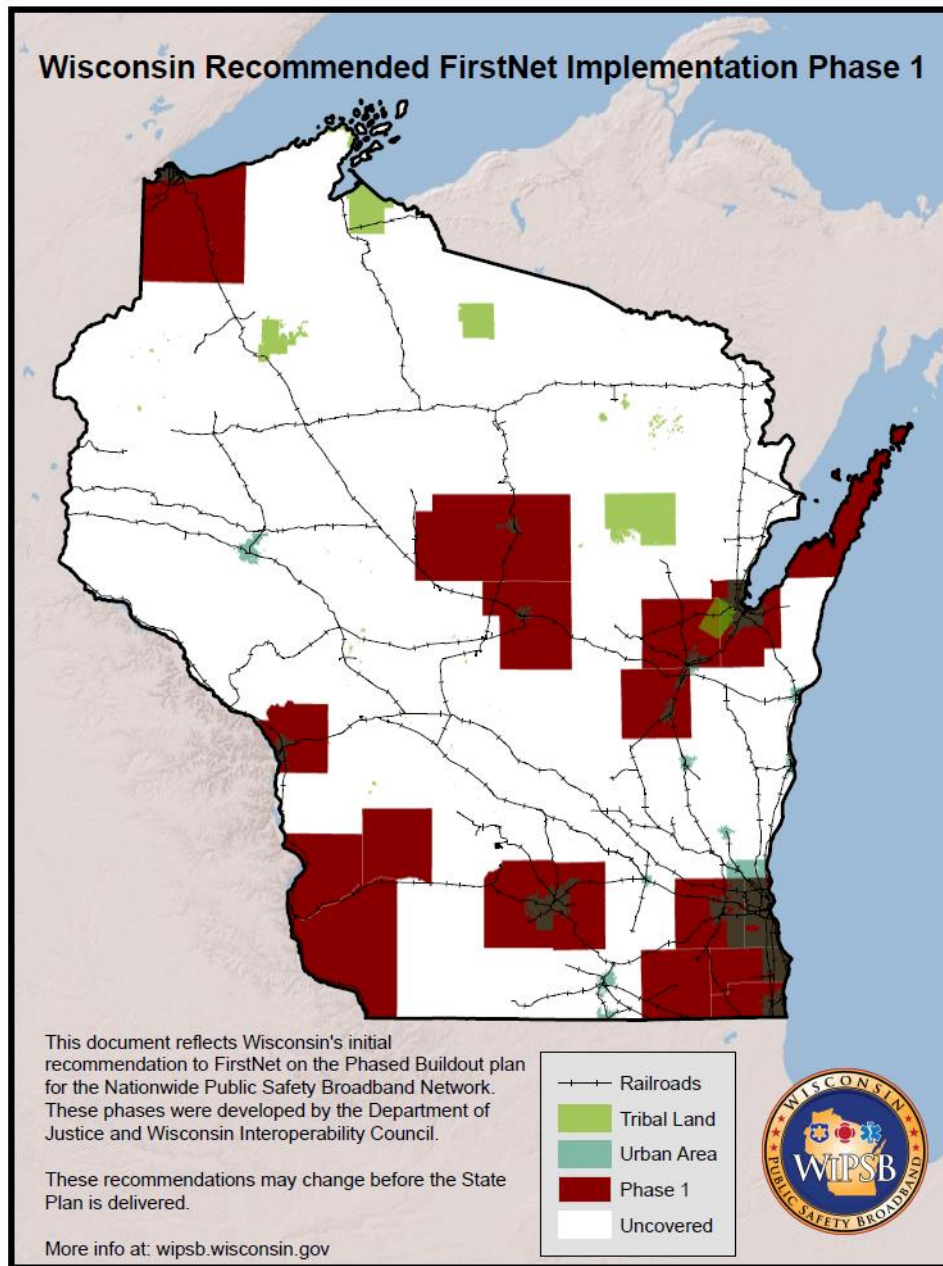
Phase 1

Figure 2: WiPSB Buildout Phase 1

Phase 1							
	Urban Area (Sq. Mi.)	Rural Area (Sq. Mi.)	Tribal Area (Sq. Mi.)	Total Area (Sq. Mi.)	Urban Population	Rural Population	Total Population
Total Included	1,097.90	11,002.69	103	12,100.58	2,272,879	1,133,616	3,406,495
Percent of Total	80.01	19.14%	10.29%	21.57%	84.46%	37.02%	59.21%

Phase 2
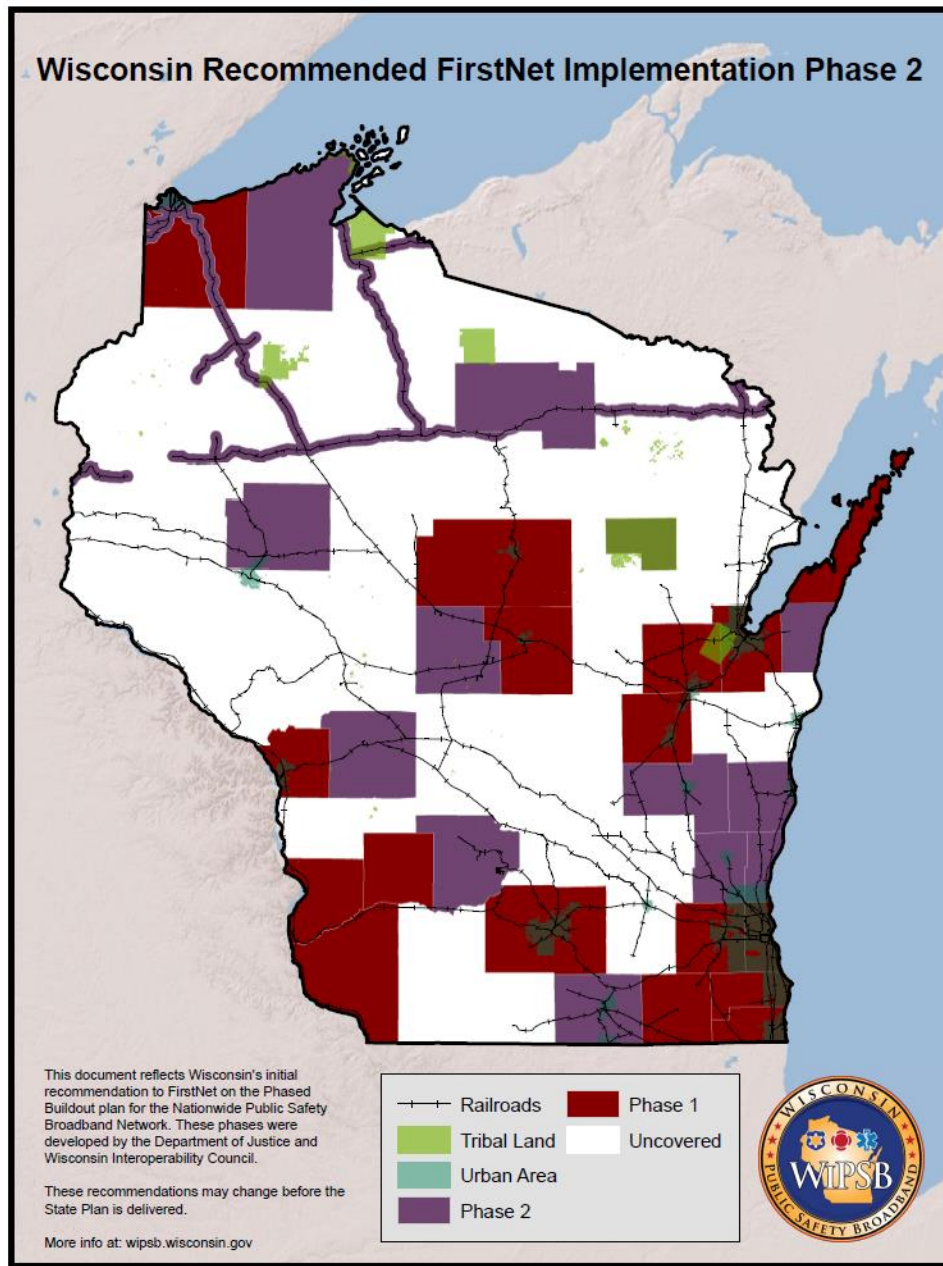
Figure 3: WiPSB Buildout Phase 2

Phase 2							
	Urban Area (Sq. Mi.)	Rural Area (Sq. Mi.)	Tribal Area (Sq. Mi.)	Total Area (Sq. Mi.)	Urban Population	Rural Population	Total Population
Total Included	201.13	11,214.36	452.75	10,812.54	275,236	681,720	956,955
Percent of Total	14.66%	20.49%	44.90%	20.35%	10.23%	22.26%	16.63%

Phase 3
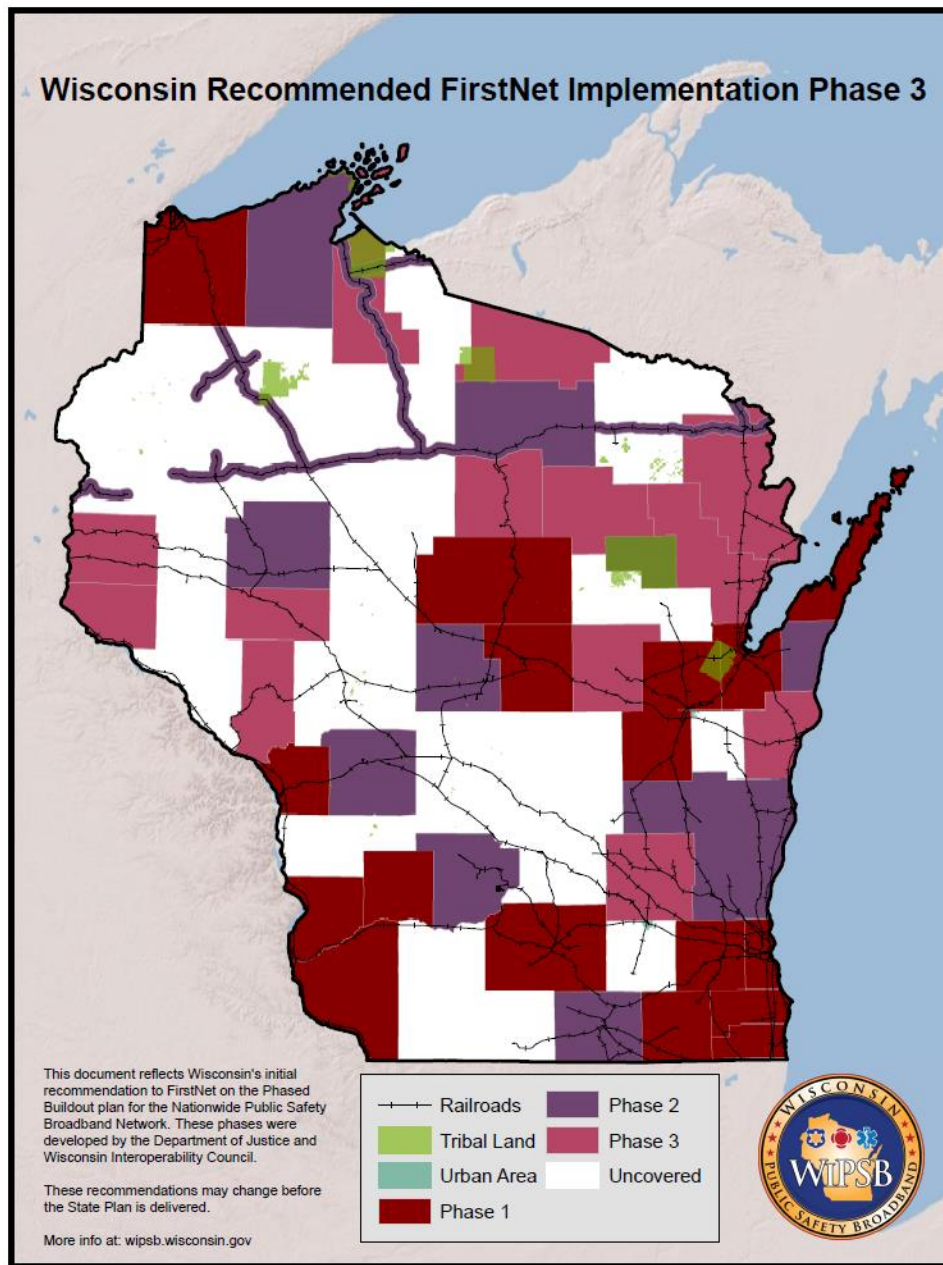
Figure 4: WiPSB Buildout Phase 3

Phase 3							
	Urban Area (Sq. Mi.)	Rural Area (Sq. Mi.)	Tribal Area (Sq. Mi.)	Total Area (Sq. Mi.)	Urban Population	Rural Population	Total Population
Total Included	60.17	10,869.26	245.75	10,761.97	114,206	522,505	636,711
Percent of Total	4.39%	19.65%	24.37%	19.28%	4.24%	17.06%	11.07%

Phase 4
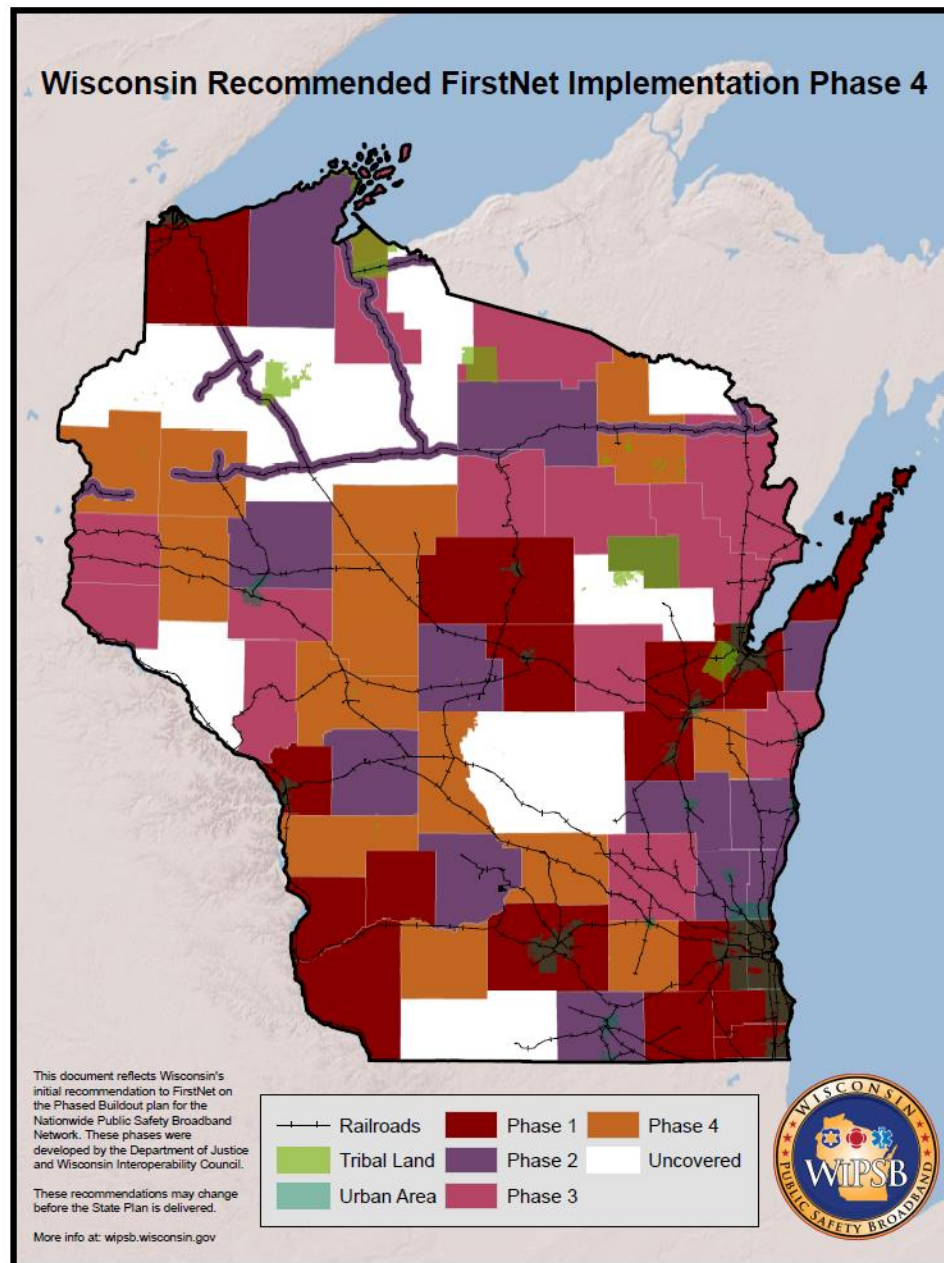
Figure 5: WiPSB Buildout Phase 4

Phase 3							
	Urban Area (Sq. Mi.)	Rural Area (Sq. Mi.)	Tribal Area (Sq. Mi.)	Total Area (Sq. Mi.)	Urban Population	Rural Population	Total Population
Total Included	13.01	11,947.85	33.98	11,005.38	28,708	451,778	480,486
Percent of Total	0.95%	19.64%	3.37%	19.18%	1.07%	14.75%	8.35%

Phase 5
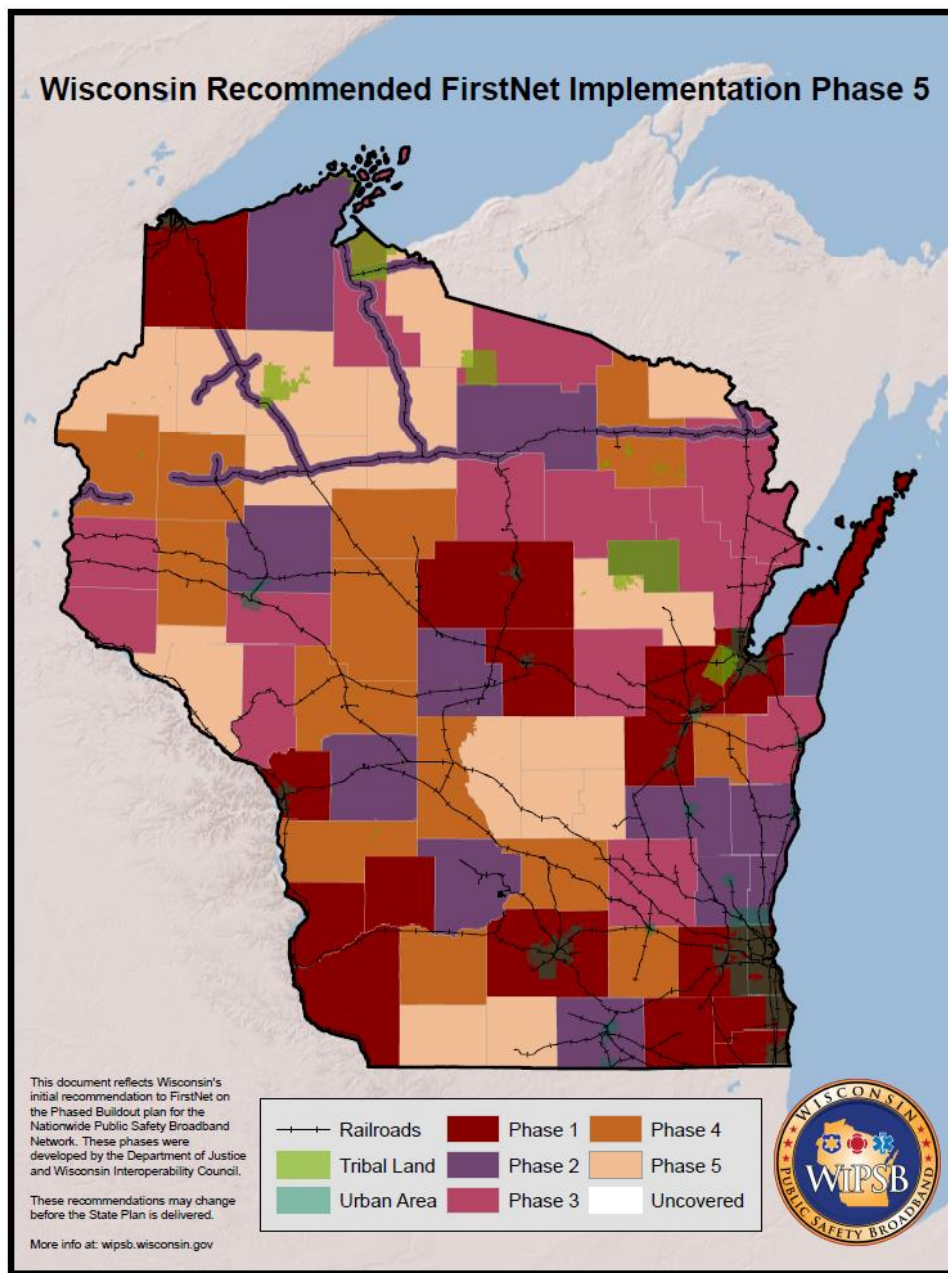
Figure 6: WiPSB Buildout Phase 5

Phase 3							
	Urban Area (Sq. Mi.)	Rural Area (Sq. Mi.)	Tribal Area (Sq. Mi.)	Total Area (Sq. Mi.)	Urban Population	Rural Population	Total Population
Total Included	0	10,888.45	172.11	11,005.38	0	272,677	272,677
Percent of Total	0%	20.11%	17.07%	19.62%	0%	8.90%	4.74%

Coverage Reviews

Interactive Coverage Review meetings have been scheduled with individual counties and major cities, allowing first responders to provide first-hand information about coverage requirements and shortcomings within their jurisdictions. This process provided participants the opportunity to engage actively in the identification and mapping of "critical service areas" (areas with intensive public safety need), and "extended service areas" (areas with coverage needs that currently have insufficient or nonexistent coverage or other service issues).

Methodology

Each Coverage Review consisted of the following tasks.

1. **Initial Contact:** Regional Interoperability Coordinators (RICs) scheduled the meetings with city and county points-of-contact (POCs), providing background information about the purpose of the Coverage Reviews. This was followed by a formal meeting invitation.
2. **CAD Data Processing:** To provide an objective justification for the prioritized areas that will be identified in the Coverage Review meeting, our Project Team asked each Public Safety Answering Point (PSAP) to provide three years of computer-aided dispatch (CAD) incident data. This data is normalized on a per-county basis so that incident density is relative to only the county providing the data. This ensures that incidents in large counties are not prioritized over incidents in less-populous counties.
3. **Coverage Review Meeting:** The Project Team conducted interactive meetings with city and county POCs in order to identify the Critical Service Areas and Extended Service Areas within their jurisdictions. During each meeting, the group collaboratively generated a map in Geographical Information System (GIS) format depicting these prioritized areas.
4. **Data Verification:** Following the meetings, our team provided the maps to the cities and counties to review for accuracy.

Findings to Date

To date, Coverage Reviews have been conducted with 37 of 72 counties and 3 of 3 cities. In addition to identifying specific areas where stakeholders need coverage within their jurisdictions, some trends came to light.

Commercial Coverage is not as good as advertised

Despite the near-ubiquitous coverage advertised by commercial carriers, many participants identified areas within their counties where there was unreliable, limited, or no coverage.

Many Critical Areas Fall Outside of Population Centers

In addition to population centers, Wisconsin has many recreational areas with large seasonal populations. Because these areas can be remote, forested, or situated along rivers, they may also have poor coverage.
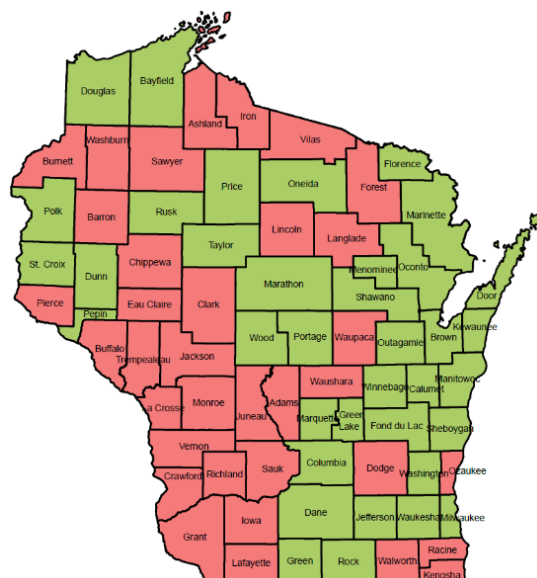

Figure 7: Completed Coverage Reviews

Collected Data

The following maps display the data collected to date, including the critical service areas, extended service areas, and the CAD incident data.

The map below shows coverage review progress as of 9/30/2016. Note that this map includes input from only 37 counties as indicated above; the remaining counties have some pre-identified critical service areas based on population centers, critical infrastructure or some other factor, but the county has not yet provided input on their specific coverage needs or service issues.

Critical service areas are indicated in red while Extended service areas are indicated in blue. **Critical service areas** are those areas of most importance to the participating agency where highly-reliable service is required. These areas include populated areas, critical infrastructure sites and other areas the stakeholder designates as critical. **Extended service areas** are areas where the participating agency reports service issues today, whether through poor commercial carrier coverage or, in some cases, frequent congestion.
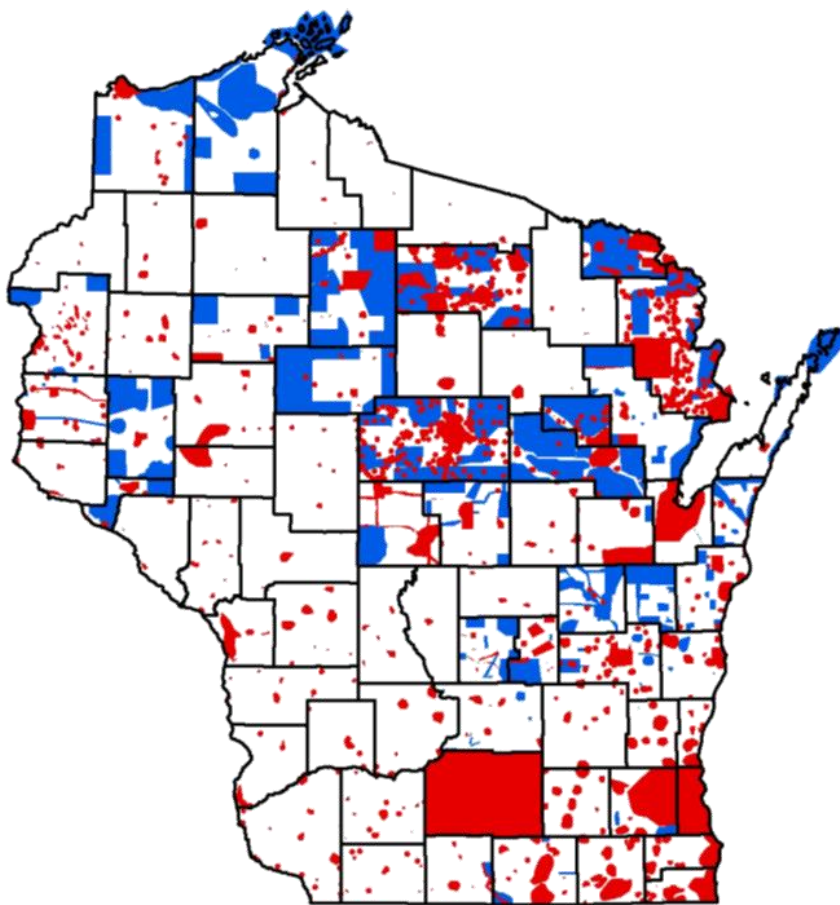

Figure 8: Critical and Extended Service Areas

The figure below illustrates CAD incident records as of 9/30/2016. Note that this data only includes the 37 counties indicated above. However, because the data also includes State Patrol incident data, the

map below depicts at least one 1 incident square mile bin across most of the state even in counties that have not yet provided CAD data.
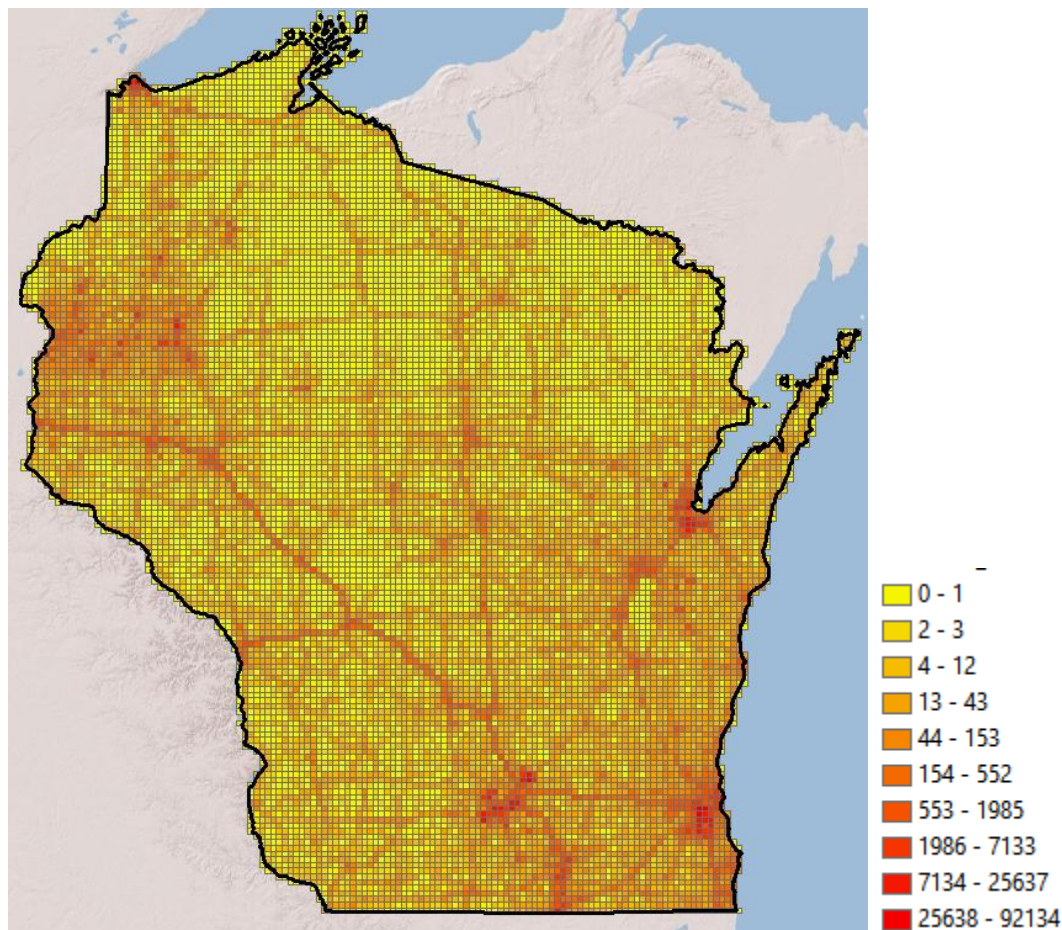

Figure 9: CAD Incident Modeling

Conclusion

The phased coverage requirements included with this report are most representative of Wisconsin users' requirements for implementation of the NPSBN over a five-year period. In developing these deployment phases, the project team and NPSBN Subcommittee considered multiple factors including population density, seasonal housing, and subjective expert opinion.

Our program will continue to perform coverage reviews throughout the remainder of 2016 with the ultimate goal of conducting a review with every county in the state. The findings from these reviews will be incorporated into the FirstNet state plan review process.

The state anticipates receiving FirstNet's state plan by May 2017.

Survey Data

Methodology

Network requirements were determined through the distribution of the WiPSB User Population Survey. This web-based survey was disseminated via email to all public safety entity (PSE) points of contact (POCs) where a valid email address was available. This distribution included 2,393 unique agencies and 2,277 unique contacts.

The User Population Survey contained four segments—Agency Demographics, Current Cellular Provider, Device Inventory, and Applications Inventory—and addresses all data points requested by FirstNet for state planning purposes. In addition to contributing to the verification of Wisconsin's PSEs and their respective POCs, the survey provided information about personnel counts, wireless purchasing, current carriers, barriers to adoption, and device and application usage.

Key Findings

The predominant carrier for public safety in Wisconsin is Verizon with 48% of agencies, with US Cellular a close second (32%).

The typical public safety cellular user in Wisconsin consumes **up to 8-9 GB of cellular data per month.**

Most public agencies in Wisconsin **do not purchase cellular service off of state contracts.**

While the average non-law enforcement public safety agency spends **$53.80 per month** per user on cellular data services, **law enforcement agencies in Wisconsin spend an average of $125 per user**.

Cost is the biggest barrier to adoption of cellular data services throughout the state. However, responding agencies are equally split between claiming to be under-funded as opposed to claiming service is too expensive.

Law enforcement agencies report **tremendous growth in body-worn camera purchases** by the end of 2017 (60%), while Fire and EMS agencies report they plan to **greatly increase their tablet (51%) and mobile hotspot purchases (54%)** over the same period.

Outside of law enforcement, **most agencies in Wisconsin report never using mobile data applications** in their daily business.

Most agencies **encourage BYOD** (bring-your-own-device) policies, where individuals utilize personally-owned devices for business purposes.

Detailed Findings

Survey Responses

As of the writing of this report, the User Population Survey is still open, and the following analysis represents approximately 15% of the expected total number of agencies. This analysis reflects the responses from 371 agencies in 70 counties, and includes data representing 30,268 users.

The following graphic shows the breakdown of responding agency disciplines.
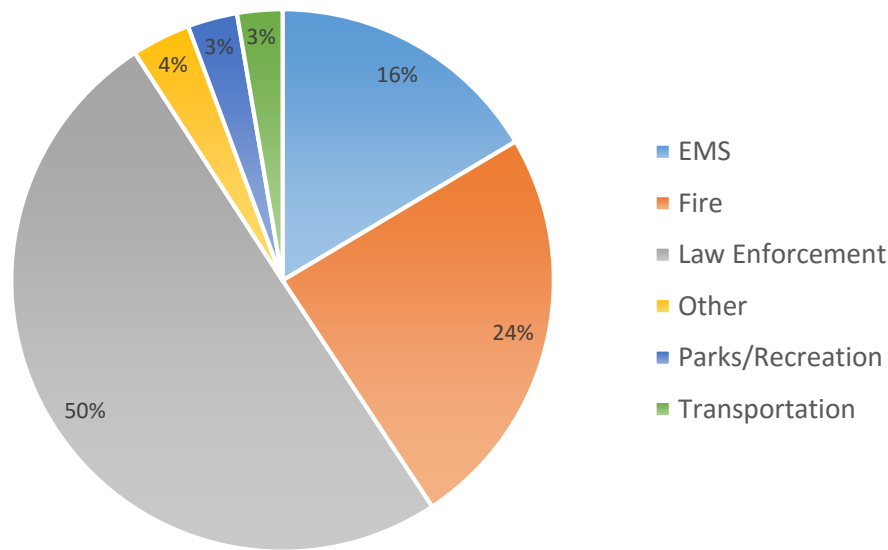
Figure 10: Survey Responses by Discipline

Given that 50% of the responses came from law enforcement agencies, the overall responses will heavily reflect the interests of the law enforcement community. However, where relevant, much of the following data will be broken down by discipline to provide fair representation for the different agency types.

Personnel Trends

With the prevalence of law enforcement responses, the results to date show that a majority of the personnel represented (77%) are full-time employees. This likely provides a substantial portion of the total statewide population, as many larger agencies are included in this count, but does mean that not all associated data will be generalizable.

Table 3: Total Personnel Represented by Survey Results

Total Personnel and Vehicles					
Full-Time Personnel	**Part-Time Personnel**	**Volunteers**	**Paid-on-call or Duty Crew**	**Emergency response vehicles**	**Non-Emergency Vehicle**
23,419	2,157	3,129	1,533	4,269	2,528

The survey data collected represents approximately 100 personnel per response (371 responding agencies and 37,035 responses total), and the majority of the responses represent full-time first responders. Therefore, it is fair to assume that the data collected primarily represents urban or suburban agencies or agencies in regional trade centers, such as large towns. Because of the very low numbers of volunteer and paid-on-call personnel reflected in this report, it is also fair to assume that volunteer agencies, such as rural fire and EMS services, are not well-represented in our findings.

Cellular Provider Trends

Data Use

Law enforcement and fire show the largest average per-user data usage. Notably, responders representing the EMS community report the lowest data use of all. However, the survey data does not distinguish between Fire/EMS versus Fire only—so it is possible that many EMS data users are actually captured within the "Fire" category.
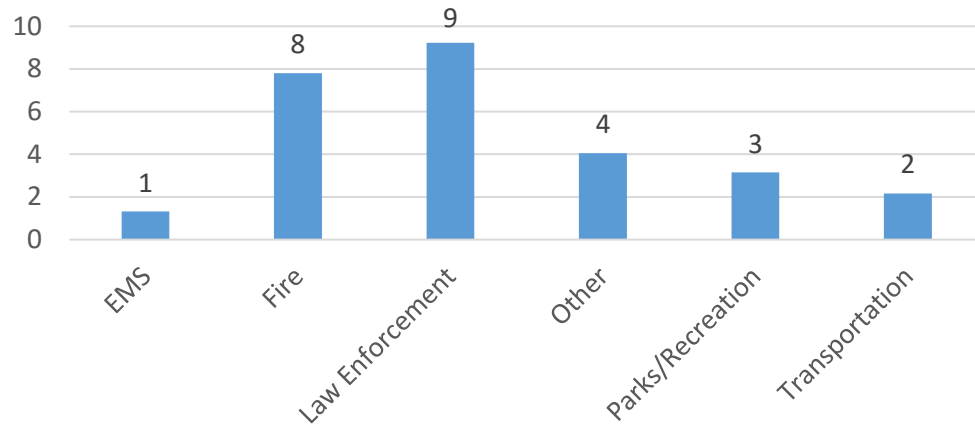

Figure 11: Average Per-User Data Usage by Discipline

Data Spending and Purchasing

In addition to greater data usage, law enforcement also spends the most per person for data. Other respondents reported spending an average of $53.80 per user, while law enforcement reported spending more than twice as much at $125 per wireless data user. This could possibly be because law enforcement users are typically assigned more than one data device per user, such as a cell phone and a vehicular modem.
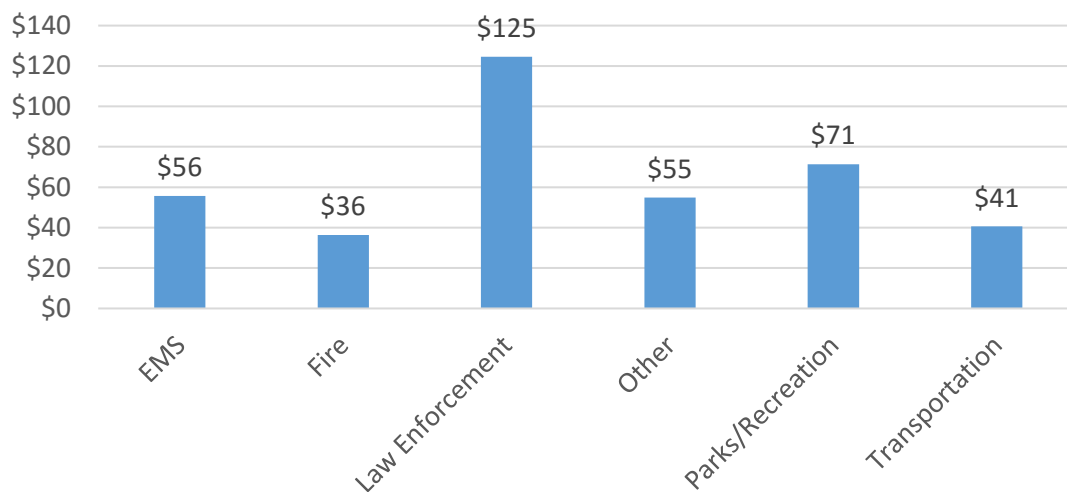

Figure 12: Per-User Spending by Discipline

Also notably, a minority of respondents reported purchasing service off of Wisconsin state contract. 60% of respondents reported purchasing service through local vehicles, including directly through the retailer or through a local contract, while only 22% of respondents reported ordering service off the state contract. This is a key insight for FirstNet and its vendor in marketing the service in Wisconsin; they will need to have a concentrated sales and marketing effort directly to individual agencies that are accustomed to ordering service directly from the vendor and not through a state contract.
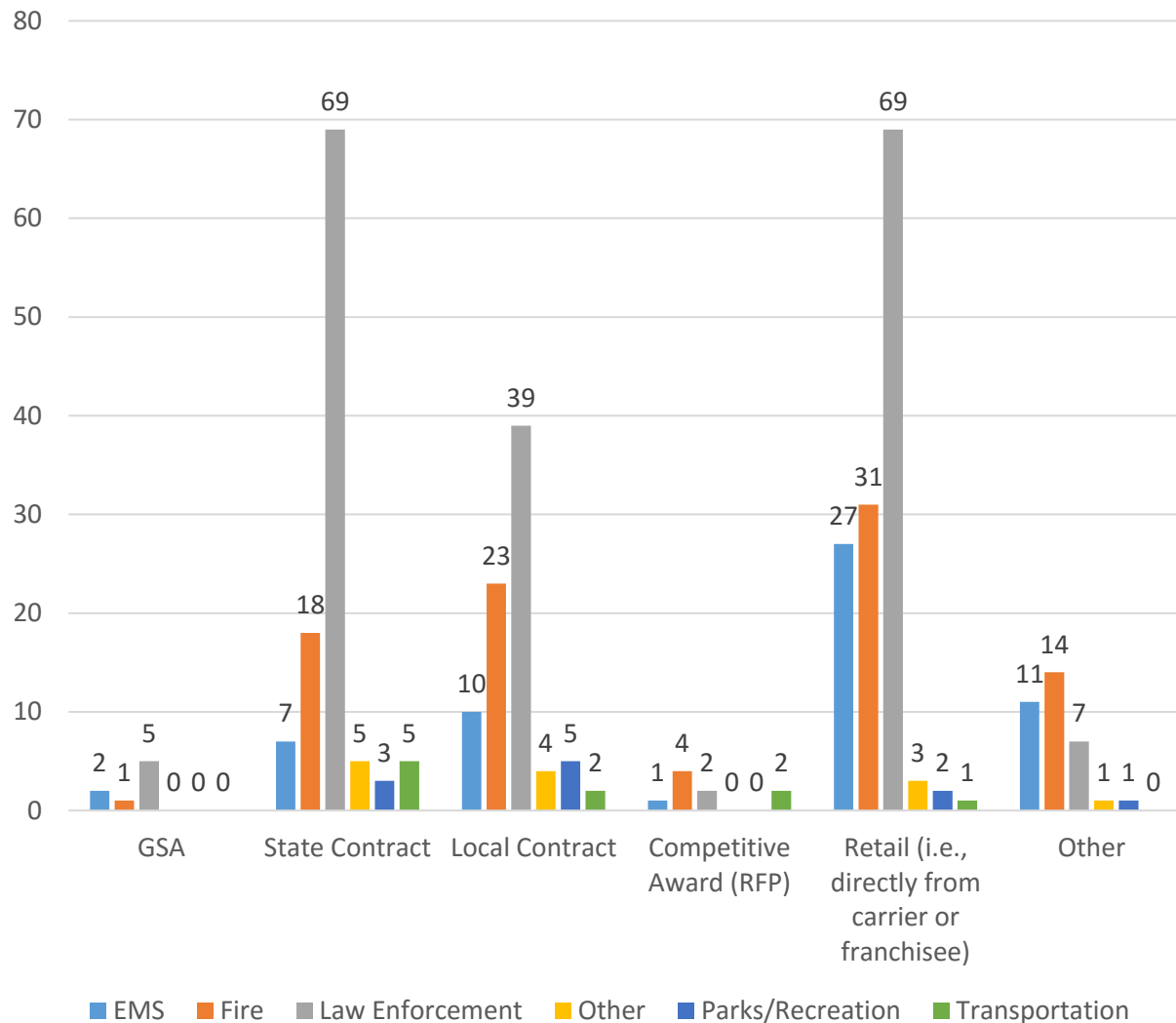

Figure 13: Method of Purchasing Service

About half of agencies responding do not require a fixed-rate plan and are simply looking for the best overall pricing. However a meaningful percentage of respondents are divided as to whether a fixed-rate or a variable-rate plan is important to them. Based on this information, FirstNet and its vendor should offer a variety of rate plans to agencies in Wisconsin to encourage the broadest possible subscriber base.
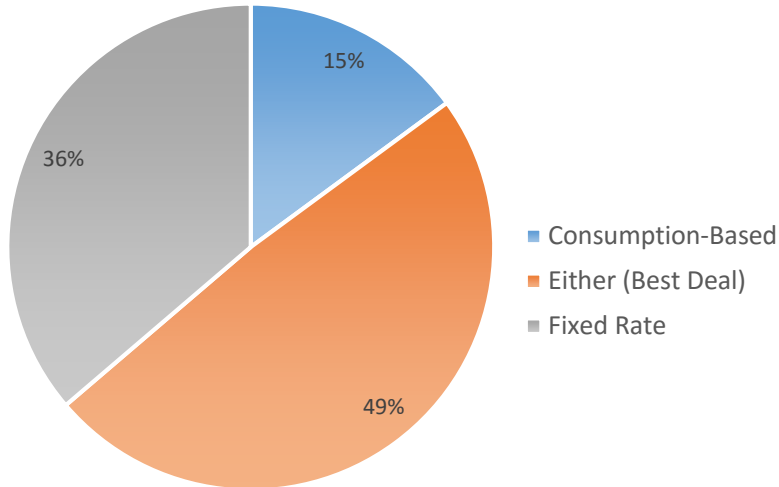
Figure 14: Preferred Plan Type

Dominant Carriers

Determining the dominant carriers provides a great deal of insight into the expectations that users will have for FirstNet. Almost 50% of responding agencies reported using Verizon for at least some of their devices, followed by U.S. Cellular, which was used by 32% of agencies. Thirteen percent of agencies use "Other" carriers; in all specified cases, this carrier is CellComm. This information reveals that the end-user baseline expectation of coverage throughout the state will be compared in fairly equal parts to Verizon and US Cellular.
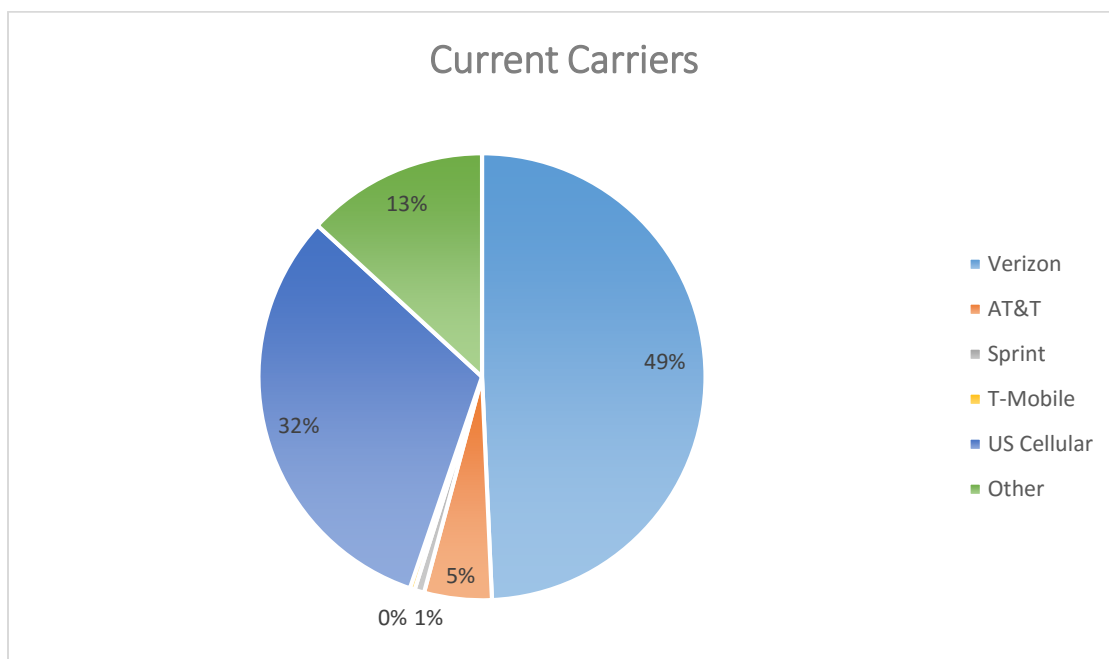

Figure 15: Predominant Carrier by Agency

Barriers to Broadband Adoption

A majority of the responses indicate experiencing no barriers to adoption, however most of the impediments are related to cost, with many fire departments acknowledging the fairness of the price of service, but indicating that they still have insufficient funding to purchase services.
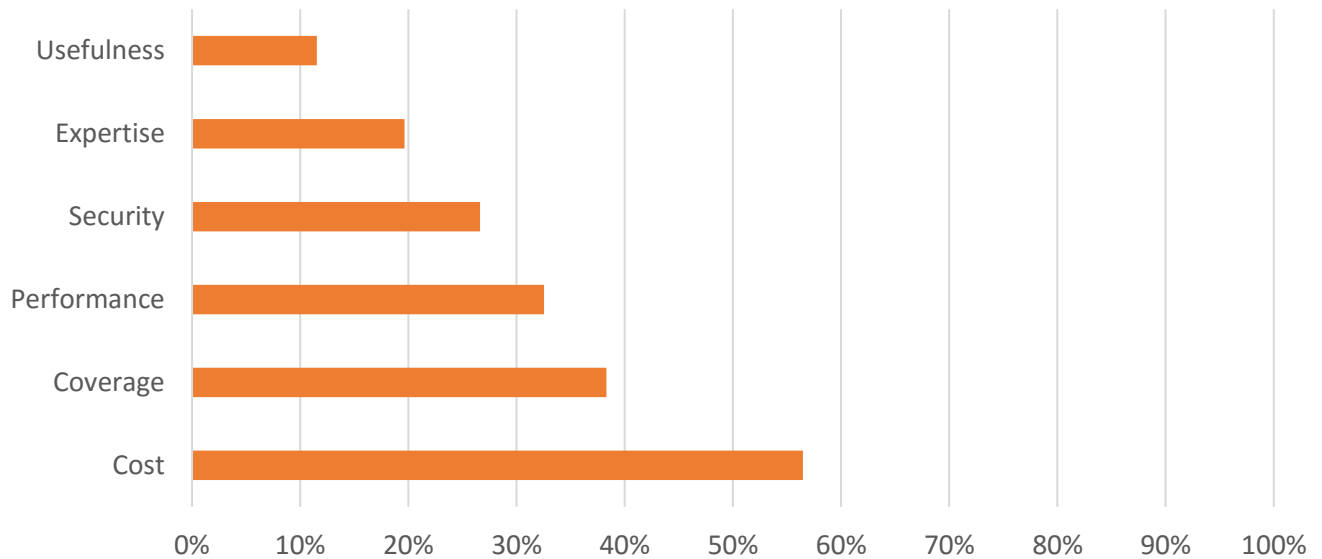

Figure 16: Barriers to Adoption

Amongst agencies that report cost as a barrier to adoption of wireless services, respondents were fairly evenly split between stating that either service is too expensive compared to not having enough funding to purchase the service they want.
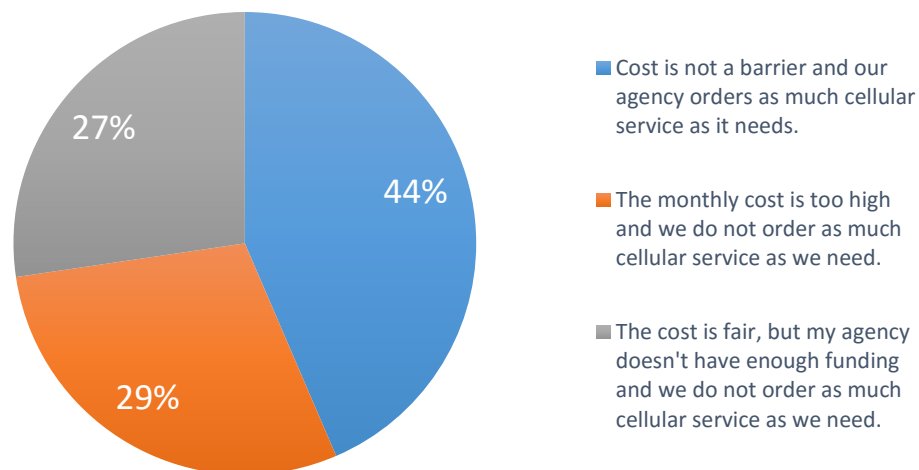

Figure 17: Barriers to Adoption: Cost Breakdown

A key insight to implementing FirstNet service in the state, however, is that about half of agencies in the state appear have a high degree of cost-sensitivity. Half of agencies cannot afford the service that they want today and will not be able to fully adopt a service that is priced comparatively with existing commercial carriers.

Devices

Devices and Short-Term Growth Forecast

Asked to identify the number of devices in service today, and the number planned by the end of 2017, the overall average increases.

Table 4: Average Percent Change across All Disciplines

Smartphones	13%
Tablets	45%
USB Modem or Wireless Card	7%
Laptop with Embedded Modem	4%
Mobile Hotspot	16%
Wearable Cameras	23%

While tablet use is expected to increase across all disciplines, some disciplines projected noticeably higher increases for specific devices. EMS and fire projected over a 50% increase in mobile hotspots, while the total number of wearable cameras increased by 60% for law enforcement by the end of next year.

Table 5: Device Growth Projection, Law Enforcement

Cellular Devices	Total in-service today	Total planned by end of 2017	% Change
Smartphones	1497	1659	11%
Tablets	1016	1171	15%
USB Modem or Wireless Card	1192	1372	15%
Laptop with Embedded Modem	722	747	3%
Mobile Hotspot	1074	1192	11%
Wearable Cameras	1468	2350	60%

Table 6: Device Growth Projection, Fire and EMS

Cellular Devices	Total in-service today	Total planned by end of 2017	% Change
Smartphones	553	650	18%
Tablets	243	367	51%
USB Modem or Wireless Card	267	302	13%
Laptop with Embedded Modem	215	245	14%
Mobile Hotspot	108	166	54%
Wearable Cameras	6	7	0%

BYOD

Most agencies report allowing use of personally-owned devices for official purposes, particularly in the fire and EMS service. Note that these results reflect, for the most part, full-time personnel. It is likely that all-or-primarily-volunteer services such as rural fire departments would have even higher levels of BYOD usage.
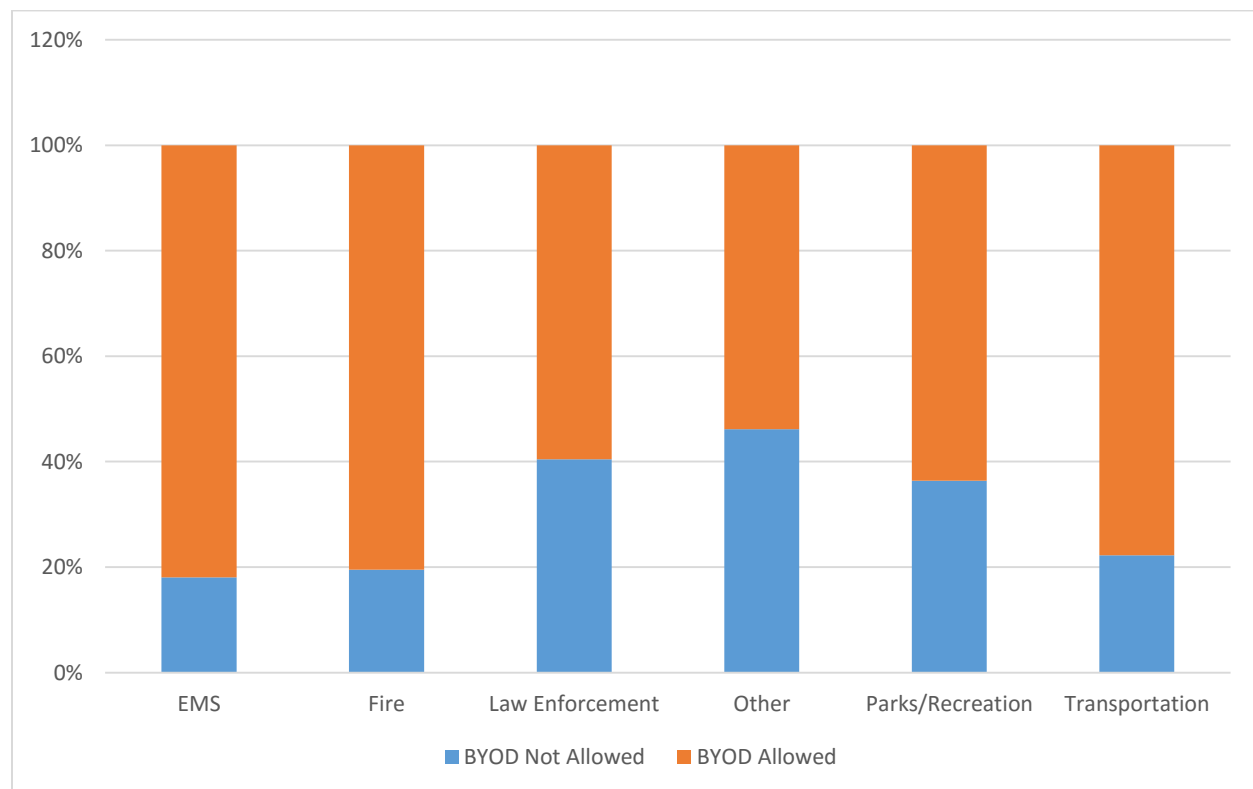

Figure 18: BYOD policies for Public Safety Agencies in Wisconsin

Applications

Applications Used

A majority of respondents across all disciplines use text messaging daily, but with the exception of law enforcement, very few other applications are used with the same frequency.
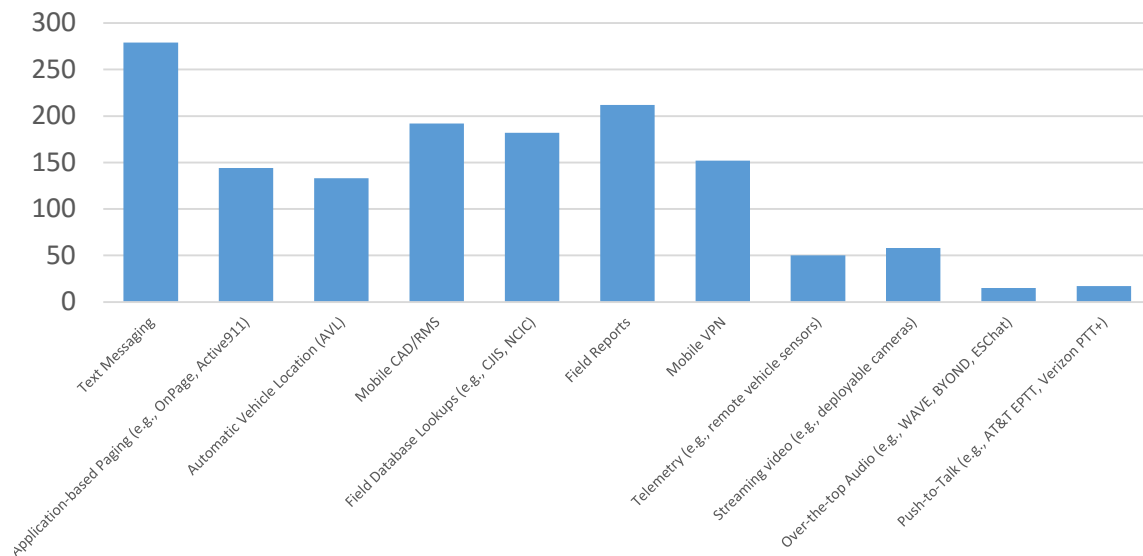

Figure 19: All Agency Type Application Use by Application and Frequency (Daily or Weekly)

Most agencies outside of law enforcement are not heavily leveraging data applications in their day-to-day business in Wisconsin. The chart below shows the sum of all reported use of applications *other than text messaging* broken down by discipline type. These results may indicate a substantial barrier to adoption for the service outside of the law enforcement community.
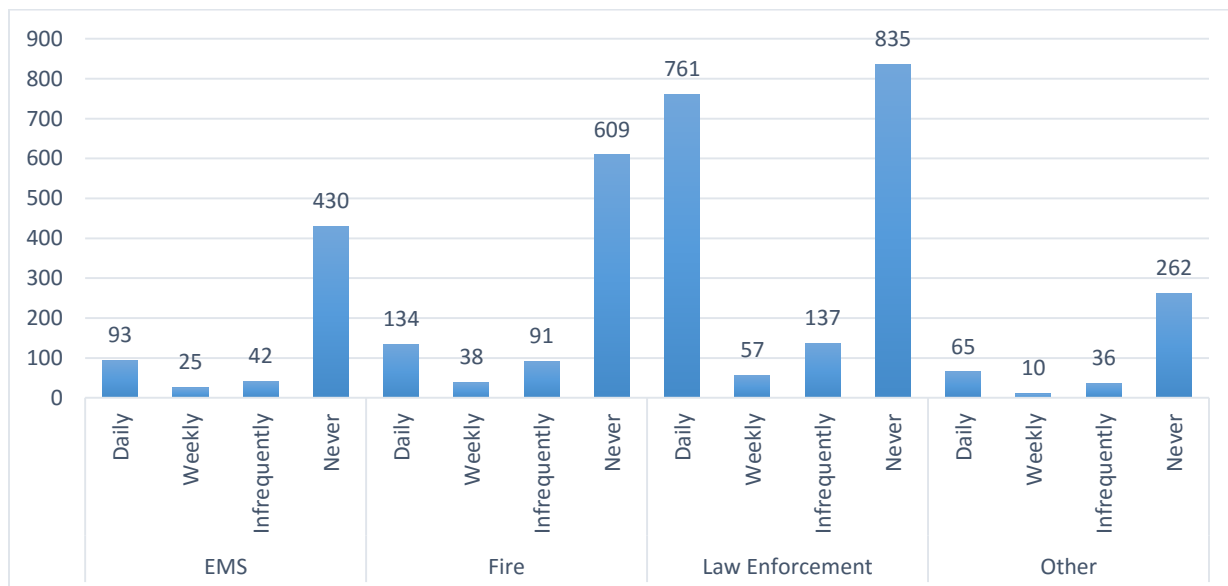

Figure 20: All Application Use by Frequency and by Agency

Conclusion

While this survey data represents a large volume of users throughout the state and provides key insights into promoting FirstNet's service throughout the state, it has some notable gaps. These results represent primarily the law enforcement community, having provided almost half of all responses. Because most responses represent full-time personnel, it is safe to assume that volunteer Fire and EMS services are under-represented as well. Such agencies would likely report even lower levels of wireless adoption and spending per user than is reflected in these results.

However, these results do represent over 30,000 individual personnel throughout the state of Wisconsin and reflect responses from nearly every county. While some populations are excluded from these results as a result of who responded to the survey, the insights provided in this data will be invaluable for planning purposes in implementing the NPSBN in Wisconsin,

Appendices

Appendix I: Wisconsin County Statistics (.xlsx)

Appendix II: Buildout Phases (.shp) (.pdf) (.png)

Appendix III: WI Buildout Phases Stats (.xlsx)

Appendix IV: Wisconsin Survey Data (.xlsx)

Appendix V: Buildout Phase Cover Letter (.pdf)