NORTH CAROLINA
2018 STATE 911 PLAN

Approved:
December 07, 2018

Prepared by:

Ritter Strategic Services, LLC

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The 911 network currently in place in North Carolina was designed in the 1960s and consists of point-to-point analog technology and low-speed data transmissions that are costly and outdated. Although the current 911 network is extremely reliable and secure, it has not kept up with technology and is not able to provide comparable service for the latest devices and methods of communicating.

Consumers and businesses are increasingly using and depending on new communications technologies and devices, such as VoIP devices, instant messaging, text messaging, Short Message Service (SMS), and email, all of which enable the transfer of huge amounts of data. In addition, consumers and businesses are increasingly giving up their landline phone service for wireless phone service only. The deaf and hard-of-hearing community is increasingly using text messaging to communicate, and many have given up use of TTY/TDD machines in favor of text messaging. As the rest of the world moves to Internet Protocol (IP)-based networks, the current E911 system will continue to lag further behind technologically, will continue to degrade, and will be unable to meet the needs and demands of consumers requesting emergency assistance. The state must transition to a digital/IP-based network and must prepare for future technological changes.

Consumers expect that they should be able to communicate with 911 using their smart phones and smart devices, including sending photos and videos or by texting. To support these trends, the North Carolina 911 Board ("the Board") and PSAPs must migrate to a platform that enables new and emerging communications services and devices to access 911. The evolution of communications technology provides an opportunity for the Board and PSAPs to make major improvements in the current 911 infrastructure, which include the capability for multimedia services that will enhance public safety, reduce response times, and save lives.

In 2017, the Board executed a contract to implement a single statewide IP-enabled NG911 system, which includes the ESInet, Next Generation 911 Core Services (NGCS), and hosted call-handling solution for primary PSAPs in North Carolina. As of November 2018, 84 PSAPs had expressed an interest in joining the NG9-1-1 system.

What is NG911? The term refers to the complete ability to transmit, receive, process, transfer, dispatch, use, and store both voice and data (in the form of pictures, videos, text messages, and incident information) associated with a 911 call or request for emergency assistance. The NG911 system that is implemented in North Carolina will contain the same functions of the current analog system, such as reliability, while providing for greater accessibility, interoperability, and a more efficient use of 911 resources. NG911 will enable the transfer of 911 calls between geographically dispersed PSAPs; the increased sharing of data and resources to improve emergency response; and improved coordination and partnerships within the 911 community.

North Carolina General Statutes ("GS") §143B-1402(a)(1) requires the Board to publish and maintain a comprehensive plan for the provision of 911 service in the state. GS §143B-1402(a)(1) further requires the Board to monitor trends in 911 and enhanced 911 technology, incorporate GIS mapping and other resources into the plan, ensure that each PSAP in the state has a back-up; and implement strategies for the efficient and effective delivery of enhanced 911 services.

This document represents the first official update to the 2010 North Carolina State 911 Plan ("the 2010 Plan"). The Board's decision in 2018 to update the 2010 Plan is timely and a strategic

imperative. Due to the complexity of new 911 technology and the inherent economies of scale, implementation of a single statewide digital network is the most effective and efficient way to provide enhanced 911 services, rather than on a county-by-county basis.

Implementing a single statewide digital network requires a level of statewide planning and coordination not previously required. Creating a three- to five-year strategic plan is a critical tool to help the Board and staff plan for and prioritize resources, amend governance, and address all needs associated with NG911, including but not limited to technology, funding, operations, and training. The 2018 North Carolina State 911 Plan will provide the Board, Board staff, PSAPs, public safety personnel, and state and local officials with a roadmap of the best route to implement NG911 and will assure equal access to enhanced 911 services to every resident of and visitor to North Carolina, regardless of the telecommunications service, device, or technology used.

Because of the interconnected and shared nature of NG911, implementation is more complex and requires collaboration among all the stakeholders in a way that was not necessary in the past. Policy and governance issues cannot be addressed by individual local jurisdictions or individual 911 authorities. NG911 requires establishing a collaborative governance framework that will enable such a shared, interconnected, and interoperable system of systems to come into existence. It is important for policy makers at every level of government to recognize that NG911 service requires a statutory and regulatory framework that assures the continued availability, quality, consistency, and sustainability of enhanced 911 service throughout the state.

Goals and objectives are important in strategic planning because they turn the Board's vision for NG911 into specific measurable targets or steps. Goals build on the vision and mission by defining and prioritizing the broad direction in response to specific priorities. Goals describe the general accomplishments to be achieved if the vision is to be achieved. Objectives articulate specific steps that are needed to complete each goal and include the owner-agency and the planned timeline. The following 10 goals are not placed in order of priority, so they may be achieved concurrently with the roll-out of North Carolina's NG911 system.

Goal 1: Provide and pay for a statewide hosted Next Generation 911 system.

Goal 2: Implement a comprehensive Cybersecurity program for the fundamental security of the ESInet, interconnected networks, software, applications, and PSAP users of the ESInet.

Goal 3: Explore and investigate the interconnection of PSAP users of the ESInet with other ESInet users and with other networks serving public safety after complete acceptance of the NG911 system from the NG911 system vendor.

Goal 4: Build and implement statewide GIS database that will be used as a core service of the NG911 system, to be based on the NENA i3 Standard and other NENA NG911 Standards as they relate to GIS.

Goal 5: Increase Board staff to provide for the reorganization and expansion of job responsibilities to better serve PSAPs.

Goal 6: Amend state law (G.S. §143B-1400 et seq.) to reflect changes in 911 service, PSAP operations, and Board responsibilities in the Next Generation 911 environment.

Goal 7: Amend state law (G.S. §143B-1400 et seq.) to define "Multi-Line Telephone System" (or MLTS) and to provide for the regulation of MLTS, to be consistent with the State's authority as well as federal law and FCC rules, upon the effective date of federal law.

Goal 8: Develop a revenue model for 911 service, NG911 service, PSAPs, and 911 Board operations.

Goal 9: Implement outreach and public education programs to keep the public, NG911 stakeholders, and industry partners informed about the Board's NG911 efforts.

Goal 10: Establish statewide minimum training standards or rules, which are consistent with NENA and APCO standards and best practices, for all 911 Telecommunicators, in collaboration with 911 stakeholder groups.

1 INTRODUCTION

1.1 Background & Project Overview

North Carolina General Statues ("GS") §143B-1402(a)(1) requires the North Carolina 911 Board ("the Board") to publish and maintain a comprehensive plan for the provision of 911 service in the state. The Board is further required to describe the allowable uses of 911 revenue in the State 911 Fund.

GS §143B-1402(a) (1) further requires the Board to monitor trends in 911 and enhanced 911 technology, incorporate GIS mapping and other resources into the plan, ensure that each PSAP in the state has a back-up; and implement strategies for the efficient and effective delivery of enhanced 911 services.

1.2 Purpose of the 2018 North Carolina State 911 Plan

This document represents the first official update to the 2010 North Carolina State 911 Plan ("the 2010 Plan"). Although Board staff recommended updates and changes in 2012, those updates were not adopted by the Board; thus, the 2012 changes were not official. The Board's decision in 2018 to update the 2010 Plan is timely and a strategic imperative. Due to the complexity of NG911 technology and the inherent economies of scale, implementation of a single statewide NG911 system is the most effective and efficient way to provide enhanced 911 services, rather than on a county-by-county basis.

Implementing a single statewide digital network requires a level of statewide planning and coordination not previously required. Creating a three- to five-year strategic plan is a critical tool to help the Board and staff plan for and prioritize resources, amend governance, and address all needs associated with NG911, including but not limited to technology, funding, operations, and training. The 2018 North Carolina State 911 Plan ("the 2018 Plan") will provide the Board, Board staff, PSAPs, public safety personnel, and state and local officials with a roadmap of the best route to implement NG911 and will assure equal access to enhanced 911 services to every resident of and visitor to North Carolina, regardless of the telecommunications service, device, or technology used.

The 2018 Plan also documents the status of 911 in North Carolina, the vision for NG911 in North Carolina, and the plan to get from here to there. The 2018 Plan sets forth the top priorities identified by the Board and its PSAP stakeholders, with the main goal to implement a NG911 system. It is vitally important to change out the current 911 system—a disparate collection of circuit-switched analog technology and non-integrated 911 call delivery operations—to an integrated and secure Internet Protocol (IP)-based call-routing system using GIS. Simply stated, the current system is no longer capable of adapting to new modes of communication, especially those that are based on IP. The 911 system must change if it is to continue to meet the public's expectation that their 911 calls will always be answered, and they will always be found regardless of the type of communication device or service they use, or regardless of their location.

The 2018 Plan is intended to establish an overall plan or vision for the statewide implementation of NG 911 services. Because the 2018 Plan serves as a strategic planning guide for the future, the 2018 Plan must remain flexible to account for unforeseen circumstances or events and should be reviewed and amended at least annually to account for and adjust to any such changes. The 2018

Plan is also intended to foster collaboration and should be used on an ongoing basis. Overall, the 2018 Plan will:

- Serve as a tool to communicate strategy for the migration toward NG911 services statewide while informing key decision makers where priorities exist;
- Serve as a tool to examine and explore new technologies and trends in 911 service;
- Ensure the effective and efficient use of 911 resources (e.g., revenue, personnel, and equipment) by focusing resources on the key priorities;
- Provide focus for the Board, Board staff, and the 911 community by providing an opportunity for interested parties to collaborate and provide their input in a structured format, resulting in greater efficiency and effectiveness in accomplishing a statewide strategy for NG911 implementation; and
- Demonstrate the value of having the Board coordinate and facilitate statewide provision of enhanced 911 services.

1.3 Updating the State 911 Plan

The goals established in the 2018 Plan are high-level, general directions, and the objectives for achieving the goals are concise, specific, and measurable. As goals and objectives are achieved, they should be documented. Any changes to the 2018 Plan should be documented in the following manner:

- The Plan is given a new version number following an annual review or following any interim update that was necessary. The number assigned at the time should be a full number; i.e., 1.0; 2.0; or 3.0.
- Any changes made to the Plan on an interim cycle are given a fractional number, such as 1.1; 1.2; or 1.3.
- The date of the official change to the Plan should be documented.
- There should be a description of what changes were made to the Plan, including the page and section numbers.
- The footer of the revised Plan should be updated to indicate a new Plan number.

Appendix A—Document Change History provides the form to use to document any updates to the 2018 Plan.

1.4 Methodology

In February 2018, the Board awarded a contract from a proposal submitted by Ritter Strategic Services, LLC (RSS) to update the existing 2010 State 911 Plan, and in June 2018, the contract was executed. At the request of the Board and staff, the timeline was reduced by 10 working days, so Board staff could submit the 2018 Plan to the 911 Board for adoption at the Board's December 2018 meeting.

The timeline was further challenged by Hurricane Florence, which began battering the North Carolina coast on Thursday, September 13, 2018, even before it made landfall near Wrightsville Beach, NC the following day. Although Florence was classified as a Category 1 storm when it made landfall, the storm brought with it catastrophic rain that caused significant flooding and damage across the state. Board staff were assigned to the state's Emergency Operations Center,

Emergency Support Function 2 (ESF2), as the PSAP Coordination unit. The primary focus was to provide coordination efforts for re-routing 911 calls from one PSAP to another, and to facilitate discussion and conversation between PSAPs and carriers when known issues impacting call delivery were identified. Members of the 2018 Study Group, who represent state and local government public safety agencies and 911 industry partners, were also focusing their expertise and energies on preparing for and responding to the storm—where it rightfully belonged. The result was an interruption in the focus, rhythm, and schedule of the collective work of Study Group members and Board staff on the 2018 Plan.

The 2018 Plan was organized to conform to the current existing national Model State 911 Plan released by NASNA and the National 911 Office. The 2018 Plan was also based on *Next Generation 9-1-1 Strategic Planning Guidebook* published in 2015 by the Office of Emergency Communications (OEC) in the Department of Homeland Security (DHS). The RSS team also reviewed 911 Plans from other states and used their collective experience in writing strategic plans.

The RSS team also reviewed 911 industry standards and best practices, met with Board staff and PSAPs, coordinated one on-site meeting of the 2018 Study Group, and facilitated conference calls with Board staff and Study Group members to review goals and objectives along with various drafts of the 2018 Plan. In addition to the one on-site Study Group meeting, the RSS team attended four regional PSAP meetings to provide attendees with an overview of the project and to obtain their input on the Board's goals and objectives. In addition, RSS facilitated one on-site staff meeting on July 18, 2018, and attended one Board meeting in Morehead City on July 27, 2018. Table 1 lists the dates and locations of the regional meetings.

Table 1—Regional PSAP Meetings

Date	Location
July 11	Woodfin, NC
July 17	Roanoke Rapids, NC
July 19	Salisbury, NC
July 26	Morehead City

1.4.1 2018 Study Group

The 2018 Plan was developed in close conjunction with Board staff and Legal Counsel as well as members of the 2018 Study Group. As part of the update process, Board and staff members appointed professionals across the state to represent the various stakeholder groups in public safety and 911. The RSS team worked with Board staff to incorporate stakeholder input and feedback into the 2018 Plan.

Table 2 contains a list of the 2018 Study Group members, along with each member's affiliation.

Table 2—2018 Study Group

Name	Title	Association
Ms. Rachel Bello	President, NC NENA	NC NENA
Mr. Greg Coltrain	VP of Business Development	Wilkes Communications/ TriCounty Broadband/ RiverStreet Networks
Mr. Brian Drum	Communications Administrator, Catawba County 911	NC NENA
Mr. Bill Greeve	Chief Information & Innovation Officer	Wake County Government, County Manager's Office
Mr. Len Hagaman	Sheriff, Watauga County	NC Sheriff's Association
Mr. Greg Hauser	NC Statewide Interoperability Coordinator (SWIC)	NC Department of Public Safety (DPS)
Ms. Gina Hawkin	Chief, Fayetteville Police Department	North Carolina Association of Chiefs of Police (NCACP)
Mr. Topper Hightower	Universal Service Executive	AT&T
Mr. Josh Holloman	Chief, EMS Division, Johnston County EMS	NC Emergency Medical Services (EMS)
Mr. Tim Johnson	Director, Center for Geographic Information and Analysis (CGIA)	CGIA
Ms. Melanie Neal	President, NC APCO	NC APCO/Guilford Metro 911
Ms. Christy Shearin	Director, Franklin County Emergency Communications	PSAP Representative
Mr. Richard Sneed	Chief, Eastern Band of Cherokee Indians	Eastern Band of Cherokee Indians
Mr. Jack Veit	County Manager, Craven County	North Carolina Association of County Commissioners (NCACC)
Mr. Lee Worsley	Executive Director	Triangle J Cog

2 HISTORY OF 911 IN THE UNITED STATES

In 1967, Indiana Congressman J. Roush called for a single nationwide telephone number to report fires. Later that year, President Lyndon Johnson recommended that a nationwide three-digit emergency telephone number be created to report all emergencies. In November 1967, after meeting with the Federal Communications Commission (FCC), AT&T[1] announced that it had reserved the numbers "911" for the nationwide emergency number.[2]

The Alabama Telephone Company implemented the nation's first 911 system in Haleyville, Alabama. On February 16, 1968, Alabama Speaker of the House Rankin Fite made the first 911 call from the Haleyville City Hall. US Congressman Tom Bevill answered the call on a telephone located in the police department.[3]

Early 911 technology had limited capability and 911 calls had to be delivered to an answering point within the caller's telephone exchange. Because there was little correlation between a telephone exchange boundary and the emergency response jurisdiction, a 911 call could end up at a PSAP that did not serve the caller's location. Basic 911 service, as it has since been defined,[4] did not provide any telephone number or location information with the call—it was a voice service only—and the caller had to provide his or her location and call-back information.

Significant advancement in 911 technology occurred with the introduction of Enhanced 911 (E911) service in the early 1980s. Using existing circuit-switched technology, 911 calls were selectively routed to the PSAP serving the caller's location. In addition, 911 call-takers could receive callers' telephone numbers and fixed locations.

An important part of E911 call routing is the placement of the caller's location information in the 911 database. The information in the 911 database is provided by two parties. First, the 911 Authority is responsible for creating the Master Street Address Guide (MSAG), with corresponding Emergency Service Zones (ESZ) and Emergency Service Numbers (ESN). The ESN enables proper routing of the landline 911 call. Telecommunications carriers comprise the second group. When an individual signs up for landline phone service, the Incumbent Local Exchange Carrier (ILEC) or Competitive Local Exchange Carrier (CLEC) updates the database management system (DBMS) with the new service address. Carriers also update the DBMS for any changed or deleted service addresses.

By the 1990s, the use of cellular technology had increased dramatically. This consumer-driven change posed serious challenges for public safety, because landline E911 systems did not have the capability of providing dynamic location information for wireless callers. In 1996, the FCC mandated wireless E911 in two phases. Phase I provides the call-back number and the address of the tower that received the wireless 911 call. Phase II provides the call-back number and the caller's approximate location, within certain accuracy parameters.

The change from landline 911 to wireless 911 was mitigated by wireless carriers that translated wireless 911 calls to mimic landline 911 calls. The translations allowed wireless 911 calls to route

[1] At that time, AT&T had a monopoly on local and long-distance telephone service and was the only telephone provider in the nation.
[2] Indiana Statewide 911 Board, *Indiana Statewide 9-1-1 Plan*, June 2018, p. 2.
[3] Alabama Chapter of NENA Website, "World's First 911 Call," http://www.al911.org/first_call.htm, April 18, 2008.
[4] 47 CFR 20.18

to a PSAP and for wireless 911 calls to be processed and dispatched without requiring costly upgrades to the PSAP. However, the nomadic aspect of wireless service has been problematic with respect to obtaining the caller's precise location. Even with Phase II service, PSAPs only receive the caller's approximate location as provided by latitude and longitude ("lat/long") and displayed on a map, which may take up to 30 seconds to obtain. Although much less reliable than landline technology, Phase II wireless E911 still represented a huge improvement in obtaining the approximate location of wireless 911 callers.

At around the same time that wireless E911 deployment was peaking, carriers began offering Voice over Internet Protocol (VoIP) service. Although this new technology was deployed similarly to wireless E911 service, VoIP E911 service introduced new challenges to PSAPs because of the nomadic nature of some VoIP communications, and how customer location information was provisioned. In 2005, the FCC ordered interconnected VoIP providers to provide their customers with E911 service. Once again, the transition to VoIP E911 service was mitigated by VoIP providers that translated VoIP 911 calls to mimic landline 911 calls, and PSAPs did not have to upgrade their call-taking equipment.

There are two types of VoIP telephone service, although the FCC did not make that distinction in its order. There is static or fixed VoIP service, and dynamic or nomadic VoIP service. Static VoIP service is that offered by cable companies and they interface with the 911 network. Those 911 calls are routed and treated the same way that landline 911 calls are; that is, those 911 calls are selectively routed to the designated PSAP with ANI and ALI and look just like landline 911 calls to the 911 call-taker. Nomadic VoIP service refers to services offered by companies such as Vonage that allow customers to move their phone when relocating to another city, state, or country (but not during a call). Nomadic VoIP 911 calls are problematic because the VoIP provider relies on its customers to re-register their service addresses when moving or relocating. As long as the customer has Internet access, he or she can make calls. However, if the customer does not change his or her address and calls 911, the 911 call will be delivered to the PSAP designated by the last address registered by the customer, not the customer's current location.

In 2004, Congress passed the ENHANCE 911 Act of 2004, which stands for "Ensuring Needed Help Arrives Near Callers Employing 911." The two purposes of this Act were to coordinate 911 and E911 services at the federal, state, and local levels, and to ensure that 911 funds are not diverted for non-911 purposes. The ENHANCE 911 Act has been amended twice since 2004, through the New and Emerging Technologies (NET) 911 Improvement Act of 2008 and the Next Generation 911 Advancement Act of 2012, which was passed as part of the Middle-Class Tax Relief and Job Creation Act of 2012. The ENHANCE 911 Act also established a National E911 Implementation and Coordination Office (ICO) to coordinate the implementation of E911 service at the federal, state, and local levels. The ICO was also charged with administering a federal PSAP 911 grant program that has been authorized to provide up to $250 million in grants.

In the early 2000s, wireless carriers in the US started offering text messaging with cell phones. Since its introduction, text messaging has grown from 30 billion in 2001, to over 2.3 trillion in 2011. In August 2014, the FCC adopted an order that requires all wireless carriers and other providers of text-messaging applications in the US to deliver interim "text-to-911" service within six months of receiving a request from a PSAP that has been certified as "text-ready."

Since the FCC Order, over 1,400 PSAPs in the nation have voluntarily certified that they are capable of receiving text messages or will be within six months.[5] In states that have not implemented NG911, such emergency "text" requests traverse the public internet and therefore cannot be prioritized—that is, there is no guarantee that the text request will be received at the appropriate PSAP in a timely manner.[6] Effective and true text-to-911 service needs an Emergency Services IP network (ESInet) to assure prompt and accurate message delivery and location.

In 2018, Public Law No. 115-127, also known as Kari's Law, was signed into law, which requires businesses that sell or lease Multi-Line Telephone Systems (MLTS) to allow users to directly dial 911 without having to dial any additional digit, code, pre-fix, or post-fix, including any trunk access code such as the digit "9." The Act requires the FCC to adopt rules, which will not be effective until February 2020.

In March 2018, H.R. 1625, the Consolidated Appropriations Act, 2018 was signed into law. Division P, *the Repack Airwaves Yielding Better Access for Users of Modern Services Act* of 2018, or the RAY BAUM'S Act of 2018, concerns access to 911 service during emergencies.[7] The Act requires the FCC, within three years of the Act's implementation date, to publish a study on the public safety benefits, feasibility, and costs of providing the public with access to 911 service during times of emergencies when mobile/cellular service is unavailable. The FCC is to study access to 911 service through the following:

- Telecommunications Service Provider-owned Wi-Fi access points and other communications technologies operating on unlicensed spectrum, without requiring any login credentials;
- Non-Telecommunications Service Provider-owned Wi-Fi access points; and
- Other alternative means.

On September 5, 2018, the Public Safety and Homeland Security Bureau of the FCC opened PS Docket No. 18-261 to implement Kari's Law and RAY BAUM'S Act. RAY BAUM'S Act requires identification of a dispatchable location with a 911 call, defined as "[a] location delivered to the PSAP by the CMRS provider with a 911 call that consists of the street address of the calling party, plus additional information such as suite, apartment or similar information necessary to adequately identify the location of the calling party. The street address of the calling party must be validated and, to the extent possible, corroborated against other location information prior to delivery of dispatchable location information by the CMRS provider to the PSAP."[8]

2.1 The Federal E911 Matching-Funds Grant Program

The E911 Implementation Coordination Office (ICO) was created in 2004 as a joint effort of the U.S. Department of Transportation National Highway Traffic Safety Administration (NHTSA)

[5] Federal Communications Commission, *Text-to-9-1-1 Master PSAP Registry*, https://www.fcc.gov/files/text-911-master-psap-registryxlsx, as of October 27, 2018.
[6] Wisconsin State Interoperability Council, NextGen 9-1-1 Workgroup, *Wisconsin Statewide NG9-1-1 Plan*, May 11, 2017, p. 14.
[7] https://www.congress.gov/bill/115th-congress/house-bill/4986.
[8] Ibid.

and the U.S. Department of Commerce National Telecommunications and Information Administration (NTIA). The ICO was created pursuant to the ENHANCE 911 Act of 2004, which also authorized grant funding to assist PSAPs in implementing NG911.

In June 2009, application and reporting requirements were published in the Federal Register and the ICO announced the availability of $41.325 million in matching grants for hardware, software, training, and consulting services directly related to upgrading a PSAP's equipment and operations. The total appropriation for the E911 Grant Program was $43.5 million. In September 2009, the funds were awarded to 30 states and territories.

The grant rules required states to match the grant amount by 50 percent, and 90 percent of the grant amount had to directly benefit PSAPs. Grantee states were further required to submit vouchers for reimbursement. To qualify for funding, a state or territory was required to apply on behalf of all eligible entities within its jurisdiction. A state was also required to submit a detailed plan that contained the projects and activities to be funded along with their estimated timelines and costs for either wireless Phase II service or migration to NG911. States or territories in which 911 fees had been diverted within 180 days of the application were deemed ineligible to apply for any such grants. Furthermore, if any state or territory submitted inaccurate information regarding 911 fee diversion or if a state or territory diverted 911 funds during the grant period, the entire grant had to be returned. According to the ICO, Arizona was the only state that diverted 911 fees to its General Fund and was required to return 100 percent of the federal grant funding.[9]

In June 2018, the ICO announced the availability of $110 million in grants, and final rules were published in the Federal Register in July 2018. The deadline to file certifications of compliance was September 10, 2018. It is anticipated that the application process will open in the first quarter of 2019. The rules for this round were largely unchanged from those adopted in 2009. The most significant change was the inclusion of tribal nations in states' NG911 plans. According to the Office of Emergency Communications (OEC) in DHS, tribal nations represent a unique and important sector of the emergency communications environment in the US.[10] Although many tribal nations have cooperative arrangements and relationships with their neighboring counties and PSAPs, tribes have historically been excluded from statewide NG911 plans. Including tribal nations and governments in NG911 planning will enhance the readiness and ability of tribal, state, and local emergency responders to communicate and coordinate effectively during any sort of emergency or incident.[11]

The Board's inclusion of the Eastern Band of Cherokee Indians in the delivery of enhanced 911 service is discussed in a subsequent subsection of this Plan.

[9] E911 Implementation Coordination Office, *E911 Grant Program Final Report,* March 2013, p. 2.
[10] Department of Homeland Security, Office of Emergency Communications, *Emergency Communications Case Study: Tribal Communications Partnerships—The Missing Piece in the Emergency Communications Landscape*, August 2013, p. 1.
[11] Ibid., p. 2.

3 THE 911 ENVIRONMENT IN NORTH CAROLINA

North Carolina is the tenth largest state in the U.S. with a population of 10,273,419 in 2017. The state's population grew 7.7 percent between 2010 and 2017, compared to 5.5 percent nationally. Since 2000, the state's population has grown over 25 percent.

With respect to land size, North Carolina is the 28th largest in the nation. Having a relatively large population and relatively low land area means that the population per square mile in the state is 196 people, compared to 87 per square mile for the nation.[12] According to the 2010 US Census, 66 percent of the state's population lived in an urban area and 34 percent lived in a rural area.

There are 100 counties in the state and over 500 municipalities. As of 2017, the two largest counties were Mecklenburg and Wake, with populations, respectively, of 1,076,837 and 1,072,203. The next largest county is Guilford, with a population of 526,953. The least populated county in the state is Tyrell, with 4,052 people. Table 3 below provides a breakdown of the various population ranges for 2017.[13] Appendix B—North Carolina Population by County: 2010 and 2017 contains the state's population by county (listed alphabetically) for 2010 and 2017.

Table 3—Breakdown of North Carolina Population, 2017

Population Range	No. of Counties	% of Total
Less than 10,000	4	4%
10,001 - 24,000	22	22%
24,001 - 50,000	20	20%
50,001 - 100,000	27	27%
100,001 - 500,000	24	24%
500,001 - 1 million	1	1%
Over 1 million	2	2%
Totals	***100***	***100%***

The ten largest cities in North Carolina, in order of population, are Charlotte; Raleigh; Greensboro; Durham; Winston-Salem; Fayetteville; Cary; Wilmington; High Point; and Greenville. North Carolina has the largest state-maintained highway system in the United States, exceeding 77,400 miles of roads. The state has over 1,500 lakes and over 37,000 miles of fresh water streams. Tourism is an important source of revenue for the state, and in 2017 visitors spent more than $1 billion in the state.

[12] US Census Bureau, American Fact Finder: Annual Estimates of the Resident Population: April 1, 2010 to July 1, 2017: North Carolina, https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk, as of October 26, 2018.

[13] Ibid.

Some of the major attractions in North Carolina are year-round golfing; snow skiing at ski resorts; fresh- and salt-water fishing; hunting; the Great Smoky Mountain National Forest; the Blue Ridge Parkway; Wrightsville Beach; the Cape Hatteras and Cape Lookout National Seashores; and the Wright Brothers National Memorial in Kitty Hawk. The vast differences in geography, population, and attractions place a unique demand on the 911 systems across North Carolina and underscore the importance of a single statewide digital network for E911 service.

Table 4 and Table 5 provide information on statewide 911 call volume.

Table 4—Statewide 911 Call Volume in 2017

	Number of 911 Calls	% of Total
Wireline 911	1,265,176	17.40%
VoIP 911	607,047	8.30%
Wireless 911	5,406,307	74.30%
Total 911 Call Volume	***7,278,530***	***100.00%***

Table 5—Year to Year Comparison: 2017 to 2018

	Sept. 2017	% of Total	Sept. 2018	% of Total	% Change: 2017-2018
Wireline	95,956	16.32%	94,267	14.85%	-1.76%
VoIP	48,696	8.28%	52,220	8.23%	7.24%
Wireless	443,302	75.40%	488,390	76.93%	10.17%
Total 911 Call Volume	***587,954***	***100.00%***	***634,877***	***100.00%***	***7.98%***

3.1 Statutory Framework for 911 Service

North Carolina General Statutes (G.S.) Chapter 143B, Article 15, Part 10, Section §143B-1400 *et seq.*, establishes the statutory provisions and requirements for 911 service at the state and local levels. The statutory provisions for 911 service in the state include, but are not limited to, the creation of a state 911 Board, the monthly 911 service charge, and eligible uses of 911 revenue.

3.2 State-Level Governance for 911 Service—the 911 Board

North Carolina adopted 911 by legislative act in 1989, and authorized local governments to adopt ordinances to fund 911 operations. In 1998, the North Carolina General Assembly created the Wireless 911 Board, pursuant to S.L. 1989-587; as codified in Chapter 62A of the N.C. General

Statutes. The Wireless Board was originally established to provide a wireless E911 system in response to FCC Order 94-102 mandating wireless E911 service.

In 2007, the North Carolina General Assembly further amended the 911 statutes to create the 911 Board and charged the 911 Board with responsibility for landline 911 as well as wireless 911 service. The General Assembly also consolidated the 911 service charge into a single statewide uniform charge effective January 1, 2008 and disallowed any other 911 fee or tax by local governments. The initial rate was 70 cents ($0.70) per connection for any type of voice communication service provider. This was done to consolidate North Carolina's 911 system under the Board with a uniform 911 service charge to integrate the state's 911 system, enhance efficiency and accountability, and create a competitive playing field among voice communication technologies. In Fiscal Year (FY) 2010,[14] the Board lowered the rate to sixty cents ($0.60), effective July 1, 2010.[15] In March 2018, the Board raised the rate to 65 cents ($0.65).

3.2.1 911 Board Composition

The Board is comprised of 17 members, as established in G.S. §143B-1401. The Secretary of the Department of Information Technology (referred to as the State Chief Information Officer) serves as Board Chair. The Governor appoints four members and the General Assembly appoints 12 members. Of the legislative Board member appointments, six are appointed based on the recommendation of the Speaker of the House of Representatives, and six are appointed based on the recommendation of the Senate President Pro Tempore.

The four appointments by the Governor are as follows:

- One municipal representative with a primary PSAP, based on a recommendation from the North Carolina League of Municipalities;
- One county representative with a primary PSAP, based on a recommendation from the North Carolina Association of County Commissioners;
- One representative of a VoIP provider; and
- One representative from the state chapter of NENA.

The six appointments by the General Assembly upon the recommendation of the House Speaker are as follows:

- One Sheriff, based on a recommendation from the NC Sheriff's Association;
- One representative of a CMRS provider operating in the state;
- One representative from the state chapter of APCO;
- Two representatives from LECs operating in the state, one of whom represents a carrier with fewer than 50,000 access lines; and
- One Fire Chief with PSAP supervisory experience based on a recommendation from the North Carolina Firefighter's Association.

The six appointments by the General Assembly upon the recommendation of the Senate Speaker Pro Tempore are as follows:

[14] In North Carolina, the Fiscal Year starts on July 1 and ends June 30 the following year.
[15] NC Department of Information Technology, *the NC 911 Board: About the NC 911 Board*, https://it.nc.gov/about/boards-commissions/911-board/about-nc-911-board, as of August 31, 2018.

- One Chief of Police, based on a recommendation from the NC Association of Chiefs of Police;
- Two representatives from CMRS providers operating in the state;
- One Rescue or Emergency Medical Services (EMS) with experience operating or supervising a PSAP, based on a recommendation from the NC Association of Rescue and Emergency Medical Services; and
- Two representatives from LECs operating in the state, one of whom represents a carrier with fewer than 200,000 access lines.

One State Official:

- Secretary of the NC Department of Information Technology, who also serves as Board Chair

Eight Local and Public Safety Officials:

- Municipality with a primary PSAP (NC League of Municipalities)
- County with a primary PSAP (NC Association of County Commissioners)
- Sheriff (NC Sheriff's Association)
- Chief of Police (NC Association of Chiefs of Police)
- PSAP (NC Chapter of APCO)
- PSAP (NC Chapter of NENA)
- Fire Chief with PSAP experience (NC Firefighter's Association)
- Rescue or EMS Chief with PSAP experience (NC Association of Rescue and Emergency Medical Services)

Eight Providers:

- Three CMRS representatives
- Four Local Exchange Carrier (LEC) representatives
- One VOIP representative

Board members serve terms of four years, are limited to two terms, and serve until their respective successor has been appointed. The Governor may remove any Board member, regardless of appointment, "…for misfeasance, malfeasance, or nonfeasance…" pursuant to G.S. §143B-13(d).[16] Board members serve without compensation, but receive per diem, subsistence, and travel allowances at the rate established in state law. Nine members constitute a quorum at a Board meeting, and the Board meets upon the call of the Chair. Board members are considered public servants and as such, are subject to the provisions of the State Government Ethics Act.

3.2.2 Powers and Duties of the 911 Board

G.S. §143B-1402 establishes the Board's powers and duties, which include the following:

1. Develop a 911 State Plan;
2. Administer the 911 Fund;
3. Distribute revenue in the 911 Fund to CMRS providers and PSAPs pursuant to requirements established by the Board;

[16] This subsection of the Executive Organization Act of 1973 concerns provisions for the appointment, qualifications, terms, and removal of members of boards or commissions.

4. Establish cooperative purchasing agreements or other contracts for the procurement of goods and services;
5. Establish policies and procedures to fund advisory services and training for PSAPs;
6. Set operating standards for PSAPs and back-up PSAPs;
7. Investigate revenues and expenditures associated with the operation of PSAPs to ensure compliance with Board rules, regulations, requirements, and policies;
8. Make and enter into contracts and agreements as needed to fulfill its statutory obligations;
9. Use funds to pay for statewide 911 projects;
10. Accepts gifts, grants, or other money for the 911 Fund;
11. Undertake its duties in a manner that is competitively and technologically neutral to communication service providers;
12. Design, create, or acquire printed or Web-based public education materials regarding the proper use of 911;
13. Adopt rules to implement G.S. §143B-1400 *et seq*.;
14. Take other necessary and proper action to implement the provisions of G.S. §143B-1400 *et seq*.; and
15. Pay private sector vendors for provisioning a communications network for providing access to 911.

G.S. §143B-1402(b) strictly prohibits the Board (or any state agency) from constructing, operating, or owning a communications network for the provision of 911 service. The Board is permitted to pay private sector firms for such networks.

3.2.3 The 911 Service Charge

G.S. §143B-1403 provides for the monthly 911 service charge that is imposed on "…each active communications service connection that provides access to the 911 system through a voice communications service…." The rate established in statute, which excludes pre-paid wireless service but includes all other communications services, is 70 cents ($0.70) per month per access line, which was effective July 1, 2008.[17] The Board is permitted to lower the service charge and lowered the rate to 60 cents per month effective July 1, 2010.[18] In March 2018, the Board raised the rate to 65 cents ($0.65). Providers of these services are required to remit the service charge to the 911 Board by the end of the calendar month following the month in which the charge was collected. Providers are entitled to retain as an administrative fee either one percent of the amount collected or $50, whichever is greater.

The 911 service charge on prepaid wireless service was established by statute to be the same rate for each retail transaction and is assessed at the retail point of sale. Pursuant to G.S. §143B-1414, retail sellers are entitled to retain up to five percent of the amount collected as an administrative fee. Retail sellers must remit the amount collected to the NC Department of Revenue either monthly or semiannually. For sellers that remit monthly, the amount collected is due by the 20th day of the month following the calendar month in which the fee was collected. For sellers that remit semiannually, the amount collected in the first six months of the calendar year is due by July 20, and the amount collected in the second six months of the calendar year is due by January 20.

[17] The inflation-adjusted rate (in October 2018 dollars) is 80 cents.
[18] The inflation-adjusted rate (in July 2018 dollars) is 70 cents.

It is important for there to be parity between or among the various types of voice communications devices and providers with respect to remittance and assessment of the 911 service charge. There should be parity in how often the 911 service charge is remitted; that is, if one group is required to remit the service charge monthly, then all groups should remit monthly. Disparate remittance periods could make it more difficult to accurately estimate 911 revenue and to efficiently manage cash flow. It is also important to maintain parity with respect to the amount providers are entitled to withhold to cover their administrative costs; that is, if one provider or group is entitled to withhold one percent, then all providers or groups should withhold the same percentage amount. Lack of parity with respect to the administrative fee could result in a lack of a competitive playing field.

3.2.4 The 911 Fund

G.S. §143B-1404 provides for the creation and administration of the 911 Fund, which is an interest-bearing special revenue fund within the State treasury. The Board administers the Fund and funds may only be used as provided for in §143B-1400 *et seq*. The statute allows the Board to retain up to two percent of the revenue for administrative expenses. Currently, the Board is setting aside only one percent for its administrative costs.[19] Ten percent of the service charge must be allocated to the Next Generation 911 Reserve Fund. The remainder of the funds are distributed between CMRS Providers and primary PSAPs. Primary PSAPs are defined as the "…first point of reception of a 911 call by a public safety answering point…."[20]

Wireless, or rather CMRS, providers receive a percentage of 911 revenue, excluding 911 revenue from wireless pre-paid retail sales, for cost recovery. PSAPs receive a percentage of all 911 revenue, including wireless pre-paid. The Board must determine the specific percentage that each group receives to ensure full cost recovery to wireless carriers; any excess funds not used for cost recovery are available for distribution to PSAPs.

G.S. §143B-1405 establishes the statutory process for CMRS cost recovery along with requirements with which wireless carriers must comply to be eligible for reimbursement of their costs to provide wireless E911 service. If there are excess funds from cost recovery at the end of a fiscal year, the Board has the authority to reallocate those funds to the PSAP Grant and Statewide 911 Projects Account, pursuant to limitations and other requirements in G.S. §143B-1407.

3.2.5 The 911 Board Staff & Committees

The Executive Director of the 911 Board is responsible for the day-to-day operations of the Board and its staff. Board staff also provide staff assistance to the Board's six committees, which are comprised of Board members and other stakeholders. Following are the committees:

- Education Committee
- Funding Committee
- Grant Committee

[19] North Carolina Department of Information Technology, the North Carolina 911 Board, *911 Fund*, https://it.nc.gov/about/boards-commissions/911-board/911-fund, as of August 31, 2018.

[20] G.S. §143B-1400(23). A public safety answering point (PSAP) is further defined in G.S. §143B-1400(25) as the "…public safety agency that receives an incoming 911 call and dispatches appropriate public safety agencies to respond to the call…."

- Technology NG 911 Committee
- Standards Committee
- Study Group

3.2.6 Accountability

In February of each odd-numbered year, the 911 Board must report to the Joint Legislative Commissioner on Governmental Operations and the Revenue Laws Study Committee on the receipts and expenditures of all funds received by the Board during the reporting period. The report must also contain the status of the 911 system and the results of any investigation of PSAPs by the Board.

The State Auditor is required by statute to audit the 911 Board at least every two years pursuant to Part 5A of Chapter 147 of the General Statutes. The audits are conducted to ensure that the 911 Fund is properly managed.

3.2.7 Intergovernmental Coordination

The responsibilities of the Board and its staff require intergovernmental coordination and collaboration for the delivery of 911 service to residents of and visitors to North Carolina. Historically, the primary purpose of coordination has been based upon the distribution of revenue from the 911 Fund and its subsequent verification and auditing. The Board's decision to provide and pay for the NG911 system will require additional coordination and collaboration with PSAPs, and other local government and public safety officials.

In its 2015 Biennial Report, the Board included an action plan to improve customer service; improve educational and outreach processes; develop a conceptual design to implement NG911; and continue conducting 911 meetings across the state to obtain input from PSAPs and the public. The Board extended the action plan into 2018 by forming the Study Group and hosting regional meetings for local officials and PSAP directors to assist in updating the State 911 Plan.

3.2.7.1 GIS/Mapping Support

Currently, North Carolina does not have a comprehensive geographic dataset of local jurisdictions for 911 service. For NG911 to be effective, it is important to have current and accurate data that is seamless across an entire region or state. The demands and challenges of NG911 will require an innovative approach to how GIS data is used, stored, and created. As a result, establishing partnerships at the state and local levels is crucial. The 911 Board has established a cooperative agreement with the North Carolina Center for Geographic Information and Analysis NC CGIA) to obtain robust GIS data from PSAPs that will support NG911 service.

3.2.7.2 Coordination of 911, Enhanced 911, and NG911 Services with Native American Tribal Nations and Governments

Section 2.1 of this Plan provided a high-level summary of the Federal 911 Grant Program and new rules established for the round of grants in 2018. To reiterate, the new rules require state applicants to include Native American Tribal Nations and governments in statewide NG911 planning and efforts. Including tribal nations and governments in NG911 planning will enhance the readiness and ability of tribal, state, and local emergency responders to communicate and coordinate

effectively during any sort of emergency or incident. Including tribal governments in NG911 planning and implementation ensures equal access to enhanced 911 services.

As part of the Board's distribution of funds and the offering of the NG911 system, inclusion of the Eastern Band of Cherokee Indians is statutorily required. The Eastern Band is the local governing body and is included as all other units of local government in North Carolina.

The inclusion of Native American Tribal Nations and governments has been addressed in the 911 general statutes. G.S. §143B-1406(g) defines the Eastern Band of Cherokee Indians as a PSAP, thereby including this tribal government in the funding and planning of all 911 service in the state, including NG911. A representative of the Tribal Council of the Eastern Band of Cherokee Indians serves on the Study Group for the 2018 State 911 Plan.

3.2.8 Board Programs and Initiatives

In 2017, the Board contracted with AT&T to provide the state's IP-enabled NG911 system, which includes the ESInet, Next Generation 911 Core Services (NGCS), and hosted call-handling solution for primary PSAPs in North Carolina. As of November 2018, 84 PSAPs had expressed an interest in joining the ESInet. On November 13, 2018, the first PSAP in the state transitioned to the ESInet. The estimated date for all PSAPs to migrate to the ESInet is December 31, 2021.

The Board has also initiated a project for an electronic Customer Relationship Management (CRM) software system, which when complete, will contain data and information about each PSAP, such as the type of CPE, CAD, and mapping systems used, 911 call volume, and other data deemed necessary by the Board and staff. The goal of this project is to provide a central reporting system for Board staff and PSAPs to enter relevant data, which will provide immediate, accurate, and reliable information about the 911 environment in North Carolina. Having this information centrally stored will allow staff to proactively address challenges and better plan for the future, which, in turn, will improve the Board's efficiency and effectiveness.

3.3 Local-Level Governance for 911 Service

In North Carolina, PSAPs are operated, managed, and staffed by local governments, either at the municipal or county level. These same local governments are responsible for funding PSAP operations. In the current analog 911 environment, 911 service has typically been delivered via a contract between a PSAP (or municipality or county) and the 911 system provider, which traditionally has been the Incumbent Local Exchange Carrier (ILEC). The 911 system provider supplies the 911 network, network monitoring, network maintenance and repair, and static ALI database as part of the contract. The PSAP purchases or leases the 911-related equipment (e.g., CPE, CAD, mapping) and is responsible for equipment maintenance and repairs. As a result, it was not typical for counties or municipalities to coordinate the provision of 911 service on a regional basis except for back-up arrangements.

NG911 will create an environment where coordination among multiple counties is possible and beneficial. In other states that have implemented NG911, regional consortia have been established for procurement advantages and redundant operating purposes. Regardless, the delivery of 911

services to the public is a local matter, although PSAPs are accountable to the Board with respect to the use of 911 funds.

3.3.1 Monthly Distribution of 911 Revenue to PSAPs

G.S. §143B-1406 provides for the process of the monthly distribution of 911 revenue to primary PSAPs. To be eligible to receive such distributions, a PSAP must provide E911 service, comply with all provisions of state 911 law, and must have received distributions in FY 2008-09. Subsection (a)(1) through (3) provides specific requirements the Board must follow concerning monthly distributions, such as setting a base amount for each PSAP. In addition, the Board "…must determine a method for establishing distributions that is equitable and sustainable and that ensures distributions for eligible operating costs and expected increases for all funded PSAPs…." The Board is further required to consider the following six factors:

1. Population served by each PSAP.
2. PSAP reports, budgets, prior disbursements, and prior costs.
3. PSAP operations, technologies used by the PSAP for 911 service, compliance with operating standards established by the Board, and level of service a PSAP delivers dispatching fire, law enforcement, and EMS and providing Emergency Medical Dispatch (EMD).
4. The tier designation of the county in which the PSAP is located.[21]
5. Any current existing interlocal agreement between a primary PSAP and a secondary PSAP, provided that the secondary PSAP was in existence as of June 1, 2010, receives funding from the primary PSAP under the agreement, and is within the primary PSAP's service area.
6. Any other information the Board deems relevant.

Standards for eligible and prohibited uses of 911 funds are provided in subsection (d). PSAPs are prohibited from using 911 funds for the following:

- The lease or purchase of real estate;
- Cosmetic remodeling of 911 Centers;
- Personnel costs for 911 Telecommunicators; and
- The purchase of mobile communications vehicles, ambulances, fire engines, or other emergency vehicles.

PSAPs may use 911 revenue only for the following:

- The non-recurring costs of establishing a 911 system;
- Expenditures for in-state training of 911 personnel regarding the maintenance and operation of the 911 system (within specific guidelines);
- Charges associated with the provision of 911 service by the 911 service supplier; and
- The lease, purchase, or maintenance of the following:
  - 911 call-taking equipment, including necessary computer hardware, software, and database provisioning.

[21] G.S. §143B-437.08 concerns development tier designations, which are based on factors such as unemployment; income; percent change in population; and per capita adjusted assessed property values.

- Addressing.
- Telecommunicator furniture.
- Dispatch equipment located exclusively within the building where the PSAP or back-up PSAP is located, except for radio-dispatch equipment.

3.3.2 Accountability

The fiscal officer of a PSAP to whom a distribution from the 911 Fund is made must deposit the funds in a special revenue fund as defined in G.S. §159-26(b)(2), designated as the Emergency Telephone System Fund. Annually, a participating PSAP must submit to the Board an approved budget detailing the revenues and expenditures eligible for reimbursement.

In accordance with G.S. §143B-1408, the Board is empowered to provide notice to any communications service provider or PSAP found by the 911 Board to be using fees from the 911 Fund for purposes not authorized by statute. The provider or PSAP must stop making any further unauthorized expenditures but may petition the Board for a hearing on the matter. If the Board determines at the hearing that the expenditure does not represent an eligible use of 911 revenue, the provider or PSAP will be required to reimburse the 911 Fund. If reimbursement is not made, the Board is authorized to suspend future distributions.

3.4 Current 911 PSAP Technology

In North Carolina, all 911 calls are answered at a primary PSAP, which is legally defined as the first agency that receives a 911 call. Primary PSAPs must be capable of receiving and processing E911 calls from all voice communications service providers. There are currently115 primary PSAPs in the state. There are also12 secondary PSAPs in the state, which the Board has defined as a PSAP that is able to receive voice and data of an E911 call that has been transferred from a Primary PSAP for dispatch of law enforcement, emergency medical services, ambulances, firefighters, or other responders. PSAPs range in size from two-position centers up to almost 60-position PSAPs.

In addition to the Public Switched Telephone Network (PSTN), there are several pieces of equipment at a PSAP that play a crucial role in the answering and processing of E911 calls. Common equipment includes the call-taking equipment, or Customer Premise Equipment (CPE); Computer Aided Dispatch (CAD); voice logging recorders; Uninterruptable Power Systems (UPS); generators; GIS/Mapping; and radio.

Typically, PSAPs enter into agreements or contracts with their 911 System Service Provider (SSP), which provides the 911 network, database, and network monitoring and maintenance. The PSAP typically enters into a separate lease/purchase agreement with the SSP for the call-taking equipment. The PSAP also provides and is responsible for the equipment mentioned above. As in most states, the level of technology in place and used varies from PSAP to PSAP, which results in varying levels of capability with respect to the provision of 911 service.

3.4.1 Wireless Phase II Status

The implementation of wireless E911 service did not significantly affect the 911 system or network. As stated previously, service providers translated wireless 911 calls to mimic landline 911 calls, so they can be received and processed by PSAPs without requiring costly equipment upgrades. In the wireless environment, a wireless 911 call routes from the Mobile Switching Center (MSC), which is essentially a wireless central office. From the MSC, the wireless 911 call travels on a dedicated, secure, and closed network to the serving Selective Router, where the call is routed to the designated PSAP. When the PSAP queries the ALI database, there are instructions to route the query to the designated wireless database. The caller's approximate location is then transmitted back to the PSAP, as measured in lat/long and displayed on a map. Obtaining the caller's approximate location instead of the address of the tower that received the call often takes up to 20 to 30 seconds to obtain.

The following carriers provide wireless service in North Carolina:

- AT&T
- Cricket Communications
- Sprint
- T-Mobile
- US Cellular
- Verizon Wireless

In addition to the carriers/providers listed above, there are numerous Mobile Virtual Network Operators (MVNOs), which purchase network services from Tier I carriers in wholesale quantities and prices, and then re-sell the service under another name. Examples are Boost, which uses the Sprint network, and Carolina West, which uses the network of Verizon Wireless.

According to the National 911 Program Office, 100 percent of the primary PSAPs in North Carolina were providing Phase II wireless E911 service as of 2016.[22]

3.5 Current 911 Infrastructure

The current 911 network in North Carolina is a patchwork of separate networks maintained by two Incumbent Local Exchange Carriers (ILECs), AT&T and Century Link. Competitive Local Exchange Carriers (CLECs), wireless carriers, and Voice over Internet Protocol (VoIP) providers connect to various Selective Routers owned by the two ILECs to provide E911 service.

Dialing "911" is more than just being connected to a 911 Telecommunicator at a PSAP. In a traditional landline environment, a caller dials "911" from his or her landline phone. The audio, or voice, is routed through a secure, dedicated, and closed network, along with the caller's telephone number (or ANI) to the Selective Router. The Selective Router compares the caller's ANI with the routing instructions in the Selective Router Database (SRDB), and selectively routes the 911 call (both audio and ANI) to the designated PSAP. Special 911 call-taking equipment at the PSAP takes the telephone number (ANI) and queries the 911 database for the caller's

[22] National 911 Program Office, *2017 National 911 Progress Report*, November 2017.

Automatic Location Information (ALI), along with the appropriate emergency response agencies. That information is sent back to the PSAP for display on a 911 call-taker's screen, who then processes the call and initiates dispatch of emergency personnel if needed.

3.6 Current 911 System Limitations

The Selective Routers in use today in North Carolina were designed in the 1970s only for analog, circuit-switched telephone networks. It is technologically impossible for an analog Selective Router to perform the functions required in the NENA i3 standard for NG911, and therefore there is no road map that will bring this equipment in that direction.

Most of the 911 trunks in the state use the Centralized Automatic Message Accounting (CAMA) signaling system, which was designed originally for billing long distance calls because it provides both the calling and the called number using in-band signaling. CAMA is a major reason why 911 callers sometimes experience longer call setup times, on the order of six to 20 seconds, while "normal" telephone calls set up in just a second or two. CAMA signaling technology is not capable of supporting the newer capabilities of communications features such as text or video. CAMA was designed for voice communications only, and therefore lacks the capacity to accept data.

In the legacy environment, CAMA allows the telephone system to send a station identification number to the PSAP via multifrequency (MF) signaling through the 911 service provider's E911 equipment. Call-taking equipment at the PSAP, often referred to as Customer Premise Equipment (CPE), is probably the most essential piece of equipment at a PSAP. The CPE receives the initial MF signaling and the CPE ensures the delivery of a voice-generated request for assistance from a 911 caller that is answered and processed by a 911 Telecommunicator.

Legacy 911 call handling is limited to processing voice calls and requires a 911 Telecommunicator to answer both incoming 911 calls and initiate the outgoing dispatch of response units. In this environment, the 911 call-taker must interpret the caller's verbally relayed information and make all dispatch entries based only on that information.

In the legacy 911 environment, wireless 911 calls are routed based on the tower that received the 911 call, not the caller's location. Federal and State laws direct routing to the appropriate PSAP; this generally means the primary PSAP closest to the caller within the jurisdiction. As a result, some wireless 911 calls are routed to the wrong PSAP and must be transferred. However, PSAPs are not always able to transfer the ANI and ALI associated with a given wireless 911 call to the appropriate PSAP. Transferring any 911 call introduces a potential point of failure, which means the potential exists for the 911 call to drop during the transfer. In addition, there are significant time delays associated with having to obtain the 911 caller's location, and those delays, in turn, increase response times. Furthermore, if the transfer took place over 10-digit phone lines, the 911 call-taker may not have a call-back number, and if the call is dropped, the caller cannot be called back. Transfers by means of a 10-digit line require 911 telecommunicators in both PSAPs to remain engaged because call data cannot be automatically transferred. Finally, transferring the 911 call sometimes confuses or angers the caller, because the caller does not understand why the call got transferred and why the same questions are being asked repeatedly. The ultimate effect is a negative impact on the quality of 911 service.

In September 2018, over 75 percent of 911 calls in North Carolina were from wireless devices, slightly less than 18 percent were from landline telephones, and about seven percent were from VoIP phones. The 911 system that was designed and built for landline service only now transports only a quarter of the state's 911 calls.

Call statistics are automatically collected across the State. These statistics show that the state's 911 call-takers had the precise location of only 25 percent of their 911 callers in September 2018 and had only an estimate of the location of over 75 percent of their callers. That is, three-quarters of the 911 callers in North Carolina had their calls routed based not on their location, but rather on the location of the tower that received the 911 call. During an emergency, such as Hurricane Florence, it can be reasonably presumed that some wireless 911 calls got bounced from the closest tower because of call overflow and the FCC's requirement to route wireless 911 calls to the next available tower if the closest one is not available. It can therefore be reasonably presumed that at least some wireless 911 calls were routed to a non-serving PSAP and had to be transferred to the appropriate PSAP.

It is clear that wireless Phase II service is a vast improvement over Phase I and Phase 0, but these 911 calls are not routed based on the caller's location. Obtaining the caller's approximate location can take up to 30 seconds to obtain; even then, the caller's true location can vary up to 100 meters—or about one football field length. The public expects more and deserves more.

4 THE FUTURE ENVIRONMENT: NEXT GENERATION 911

4.1 The Drive to Next Generation 911

The current 911 systems in place in the US were built in the 1970s and were based on circuit-switched technology. A circuit is a connection or line between two points, using various media such as copper, coaxial cable, fiber, or radio wave. A circuit-switched network is one that establishes a physical circuit temporarily on demand and keeps the circuit open and reserved for the user until the user disconnects. The current 911 systems were designed to handle only one type of communications device: analog landline telephone service.

The explosive growth in communications technology is forcing 911 Authorities at every level of government to change the way they operate in order to provide equivalent services to constituents. To support these trends, PSAPs must migrate to a platform that enables new and emerging communications services and devices to access E911. The evolution of communications technology provides an opportunity for the 911 Board and PSAPs to make major improvements in the current E911 infrastructure. These improvements include the capability for multimedia services that will enhance public safety, reduce response times, and save lives.

Residents and businesses no longer live or operate in small isolated communities, and telecommunications services are no longer local-only offerings. People's lives take place in widespread areas with a multitude of communications options, and communications are no longer constrained to a fixed location. Traditional communications companies are transforming their circuit-switched networks into packet switched networks to accommodate the transport of voice, data, and video. The trend is only going to accelerate in the coming months and years.

Consumers and businesses are increasingly using and depending on new communications technologies and devices, such as VoIP devices, instant messaging, text messaging, Short Message Service (SMS), and email. These new technologies and devices enable the transfer of huge amounts of data. In addition, consumers and businesses are increasingly giving up their landline phone service for wireless phone service only. The deaf and hard-of-hearing community is increasingly using text messaging to communicate. Many have given up use of TTY/TDD machines in favor of text messaging. Consumers expect that they should be able to communicate with 911 using their smart phones and smart devices, including sending photos and videos or by texting.

As the rest of the world moves to Internet Protocol (IP)-based networks, the current E911 system will continue to lag further behind technologically, will continue to degrade, and will be unable to meet the needs and demands of consumers requesting emergency assistance. Every time a new technology is introduced (e.g., wireless, VoIP, texting) or system functions are expanded (e.g., location determination), the existing E911 network and equipment must undergo significant, convoluted, and costly engineering changes. These changes result in significant time delays and solutions that are not completely effective. The current 911 network and infrastructure cannot effectively or adequately support the network and technology needs of the future. The state's 911 systems must transition to a digital/IP-based network and must prepare for future technological changes.

The way PSAPs operate and provide 911 service is changing rapidly, but currently, PSAPs attempt to respond to today's requests for service using yesterday's technology. Delivering additional data

with a 911 call requires a digital network to provide the speed and data capacity to properly route and deliver a 911 call based on the call's location (rather than the location of the wireless tower, for example) to the appropriate PSAP. The existing analog, circuit-switched 911 networks in the state must be upgraded to a single, statewide 911 IP-based network. Such a network will improve call set-up time, increase the speed at which voice and data arrive at the PSAP, and improve response time, thereby saving lives. A single statewide IP-based network will also provide for call load sharing and host equipment sharing; the latter will allow local governments to retain control over how 911 calls are processed and dispatched, while minimizing 911 costs through centralizing network, equipment and software.

The technology associated with a digital network cannot be implemented on a county-by-county and on an "as a local government can afford it" basis. There must be a plan and funding that provide for the implementation of a single IP-based statewide network to transport 911 requests for service to the appropriate PSAP. The funding source for NG911 must be technology neutral, provide parity across all devices and carriers, and must cover the complete cost of the NG911 system. The plan must account for the fact that while telecommunications and access to E911 service are becoming increasingly borderless, emergency response is, and always will be, a local response; that is, if something goes wrong during a 911 call, local authorities are held accountable to their constituents.

It is nationally accepted that 911 call-takers and dispatchers in local 911 centers are the true first responders to any incident, whether isolated or widespread, human-caused or natural, accidental or deliberate. Yet, 911 service, infrastructure, training, and operations are rarely included in any federal government appropriations or homeland security grant programs. It is simply not good enough to merely implement or facilitate the implementation of a NG911 system without considering the impacts to PSAPs to prepare and train their 911 employees for answering, processing, and dispatching calls in a NG911 environment. PSAPs need a road map to implement NG911 to ensure that every resident can access and obtain the same level and quality of 911 service.

4.2 What is Next Generation 911?

Much work has been done in many forums to design a 911 system to meet consumer expectations and technological changes. In the future, consumers will be able to access 911 from any networked communication device, with location automatically provided at the beginning of the call.

Internet Protocol (IP) is the technology that will be used for the future 911 network, which is being called Next Generation 911, or NG911. According to the National Emergency Number Association (NENA), NG911 is:

> *"An Internet Protocol (IP) based replacement for E9-1-1 features and functions that supports all sources of emergency access to the appropriate PSAPs, operates on reliable, secure, managed, multi-purpose IP networks, and provides expanded multimedia capabilities for PSAPs and other emergency responders."*

According to the Association of Public Safety Communications Officials (APCO) Project 43, NG911 is:

> *"A secure, nationwide, interoperable, standards-based, all-IP emergency communications infrastructure enabling end-to-end transmission of all types of data, including voice and multimedia communications from the public to an Emergency Communications Center."*

In other words, NG911 is

- A secure and open architecture that uses a reliable and managed IP network to allow new communications devices such as text messaging, data, pictures, and video to access 911 service.
- A system that enables call access, transfer, and backup among and between PSAPs without geographic or technical restrictions.
- An architecture that will facilitate an interoperable system of systems for all emergency response organizations.
- A system that will contain the same functions of the legacy 911 system, such as redundancy and reliability (e.g., 99.999% up time), while providing for greater accessibility, interoperability, functionality, and a more efficient use of 911 resources.

When fully implemented, NG911 will enable:

- Transfers of 911 calls between geographically dispersed PSAPs, and from PSAPs to remote public safety dispatch centers, if necessary;
- Increased sharing of data, resources, procedures, and standards to improve emergency response;
- Reductions in capital and operating costs for the state and PSAPs; and
- Improved coordination and partnerships within the emergency response community.

Table 6 below provides a high-level summary of the differences between the current 911 system and NG911.

Table 6—The Difference Between Current 911 & NG911

Current 911	NG911
Virtually all calls are voice calls via landline, wireless, or VoIP telephones over analog lines/circuits/trunks.	Voice, text, pictures, videos, etc., from many types of communications devices, sent over IP networks. Callers will be able to access 911, regardless of the device used, ensuring equal access to 911.
Most of the situational information is provided by the caller via voice.	Advanced data sharing is automatically done, and situational information can be provided automatically (ACN, Telematics).

Current 911	NG911
Calls are routed on analog lines through analog Selective Routers; callers' locations are provided by querying the appropriate database and sending that location information back to the PSAP.	Calls are routed automatically based on the caller's geographic location. Physical location of PSAP becomes immaterial and transparent to caller. Caller's location is provided with the call.
Limited ability to forward or transfer calls with complete data.	PSAPs are able to transfer 911 calls across the state with voice and accompanying data.
Limited ability to handle overflow situations; callers can either get a busy signal or constant ringing.	PSAPs are able to control call congestion situations, including the ability to dynamically reroute calls.
Complex analog trunking and data network.	Managed private ESInet.
Only accepted media is voice.	Voice, Text, Video.
Call routing is based on translation from the 911 caller's phone number.	Call routing is based on translation from the 911 caller's location.

4.3 How does NG911 Work?

In the NG911 environment, when telephone service is provisioned or modified, the customer address will be pre-validated against the local GIS (using the Location Validation Function, LVF) to ensure the address is correct; this also ensures the call can be geospatially routed.

When a 911 call is placed, location information is included in the Geolocation header of the call data. The location information can be provided in one of two ways. The first type of location information is the civic address, which is defined as Presence Information by Document Format-Location Object, or PIDF-LO. The second type of location information is by reference, which is a geographic point as identified by lat/long, which is defined as the location Uniform Resource Identifier, or URI.

The location information is passed by the Emergency Services Routing Proxy, or ESRP, to the Emergency Call Routing Function, or ECRF, for proper routing of the 911 call. At the same time, the device or network queries the Emergency Call Routing Function (ECRF) for routing. The ECRF provides what is called "next hop routing" to the Emergency Services Routing Proxy (ESRP). All of this is accomplished by using what is called a Location to Service Translation (or LoST) protocol.

The ECRF determines the appropriate PSAP to receive the call based on the caller's or device's location, then applies policy routing rules established by the PSAP and 911 Board, and the call is routed to the PSAP that serves the caller's location. All these actions or events take place on the ESInet, which transports the call and its associated data.

4.4 The NENA i3 Standard

The National Emergency Number Association ("NENA") is an ANSI-accredited Standards Developer and is at the forefront of developing standards for emergency calling services. NENA follows the Internet Engineering Task Force (IETF) standards[23] and adds specific service-related features that apply to 911 service. In addition, NENA publishes 911 information documents that often contain recommended best practices.

The NENA i3 standard details the network, components, and interfaces required for NG911 service. Specifically, the term "i3 standard" generally refers to NENA Standard 08-003, *Detailed Functional and Interface Standard for NG9-1-1 (i3)*, or NENA STA 010.2-2016, *Detailed Functional and Interface Standards for the NENA i3 Solution*. According to NENA the i3 Standard

> *"…describes the 'end state' that has been reached after a migration from legacy Time Division Multiplex (TDM) circuit-switched telephony, and the legacy E9-1-1 system built to support it, to an all IP-based communication system with a corresponding IP-based Emergency Services IP network…."*[24]

The NENA i3 Standard has the following 11 critical underlying assumptions:

1. All calls entering the Emergency Services IP Network (ESInet) are Session Initiation Protocol (SIP)-based.
2. Access network providers operate a location function for their networks.
3. All calls entering the ESInet will normally have location data in the signaling with the call.
4. The 911 authorities have converted their tabular Master Street Address Guide (MSAG) and Emergency Service Numbers (ESNs) to a GIS-based Location Validation Function (LVF) and Emergency Call Routing Function (ECRF).
5. The 911 authorities have accurate and complete GIS data, which are used to provision the LVF and ECRF. In addition, a change to the GIS system automatically updates the ECRF and LVF, which may affect routing.
6. All civic locations are validated by the access network against the LVF prior to an emergency call being placed (analogous to MSAG-validation).
7. All civic locations are periodically revalidated against the LVF to ensure that the location remains valid as the GIS system changes.
8. Legacy PSAP Gateways (LPGs) are included in the i3 architecture as the interface between i3 ESInets and legacy PSAPs, and between i3 PSAPs and legacy PSAPs.
9. Legacy Network Gateways (LNGs) are included in the i3 architecture as the interface between legacy originating networks and i3 ESInets.
10. Federal, state, and local laws, regulations, and rules are modified to support NG911 system deployment.

[23] The Internet Engineering Task Force (IETF) is the entity that creates and defines IP standards. The IETF also defines related protocols used on the public Internet and that may be adopted for use on private IP networks, including public safety IP networks.

[24] National Emergency Number Association, *NENA STA 010.2-2016 Detailed Functional and Interface Standards for the NENA i3 Solution, p. 15.*

11. The specific protocol mechanisms, especially interworking of legacy telecom and ESInet/NGCS protocols are North-America specific and may not be applicable in other areas.

Figure 1 provides a basic diagram of the NENA i3 architecture. The green shaded areas denote areas that are considered within the i3 domain and covered by NENA STA 010.2-2016. The main purpose of the NENA STA 010.2-2016 is to define the end operating state of a new 911 delivery system that replaces the existing legacy 911 system with the same features and capabilities of the legacy system but with modern, IP- and SIP-based components and technologies, which provide greater capabilities beyond the current legacy 911 system. While the i3 architecture encompasses many areas, much of it is devoted to the treatment of a 911 call in the SIP format, through the i3 architecture, using the functional elements defined in NENA STA 010.2-2016.

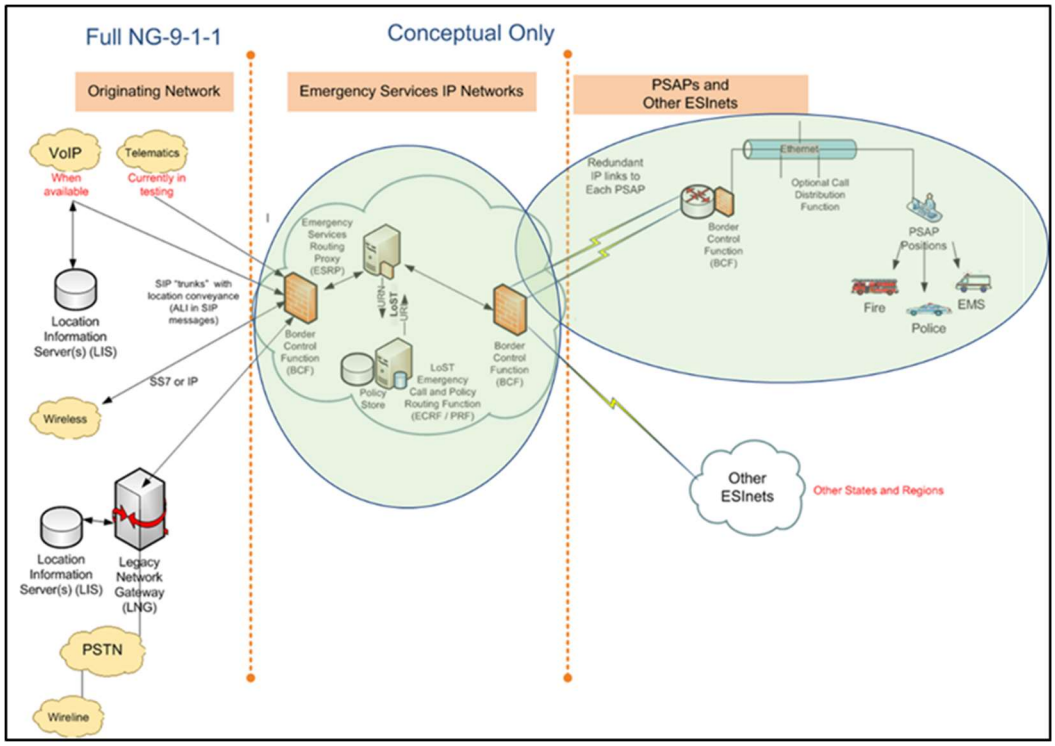

Figure 1 - Simplified NENA i3 NG911 Conceptual System Diagram

NENA STA 010.2-2016 encompasses requirements for many physical and logical elements of NG911 service, including the ESInet, the Border Control Function (BCF), the Session Border Control (SBC), the Emergency Service Routing Proxy (ESRP), the Emergency Call Routing Function (ECRF), Location Validation Function (LVF), Session Initiated Protocol (SIP), and Security.

4.4.1 i3 ESInet Standards and Best Practices

According to NENA, an ESInet is a managed IP network that is used for emergency services communications and that can be shared by all public safety agencies.[25] NENA addresses the ESInet through a combination of specific standard language in STA-010.2-2016 and a best practices document titled *NENA Emergency Services IP Network Design for NG9-1-1 (NID), NENA 08-506* (released in December 2011).

The ESInet is the core of NG 911 and is needed to provide NG911 services to the PSAP. The ESInet is the IP transport infrastructure upon which independent application platforms and core functional processes will be deployed. An ESInet will provide for broadband speed transmissions and allow prioritized, efficient, and prompt delivery of texts, videos, pictures, and other data that will be used by 911 Telecommunicators at the PSAP and by responding units for safer and more effective emergency responses in the field.

Following are highlights from the i3 standard related to ESInets:

- Each PSAP must be connected to an ESInet.
- Origination networks are not included as part of the ESInet.
- ESInets must be accessible from the global Internet, with calls going through the Border Control Function (BCF).
- Connection to the Internet is acceptable, preferably through a Virtual Private Network (VPN).
- Access to ESInets must be controlled. Only public safety agencies and their service providers may be connected directly to the ESInet.
- Elements connected to the ESInet should not be referred to by their IP address, but through a hostname using DNS.
- There must be no single point of failure for any critical service or function hosted on the ESInet. Certain services designated as non-critical may be exempt from this requirement. However, the BCF, internal ECRF, ESRP, logging service, and security services should never be exempt from this requirement. Services must be deployed to survive disaster, deliberate attack, and massive failure.

4.4.2 NG911 Security Standard

Out of necessity, PSAPs will be connected (indirectly through the ESInet) to the global Internet to accept calls. As a result, PSAPs will likely experience deliberate attacks on their systems. The types of vulnerabilities that NG911 systems must manage and protect against will fundamentally change and will require constant vigilance to create a secure and reliable operating environment. NG911 systems must have robust detection and mitigation mechanisms to deal with such attacks.

Cyber risks are inherent in systems such as the ESInet that are open to the internet. Safeguarding the NG911 system, including the PSAPs, from cyber-attacks is yet one more reason why it makes sense to have a singular statewide system that is managed and monitored by the Board; cyber security is costlier and more difficult to provide if done PSAP-by-PSAP.

[25] National Emergency Number Association, *NENA Master Glossary of 9-1-1 Terminology*, NENA-ADM-000.18-2014, July 29, 2014, p. 75.

The NENA i3 standard provides overall security requirements for NG911. There is also a separate standard, *NENA Security for Next-Generation 9-1-1 Standard (NG-SEC)*, NENA 75-001, which addresses security requirements.

The i3 security standard deals with authentication and authorization functions. Pursuant to this standard, all transactions must be protected with authentication, authorization, integrity protection, and privacy mechanisms specified in the i3 document. In addition, common authentication (single sign-on) and common rights management and authorization functions must be used for all elements in the network.

The NENA NG-SEC standard establishes minimum guidelines and requirements for the protection of NG911 assets and elements, and to provide a basis for auditing and assessing levels of security and risk. Certain applications may require access from external, public transport networks such as the Internet. These applications are placed on special, external network segments referred to as Demilitarized Zones (DMZs). The DMZ provides an intermediate environment for interaction with external domains without permitting access to internal domains or networks. This layering technique can improve the security posture of a system that requires an application to face the Internet without exposing the internal network. When applications require access from external, public transport networks (i.e. Internet), they shall be placed on a DMZ, or shall employ network-based encryption and authentication mechanisms such as a VPN.

The equipment supporting virtual or logical networks can pose a unique risk. All guidelines for the use of firewalls, intrusion detection, remote access, and all other relevant security principles shall be followed when designing interaction between virtual networks. The routers and switches supporting these networks can be used as "islands" to hop between networks of different security classification. The NENA NG-Sec standard lists the various ways that these risks can be managed.

Appendix C—NENA NG911 Standards and Best Practices Reference Chart contains a spreadsheet with the various NENA Standards as they relate to NG911.

4.5 NG911 Considerations

Internet Protocol and broadband technologies will have tremendous beneficial impacts to current 911 service and PSAP operations. At the same time, these new technologies have the potential to pose significant challenges to PSAPs. It is important for policy makers and elected and appointed officials at all levels of government to understand that the Board and PSAPs must have the resources needed to maximize benefits, minimize costs and challenges, and effectively incorporate and use NG911 technologies.

In 2017, APCO published the report, *PROJECT 43™ Broadband Implications for the PSAP: Analyzing the Future of Emergency Communications,*[26] and identified the following six areas of impact:

- Operations
- Governance

[26] Association of Public Safety Communications Officials, *PROJECT 43™ Broadband Implications for the PSAP: Analyzing the Future of Emergency Communications*, 2017.

- Cybersecurity
- Technology
- Training
- Workforce

4.5.1 NG911 & Operations

According to APCO, NG911 will have its biggest impact on 911 operations because of the PSAP's role as the first layer in emergency response. NG911 will allow PSAPs to leverage information sharing resources such as electronic health records; building records and floor plans; camera systems and detectors; officer-worn body cameras; and video from surveillance systems. As a result, PSAPs will need to amend their Standard Operating Procedures (SOPs) to account for new sources of information, increased call processing times, and more mutual aid incidents, to name a few. The revised SOPs must ensure that the handling, disseminating, and storage of all the information received with a call meets statutory requirements.

Increased call processing times, in turn, have the potential to increase call answering times, which in turn, could require the hiring of more 911 call-takers. In addition, PSAPs may need to create new positions to process and analyze all the various pieces of data that will arrive with a 911 call. Obviously, training PSAP personnel for the changes resulting from NG911 service is critical. 911 Telecommunicators will need to be trained on how to process all the new additional information in a fast-paced, stressful, and high-emotion environment.

When wireless E911 was implemented, PSAPs experienced an increase in multiple 911 calls about a given incident. This trend is expected to continue, and PSAPs will need to be prepared to handle multiple pictures, videos, texts, and calls to 911 about any given incident. Finally, the potential exists for non-emergency calls to increase, due to the increased use of social media applications. PSAP staff will have to balance the need to focus on emergencies with the public's expectation for an immediate response to those non-emergencies. In other words, in today's environment, PSAPs may get complaints about it taking longer than expected for a 911 call to be answered. In the future, PSAPs should expect to receive complaints about long waits for responses to non-emergency texts, for example.

4.5.2 NG911 & Governance

APCO emphasized that states that have established a state 911 authority have made the most progress in implementing NG911, provided there is input from PSAPs and other stakeholders. Such state authorities must remove statutory or regulatory barriers that can impede the modernization of 911 service. Examples include regulations that treat 911 service as a single-provider system accompanied by legacy requirements; 911 system service provider (SSP) certification restrictions; references to tariffs and Local Access Transport Areas (LATAs); lack of parity among carriers regarding liability; and rules that implicitly prohibit the use of IP-routing and NG911 architecture.

State authorities must also enact or amend laws and rules that will ensure that NG911 can be implemented statewide with seamless and secure interoperability. Examples include liability parity across all communications and NG911 providers; mutual aid agreements; and records

retention laws, public records and public information requests, because a 911 call will involve more than just voice.

One of the key lessons learned from past 911 implementation is the importance of statewide coordination to maintain focus and priorities for funding and support of 911 emergency services. Other benefits of statewide coordination include improved service uniformity and quality across the entire state, along with a potential reduction in costs associated with implementation of a NG 911 system. Statewide coordination and management of the NG911 system will help ensure the security and reliability of the ESInet. Statewide coordination will focus efforts; maintain priorities; ensure the timely achievement of NG911 goals; and ensure that every resident in the state will have equal access to NG 911 services. Finally, the presence of state-level standards and requirements will help ensure that desired future interoperability will be achieved and will provide economic incentives for host-sharing and regional collaboration, while simultaneously ensuring local autonomy and control of emergency response.

4.5.3 NG911 & Technology

As stated previously, the ESInet is the building block of NG911 and will replace the traditional network transport mechanisms. The ESInet provides interoperability between and among PSAPs on the same ESInet. The ESInet also facilitates hosted CPE solutions, which have the potential to bring about a higher level of reliability by placing core systems at redundant hosted locations. Doing so, in turn, provides operational continuity in local- or large-scale disasters. Hosted CPE solutions also reduce costs for the affected PSAPs because they are sharing equipment and could tend to minimize the need for hot back-up PSAPs. It is important for the 911 Board to work with the NG911 system vendor and PSAPs to establish interconnection policies, procedures, and best practices, including cyber-security, based on applicable NENA standards.

NG911 also provides opportunities for interconnectivity with other entities or agencies that are not PSAPs, and with other networks that serve public safety. Interconnectivity with entities not on the 911 ESInet or with other ESInets or public safety networks is complex and is associated with significant cybersecurity risk. It is important for the Board to investigate such possibilities in the future after the NG911 system has been implemented and accepted. The Board will need to work with the NG911 vendor, PSAPs, and the entities considering interconnection. The Board and NG911 vendor will need to define the interconnection terms, responsibilities, technical requirements, conditions, and costs to address how agencies will join the network, along with interconnection policies, shared responsibilities and costs, and cyber-security, for example. In addition, the Board will need to work with the NG911 system vendor to establish Service Level Agreements (SLAs) for allowed interconnections.

NG911 requires a GIS system that includes a GIS database with a map layer that defines the geographical jurisdictional boundaries of each PSAP in the state. One of the major administrative tasks in NG911 is the maintenance of the GIS database, which will largely replace the MSAG. In addition, the GIS system must be able to reliably convert civic or street addresses to coordinate locations (e.g., lat/long) in order to plot or map the caller's location accurately. It is important for the 911 Board to ensure that the GIS data development and maintenance associated with NG911 meets NENA standards.

In the NG911 PSAP, 911 calls (or, rather, 911 requests for assistance) will need to be answered, processed, dispatched, and stored using equipment that is capable of receiving and interpreting the

data that will be delivered with the call. The CPE must also provide standard interfaces to existing CAD and mapping applications. At the same time, until the legacy 911 system is decommissioned, the CPE must be capable of handling legacy 911 calls as well.

In NG911, CAD systems will need to be capable of exchanging data with the CPE using open standards, which means future CAD systems will need to be XML-capable. Another major component of the NG911 PSAP will be logging and storing all data and new data streams, which will require logging recorders that are capable of recording data in addition to voice, as well as recording key strokes of the CAD and CPE systems.

4.5.4 NG911 & Training

911 Telecommunicators provide the only link for the public to access or request emergency services; these essential PSAP employees are the true first responders. It is well-established that training 911 Telecommunicators is fundamental to the success of 911 service. The ability to maintain quality services for both the public and emergency responders is dependent upon the training provided, both at initial hire and on-going.

According to APCO, NG911 will provide a more immersive environment for 911 call-takers and dispatchers, who may see much of what responders see while on scene. While this additional information will ultimately improve or enhance emergency response, PSTs will be exposed to even more stress than they currently face. Both APCO and NENA have reiterated the importance of establishing a comprehensive stress management program. In 2013, NENA issued *NENA Standard on 9-1-1 Acute/Traumatic and Chronic Stress Management, NENA-STA-002.1-2013* to provide awareness of the serious risks posed by work-related stress on the mental and physical health of 911 Telecommunicators in their role as the nation's first first-responders.[27] The NENA standard also establishes best practices for PSAP comprehensive employee stress management programs.

It is essential for the long-term success of NG911 that state and local elected and appointed officials and PSAP authorities view training as a necessary and required investment to provide a consistent level of 911 service across the state. Without adequate training of PSAP personnel, even the best technical solution will fail. NG911 will require additional training of all 911 Telecommunicators to learn how to process different types of requests for assistance, such as texting, videos, social media, and other applications yet to be invented. Regardless of PSAP size, training across PSAPs in the state should include minimum baseline training so that 911 call-takers and dispatchers can proficiently answer, process, and dispatch calls from other jurisdictions in the NG911 environment, as well as maintain proficiency with legacy technology. Finally, because of the nature of NG911 service itself, all PSAP personnel must receive basic training in cybersecurity.

4.5.5 NG911 & the Workforce

Currently, PSAPs across the nation are faced with high-turnover and burn-out. Relatively low pay, limited career growth opportunities, and a fast-paced, life-or-death stressful environment have limited the ability of PSAPs to recruit and retain qualified 911 Telecommunicators. The critical

[27] National Emergency Number Association, *NENA Standard on 9-1-1 Acute/Traumatic and Chronic Stress Management, NENA-STA-002.1-2013*, August 5, 2013, p. 8.

nature of 911 service requires a special kind of employee with a unique set of knowledge, skills, and abilities; NG911 will add to the workforce challenges.

PSAPs may need to modify their hiring processes, may have to hire additional 911 Telecommunicators, may have to add new positions, such as data analyst, and may have to increase job requirements for 911 Telecommunicators, as they will now have to manage and analyze all the additional data that will arrive with the request for service.

At the same time, NG911 may provide more options for career growth and enhancement for PSAP personnel, due to the role they will play in aiding, enhancing, and improving emergency response in the field. According to APCO, in addition to current knowledge, skills, and abilities, the 911 Telecommunicator in a NG911 PSAP will need to have the following:

- Basic knowledge of IT systems, technology administration, cybersecurity, and GIS and related mapping tools;
- Proficiency with social media tools;
- Ability to examine various types of data for quality, authenticity, and reliability;
- Ability to interpret the meaning of arriving data and determining the best agency to respond and the type of response; and
- Ability to collaborate with counterparts in other PSAPs, EOCs, or jurisdictions.

4.6 Why It Is Time to Move to NG911

Consumers and businesses are using and depending on new communications technologies and devices, such as Voice over Internet Protocol (VoIP) devices, instant messaging, text messaging, Short Message Service (SMS), and email. These new technologies and devices enable the transfer of huge amounts of data. In addition, consumers are increasingly using only wireless phones in their homes. According to the Centers for Disease and Control (CDC), as of December 2017, 53.9 percent of households in the US were using wireless only, a 3.1 percent increase from the previous year. More than 75 percent of adults aged 25-34 were living in a wireless-only household, and 67 percent of adults aged 18-24 were wireless only. Not surprisingly, the percentages fell as household age increased: 64 percent of adults between 35 and 44 were wireless only, compared to 48 percent for ages 45-64 and 26 percent for those over the age of 65.[28]

The deaf and hard-of-hearing community is increasingly using text messaging to communicate. Many have given up use of TTY/TDD machines in favor of text messaging. Consumers expect that they should be able to communicate with 911 using their smart phones and smart devices, including sending photos and/or videos, or by texting. It is no longer feasible to tweak or modify the existing analog 911 network to support the new technologies in use by consumers and businesses. Delivering additional data on a 911 call requires a digital network to provide the speed and data capacity to accurately route and deliver a 911 call based on its location to the correct PSAP.

[28] Stephen J. Blumberg, Ph.D., and Julian V. Luke, *Wireless Substitution: Early Release of Estimates From the National Health Interview Survey, July–December 2017*, Division of Health Interview Statistics, National Center for Health Statistics, Centers for Disease Control, June 2018.

The existing 911 network is not capable of transmitting data such as text messages, pictures, or videos. IP-based technologies, including those supported through smartphones, tablets, and mobile apps, are widely prevalent throughout the public and can send an array of information to the PSAP. Current 911 systems have limited messaging capability (only query and response), limited data content, and are further constrained by the limited capabilities of networks and PSAP equipment such as CPE and CAD. Yet, the communications industry is going through a major evolution to the multi-media world. The nation's 911 networks are quickly becoming an island in the middle of advanced technologies that are already available to consumers and will be available to first responders through the National Public Safety Broadband Network (NPSBN) via FirstNet.

NG911 promises new opportunities for PSAPs to build in interoperability, security, economies of scale, competition, and innovation that will vastly improve the efficiency and effectiveness of emergency response. Improvements in call location technology and in GIS will enable the routing of calls based on the caller's location, rather than the tower that received the call. In summary, NG911 service provides the ability to:

- Route 911 calls based on the caller's location, as opposed to the wireless tower that received the 911 call.
- Deliver text-to-911 in a reliable way with the same priority as a 911 call.
- Deliver video-to-911.
- Provide for 911 call load sharing among PSAPs during emergencies.
    - For example, when a storm overloads one PSAP, a neighboring PSAP can automatically receive overflow calls, ensuring that 911 requests for service are answered by a trained 911 Telecommunicator in a timely manner.
- Provide accurate, reliable, and timely location information for 911 Telecommunicators and field responders, especially for wireless and other nomadic 911 callers.

5 ECONOMICS

When "traditional" landline E911 systems were implemented, the Incumbent Local Exchange Carrier (ILEC) was also the 911 service provider and charged rates that were set by tariff by the state public utility authority. To ensure that local governments could fund 911 service—including paying the ILEC for provisioning 911 service—state legislatures implemented a service charge on landline telephone service. The local 911 fee usually varied from county to county, which has contributed to the fragmented nature of 911 service. To implement 911 service, most states required counties to hold referendums to determine if residents were supported 911 fees. Although 911 referendums have historically received overwhelming support from the public, there have been areas of the country where 911 has not been implemented due to the lack of support from the public.

There is no standard funding mechanism for 911 service in the nation. Every state with 911 legislation in place has unique funding sources and requirements. That is, there are over 6,000 primary and secondary PSAPs in the nation that that are funded in a variety of ways. Some states have imposed statutory restrictions on the use of 911 revenue, while other states have placed such responsibility and authority with a state oversight board. Still, other states place no restrictions at all on the use of 911 revenue.

The most common source of funding for 911 service is still a surcharge on landline, wireless, pre-paid wireless, and VoIP service, either in the form of a per-line flat surcharge, or as a percentage of billing. In some states, local governments fund on-going 911 operations through a dedicated property or sales tax and use bond sales to finance equipment or facility projects. In other states, funding 911 service is a shared option between a state and its local governments, while a few states pay for everything associated with a 911 call, including personnel.

The current E911 service charge is not so much a user's fee but is rather an access charge. Anyone with a landline, wireless, VoIP, or broadband connection has access to 911 service. The service charge is the same regardless of whether an individual calls 911 once, multiple times, or never. If the 911 service charge were to reflect the total cost of providing 911 service, including 911 personnel, the resulting service charge would be significantly higher than the current statutory limit. Due to the statutory limits on the service charge rate, and because 911 response is a local responsibility, local governments must also fund 911 service using local revenue, which can be challenging in today's environment of shrinking resources and increased demand for all government services. The public's expectation is that 911 service is all encompassing—from the second the phone is picked up until the second that emergency responders arrive on scene—as well as seamless, transparent, and universal for all technologies and devices.

The 911 industry is capital-intensive, which means that PSAPs must be able to fund or pay for their current and future equipment and infrastructure needs. Historically, PSAPs set 911 revenue aside for a period of years and used this set-aside to replace old equipment. Once the new equipment was installed, a PSAP started setting aside 911 revenue again. This type of expenditure is different than and separate from the repair and maintenance of equipment that is used 24 hours per day, 365 days per year, without interruption. With the advent of NG911, the Board is facing the same challenge: how to continue to pay for its current, on-going costs of funding its operations and the legacy 911 system, as well as pay for the statewide NG911 system.

Another problem facing PSAPs and state 911 authorities is the diversion of 911 funds to the general fund of either a local or state government. The ENHANCE 9-1-1 Act of 2004 imposed penalties on state and local governments that divert 911 funds by making them ineligible for any federal grants for homeland security. However, the penalty has not had the desired effect because states do not feel the penalty directly; 911 centers and the residents they serve feel the pinch in terms of increased budget pressures, increased agency fees and taxes, increased wait times for 911 calls to be answered, and increased response times, to name a few.

Many public finance economists would identify the following criteria to determine an adequate long-term funding source for 911:

- The funding method should encompass the principle of access, so every device, technology, application, or service capable of accessing the legacy/analog 911 system and the NG911 system should share in the total cost of 911 service.
- The funding method should be technology, service, vendor/provider, and competitively neutral, so that it does not give competitive advantages to any particular telecommunications, broadband, or data provider at the expense of other providers.
- The funding method should provide parity with respect to the type of wireless service used by the consumer. That is, if a 911 fee is imposed on wireless service, the wireless pre-paid fee should be set at a percentage of the retail point of sale value that is equivalent to the monthly wireless 911 fee for wireless subscribers. Setting the wireless pre-paid fee as a flat fee does not account for inflation or the number of minutes purchased.[29]
- The funding method should be easy to understand and administer.
- The funding method should be periodically adjusted for inflation.

5.1 NG911 Funding Considerations in North Carolina

At the local level, many PSAPs are bound by existing long-standing contractual obligations based on old technology. Local governments receive monthly distributions (per G.S. §143B-1406) for eligible 9-1-1 expenses. Local governments must allocate funds for other expenses associated with PSAP operations, such as personnel costs, physical facilities and other expenses excluded from eligible expenses by G.S. §143B-1406. Some costs to migrate to the ESInet may pose a significant challenge to smaller local governments that lack available and adequate funding. These constraints support planning for regional primary PSAPs and consolidation of PSAPs. A funding method is needed to share costs across the state to guarantee the same level of access for every resident of North Carolina regardless of their location or the device or technology used.

Upgrading PSAP CPE and CAD systems is as important as building out the NG911 network; it will not serve the state's residents to have a robust, secure ESInet that can deliver a plethora of data when PSAPs and emergency responders are limited by outdated analog equipment. It is not

[29] In 2016, the 911 districts in Louisiana were successful in passing legislation that raised the regular wireless rate from 85 cents to $1.25 and raised the pre-paid rate to three percent of the value of the prepaid minutes. The districts determined that three percent would bring in the equivalent of the monthly wireless fee of $1.25, so parity was achieved. By setting the fee as a percentage of sales, revenue will increase as the number of minutes increases and will keep up with inflation.

clear if the current 911 service charge revenue can support the necessary upgrades to NG911-capable CPE and CAD systems. Adding to this challenge for PSAPs is how to pay for the training that will be required of all PSAP employees in a NG911 PSAP. Currently, PSAPs pay for on-the-job training, but this training does not include the standardized training that will be needed for NG911. 911 Telecommunicators will need extensive one-time and on-going training to process this new and unfamiliar content, such as photos and videos. The implementation of NG911 service will require PSAPs to revise their current standard operating procedures and provide training on those changes. Effective public policy must recognize these realities and the statutory framework must assure adequate and sustainable funding to support equal access to a consistent level of 911 throughout the entire state.

It is important to repeat that the Board and PSAPs will be paying for the both the current legacy 911 system and the new NG911 system until transition is 100 percent complete statewide. Because the existing legacy 911 network will have to co-exist with the NG911 network, operating costs during the transition will be higher. As a result, the revenues generated by the current 911 service charge may not be enough to pay for NG911 implementation costs and the current system at the same time, as well as the Board's operations. It is anticipated that Board staff responsibilities and job requirements will increase with the responsibilities of implementing NG911. Funding a statewide NG911 implementation can be a challenge for a variety of reasons, such as limited Board resources; competing budgetary requirements; increased PSAP costs; the unwillingness of elected officials to approve service charge increases; and a concern that 911 revenue will be used for non-911 purposes.

The table on the following pages provides historical information on 911 revenues and expenditures between FY 09-10 (FY ending June 30, 2010) and FY 17-18 (FY ending June 30, 2018). The data has not been adjusted for inflation and does not include expenditures for PSAP grants. In the eight-year period, CMRS revenue, VoIP revenue, and wireless pre-paid revenue increased over 90 percent, 108 percent, and 209 percent, respectively. However, during the same time, PSAP revenue fell by almost 25 percent, and wireline revenue decreased over 65 percent. As a result, total 911 revenue has fallen by 10 percent, not accounting for inflation. Although expenditures have fallen by 21 percent in that same period, the decrease appears to be a result of a 64 percent drop in CMRS/wireless carrier cost recovery and a 16 percent drop in PSAP distributions. The Board is going to be increasingly challenged to meet its requirements and obligations for funding the current legacy system during transition to NG911, funding the implementation and on-going costs of the NG911 system, and funding its operations.

Table 7—911 Revenues and Expenditures

	FY 09-10	FY 10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15	FY 15-16	FY 16-17	FY 17-18
CMRS Revenue	$3,309,837.20	$3,496,353.76	$8,672,956.87	$8,695,988.81	$8,869,200.73	$8,946,807.62	$8,581,880.79	$6,774,521.15	$6,351,992.60
% change prev. year		5.6%	148.1%	0.3%	2.0%	0.9%	-4.1%	-21.1%	-6.2%
PSAP Revenue	$47,550,175.69	$41,111,039.56	$34,691,827.45	$34,783,955.21	$35,476,803.02	$35,787,230.61	$34,327,523.25	$32,894,265.39	$35,994,624.83
% change prev. year		-13.5%	-15.6%	0.3%	2.0%	0.9%	-4.1%	-4.2%	9.4%
Wireline	$28,532,707.92	$22,593,411.48	$19,777,561.53	$18,829,638.75	$16,643,670.61	$15,152,361.70	$12,765,599.15	$11,474,327.38	$9,905,075.90
% change prev. year		-20.8%	-12.5%	-4.8%	-11.6%	-9.0%	-15.8%	-10.1%	-13.7%
VoIP	$5,693,264.38	$5,681,690.73	$6,331,959.88	$7,416,842.50	$8,896,176.23	$9,332,952.03	$11,989,990.51	$11,380,771.14	$11,866,812.87
% change prev. year		-0.2%	11.4%	17.1%	19.9%	4.9%	28.5%	-5.1%	4.3%
Prepaid Wireless	$0.00	$0.00	$0.00	$0.00	$3,888,776.39	$8,737,688.19	$11,102,700.15	$9,695,756.87	$12,032,784.87
% change prev. year						124.7%	27.1%	-12.7%	24.1%
Total (no interest)	**$85,085,985.19**	**$72,882,495.24**	**$69,474,307.04**	**$69,726,425.40**	**$73,774,627.10**	**$77,957,040.13**	**$78,767,693.90**	**$72,219,641.53**	**$76,151,291.01**
% change prev. year		-14.3%	-4.7%	0.4%	5.8%	5.7%	1.0%	-8.3%	5.4%
NG911 Fund	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$4,197,053.49	$7,997,382.62	$8,546,721.91
Interest	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$6,509.75	$75,508.92	$226,928.87
Total NG911 Balance w/int.	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$4,203,563.24**	**$8,072,891.54**	**$8,773,650.78**
CMRS Interest	$235,203.60	$63,160.59	$23,745.10	$16,678.25	$14,324.50	$9,558.92	$21,021.57	$47,544.01	$71,506.00
PSAP Interest	$197,755.68	$122,055.69	$55,212.86	$31,454.10	$27,704.92	$48,302.75	$85,422.43	$89,546.68	$142,640.43
Subtotal Interest	$432,959.28	$185,216.28	$78,957.96	$48,132.35	$42,029.42	$57,861.67	$106,444.00	$137,090.69	$214,146.43
Total 911 Revenue w/int.	**$85,518,944.47**	**$73,067,711.52**	**$69,553,265.00**	**$69,774,557.75**	**$73,816,656.52**	**$78,014,901.80**	**$78,874,137.90**	**$72,356,732.22**	**$76,365,437.44**
% change prev. year		-14.6%	-4.8%	0.3%	5.8%	5.7%	1.1%	-8.3%	5.5%
Cost Ctr. 290053500									
Admin	$802,417.49	$737,325.10	$701,760.56	$704,307.42	$745,198.36	$787,444.94	$795,633.27	$720,166.40	$769,204.98
Admin Interest	$91,855.74	$21,930.34	$17,149.11	$11,543.15	$11,280.45	$12,957.88	$17,757.42	$24,199.60	$26,312.37

Total w/int.	**$894,273.23**	**$759,255.44**	**$718,909.67**	**$715,850.57**	**$756,478.81**	**$800,402.82**	**$813,390.69**	**$744,366.00**	**$795,517.35**
CMRS Disbursements (Wireless Cost Recovery)	$8,297,141.94	$8,890,665.99	$8,856,434.14	$7,621,280.79	$6,949,006.44	$8,317,137.47	$6,296,810.75	$4,679,825.96	$2,951,543.93
% change prev. year		7.2%	-0.4%	-13.9%	-8.8%	19.7%	-24.3%	-25.7%	-36.9%
PSAP Disbursements	$63,935,114.45	$63,152,399.63	$47,976,903.61	$48,692,276.13	$51,439,759.64	$51,945,568.95	$50,003,346.34	$52,469,040.51	$53,275,245.94
% change prev. year		-1.2%	-24.0%	1.5%	5.6%	1.0%	-3.7%	4.9%	1.5%
Admin Expenses	$553,868.23	$458,919.19	$491,489.48	$595,383.66	$654,898.61	$737,626.95	$926,485.09	$811,721.97	$967,214.00
% change prev. year		-17.1%	7.1%	21.1%	10.0%	12.6%	25.6%	-12.4%	19.2%
NG 911 Expenditures	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$68,064.44
% change prev. year		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Expenditures Without PSAP Grants	**$72,786,124.62**	**$72,501,984.87**	**$57,324,826.99**	**$56,908,940.46**	**$59,043,664.66**	**$61,000,333.58**	**$57,226,641.90**	**$57,960,588.23**	**$57,194,003.52**
% change prev. year		-0.4%	-20.9%	-0.7%	3.8%	3.3%	-6.2%	1.3%	-1.3%

6 GOALS AND OBJECTIVES FOR 911 SERVICE

The transition to NG911 will not take place in a "flash-cut," but will instead occur on a PSAP-by-PSAP basis; the complete transition will take several years and require extensive changes at both the state and local levels. Coordination among participating entities during transition is important but also complex and challenging. NG911 involves shared networks, shared databases, and shared applications.

Because of the interconnected and shared nature of NG911, implementation is more complex and requires collaboration among all the stakeholders in a way that was not necessary in the past. Policy and governance issues cannot be addressed by individual local jurisdictions or individual 911 authorities. NG911 requires establishing a collaborative governance framework that will enable such a shared, interconnected, and interoperable system of systems to come into existence. It is important for policy makers at every level of government to recognize that NG911 service requires a statutory and regulatory framework that assures the continued availability, quality, consistency, and sustainability of enhanced 911 service throughout the state.

Goals and objectives are important in strategic planning because they turn the Board's vision for NG911 into specific measurable targets or steps. Goals build on the vision and mission by defining and prioritizing the broad direction in response to specific priorities. Goals describe the general accomplishments to be achieved if the vision is to be achieved. Objectives articulate specific steps that are needed to complete each goal and include the owner-agency and the planned timeline. Objectives should be SMART: Specific; Measurable; Actionable; Realistic; and Time-Bound.

The following goals and objectives are categorized under six functional areas consistent with the NASNA Model State 911 Plan. The categories are Technology; Governance; Statutory; Funding; Public Education & Outreach; and Training. The 10 goals presented on the following pages are not placed in order of priority, so they may be achieved concurrently with the roll-out of North Carolina's NG911 system. Each goal is presented on a separate page.

Technology Goal 1			
Provide and pay for a statewide hosted Next Generation 911 system.			
Objective Number	**Description**	**Ownership**	**Target Dates**
1	Amend the definition of a 911 system to include NG911 and to better reflect the complete handling of a 911 call.	911 Board 911 Board Staff	Legislative Session beginning January 2019
1.1	Amend the current statutory definition of "911 system" by adding the following: Delivers 911 calls to the State NG911 Network as provided by G.S. §143B-1404(e).	911 Board 911 Board Staff	Legislative Session beginning January 2019
2	Work with the Board's NG911 system vendor to ensure the NG911 system is built and deployed within contractual specifications and the NENA i3 standard.	911 Board 911 Board Staff NG911 system vendor	12/31/2021
3	Build, equip, and operate the Network Management and Assistance Center (NMAC); train NMAC staff for Tier 1 and Tier 2 support to PSAPs.	911 Board 911 Staff	June 2019
4	Initiate program inclusion with all primary PSAPS as users of the statewide NG911 system.	911 Board 911 Board Staff NG911 system vendor PSAPs	70% by 12/31/18 80% by 07/01/19 85% by 12/31/19 90% by 12/31/20 100% by 12/31/21
5	Work with Board's NG911 system vendor to ensure that PSAPs migrate to the ESInet from their legacy call delivery network within contractual specifications and in compliance with NENA i3 standard and NENA Standard 75-001 (NG911 Security).	911 Board 911 Board Staff NG911 system vendor PSAPs	Target dates are those established in contract for going live on ESInet
6	Initiate and complete the process for the migration of secondary PSAPs (as defined and approved by the 911 Board) as users of the statewide NG911 system to coincide with the migration of the primary PSAP.	911 Board 911 Staff NG911 system vendor PSAPs	Dates to be consistent with those established in Objective 5

Technology Goal 2			
Implement a comprehensive Cybersecurity program for the fundamental security of the ESInet, interconnected networks, software, applications, and PSAP users of the ESInet.			
Objective Number	**Description**	**Ownership**	**Target Dates**
1	Develop documented cybersecurity policies, procedures, requirements, and processes for ESInet users, in compliance with the NENA NG911 i3 Standard and NENA Standard 75-001. Ensure that such policies, procedures, requirements, and processes are updated as needed in compliance with NENA i3 and other cybersecurity standards as they relate to IP-enabled networks.	911 Board 911 Board Staff NG911 system vendor	7/1/2019
2	Provide 24/7/365 network monitoring and surveillance of the NG911 system.	911 Board 911 Board Staff NG911 system vendor	Ongoing

Technology Goal 3			
Explore and investigate the interconnection of PSAP users of the ESInet with other ESInet users and with other networks serving public safety after complete acceptance of the NG911 system from the NG911 system vendor.			
Objective Number	**Description**	**Ownership**	**Target Dates**
1	Explore ways to further expand the NG911 system in support of PSAPs and 911 service.	911 Technical Committee 911 Board 911 Board Staff NG911 system vendor	After 12/31/2021
2	Work with NG911 system vendor to determine and define technical requirements, responsibilities, conditions, costs, and Service Level Agreements (SLAs) for future interconnectivity with the ESInet.	911 Technical Committee 911 Board 911 Board Staff NG911 system vendor	After 12/31/2021
3	Collaborate, research, and explore, where applicable and appropriate, on technology initiatives that affect 911 service with other jurisdictions and networks that serve public safety.	911 Technical Committee 911 Board 911 Board Staff PSAPs	After 12/31/2021

Technology Goal 4			
Build and implement statewide GIS database that will be used as a core service of the NG911 system, to be based on the NENA i3 Standard and other NENA NG911 Standards as they relate to GIS.			
Objective Number	**Description**	**Ownership**	**Target Dates**
1	Work with North Carolina Center for Geographic Analysis (CGIA) to establish GIS standards for local GIS databases for NG911.	911 Board 911 Board Staff CGIA NG911 GIS contractor PSAPs	Dates consistent with implementation requirements.
2	Establish and implement maintenance requirements for GIS data to ensure accuracy and to ensure that GIS data is in sync with NG911 system.	911 Board 911 Board Staff CGIA NG911 GIS contractor PSAPs	Dates consistent with implementation requirements.
3	Obtain and implement PSAP jurisdictional and other GIS data necessary for NG911 implementation.	911 Board 911 Board staff CGIA NG911 GIS contractor NG911 system vendor PSAPs	Dates consistent with implementation requirements.

Governance Goal 5			
Staff the Board to meet its duties, facilitate all aspects of 911 service, and provide advisory services to PSAPs, pursuant to G.S. § 143B-1402(a)(4).			
Objective Number	**Description**	**Ownership**	**Target Dates**
1	Create a PSAP Assistance Team to serve as a Board liaison to PSAPs, as well as assist PSAPs with operational, organizational, technological, funding, and training needs.	911 Board 911 Board Staff	12/31/2019
2	Staff NMAC with experienced and trained staff as needed to provide Tier One and Tier Two proactive and reactive support for the state's PSAPs.	911 Board 911 Board Staff	
3	Modernize, update and streamline the Board's financial management systems, processes and procedures, including a. Updating eligible uses of 911 funds to account for technological changes; b. Clarifying and simplifying the reimbursement process, including but not limited to simplifying Board staff internal review; c. Providing clear, concise, consistent, and reasonable documentation requirements; and d. Implementing web-based financial management of the Board's funding operations.	911 Board 911 Board Staff	

Statutory Goal 6			
Seek legislative amendments to G.S. §143B-1400 *et seq.* to reflect changes in 911 service, PSAP operations, and Board responsibilities in the Next Generation 911 environment.			
Objective Number	**Description**	**Ownership**	**Target Dates**
1	Amend, modify, or establish state contracts and pricing for 911 equipment, services, and supplies.	911 Board 911 Board Staff	On-going
2	Amend definitions of 911 system to reflect NG911 environment and technology.	911 Board 911 Board Staff	Legislative Session beginning January 2019
3	Re-define primary PSAP and secondary PSAP to reflect their roles in NG911.	911 Board 911 Board Staff	Legislative Session beginning January 2019
4	Amend funding formula to provide the Board with greater flexibility in the transition period from legacy 911 to NG911.	911 Board 911 Board Staff	On-going

Statutory Goal 7			
Seek legislative amendments to G.S. §143B-1400 *et seq.* to define "Multi-Line Telephone System" (or MLTS) and to provide for the regulation of MLTS, to be consistent with the State's authority as well as federal law and FCC rules, upon the effective date of federal law.			
Objective Number	**Description**	**Ownership**	**Target Dates**
1	Upon transition to the NG911 network, begin collecting data on the level of location information at PSAPs, 911 call volume for MLTS calls, and other statistics as cited by the FCC.	911 Board 911 Board staff NG911 system vendor PSAPs	On-going

Funding Goal 8			
Develop a revenue model for 911 service, NG911 service, PSAPs, and 911 Board operations.			
Objective Number	**Description**	**Ownership**	**Target Dates**
1	Review, revise, and update the eligible uses of 911 revenue and seek legislative changes as necessary to align with PSAP services in the NG911 environment.	911 Board 911 Board Staff	12/31/19
2	Improve and optimize the reimbursement process.	911 Board 911 Board Staff PSAPs	12/31/19
3	Foster and facilitate PSAP consolidation and regional collaboration by establishing a process whereby PSAPs pursuing consolidation can request technical, financial, and project management assistance from the 911 Board and 911 Board staff.	911 Board 911 Board Staff PSAPs	On-going

Engagement & Public Education Goal 9			
Implement outreach and public education programs to keep the public, NG911 stakeholders, and industry partners informed about the Board's NG911 efforts.			
Objective Number	**Description**	**Ownership**	**Target Dates**
1	Develop an information sharing program to effectively communicate Board and Staff's vision, initiatives, and responsibilities for NG911.	911 Board 911 Board Staff	On-going
2	Update the Peer Review System to account for changes in PSAP operations and NG911.	911 Board 911 Board Staff PSAPs	On-going

Training Goal 10			
Establish statewide minimum training standards or rules that are consistent with NENA and APCO standards and best practices for all 911 Telecommunicators, in collaboration with 911 stakeholder groups.			
Objective Number	**Description**	**Ownership**	**Target Dates**
1	Complete development of training standards and implement, in collaboration and consultation with 911 stakeholder groups.	911 Education Committee 911 Board 911 Board Staff	On-going
2	Create repository of training resources and best practices.	911 Education Committee 911 Board 911 Board Staff	On-going

7 MECHANISM FOR MANAGING AND COORDINATING NORTH CAROLINA'S 911 SYSTEM

The purpose of this section is to provide a brief description of the mechanisms that are in place to ensure that local, regional, and state-level system functions are coordinated, mutually supportive, comprehensive in scope, and efficient in operation.

Board staff are responsible for executing the Plan and taking the lead in updating the Plan as progress is made on achieving the Board's goals. Goals and objectives that are achieved should be documented, and any new objectives should be added.

The Board has allocated its resources to successfully implement its goals, with the focus on NG911. The Board is also held accountable for its activities and operations. The Board is required to report to the Legislature every two years and is subject to audit by the State Auditor. As an agency of state government, the Board is subject to state open meetings laws and the Public Records Act. Rulemaking takes place under the Administrative Procedures Act, which involves a public process that allows stakeholder and public input.

8 NG911 IMPLEMENTATION PLAN

The path from the current analog 911 system to NG911 is not linear in nature, and each PSAP's migration to the ESInet has the potential to be different because of the different equipment and set-up at each PSAP. In NG911, voice and data will be delivered to the PSAP as an IP data stream, unlike the current analog E911 system today where voice is delivered down one analog path, and the ALI data delivered down a different data circuit path. As a result, PSAP equipment must be capable of accepting and processing the single IP data stream and sending it to a call-taker workstation in a usable format. Thus, PSAPs may need to either replace or upgrade their call-taking equipment to become NG-capable.

Projects of the size and scope to implement a single statewide NG911 system require scrupulous oversight and a detailed implementation plan. The Board has established a detailed Implementation Plan, which is contained in a document separate from the 2018 State 911 Plan.

APPENDIX

Appendix A—Document Change History

Version	Publication Date	Description of Change

Appendix B—North Carolina Population by County: 2010 and 2017

County	2010 Census	% of State Pop.	2017 Estimate	% of State Pop.	% Change
Alamance	151,131	1.58%	162,391	1.58%	7.45%
Alexander	37,198	0.39%	37,286	0.36%	0.24%
Alleghany	11,155	0.12%	11,031	0.11%	-1.11%
Anson	26,948	0.28%	24,991	0.24%	-7.26%
Ashe	27,281	0.29%	26,957	0.26%	-1.19%
Avery	17,797	0.19%	17,536	0.17%	-1.47%
Beaufort	47,759	0.50%	47,088	0.46%	-1.40%
Bertie	21,282	0.22%	19,224	0.19%	-9.67%
Bladen	35,190	0.37%	33,478	0.33%	-4.87%
Brunswick	107,431	1.13%	130,897	1.27%	21.84%
Buncombe	238,318	2.50%	257,607	2.51%	8.09%
Burke	90,912	0.95%	89,293	0.87%	-1.78%
Cabarrus	178,011	1.87%	206,872	2.01%	16.21%
Caldwell	83,029	0.87%	81,981	0.80%	-1.26%
Camden	9,980	0.10%	10,581	0.10%	6.02%
Carteret	66,469	0.70%	68,881	0.67%	3.63%
Caswell	23,719	0.25%	22,646	0.22%	-4.52%
Catawba	154,358	1.62%	157,974	1.54%	2.34%
Chatham	63,505	0.67%	71,472	0.70%	12.55%
Cherokee	27,444	0.29%	28,087	0.27%	2.34%
Chowan	14,793	0.16%	14,105	0.14%	-4.65%
Clay	10,587	0.11%	11,074	0.11%	4.60%
Cleveland	98,078	1.03%	97,334	0.95%	-0.76%
Columbus	58,098	0.61%	55,936	0.54%	-3.72%
Craven	103,505	1.09%	102,578	1.00%	-0.90%
Cumberland	319,431	3.35%	332,546	3.24%	4.11%
Currituck	23,547	0.25%	26,331	0.26%	11.82%
Dare	33,920	0.36%	36,099	0.35%	6.42%
Davidson	162,878	1.71%	165,466	1.61%	1.59%

County	2010 Census	% of State Pop.	2017 Estimate	% of State Pop.	% Change
Davie	41,240	0.43%	42,456	0.41%	2.95%
Duplin	58,505	0.61%	59,039	0.57%	0.91%
Durham	267,587	2.81%	311,640	3.03%	16.46%
Edgecombe	56,552	0.59%	52,747	0.51%	-6.73%
Forsyth	350,670	3.68%	376,320	3.66%	7.31%
Franklin	60,619	0.64%	66,168	0.64%	9.15%
Gaston	206,086	2.16%	220,182	2.14%	6.84%
Gates	12,197	0.13%	11,544	0.11%	-5.35%
Graham	8,861	0.09%	8,541	0.08%	-3.61%
Granville	59,916	0.63%	59,557	0.58%	-0.60%
Greene	21,362	0.22%	21,015	0.20%	-1.62%
Guilford	488,406	5.12%	526,953	5.13%	7.89%
Halifax	54,691	0.57%	51,310	0.50%	-6.18%
Harnett	114,678	1.20%	132,754	1.29%	15.76%
Haywood	59,036	0.62%	61,084	0.59%	3.47%
Henderson	106,740	1.12%	115,708	1.13%	8.40%
Hertford	24,669	0.26%	23,906	0.23%	-3.09%
Hoke	46,952	0.49%	54,116	0.53%	15.26%
Hyde	5,810	0.06%	5,363	0.05%	-7.69%
Iredell	159,437	1.67%	175,711	1.71%	10.21%
Jackson	40,271	0.42%	42,973	0.42%	6.71%
Johnston	168,878	1.77%	196,708	1.91%	16.48%
Jones	10,153	0.11%	9,597	0.09%	-5.48%
Lee	57,866	0.61%	60,430	0.59%	4.43%
Lenoir	59,495	0.62%	56,883	0.55%	-4.39%
Lincoln	78,265	0.82%	82,403	0.80%	5.29%
Macon	33,922	0.36%	34,732	0.34%	2.39%
Madison	20,764	0.22%	21,746	0.21%	4.73%
Martin	24,505	0.26%	22,789	0.22%	-7.00%
McDowell	44,996	0.47%	45,159	0.44%	0.36%
Mecklenburg	919,628	9.64%	1,076,837	10.48%	17.09%

County	2010 Census	% of State Pop.	2017 Estimate	% of State Pop.	% Change
Mitchell	15,579	0.16%	15,072	0.15%	-3.25%
Montgomery	27,798	0.29%	27,435	0.27%	-1.31%
Moore	88,247	0.93%	97,264	0.95%	10.22%
Nash	95,840	1.01%	93,991	0.91%	-1.93%
New Hanover	202,667	2.13%	227,198	2.21%	12.10%
Northampton	22,099	0.23%	19,862	0.19%	-10.12%
Onslow	177,772	1.86%	193,893	1.89%	9.07%
Orange	133,801	1.40%	144,946	1.41%	8.33%
Pamlico	13,144	0.14%	12,689	0.12%	-3.46%
Pasquotank	40,661	0.43%	39,743	0.39%	-2.26%
Pender	52,217	0.55%	60,958	0.59%	16.74%
Perquimans	13,453	0.14%	13,474	0.13%	0.16%
Person	39,464	0.41%	39,370	0.38%	-0.24%
Pitt	168,148	1.76%	179,042	1.74%	6.48%
Polk	20,510	0.22%	20,558	0.20%	0.23%
Randolph	141,752	1.49%	143,282	1.39%	1.08%
Richmond	46,639	0.49%	44,798	0.44%	-3.95%
Robeson	134,168	1.41%	132,606	1.29%	-1.16%
Rockingham	93,643	0.98%	90,949	0.89%	-2.88%
Rowan	138,428	1.45%	140,644	1.37%	1.60%
Rutherford	67,810	0.71%	66,551	0.65%	-1.86%
Sampson	63,431	0.67%	63,430	0.62%	0.00%
Scotland	36,157	0.38%	35,093	0.34%	-2.94%
Stanly	60,585	0.64%	61,482	0.60%	1.48%
Stokes	47,401	0.50%	45,717	0.45%	-3.55%
Surry	73,673	0.77%	72,224	0.70%	-1.97%
Swain	13,981	0.15%	14,294	0.14%	2.24%
Transylvania	33,090	0.35%	33,956	0.33%	2.62%
Tyrrell	4,407	0.05%	4,052	0.04%	-8.06%
Union	201,292	2.11%	231,366	2.25%	14.94%
Vance	45,422	0.48%	44,211	0.43%	-2.67%

County	2010 Census	% of State Pop.	2017 Estimate	% of State Pop.	% Change
Wake	900,993	9.45%	1,072,203	10.44%	19.00%
Warren	20,972	0.22%	19,883	0.19%	-5.19%
Washington	13,228	0.14%	12,012	0.12%	-9.19%
Watauga	51,079	0.54%	55,121	0.54%	7.91%
Wayne	122,623	1.29%	124,172	1.21%	1.26%
Wilkes	69,340	0.73%	68,576	0.67%	-1.10%
Wilson	81,234	0.85%	81,671	0.79%	0.54%
Yadkin	38,406	0.40%	37,774	0.37%	-1.65%
Yancey	17,818	0.19%	17,744	0.17%	-0.42%
Totals	***9,535,483***	***100.00%***	***10,273,419***	***100.00%***	***7.74%***

Appendix C—NENA NG911 Standards and Best Practices Reference Chart

DATA STRUCTURES DOCUMENTS (including NG911)		
02-010	Standard Legacy Data Formats For 9-1-1 Data Exchange GIS Mapping	2011/03/28
02-501	Wireless (Pre-XML) Static and Dynamic ALI Data Content Information Document	2006/10/16
02-503	XML Namespaces Information Document	2007/02/23
04-005	ALI Query Service Standard	2006/11/21
71-001	NG9-1-1 Additional Data Standard	2009/09/17
NENA-STA-004.1-2014	NENA Next Generation United States Civic Location Data Exchange Format (CLDXF)	2014/03/23
NENA-STA-008.2-2014 (orig. 70-001)	NENA Registry System (NRS) Standard	2014/10/06
NENA/APCO-INF-005	NENA/APCO Emergency Incident Data Document (EIDD) Information Document	2014/02/21
DATA MANAGEMENT DOCUMENT (including NG911)		
02-011	Data Standards for Local Exchange Carriers, ALI Service Providers & 9-1-1 Jurisdictions	2012/05/12
02-013	Data Standards for the Provisioning and Maintenance of MSAG Files to VDBs and ERDBs	2008/06/07 Reviewed 9/12/2014
02-014	GIS Data Collection and Maintenance Standards	2007/06/17
02-015	Standard for Reporting and Resolving ANI/ALI Discrepancies and No Records Found for Wireline, Wireless and VoIP Technologies	2009/06/06
02-502	NENA Company ID Registration Service Information Document	2008/11/12
06-001	Standards for Local Service Provider Interconnection Information Sharing	2004/08/01
71-501	Synchronizing Geographic Information System Databases with MSAG & ALI Information Document	2009/09/08
71-502	An Overview of Policy Rules for Call Routing and Handling in NG9-1-1 Information Document	2010/08/24
NENA-INF-011.1-2014	NENA NG9-1-1 Policy Routing Rules Operations Guide	2014/10/06
NENA-INF-014.1-2015	NENA Information Document for Development of Site/Structure Address Point GIS Data for 9-1-1	2015/09/18
NENA-STA-003.1.1-2014	NENA Standard for NG9-1-1 Policy Routing Rules	2014/12/01
NENA-REQ-002.1-2016	NENA Next Generation 9-1-1 Data Management Requirements	2016/03/10
NG911 TRANSITION PLANNING DOCUMENTS		
NENA-INF-008.2-2014 (originally 77-501)	NG9-1-1 Transition Plan Considerations Information Document	2013/11/20

SECURITY DOCUMENTS		
04-503	Network/System Access Security Information Document	2005/12/01
75-001	Security for Next-Generation 9-1-1 Standard	2010/02/06
75-502	Next Generation 9-1-1 Security Audit Checklist Information Document	2011/12/14
VOICE OVER INTERNET PROTOCOL (VoIP) DOCUMENTS		
08-001	Interim VoIP Architecture for Enhanced 9-1-1 Services (i2) Standard	2010/08/11
08-503	VoIP Characteristics Information Document	2004/06/10
08-504	VoIP Standards Development Organization Information Document	2004/06/08
57-503	Procedures for Notification of ERDB & VPC Operators of ESN Changes by 9-1-1 Administrator Information Document	2008/01/08
58-502	VoIP Funding and Regulatory Issues Information Document	2006/06/06
NEXT GENERATION 9-1-1 (NG911) DOCUMENTS		
08-002	Functional and Interface Standards for Next Generation 9-1-1	2007/12/18
08-003	Detailed Functional and Interface Standards for the NENA i3 Solution	2011/06/14
08-501	Interface between the E9-1-1 Service Provider Network and the Internet Protocol (IP) PSAP Information Document	2004/06/15
08-505	Methods for Location Determination to Support IP-Based Emergency Services Information Document	2006/12/21
08-506	Emergency Services IP Network Design for NG9-1-1 Information Document	2011/12/14
08-751	NENA i3 Requirements Document	2006/09/28
08-752	Location Information to Support IP-Based Emergency Services Requirements Document	2006/12/21
57-750	NG9-1-1 System and PSAP Operational Features and Capabilities Requirements Document	2011/06/14
NENA-INF-003.1-2013	Potential Points of Demarcation in NG9-1-1 Networks Information Document	2013/03/21
NENA-INF-006.1-2014	NG9-1-1 Planning Guidelines Information Document	2014/01/08
NENA-INF-009.1-2014	Requirements for a National Forest Guide Information Document	2014/08/14
NENA/APCO-REQ-001.1.1-2016	NENA/APCO NG9-1-1 PSAP Requirements Document	2016/01/15
WIRELESS 9-1-1 INTEGRATION DOCUMENTS		
57-001	Wireless E9-1-1 Overflow, Default, and Diverse Routing Standard & A PSAP Manager's Guide to GIS & Wireless 9-1-1	2004/11/18
57-002	E9-1-1 Wireless Maintenance Call Routing & Testing Validation Standard including Call Routing & Testing Validation Worksheet & Sample Non-Disclosure Agreement	2007/06/09

Appendix D—Glossary of Acronyms

The following Acronyms are used in this document.[30]

Acronym	Description
ALI	Automatic Location Identification
BCF	Border Control Function
CIDB	Call Information Database
CPE	Customer Premises Equipment
ECRF	Emergency Call Routing Function
ESInet	Emergency Services IP Network
E-MF	Enhanced - Multi-Frequency
EO	End Office
ESN	Emergency Services Number
ESME	Emergency Services Message Entity
ESRP	Emergency Services Routing Proxy
ESGW	Emergency Services Gateway
HELD	HTTP-Enabled Location Delivery Protocol
i2	NENA 08-001—Interim VoIP Architecture for Enhanced 911 Services (i2)
i3	NENA 08-003—Detailed Functional and Interface Standard for NG9- 1-1 (i3)
IETF	Internet Engineering Task Force
IP	Internet Protocol
LIF	Location Interwork Function
LIS	Location Information Server
LoST	Location to Service Translation
LRF	Location Retrieval Function
LNG	Legacy Network Gateway
LPG	Legacy PSAP Gateway
LSRG	Legacy Selective Router Gateway

[30] National Emergency Number Association, *NENA Master Glossary of 9-1-1 Terminology*, NENA-ADM-000.18-2014, 07/29/2014.

Acronym	Description
MCS	MSAG Conversion Services
MF	Multi-Frequency
MLP	Mobile Location Protocol
MSAG	Master Street Address Guide
MSC	Mobile Switching Center
NENA	National Emergency Number Association
NG911	Next Generation 911
NIF	NG911 Specific Interwork Function
OSI	Open Systems Interconnection
pANI	Pseudo Automatic Number Identification
PIF	Protocol Interworking Function
PSAP	Public Safety Answering Point
RTP	Real Time Transport Protocol
SBC	Session Border Controller
SIP	Session Initiation Protocol
SLA	Service Level Agreement
SR	Selective Routing, Selective Router [a.k.a., E911 Tandem, or Enhanced 911 (E911) Control Office]
SS7	Signaling System 7
SSP	System Service Provider
TDM	Time Division Multiplexing
UA	User Agent
URI	Uniform Resource Identifier
VoIP	Voice over Internet Protocol
VSP	VoIP Service Provider
WCM	Wireline Compatibility Mode