Luzerne County
911 Center

100 Young Street
Hanover Township, Pennsylvania 18706

Next Generation Radio System
Needs Assessment and Strategic Plan Report

Submitted By

MCM Consulting Group, Inc.
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EXECUTIVE SUMMARY

The Luzerne County 911 center is charged with providing 9-1-1, non-emergency and administrative call taking and dispatching services for residents, visitors, police, fire, EMA, EMS and other services throughout the county. Luzerne County has a 2015 census population of 318,449. The county is 906 square miles in size, of which 890 square miles are land and 16 square miles are water. The county has dispatching responsibilities for 174 public safety entities which includes 67 volunteer fire departments, 46 police departments, 43 EMS, 16 medic units, the Sheriff's department and Emergency Management all operating on the high frequency (VHF) band.

Call taking for both 9-1-1, non-emergency and administrative calls, along with corresponding dispatch functions are handled through the 911 center. The 911 center handled a call volume for Luzerne County of 447,026 incoming calls in 2015. Calls to the 911 center include non-emergency calls and administrative calls as well as 9-1-1 calls. A total of 175,222 calls were wireless 9-1-1 calls, 48,154 were wireline 9-1-1 calls, 7,338 were VoIP calls, 336 were TTY 9-1-1 calls and 215,976 were non-emergency and administrative calls. Total dispatches in 2015 were 275,435 for police, 70,918 for fire, EMS, and rescue.

Luzerne County ranks 12th in population statewide and ranks 9th in 911 call volume.

Luzerne County requested MCM Consulting Group, Inc. (MCM) to conduct a comprehensive needs assessment and formulate a strategic plan to develop a next generation radio communications network for the public safety agencies in Luzerne County. Luzerne County's intent is to create an interoperable, single band radio solution serving all law enforcement, fire, emergency medical services (EMS), emergency management (EM) and other county agencies within Luzerne County.

The goal of MCM was to provide a comprehensive and complete analysis of Luzerne County's voice radio communications network for the public safety agencies in Luzerne County and provide a strategic plan for the county's future next generation radio system.

A critical aspect of this project was to obtain input from the employees and agencies in the county that use and are supported by the 911 center. As stakeholders, it is important that all recommendations and solutions address as many of their needs and requirements as possible within the confines of available funding.

MCM performed this next generation and strategic planning under contract with Luzerne County 911. The project team consisted of the following Luzerne County personnel: Fred Rosencrans, Executive Director; Andrew Zahorsky, Data & Technical Support Manager; Bill Ives, Technical Support Supervisor; Mike Ankenbrand, CAD/GIS Supervisor; John Ankenbrand, Technical Support and the following MCM personnel: Michael McGrady, President; Jonathan Hansen, Director of Operations; Bob Anderson, Senior Consultant; Mike Crago, Senior Consultant; Ron Godava, Senior Consultant; and Dave Haas, GIS Consultant.

The project kickoff meeting was held on June 17, 2015. This meeting introduced all members of the project team and outlined the tasks, deliverables and estimated schedule for the project.

The project was broken into two (2) phases. The scope of each phase was:

Phase I: The needs assessment, survey and interviews were conducted with the 911 employees and representative agencies served by the 911 center to determine the most needed improvements. This phase included compilation and analysis of all data collected during the survey and interview process, as well as a review of any previously completed assessments. A summary report of the findings was generated. In addition, a physical site survey and equipment inventory of the 911 center and the 13 county primary transmit/receive sites were performed. A report detailing the physical survey results is included in phase I.

Phase II: This strategic planning phase included radio vendor presentations to obtain information to allow for recommended solutions to improve and/or replace the current 911 center radio console system, and the current radio and microwave systems. After reviewing the aforementioned information with key county stakeholders, a strategic plan was generated. A corresponding budgetary estimate for initial capital cost and ongoing maintenance costs for each improvement was

generated. Radio propagation coverage maps depicting predicted signal levels were also provided in this phase.

MCM has completed all tasks included in Phase 1 and Phase 2 of this project. Needs assessment surveys and interviews have been conducted, the data has been compiled, analyzed and incorporated in this report and the physical site surveys and equipment inventory have been completed and included as well.

KEY FINDINGS

Some key findings (based on frequency of response from agencies) from Phase 1 of the project include:

- Luzerne County does not have a county-wide radio system. It has a quilt work of systems cobbled together to make up the present system.

- The county's radio transmitters are "end of life" as of 2020.

- There are no standards currently in place for field user pager, portable, mobile or control station radio equipment. This has allowed non-public safety grade equipment to be used by field users.

- Preventive maintenance of field user equipment is lacking.

- Significant grounding and maintenance issues need to be addressed at the county radio sites.

- Immediate county-wide analog radio improvements are needed for EMA, EMS, fire and police agencies.

- A new P25, Phase II digital radio system is recommended for the long term future requirements for the county's EMA, EMS, fire and police agencies.

- There is an underlying desire and need for interoperability among the users, bordering counties and Commonwealth agencies.

- Radio coverage is inconsistent for many areas and non-existent for some areas of the county.

- Co-channel interference issues are a major concern to many agencies operating on several police zones.

- Users of the system desire improved portable and mobile radio coverage.

- Portable in building coverage is a perceived issue almost everywhere.

- Numerous public safety agencies use their own "operations" channels that are not monitored in the 911 center.

- Users of the system expressed concern over issues in dispatching during high call volume times.

- An additional dispatcher is needed during times of high call volume and during large-scale incidents and weather emergencies.

- The City of Wilkes-Barre holds the license for their frequencies while the county provides and maintains the equipment but does not control the site.

- Non-county and non-public safety entities are currently co-located on county sites but do not pay rent for their tower or shelter space.

- Co-located non-county owned paging equipment is causing interference with county owned equipment.

- Co-location interference agreements need to be implemented for all county sites.

- Lack of funding for capital and ongoing cost is the number one financial concern of both users and non-users of the system.

Details about the key findings listed above provide insight into the needs assessment surveys and interviews can be found in subsequent sections of this report.

It must be noted that all agencies MCM surveyed and interviewed during this phase of the project were extremely receptive to the goal of the project and were very responsive and helpful. Everyone involved is committed to improving the service they provide to their constituents as well as the safety of their personnel and view this undertaking as a critical step in the process of improvement.

MCM Consulting Group, Inc. is recommending a two phase approach to system improvements:

Phase I

Immediate county-wide analog radio improvements are recommended for the system to reach just the basic level of a public safety radio system. These include but are not limited to, co-location interference agreements need to be implemented for all county sites, upgrade grounding to R56 standards or similar standard, implement security at the tower sites, implement proper practices for installation of antennas, lines, multicouplers and combiner systems, realign the FCC licenses to eliminate co-channel interference, add simulcast transmissions county-wide, realign the current police and fire zones to allow for the addition of a repeated operations channel and separate EMS and fire dispatch channels, and implement minimum standards for field user equipment (pagers, portable and mobile radios).

MCM also recommends that the current non-licensed analog microwave system be replaced with a digital Multiprotocol Label Switching (MPLS) microwave "ring" system with ring protection that would be required to link the operational zones. The system must be ethernet capable and have a minimum bandwidth of 150 mbps for the new system. The selected vendor for this project would be responsible for a complete "turnkey" job to include path surveys, equipment selections and FCC licensing. If funding is not available for the new microwave system during the phase I improvements, then these improvements should be included in phase II of the project.

All improvements completed in phase I will be provisioned to be reused in phase II.

Phase II

Based on the availability of VHF frequencies, unify the radio communications of all "county responsible" entities onto one "platform" or radio frequency band by recommending a VHF, IP based, P25 phase II (for spectrum capacity) "trunked" (for spectrum efficiency) multi zone "simulcast" (for coverage)" configuration.

MCM recommends that the county purchase the initial portable and mobile radios and pagers for the public safety agencies following the formula listed on page 54 of this report.

Finally, MCM recommends that the current Zetron ACOM radio console system be upgraded to Zetron IP based ACOM Novus console system. The new system would be warrantied to be compatible with the existing and the new radio system equipment.

MCM appreciates this opportunity to assist Luzerne County in developing its plan for improvements to the current system and for the future next generation radio system.

BACKGROUND AND INTRODUCTION

Luzerne County retained MCM in June of 2015 to complete a two phase contract designed to:

1. Review the existing radio communication system network.
2. Assist key stakeholders with prioritizing needs and requirements
3. Recommend potential solutions to migrate their current radio system(s) to a single band, next generation radio network and to improve interoperability & radio network performance.

The Luzerne County Executive and the county council have shown their support for their residents and public safety agencies by approving the ACT12 surcharge to support 9-1-1 through monthly contributions included in their telecommunications service bill. The revenues generated by these surcharges, as well as county general fund monies are used to fund capital improvements as well as offset operating expenses.

A key goal of the needs assessment and strategic plan project is to match the highest priority needs to the potential available funding. Based upon results of the needs assessment surveys & interviews, site surveys and discussions with agency stakeholders, a final plan has been developed that maximizes the use of potential available funds to improve the radio communication system network. The results of this project will also serve to build a framework for future funding requirements and an evolutionary network improvement plan. All involved parties recognize that current funding sources are not sufficient to accomplish completing all of the improvements at the same time, so an incremental, prioritized, multi-phased approach was called for.

The 911 center is an entity within the 911 department and provides 9-1-1, non-emergency and administrative call taking and dispatch for its residents, visitors, fire, police, EMA, EMS and numerous county agencies throughout the county.

For normal day-to-day operations the 911 center currently relies upon the use of numerous VHF channels to dispatch and support fire, law enforcement, EMS agencies and EMA throughout the county.

The 911 center currently has a budgeted staff of 97 including:

Number of Positions	Title of Position
1	911 Executive Director
1	PSAP Manager
1	Data and Technical Support Manager
1	Lead PSAP Supervisor
1	Quality Assurance and Training Coordinator
1	Training & Protocol Supervisor
1	QA/Policy & Procedure Supervisor
1	CAD/GIS Supervisor
1	Data Mapping Specialist
1	Technical Support Supervisor
1	Technical Support Supervisor (part time)
1	Technical Support Specialist
1	Data Entry/CLEAN Clerk
9	Shift Supervisors
33	Telecommunicator Specialists
32	Telecommunicators
8	Call takers (part time)
1	Executive Administrative Assistant
1	Clerk Typist III

Normal shift staffing of the 911 center consists of three shifts, 07:30 – 15:30, 15:30 – 23:30 and 23:30 – 07:30 of approximately 20 telecommunicators on the daylight and afternoon shifts and 18 on the midnight shift with an average shift strength of 12 telecommunicators 07:30 – 23:30 and 10 telecommunicators 23:30 – 07:30, including 2 shift supervisors (23:30 – 07:30 will maintain a shift compliment of 11 telecommunicators on Friday and Saturday) including a minimum of 1 shift supervisor per shift. Monday through Friday, excepting holidays, during regular business office hours the staff is complimented by the PSAP manager.

Telecommunicators are typically assigned the following dedicated duties as staffing, call volume and call type allow:

• 4 Dedicated call takers on day shift, 3 on 3rd shift
• 5 Law enforcement dispatchers
• 3 EMS/fire dispatchers on day shift, 2 on 3rd shift
• 1 Shift supervisor (3 short)

The 9-1-1 center is physically located in the Luzerne County 911 facility, 100 Young Street, Hanover Township, PA 18706. The county has 19 main positions in the 911 center and 6 training positions. The current configuration of the dispatch center includes:

• 6 Call taker positions
• 5 Law enforcement dispatch positions (6 if Hazleton is available, usually on weekends.)
• 3 Back up positions
• 4 EMS/fire dispatch positions
• 1 Shift supervisor position
• 6 Training positions

Megan Hannon has responsibility for the day-to-day operation of the Luzerne County 911 center. Megan reports to the Executive Director, Fred Rosencrans. Director Rosencrans reports to the Operational Services Director.

Standard Operating Guidelines (SOG's) are used by the 911 center staff to perform their duties. The county recently signed a contract to have the SOG's evaluated and rewritten as necessary.

Multiple backup power systems are located in the facility and provide electrical service to the 911 center equipment as well as other parts of the facility in the event of a commercial power outage. It should be noted that the county has a UPS installed in the equipment room to provide backup power to the 911 center while the generator comes up to speed.

Luzerne County operates VHF 150-160 MHz frequencies located on 13 primary transmission/receive sites and uses two licensed and numerous unlicensed microwave links for connectivity to its sites. The county is licensed for the UHF MED channels but does not currently use them on a day to day basis.

It should be also noted that remediation work needs to be done at almost all of the Luzerne County tower and transmission sites.

Various frequencies and equipment are located at each site. Please see the individual site surveys in Appendix 7 for specific frequency and equipment inventory.

For more details about the physical infrastructure that makes up the 911 radio communication system network, please see Appendix 7 to this report as well as the physical site survey reports.

MCM personnel conducted needs assessment surveys and interviews from October 6, 2015 through October 29, 2015. The majority of the interviews were conducted face-to-face with participating agencies at various sites throughout the county. Phone interviews were used for those who could not attend an interview in person. A total of all agencies interviewed are included in later sections of this report. A copy of the questionnaire used to collect interview data is included in Appendix 6 to this report.

Once the interviews were completed, the data was compiled and a statistical model was developed to tabulate and sort the data elements. This allowed MCM to analyze the data in unique ways according to type of agency and geographic location of agency. From these assumptions a plan for the immediate, short, medium and long term can be developed and obstacles can be identified.

This report is the deliverable for Phase 1 of this project. The data and observations contained in this report were also used to complete Phase 2 of the project. Phase 2 includes recommendations and potential design scenarios along with their corresponding budgetary estimates.
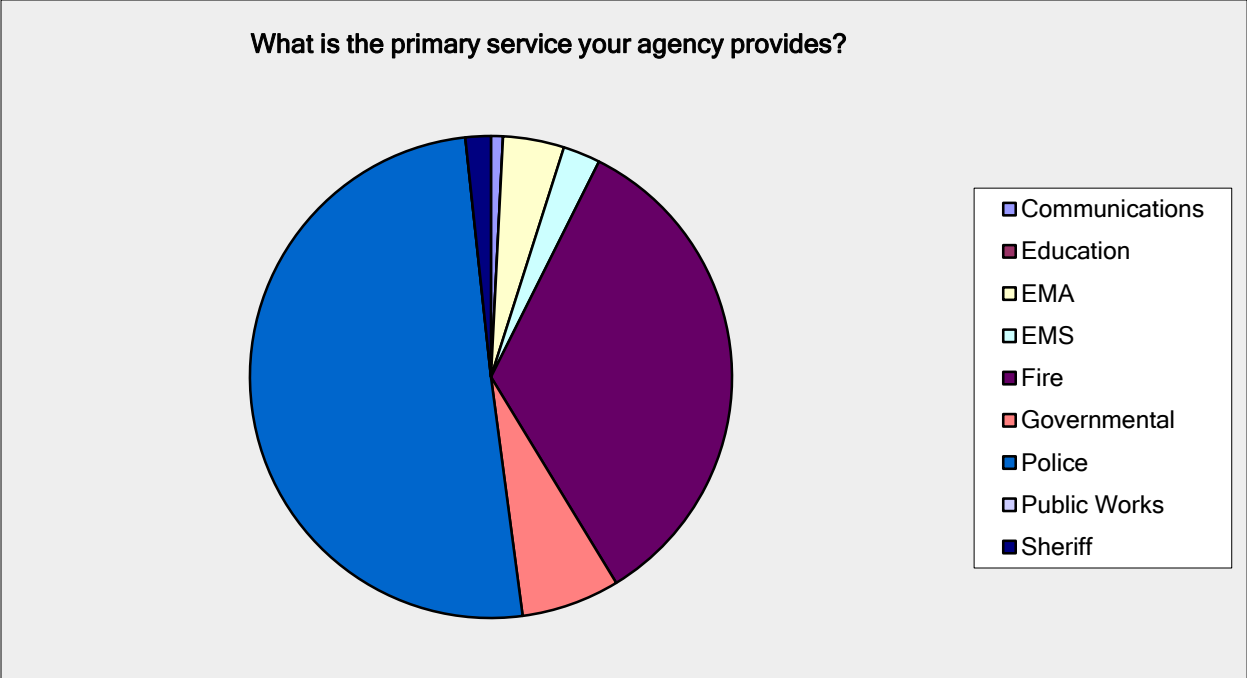
SECTION 1 – Needs Assessment Summary
Introduction

The needs assessment surveys and interviews were performed October 6, 2015 through October 29, 2015. The face-to-face interview sessions (telephone interviews were used for those who could not attend the interview sessions) were very productive in terms of gathering detailed, specific information directly from agency personnel who use or would like to use the Luzerne County radio system network on a daily basis. Participants were eager to provide as much information as possible as they understand the importance of the outcome of this project as it relates to aiding them in performing their duties efficiently and safely.

The interview form used to collect data from participating agencies was developed after MCM met with the project committee to discuss their goals for the project and after collecting some historical background concerning the network. The information set was designed to collect pertinent data that would shed light on real world issues agencies face when using the network and to allow realistic design scenarios to be developed to improve the network. A copy of the interview form is included in Appendix 6 to this report.

A total of 121 agencies/users were either surveyed or interviewed throughout the county. Agencies/users were from the follow groups:

What is the primary service your agency provides?		
Answer Options	Response Percent	Response Count
Communications	0.8%	1
Education	0.0%	0
EMA	4.1%	5
EMS	2.5%	3
Fire	33.9%	41
Governmental	6.6%	8
Police	50.4%	61
Public Works	0.0%	0
Sheriff	1.7%	2
	answered question	121

What is the primary service your agency provides?

Legend:
- Communications
- Education
- EMA
- EMS
- Fire
- Governmental
- Police
- Public Works
- Sheriff

There were a number of common themes that emerged during the process of collecting data from all of the agencies.

The following sections provide details from responses to each area of the questionnaire. Interview data was compiled and a database was developed to sort and analyze the data elements for each section. Data was sorted by agency type. Where applicable, rating data was averaged by agency type and location to reveal any underlying trends.

Needs Assessment Survey Form Section Results

Highlights of the results from each section of the needs assessment survey will be presented in this portion of the report. Summary statistics in graph form are included where applicable.

Part 1: Usage and Interoperability

This section of the interview was designed to capture background information about the agency being interviewed such as services provided, area served, mutual aid responsibilities and interoperability requirements. Interoperability requirements with local, county, state and federal agencies were defined. Every agency provides a level of mutual aid to neighboring municipalities and in the instance of agencies located near county borders, the neighboring county as well. For example, the Commonwealth of Pennsylvania uses an 800 MHz network for all of their dispatch communications. With the exception of the 911 center and EM, Luzerne County agencies have limited 800 MHz capabilities; therefore, an inter-band solution (Inter-RF Subsystem Interface (ISSI) Gateway) would be needed for seamless interoperability.

The following charts depict interoperability tabulated results obtained in this section:

Typical interoperability requirements:

Interview Section 1, Question 6

What are your most typical interoperability requirements? Check all that apply.		
Answer Options	Response Percent	Response Count
Local	91.4%	106
County	73.3%	85
State	37.9%	44
Federal	13.8%	16
answered question		116

What are your most typical interoperability requirements? Check all that apply.
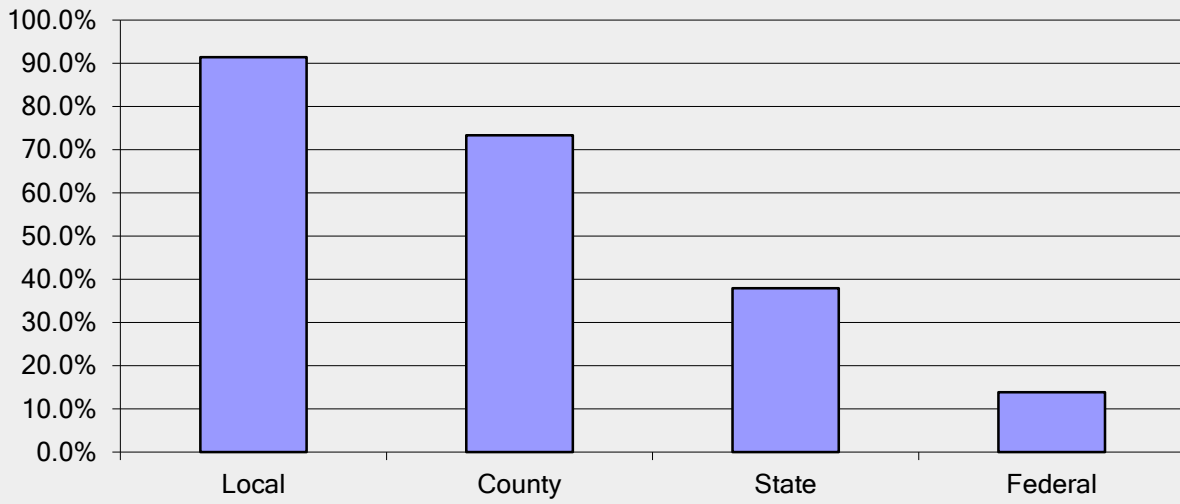
Typical interoperability requirements:

Interview Section 1, Question 7

Answer Options	Response Percent	Response Count
Daily	17.5%	20
Event	53.5%	61
Both	28.9%	33
	answered question	114

Do you have any ongoing, daily interoperability requirements or are they event based needs?

Legend:
- Daily
- Event
- Both
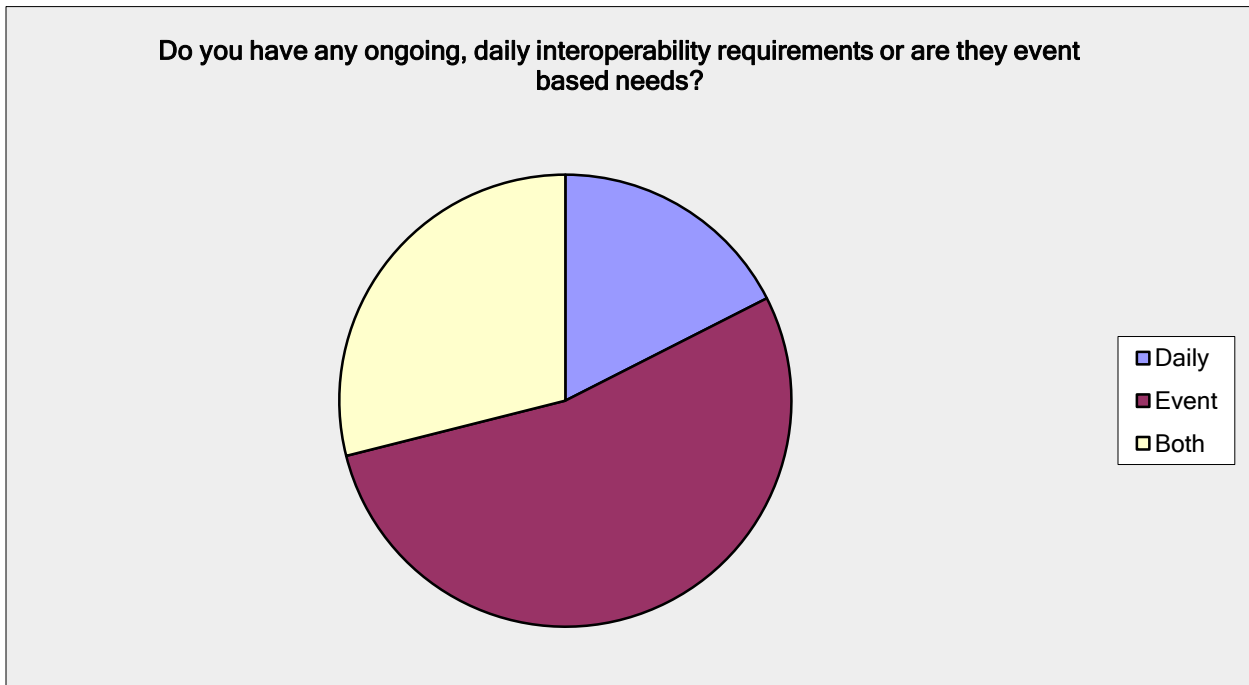
Part 2: Current Equipment Inventory in Use

This section of the interview form was used to collect data describing the communication radio system network equipment used by each agency. Important data elements collected include the quantity, type and age of equipment being used. Any network-based solution must consider the impact on the equipment being used by all agencies in the county. The cost to replace or upgrade portable, mobile and base radios already in use can be a major issue when deciding what type of network infrastructure upgrades or improvements are feasible. Equipment age is also a factor because some older models of equipment are not capable of being upgraded or expanded.

Radio channels used by each agency were also documented, including "private" or "secondary" channels. A number of agencies have and use their own secondary channels. Also, there are a limited number of cell phones in use to aid in communications capacity and interoperability between agencies.

Secondary channels, unless maintained by the 911 center and cell phones, are acceptable to use for interdepartmental communications, however they are not considered acceptable for emergency communications.

This solution may provide adequate interoperability on a daily basis if no major incident occurs. In the event of a major event of any kind the cell network will quickly become overloaded and prove to be useless to agencies in the county. In discussions with residents and users and from our experience traveling the county, cellular coverage is not universal. Realistically, from the standpoint of the cellular carriers the population base in rural areas drives their allocation of resources and unfortunately it is unrealistic to anticipate significantly more assets being deployed in the region that would increase coverage or capacity.

The following charts depict the type of equipment tabulated average results obtained in this section:
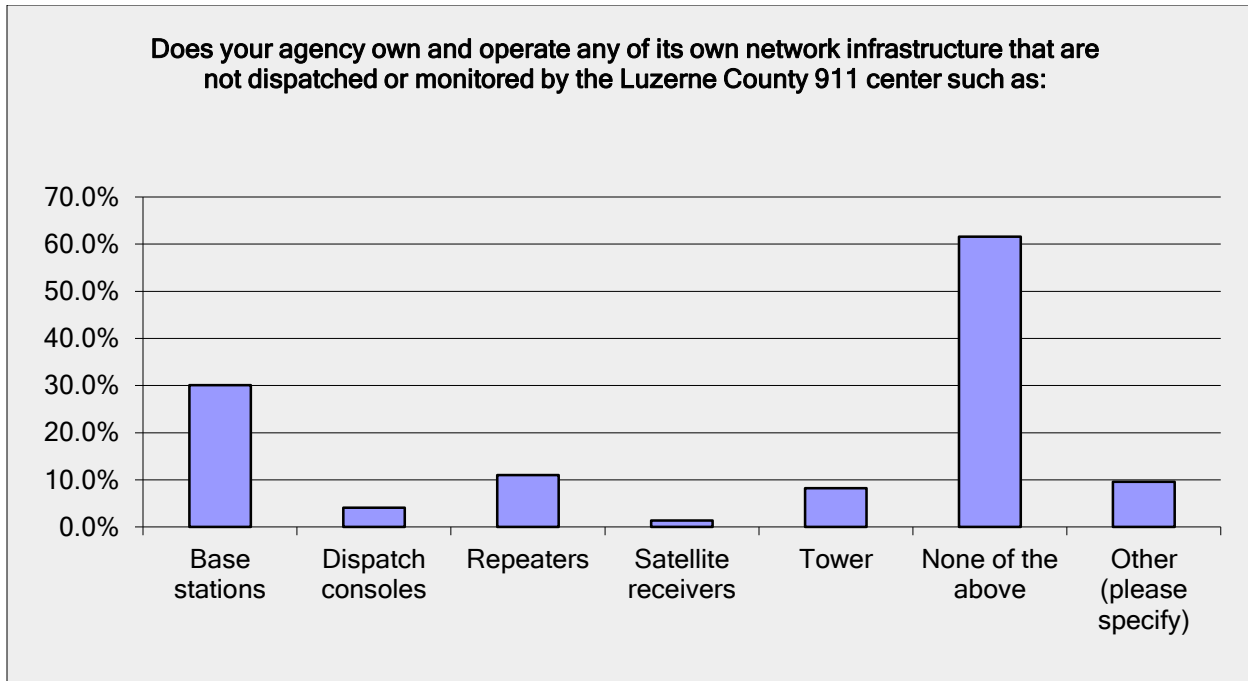
Current Inventory in Use:

Interview Section 2, Question 8

Please provide the quantity of all the listed communications devices utilized by personnel within your agency. [A separate inventory list of all two way radios (mobile and portable) and pagers including manufacturer, model number, age and number of units will be required in Appendix A]			
Answer Options	Response Average	Response Total	Response Count
Two Way Radio - Mobile	7.96	629	79
Two Way Radio - Portable	19.65	1,552	79
Pager	12.53	990	79
Conventional Cell	1.30	103	79
Commercial Pager	.19	15	79
Mobile Data Terminal	4.95	391	79
Laptop (CDPC, GSM, CDMA data)	.91	72	79
Blackberry, Droid, IPhone	2.18	172	79
PTT Cell (Nextel)	.01	1	79
Other (description and quantity)	.59	47	79
		answered question	79

Current Inventory in Use

Interview Section 2, Question 10

Does your agency own and operate any of its own network infrastructure that are not dispatched or monitored by the Luzerne County 911 center such as:		
Answer Options	Response Percent	Response Count
Base stations	30.1%	22
Dispatch consoles	4.1%	3
Repeaters	11.0%	8
Satellite receivers	1.4%	1
Tower	8.2%	6
None of the above	61.6%	45
Other (please specify)	9.6%	7
	answered question	73

Does your agency own and operate any of its own network infrastructure that are not dispatched or monitored by the Luzerne County 911 center such as:

Bar chart showing percentages for the following categories:
- Base stations: ~30.0%
- Dispatch consoles: ~4.0%
- Repeaters: ~11.0%
- Satellite receivers: ~1.5%
- Tower: ~8.0%
- None of the above: ~61.0%
- Other (please specify): ~9.5%

Y-axis ranges from 0.0% to 70.0% in 10.0% increments.

Part 3: Radio Network Coverage and Capacity

Section 3 captures information relating to the quality of service (QoS) and capacity provided by the radio portion of the communication system network. Participants were asked to rate the coverage and capacity of the network in terms of pagers, mobile and portable radios. The number of radio channels available for their use during normal daily operations as well as emergency/disaster situations was also surveyed. The rating scale was from 1 to 5 (1 – Poor; 3 – Average; 5 – Excellent).
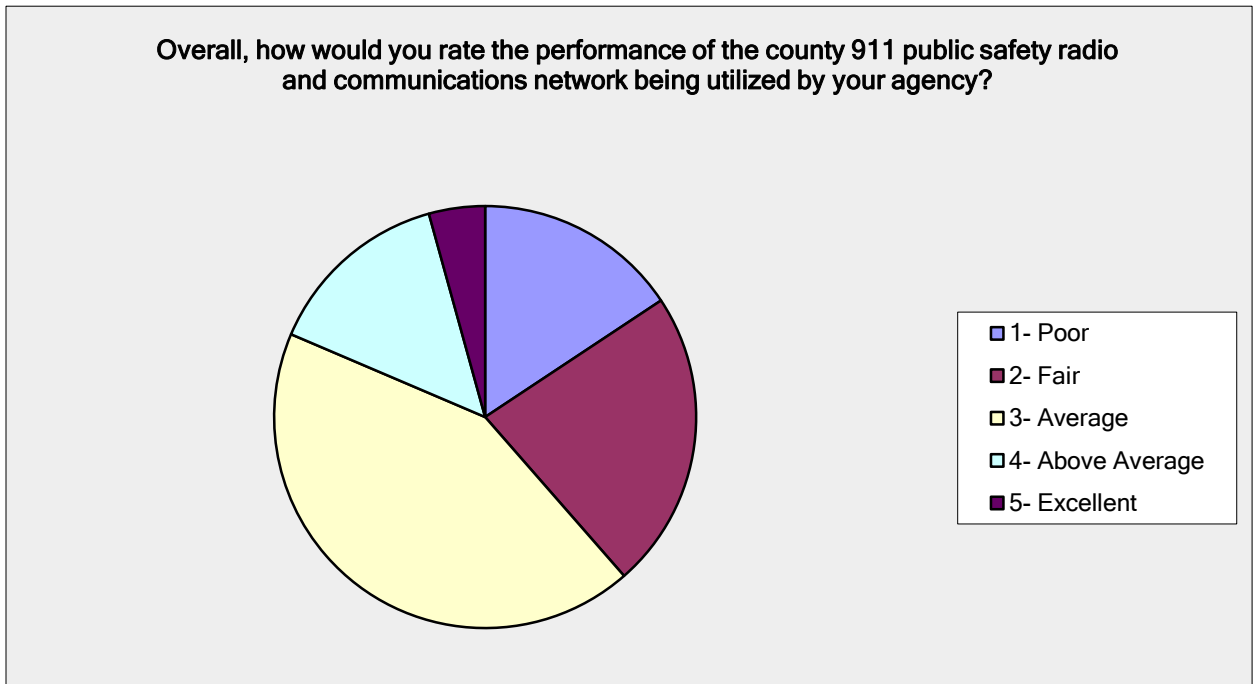
If participants felt more channels were needed, they were asked to describe the quantity of channels and how they would use the channels. Any additional channels would have a direct impact on the capacity needed for a future radio and microwave system.

The following charts depict some of the tabulated results in regard to system capacity obtained in this section:

Performance of the System:

Interview Section 3, Question 12

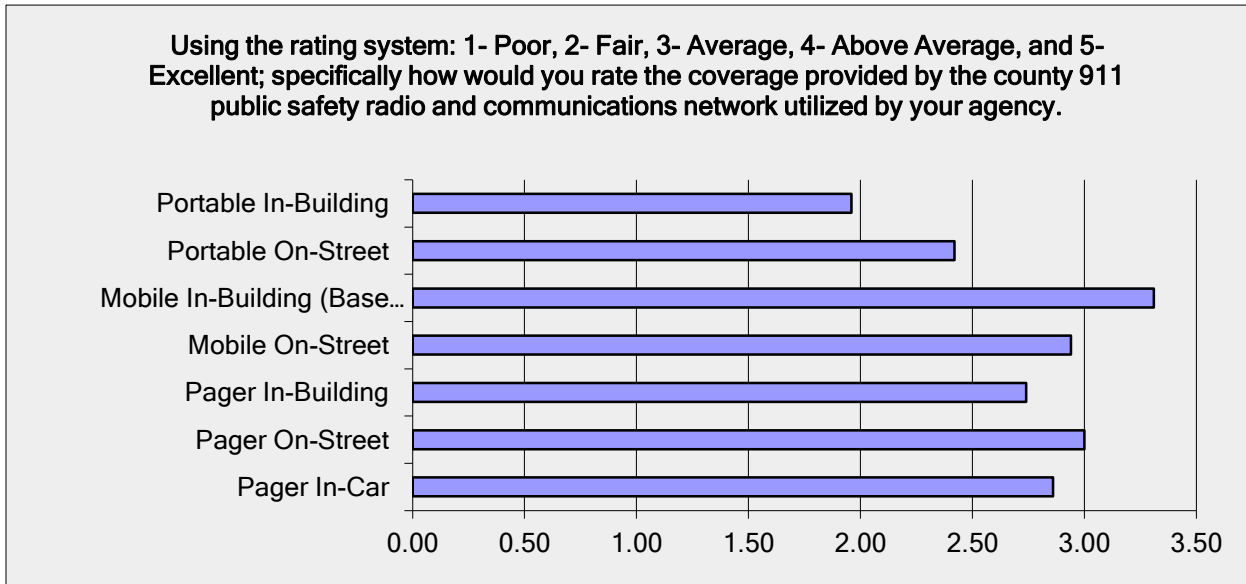| Overall, how would you rate the performance of the county 911 public safety radio and communications network being utilized by your agency?		
Answer Options	Response Percent	Response Count
1- Poor	15.7%	11
2- Fair	22.9%	16
3- Average	42.9%	30
4- Above Average	14.3%	10
5- Excellent	4.3%	3
answered question		70

Interview Section 3, Question 13

Each participant was also asked to rate the quality of the coverage provided by the network for mobile, portable and pager units. The rating scale was from 1 to 5 (1 – Poor; 3 – Average; 5 – Excellent).
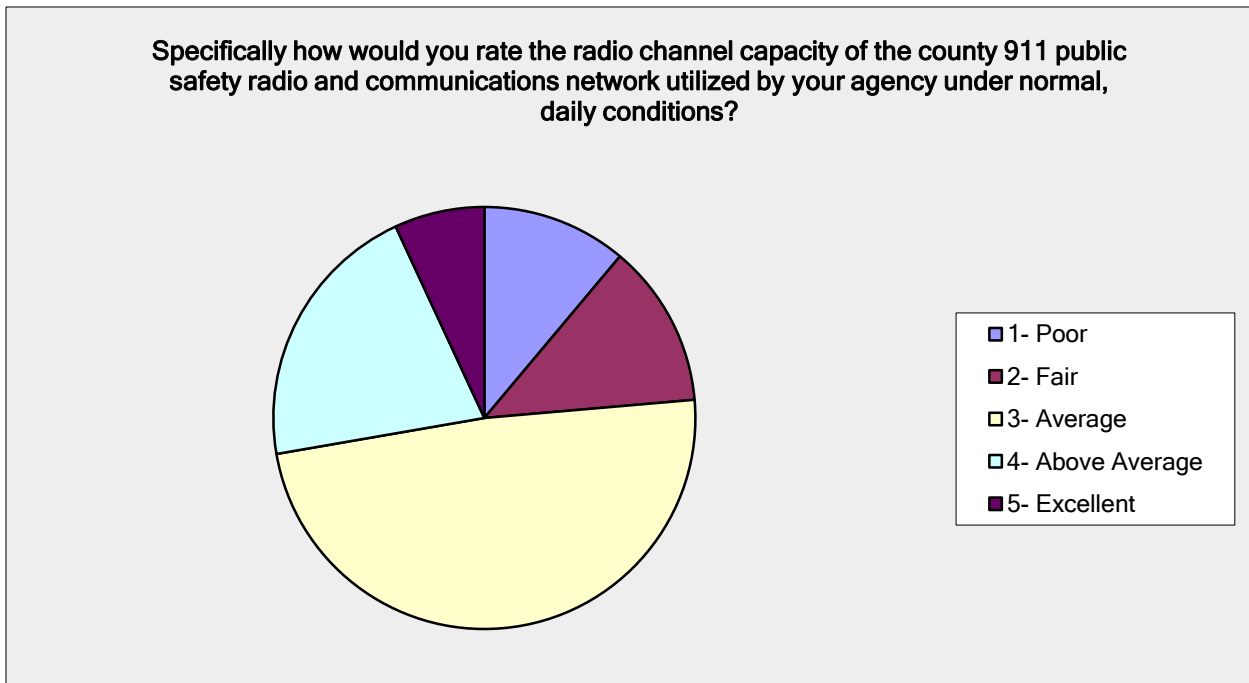
Using the rating system: 1- Poor, 2- Fair, 3- Average, 4- Above Average, and 5- Excellent; specifically, how would you rate the coverage provided by the county 911 public safety radio and communications network utilized by your agency.							
Answer Options	Poor	Fair	Average	Above Average	Excellent	Rating Average	Response Count
Pager In-Car	12	9	35	9	7	2.86	72
Pager On-Street	11	4	39	10	8	3.00	72
Pager In-Building	12	14	34	5	7	2.74	72
Mobile On-Street	6	14	37	8	7	2.94	72
Mobile In-Building (Base Station)	1	9	39	13	10	3.31	72
Portable On-Street	17	22	22	8	3	2.42	72
Portable In-Building	30	23	12	6	1	1.96	72
						answered question	72

Using the rating system: 1- Poor, 2- Fair, 3- Average, 4- Above Average, and 5- Excellent; specifically how would you rate the coverage provided by the county 911 public safety radio and communications network utilized by your agency.

Radio Channel Capacity Normal Conditions:

Interview Section 3, Question 22

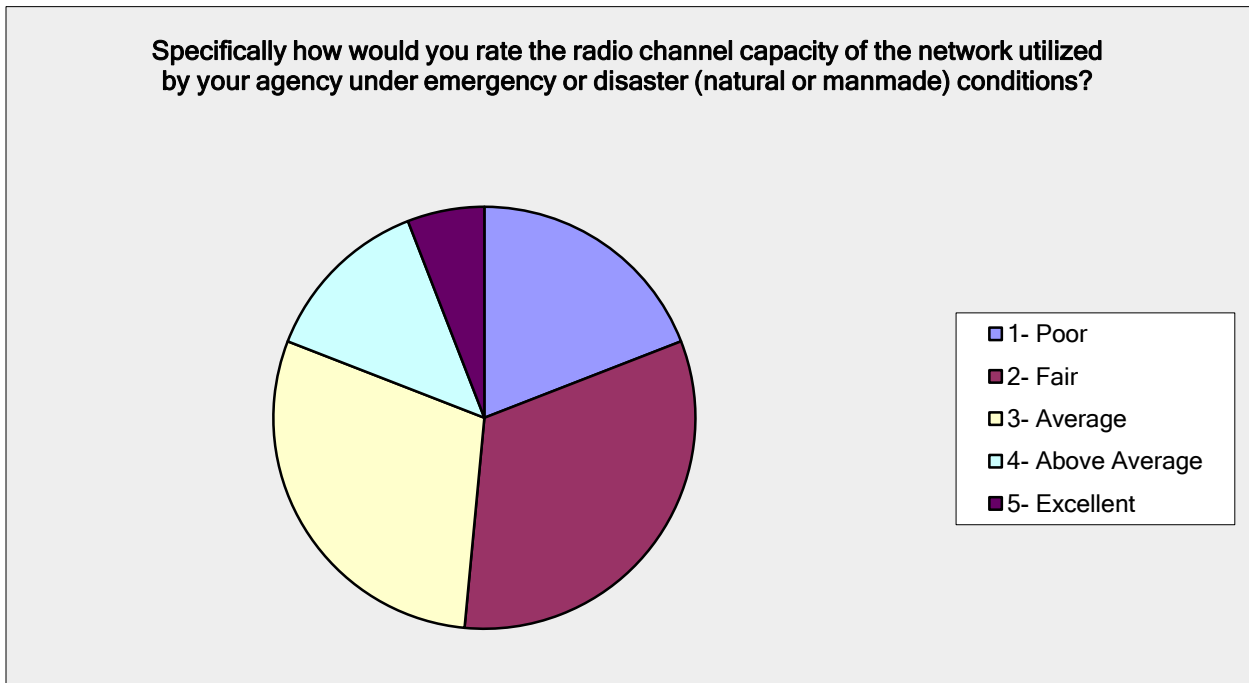| Specifically, how would you rate the radio channel capacity of the county 911 public safety radio and communications network utilized by your agency under normal, daily conditions?		
Answer Options	Response Percent	Response Count
1- Poor	11.1%	8
2- Fair	12.5%	9
3- Average	48.6%	35
4- Above Average	20.8%	15
5- Excellent	6.9%	5
answered question		72

Specifically how would you rate the radio channel capacity of the county 911 public safety radio and communications network utilized by your agency under normal, daily conditions?

- 1- Poor
- 2- Fair
- 3- Average
- 4- Above Average
- 5- Excellent

Radio Channel Capacity Emergency Conditions:

Interview Section 3, Question 23

Specifically, how would you rate the radio channel capacity of the network utilized by your agency under emergency or disaster (natural or manmade) conditions?		
Answer Options	Response Percent	Response Count
1- Poor	19.1%	13
2- Fair	32.4%	22
3- Average	29.4%	20
4- Above Average	13.2%	9
5- Excellent	5.9%	4
answered question		68

Specifically how would you rate the radio channel capacity of the network utilized by your agency under emergency or disaster (natural or manmade) conditions?

- □ 1- Poor
- ■ 2- Fair
- □ 3- Average
- □ 4- Above Average
- ■ 5- Excellent

Part 4: Network Functions and Capabilities

This portion of the interview was meant to collect data relating to functions and capabilities currently provided by the existing radio communications system network and what functions or capabilities participants felt were most lacking. This is an important data point that will be used to help identify and prioritize the amount of capacity the new microwave system will require.

Existing Network Functions and Capabilities Normal Conditions:

Section 4, Question 25

What existing county 911 public safety radio and communications network functions and/or capabilities do you find most useful in your daily operations? Check as many as apply:		
Answer Options	Response Percent	Response Count
Automatic Vehicle Locators (AVL)	18.6%	13
Hand Held Computers (PDA's, etc.)	4.3%	3
Mobile Data Computers/Terminals (MDC/MDT)	60.0%	42
Radio Identifiers	52.9%	37
Simplex Dispatch Channel	8.6%	6
Repeated Dispatch Channel	40.0%	28
Simplex Operations Channel	8.6%	6
Repeated Operations Channel	32.9%	23
Separate Dispatch and Operation Channels	35.7%	25
Tactical Repeaters (on scene)	12.9%	9
In Vehicle Repeaters	5.7%	4
Silent Dispatch	10.0%	7
Fire Station Siren	1.4%	1
Other (please specify)		5
answered question		70

Existing Network Functions and Capabilities Emergency Conditions

Section 4, Question 26

What existing County 911 public safety radio and communications network functions and/or capabilities do you find most useful in major emergency or disaster situations? Check as many as apply:		
Answer Options	Response Percent	Response Count
Automatic Vehicle Locators (AVL)	20.0%	14
Hand Held Computers (PDA's etc.)	8.6%	6
Mobile Data Computers/Terminals (MDC/MDT)	55.7%	39
Radio Identifiers	50.0%	35
Simplex Dispatch Channel	10.0%	7
Repeated Dispatch Channel	37.1%	26
Simplex Operations Channel	11.4%	8
Repeated Operations Channel	35.7%	25
Separate Dispatch and Operations Channels	37.1%	26
Tactical Repeaters (on scene)	14.3%	10
In Vehicle Repeaters	5.7%	4
Silent Dispatch	11.4%	8
Fire Station Siren	5.7%	4
Other (please specify)		5
answered question		70

Most Lacking Network Functions and Capabilities:

<u>Section 4, Question 27</u>

What functions or capabilities do you feel are most lacking in the existing county 9-1-1 public safety radio and communications network for either day-to-day or major emergency/disaster situations? Check as many as apply:		
Answer Options	Response Percent	Response Count
Automatic Vehicle Locators (AVL)	24.1%	13
Hand Held Computers (PDA's, etc.)	20.4%	11
Mobile Data Computers/Terminals (MDC/MDT)	33.3%	18
Radio Identifiers	33.3%	18
Simplex Dispatch Channel	13.0%	7
Repeated Dispatch Channel	24.1%	13
Simplex Operations Channel	11.1%	6
Repeated Operations Channel	44.4%	24
Separate Dispatch and Operation Channels	29.6%	16
Tactical Repeaters (on scene)	37.0%	20
In Vehicle Repeaters	46.3%	25
Silent Dispatch	9.3%	5
Fire Station Siren	1.9%	1
Other (please specify)		9
answered question		**54**

Most Useful Future Network Functions and Capabilities:

<u>Section 4, Question 28</u>

What functions or capabilities that you do not currently have that you feel would be useful in your department.		
Answer Options	Response Percent	Response Count
Automatic Vehicle Locators (AVL)	23.7%	14
Hand Held Computers (PDA's, etc.)	37.3%	22
Mobile Data Computers/Terminals (MDC/MDT)	37.3%	22
Radio Identifiers	23.7%	14
Simplex Dispatch Channel	5.1%	3
Repeated Dispatch Channel	10.2%	6
Simplex Operations Channel	6.8%	4
Repeated Operations Channel	35.6%	21
Separate Dispatch and Operation Channels	15.3%	9
Tactical Repeaters (on scene)	37.3%	22
In Vehicle Repeaters	42.4%	25
Silent Dispatch	6.8%	4
Fire Station Siren	1.7%	1

Emergency Notification Systems	35.6%	21
Other (please specify)		8
	answered question	59

Part 5: Reliability, Availability and Stability

In Section 5 of the interview, participants were asked to provide information rating the reliability, availability and stability of both the radio portion of the communications system network as well as the overall 911 network (including 911 center equipment infrastructure, personnel and SOP's). The rating scale was from 1 to 5 (1 – Poor; 3 – Average; 5 – Excellent).

They were also asked to describe any performance degradation noticed during periods of high call volume and if they experience any operational problems in the last 3 years which may have been caused by a network outage or period of degraded performance. These questions were included to gain insight into the performance of the network from the actual user agency perspective.
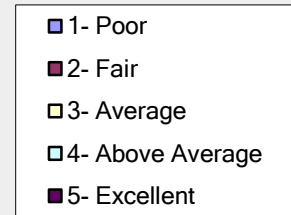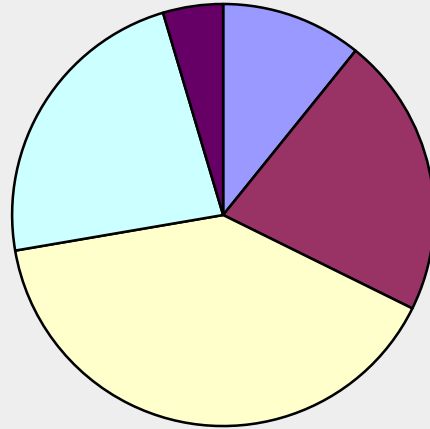
The following charts depict some of the tabulated results obtained in this section:

Reliability of the Network:

Interview Section 5, Question 29

Specifically, how would you rate the overall reliability of the county 911 public safety radio and communications network used by your agency?		
Answer Options	Response Percent	Response Count
1- Poor	10.8%	7
2- Fair	21.5%	14
3- Average	40.0%	26
4- Above Average	23.1%	15
5- Excellent	4.6%	3
	answered question	65

Specifically how would you rate the overall reliability of the county 911 public safety radio and communications network used by your agency?

- 1- Poor
- 2- Fair
- 3- Average
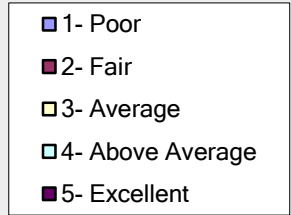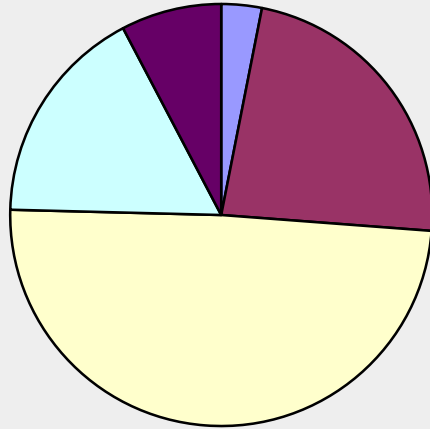- 4- Above Average
- 5- Excellent

Availability of the Network:

Interview Section 5, Question 30

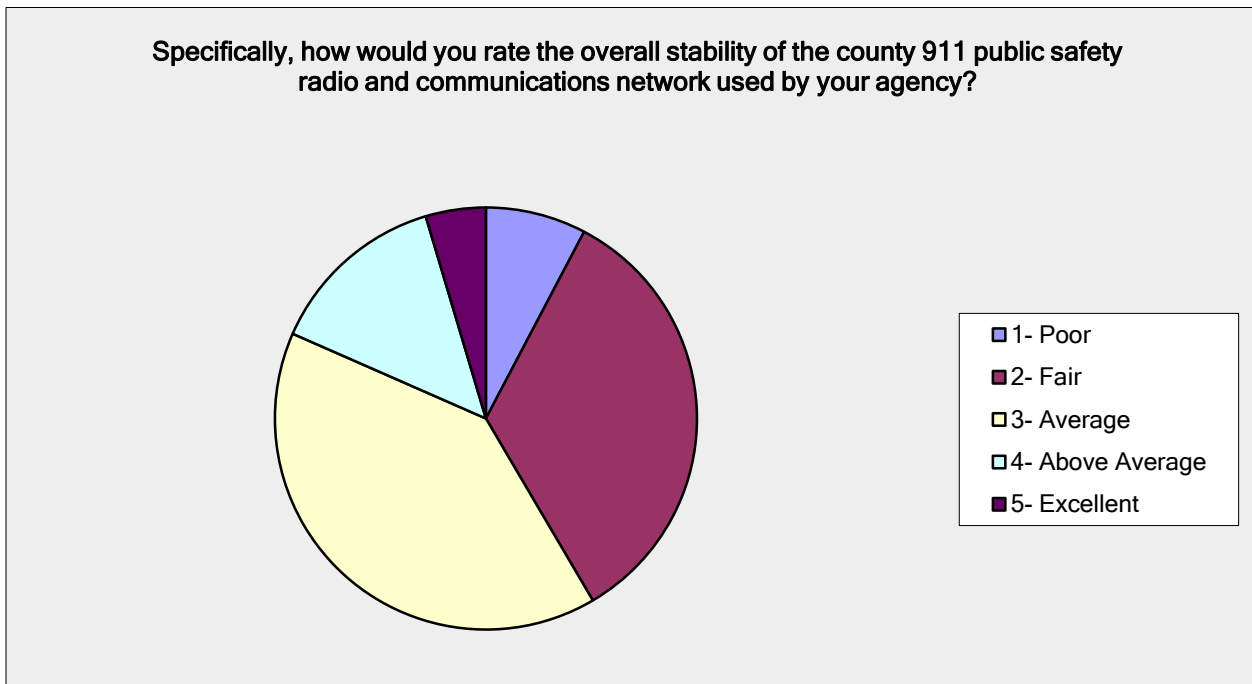| Specifically, how would you rate the overall availability of the county 911 public safety radio and communications network used by your agency?		
Answer Options	Response Percent	Response Count
1- Poor	3.1%	2
2- Fair	23.1%	15
3- Average	49.2%	32
4- Above Average	16.9%	11
5- Excellent	7.7%	5
answered question		65

Specifically how would you rate the overall availability of the county 911 public safety radio and communications network used by your agency?

Legend:
- 1- Poor
- 2- Fair
- 3- Average
- 4- Above Average
- 5- Excellent

Stability of the Network

Interview Section 5, Question 31

Specifically, how would you rate the overall stability of the county 911 public safety radio and communications network used by your agency?		
Answer Options	Response Percent	Response Count
1- Poor	7.7%	5
2- Fair	33.8%	22
3- Average	40.0%	26
4- Above Average	13.8%	9
5- Excellent	4.6%	3
	answered question	65

Specifically, how would you rate the overall stability of the county 911 public safety radio and communications network used by your agency?

- 1- Poor
- 2- Fair
- 3- Average
- 4- Above Average
- 5- Excellent

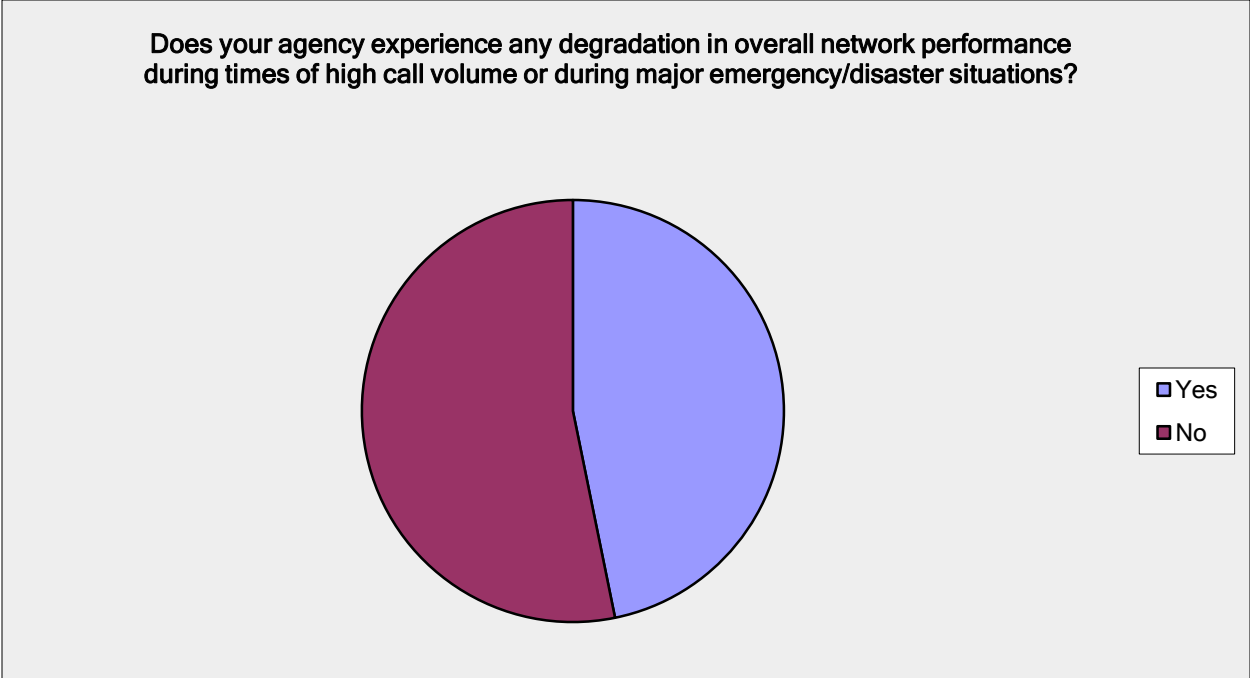# Part 6: Use in High Call Volume Situations

Section 6 was designed to gain further detailed insight into the types of difficulties users encountered during various operational scenarios that stress the capabilities of the 911 network beyond normal day-to-day operations. This information will help develop improvement plans. Participants were also asked if they had experienced difficulties in the past, could they, from their user perspective, attribute the difficulties to a particular area of the network. Looking at these issues from the user perspective and then comparing this input to the perspective from the 911 center staff can help reveal gaps between user needs and service provided.

The following charts depict some of the tabulated results obtained in this section:

Difficulties During High Call Volume:

Section 6, Question 38

Does your agency experience any degradation in overall network performance during times of high call volume or during major emergency/disaster situations?		
Answer Options	Response Percent	Response Count
Yes	46.8%	29
No	53.2%	33
If Yes (please provide a brief description)		28
answered question		62

Does your agency experience any degradation in overall network performance during times of high call volume or during major emergency/disaster situations?


Legend:
- ■ Yes
- ■ No

Unplanned Network Outages:
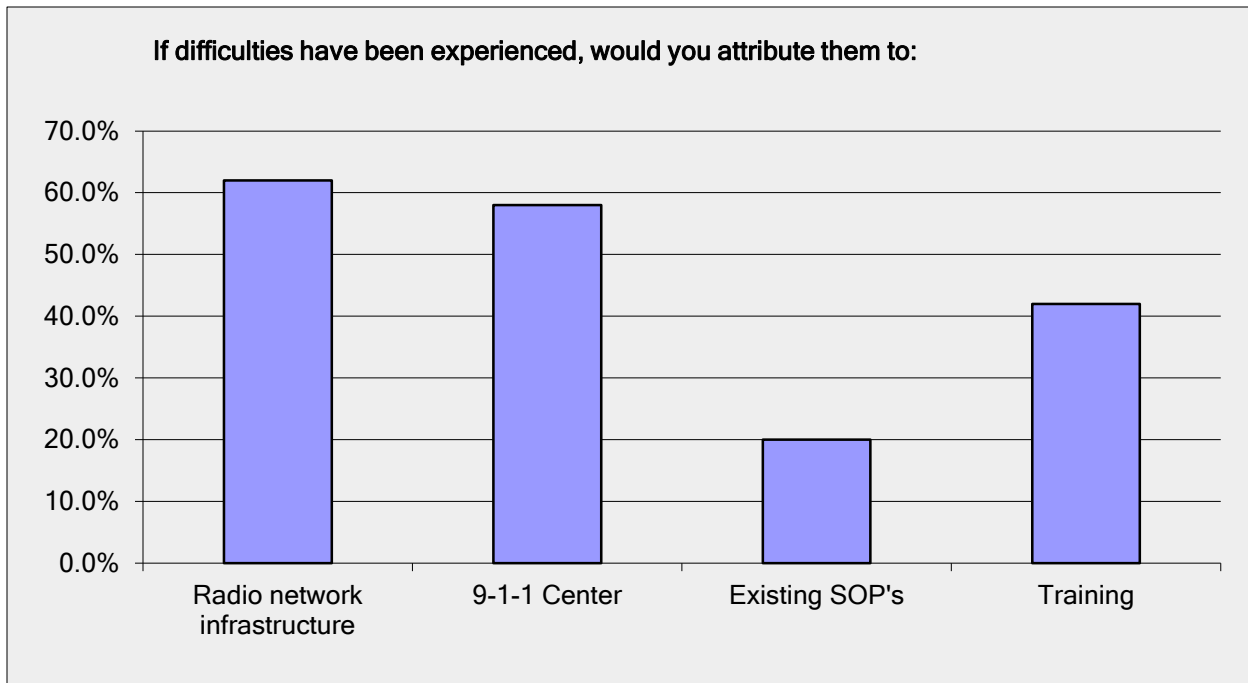
Section 6, Question 39

In the last 3 years has any unplanned network outage or performance degradation occurred which impaired your ability to be dispatched or respond appropriately to an emergency?		
Answer Options	Response Percent	Response Count
Yes	28.1%	18
No	71.9%	46
If Yes (please provide a brief description)		17
answered question		64

In the last 3 years has any unplanned network outage or performance degradation occurred which impaired your ability to be dispatched or respond appropriately to an emergency?
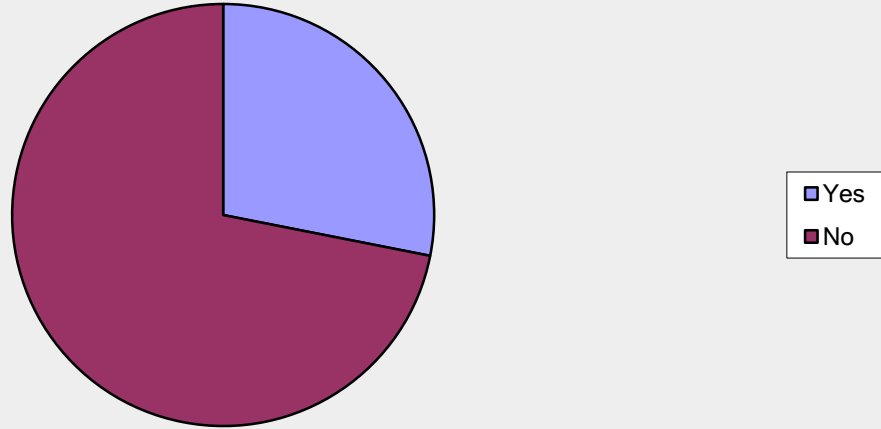
Reasons for Difficulty:

Interview Section 6, Question 42

If difficulties have been experienced, would you attribute them to:		
Answer Options	**Response Percent**	**Response Count**
Radio network infrastructure	62.0%	31
9-1-1 Center	58.0%	29
Existing SOP's	20.0%	10
Training	42.0%	21
Other factors? Please provide a brief explanation:		17
answered question		50

If difficulties have been experienced, would you attribute them to:

A bar chart showing four categories with their approximate percentages:
- Radio network infrastructure: ~62%
- 9-1-1 Center: ~58%
- Existing SOP's: ~20%
- Training: ~42%

The y-axis ranges from 0.0% to 70.0% in 10.0% increments.

Part 7: Maintainability of Network

Section 7 deals with maintenance issues related to field unit equipment elements in the network. Data collected here will help provide insight into equipment performance as it relates to operational readiness and potential quality of service (QoS) issues. Financial data was collected to be able to determine the amount of money being spent countywide on an annual basis to keep equipment in an operationally ready state. This can also reveal problems caused by aging equipment.

The data reveals that the majority of the users of the system do not have a preventive maintenance program or service agreements in place. They use what is termed in the industry as a PPU (pay per use) agreement or have no agreement in place at all. This is cost effective only if a budget fund is maintained by the departments for large unexpected repair expenses. We recommend each pager, mobile and portable radio has preventive maintenance once a year.

Pagers and portable radios were the equipment named most often to be in need of repair or maintenance.
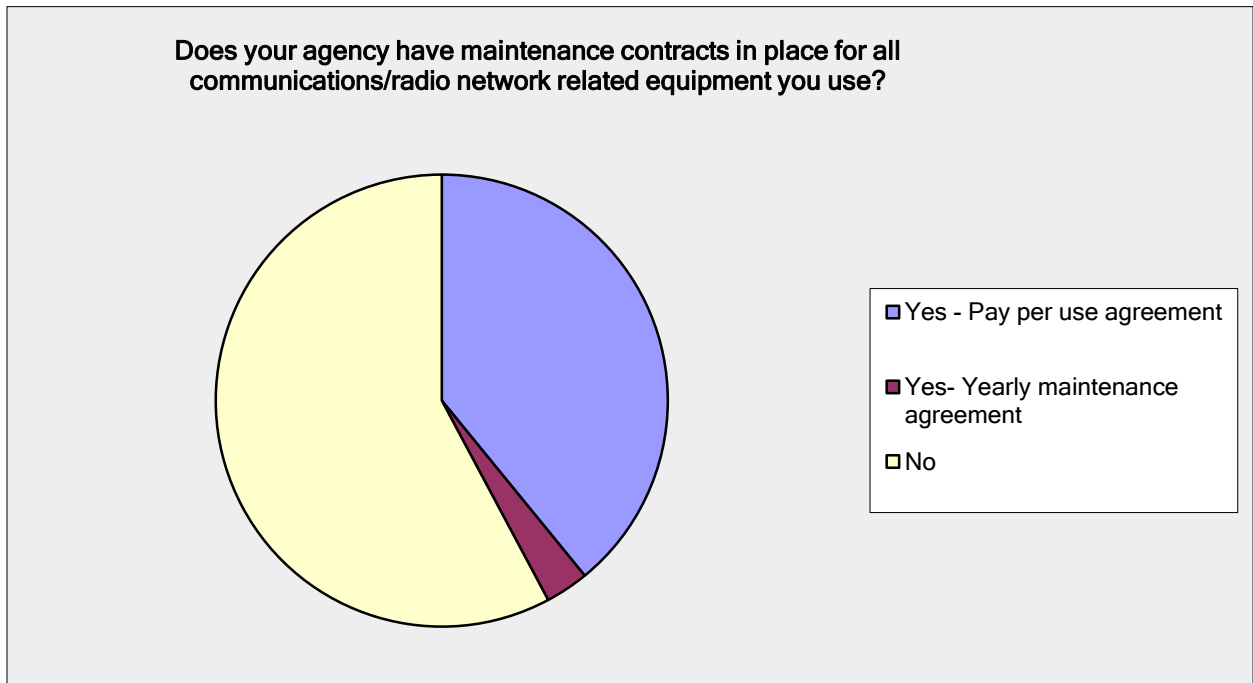
The majority of the users of the system were overall satisfied with the service they received from their two-way radio dealers.

The following charts depict some of the tabulated results obtained in this section:

Maintenance Contracts in Place:

Section 7, Question 43

Does your agency have maintenance contracts in place for all communications/radio network related equipment you use?		
Answer Options	Response Percent	Response Count
Yes - Pay per use agreement	39.1%	25
Yes- Yearly maintenance agreement	3.1%	2
No	57.8%	37
answered question		64

Does your agency have maintenance contracts in place for all communications/radio network related equipment you use?

- Yes - Pay per use agreement
- Yes- Yearly maintenance agreement
- No

Equipment with Most Frequent Maintenance Needs:

Section 7, Question 45

Which network equipment requires the most frequent maintenance routines?		
Answer Options	Response Percent	Response Count
Base Stations	5.5%	3
Pagers	32.7%	18
Portable Radios	61.8%	34
Mobile Radios	21.8%	12
MDC/MDT's	23.6%	13
Siren Control	0.0%	0
Other (please list)		0
	answered question	55

Which network equipment requires the most frequent maintenance routines?
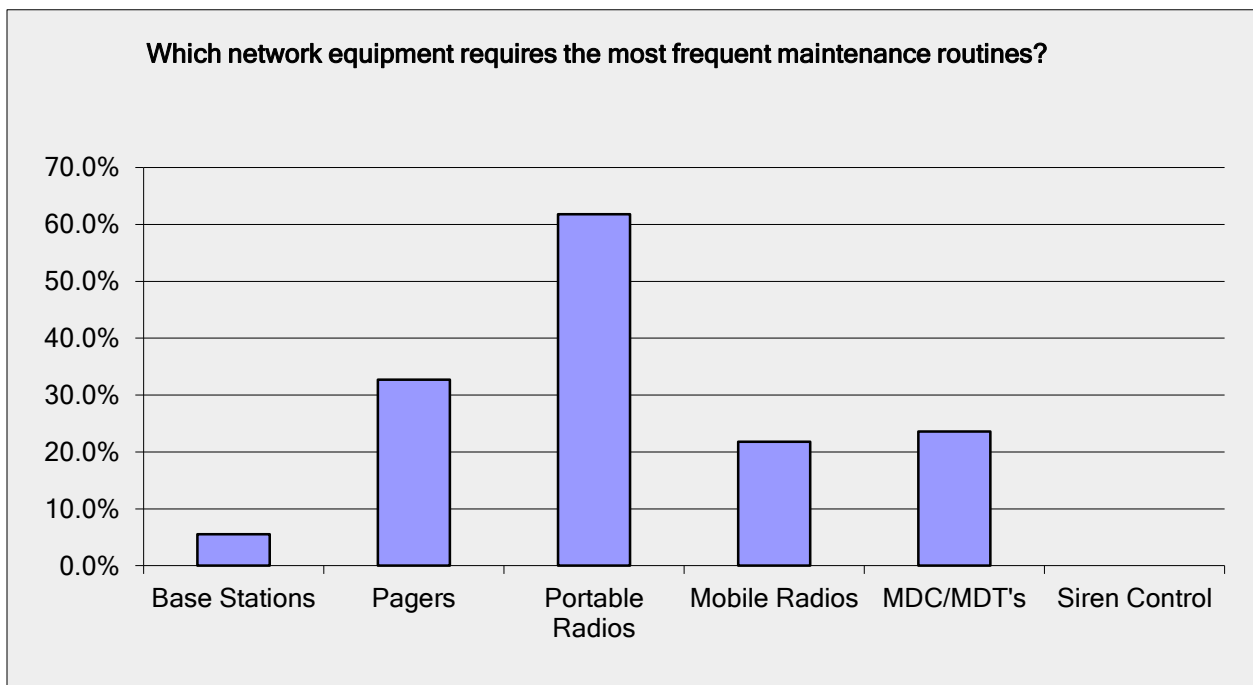
Responsiveness of Maintenance Providers:

Section 7, Question 49

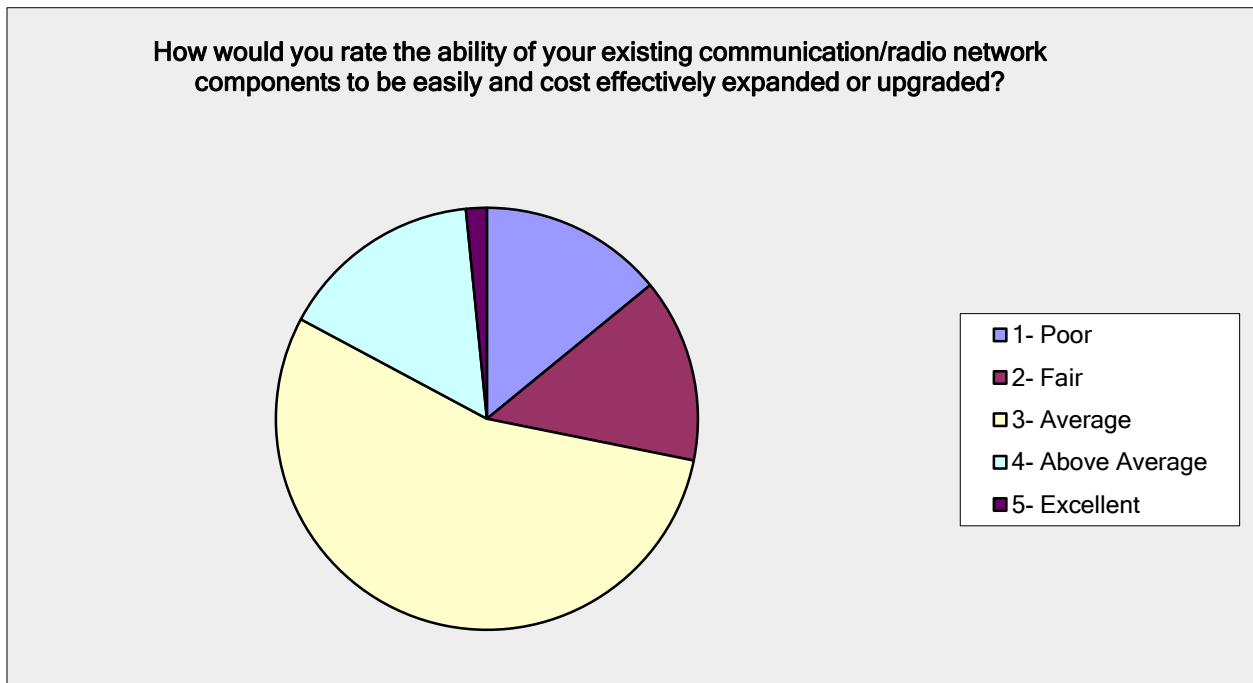| Are your maintenance service providers timely, responsive and effective?		
Answer Options	Response Percent	Response Count
Yes	93.1%	54
No	6.9%	4
If No, please provide a brief description of maintenance issues you have experienced:		2
answered question		58

Are your maintenance service providers timely, responsive and effective?

- Yes
- No
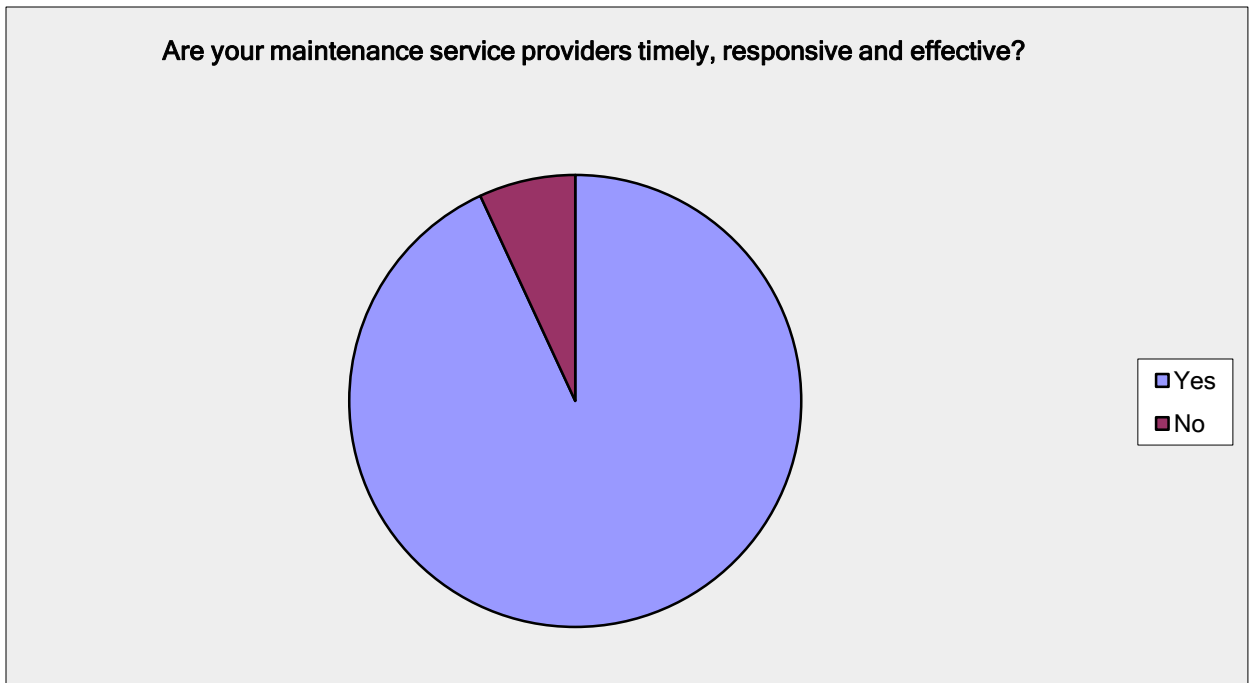
Part 8: Expansion Capability

This portion of the interview was meant to provide data regarding the expansion/upgrade capabilities of network components. Data collected here helped to develop an understanding of potential limitations that exist due to age and type of equipment in use as well as other constraints including limited available funds.

Expanded or Upgrading of Equipment:

Section 8, Question 51

How would you rate the ability of your existing communication/radio network components to be easily and cost effectively expanded or upgraded?		
Answer Options	Response Percent	Response Count
1- Poor	14.1%	9
2- Fair	14.1%	9
3- Average	54.7%	35
4- Above Average	15.6%	10
5- Excellent	1.6%	1
	answered question	64
	skipped question	61

How would you rate the ability of your existing communication/radio network components to be easily and cost effectively expanded or upgraded?

Legend:
- 1- Poor
- 2- Fair
- 3- Average
- 4- Above Average
- 5- Excellent

Part 9: What Works Well Today

Section 9 and Section 10 deal with the same categories used to describe key aspects of the communication system network. Section 9 is designed to collect data about what is working well in the existing network while Section 10 asks the contrary – What are the most needed improvements? Participants were asked to answer these questions in a priority order. This data summarizes many of the questions asked throughout the interview and will help prioritize which improvements and upgrades will affect the future capacity of the microwave system.

Items by Number of Responses are Listed Below:

Section 9

1. MDT's/CAD
2. Paging Channel
3. All agencies on VHF

Part 10: Most Needed Improvements

As described above, this portion of the interview was meant to summarize and capture the most critical improvements network users feel are needed. For the majority of participants, this was the most important section and a great deal of information was gathered and will help prioritize which improvements and upgrades will affect the future capacity of the microwave system.

Items by Number of Responses are Listed Below:

Section 10

1. Improved radio coverage
2. Decreased radio system interference
3. Additional staffing at the 911 center

Part 11: Comments and Suggestions

The final section of the interview was used to capture any other input from participants which either did not fit into the other sections, or for information that they wanted to highlight.

Almost all of the responses mirrored the responses throughout this report.

SECTION 2 - Physical Site Survey and Equipment Inventory Introduction

Each of the transmission sites in the microwave and radio communications system network was physically surveyed to determine their operational status and to inventory equipment located at each site. The site surveys were conducted October 2015 to April of 2016. Additional information was obtained from the county and the county's two-way radio service provider.

Contents of the site survey report includes a list of channels in use at the sites, digital photos of each site including the tower or structure and equipment shelter/room, antennas at the site along with information describing site security, power, interconnect, lightning and surge suppression, etc.

Once again, several common themes emerged when looking at the results of the site surveys. This information is included in the attached site survey reports located in Appendix 7 along with recommended detailed remediation steps and improvements plans.

Below is a summary of the finding:

Summary

The following report is based on the information gathered during the site surveys that included visitations (sometimes multiple) to thirteen communication towers and transmit locations and our observations at those locations. It is also based on computer generated propagation studies, conversations with county personnel and their contracted two-way service provider, end user surveys, review of their forty-seven plus FCC licenses along with county provided frequency and equipment inventory lists.

The thirteen locations included, Mt. Top (Penobscot), Campbell's Ledge, Dallas, Shickshinny, Nescopeck, EMA center, 911 center, Bear Creek, White Haven, 9th St. (Hazleton), Freeland, VA Hospital and Parkview Circle (Wilkes Barre City).

The majority of the sites visited were found to be relatively clean and in fair to good condition with some physical remediation needed. Five of the thirteen sites

are equipment rooms located within another building. Eight are stand-alone shelters.

Note: The City of Wilkes-Barre holds the license for their frequencies while the county provides and maintains the equipment but does not control the site. This needs to remedied by the county owning and maintain both the frequencies and the equipment.

Although the county has FCC licenses in all bands, they are committed to using the VHF band. The county does not use the UHF Med frequencies; the three channels of 800 MHz the county is licensed for were a test trunked installation by EF Johnson that is no longer in service. The simplex 800 MHz frequencies were being used for mobile data and those are also out of service. 100% of all the county's VHF equipment is Motorola Quantar which has an "end of life date of 2020". This means that all of the county's radio transmitters will need to be replaced.

The county has a county-wide VHF simulcast fire paging channel along with a mix of regional simplex and repeated fire/EMA and police channels that contribute to operational problems.

There are coverage issues that became more apparent when the county went to the FCC mandated narrow band frequencies, and there are co-channel interference issues from places like Mifflin County. The Mifflin County interference was investigated further as a side issue to the "needs assessment" project. This included "on air" signal level tests with technicians posted in both Mifflin and Luzerne counties. A separate report has been issued on the findings.

There are adjacent channel interference problems, but these appear to be from older installation techniques and aging antenna systems that are allowing the interference to occur.

There is a presence of very high powered commercial paging systems in place at several locations that needs to be addressed. These systems also operate on VHF and can cause unintentional interference. Additionally, non-county and non-public safety entities are currently co-located on county sites but do not pay rent for their tower or shelter space. This needs to be addressed with site agreements being

implemented with all non-county, non-public safety entities. The site agreements would also include co-location interference language.

There are few legitimate receiver multi-couplers in the system, as the previous installers used transmitter power splitters in a backwards configuration to combine receivers.

Grounding is a major issue throughout the system. Although there were some attempts at grounding, R56 or similar standards do not exist. None of the sites incorporate a "halo" grounding system or common bonding of all metal features. In fact, at Mt. Top, antenna cables entered through the booted ports and go directly to the equipment, bypassing a ground bus bar with at least ten Polyphasers mounted to it, but no cables attached. It seems "decorative".

The county should also consider site monitoring for both vandalism and equipment status. There was a hole cut in the fence at one site and we were told that someone tried to carry off a generator. We found on our site visits AC units out of service where a room temperature monitor would have triggered an alarm. They did have a camera system at one location connected to an onsite DVR, but the video could not be sent to the 911 center. The county would just replay the event after it happened.

A review of all the county's VHF frequencies was conducted to first see who shares the county's frequencies to see if some realignment could be used to avoid co-channel interference. A majority of the adjacent channel interference can be remediated with installation of filters, antenna replacement and better cabling.

Replacement of "cable termination adapters" with the proper cable connectors will also help.

The end user interviews have produced several reoccurring issues that included poor or nonexistent coverage in certain areas, congested channel usage and interference. It would be a suggestion that due to the highly congested fire, ambulance and police radio frequencies, that any new radio equipment such as portables and mobiles be of a high quality to ensure the receiver selectivity required to avoid adjacent channel interference.

Another issue is the county's connectivity which includes two channels of licensed 6 GHz microwave but for the most part the county's system is an unlicensed spread spectrum 5 GHz non-redundant microwave in a spur configuration.

In summary, there are several levels of upgrades that can be applied, which range from level one immediate to level three long term and can be used to improve the system. These include site remediation, installation and equipment upgrades, system modifications, security and operational changes. These can be incorporated as time and budgets allow.

SECTION 3 – Recommendations

Philosophy of the Plan

Our philosophy in any plan is to provide an evaluation of all the current and existing systems and evaluate their life cycle; we look for issues and potential problems in these systems and make recommendations for improvement. A key component of this plan is to present a wide range of potential solutions and to identify any systems that are proprietary in their equipment.

Today there are very high quality and sophisticated technologies in the marketplace that are totally proprietary in their equipment and if purchased, will limit your ability to obtain competitive bids for equipment. This will force you into a single source situation for a supplier and therefore provide you with no ability to obtain the best competitive cost for equipment. There are some features and advantages that these systems provide, which are unique and provide enhanced security and unique operational components, although many of these will not significantly enhance the fundamental operational value to the end user. These systems are generally significantly more expensive than the high quality open source equipment available. There is also high quality sophisticated open source systems available with very attractive pricing.

Purchasing systems that are proprietary is a decision that government agencies must make, taking into consideration all of the factors involved in the value of the technology versus the price and value of open source technologies. MCM Consulting Group, Inc. as a matter of course does not recommend proprietary systems. It is our philosophy that the cost/value relationship does not, in most areas, have validity. In a major metropolitan area these purchases can be necessary, but virtually unlimited financial resources must be available. We do not, however, provide information and descriptions on these systems, unless the client specifically requests their inclusion. We can provide budgetary estimates from past experience if the client requests.

The Plan

During the process of this project, we defined a number of tasks and evaluations that needed to be concluded to determine a number of facts and to measure the existing systems and the users of these systems. As a component of this, an in-depth survey of the entire system's infrastructure was undertaken. Additionally, face-to-face interviews were conducted, as well as an interview form created. Telephone interviews were offered to gather and quantify the issues the community recognizes in this communications system. Our goals were multifaceted; it is our belief that to develop a long-term plan for a large community (the County of Luzerne) we need to understand the following conditions.

- The compatibilities of the current systems.
- The locations of the current systems.
- An in depth inventory of the current systems and sites.
- Review via the interview process the needs of the users and potential users.
- Document the perceptions of the current and potential users.
- Develop a list of the needs of the first responder network and develop a series of plans to satisfy these requirements.

The results of these surveys were documented previously in this document. Here we develop the plan, in phases, that implements the needs identified by the public safety community and also incorporates our past experience in developing and implementing these systems.

After a detailed evaluation of the existing (as built) system, and an extensive interview process in addition to the extensive investigations conducted, MCM Consulting Group, Inc. has developed a plan with recommendations for Luzerne County.

Recommendations

It is recommended that steps be taken in phases to update, and ultimately replace, the current analog radio, microwave and radio console equipment and systems. Updates should be completed by 2017. After this is completed, MCM recommends the county replace their existing analog system with a P25 digital radio system by 2021.

The improvements made in phase I will be provisioned to be reused in phase II, so no monies are wasted.

Phase I – 2016-2017

Remediation:

Site remediation suggestions can be found on the last page of each site survey report. However, they can be generalized into four categories: grounding, security, maintenance and installations.

(a)   R56 or similar grounding standards need to be applied at all sites that run the gamut from grounded strike plate cable entrance systems and polyphaser termination of all cables as they enter the shelter. This will help protect what the county currently has at the sites.

(b)   Security for the immediate term would include the repair of the hole in the fence at Campbell's Ledge, replace or repair the barbed wire top at Mountain Top and do a complete perimeter fencing of White Haven and Shickshinny. Consider replacement of all locks and door access codes to reduce the number of unauthorized entrances.

(c)   Repair the rusting door at Mountain Top and apply vegetation control where needed.

(d)   Relocate propane gas tanks away from buildings as far as possible but within the fenced-in compound.

Installation upgrades:

Installations that were done in the past may no longer meet the requirements of today.

(a)   Remove any RF connector "adapters" and terminate all cables to their intended load with the proper connector to eliminate losses and potential interference issues.

(b)   Sweep all transmission lines for faults and antenna issues.

(c)   Replace transmission lines and antennas as needed.

Equipment upgrades:

(a)   Install, "RF filters" to receiver inputs to improve selectivity.

(b)   Replace the Motorola Quantar equipment that has a manufacturer's marked "end of life".

System modifications:

(a)   Employ the use of legitimate receiver multi-couplers where applicable and eliminate the use of backwards installed transmitter power dividers.

(b)   Install legitimate transmitter combiners where applicable.

(c)   Construct a new tower at White Haven to raise the antennas and improve coverage in the immediate area around the tower. This was a discovered issue during end user surveys. Our computer generated propagation studies indicate improvement in and around the tower with an increase in antenna elevations as would be expected.

(d)   Develop Red Rock (LUZE06 SRND) site to enhance radio coverage in the northwestern area of the county.

(e)   Develop Lookout Mountain (Pennsylvania Game Commission (PGC)) site for microwave path continuity.

(f)   Construct a new tower in the Hunlock Creek area. This tower is needed for the microwave system and for increased coverage in the Lehman Township area.

(g)   If filtering does not mitigate interference, remove all commercial paging operations from county sites or move from leased location that have a commercial paging system in place.

(h)   Implement colocation agreements with all non-county, non-public safety users. Include colocation interference language in the agreements.

(i)   The county should obtain ownership of the Wilkes-Barre FCC licenses since they own and maintain the equipment for the city.

(h)   Add "legitimate" simulcast devices to eliminate manual timing of the system. This would improve tone and voice audio quality.

Operational changes:

(a)   Change the frequency of Zone A receiver input to eliminate interference issues with Mifflin County.

(b)   Separate fire and ambulance channels by relocating one or the other onto an existing set of radio frequencies or conduct a frequency search for a new set of frequencies that would allow repeated operation. This was a discovered issue during end user surveys.

(c)   Eliminate the practice of having both simplex and repeated operations on the same frequency. With this current configuration one or the other will not know who is using the channel.

(d)   Reduce the number of fire zones from 9 to 6, with the city of Wilkes-Barre being a zone unto themselves. This will allow the county to reallocate frequencies for separate dispatch and operational channels for EMS and Fire.

(e)   Reduce the number of police zones from 8 to 5, with the city of Wilkes-Barre being a zone unto themselves. This will allow the county to reallocate frequencies for operational channels for police.

Security:

(a)   Install site monitoring equipment that would alert to unauthorized entry, power loss and overheated conditions. Video may also be employed. Due to limited bandwidth of the current connectivity on the microwave system, a separate link may be necessary unless the new microwave system is implemented as soon as possible (see (b).

(b)   MCM also recommends that the current unlicensed microwave system be replaced with a digital Multiprotocol Label Switching (MPLS) microwave "ring" system with ring protection to link the operational zones. The system must be Ethernet capable and have a minimum bandwidth of 150 mbps for the new system. The selected vendor for this project would be responsible for a complete "turnkey" project to include path surveys, equipment selections and FCC licensing. This would also make the system more public safety acceptable towards integration into state wide configurations.

Summary of Phase I Improvements:

PROPOSED ANALOG IMPROVEMENTS
1. Develop Red Rock (LUZE06 SRND) site.
2. Improve grounding conditions at all sites (see remediation summary report).
3. Install legitimate receiver multi-coupler units where required.
4. Install legitimate transmitter combiners where required.
5. Develop State site LUZE06 and Lookout Mountain (for microwave path only). LUZE06 is located on the western county border at the Red Rock fire tower near the junction of Sullivan, Columbia and Luzerne Co. Lookout Mountain off the Suscon Rd. in State Game Lands 91 in the east-northeast part of the county.
6. Install new ring protected licensed microwave system (ref: note1), (see proposed path map).
7. Develop the White Haven and Hunlock Area tower sites.
8. Enhance county-wide fire paging, Red Rock LUZE06 added (see prop study).
9. Develop and enhance county-wide fire simulcast repeated operations channel (use 151.280. and ???), (4 sites now in service).
10. Expand and enhance county-wide police simulcast / repeated GA system (4 sites now in service).

11. Develop a county-wide EMS simulcast repeated operation channel (use the 911 admin frequency set).
12. Develop repeater operations in "all" police and fire zones (this needs to have additional review).
13. Remove (where allowed) all commercial paging equipment from sites if they are found to be causing harmful interference.
14. Implement colocation and interference agreements.
15. Obtain ownership of Wilkes-Barres's FCC frequencies.
16. Change repeater input frequency of police zone A (Wilkes-Barre).
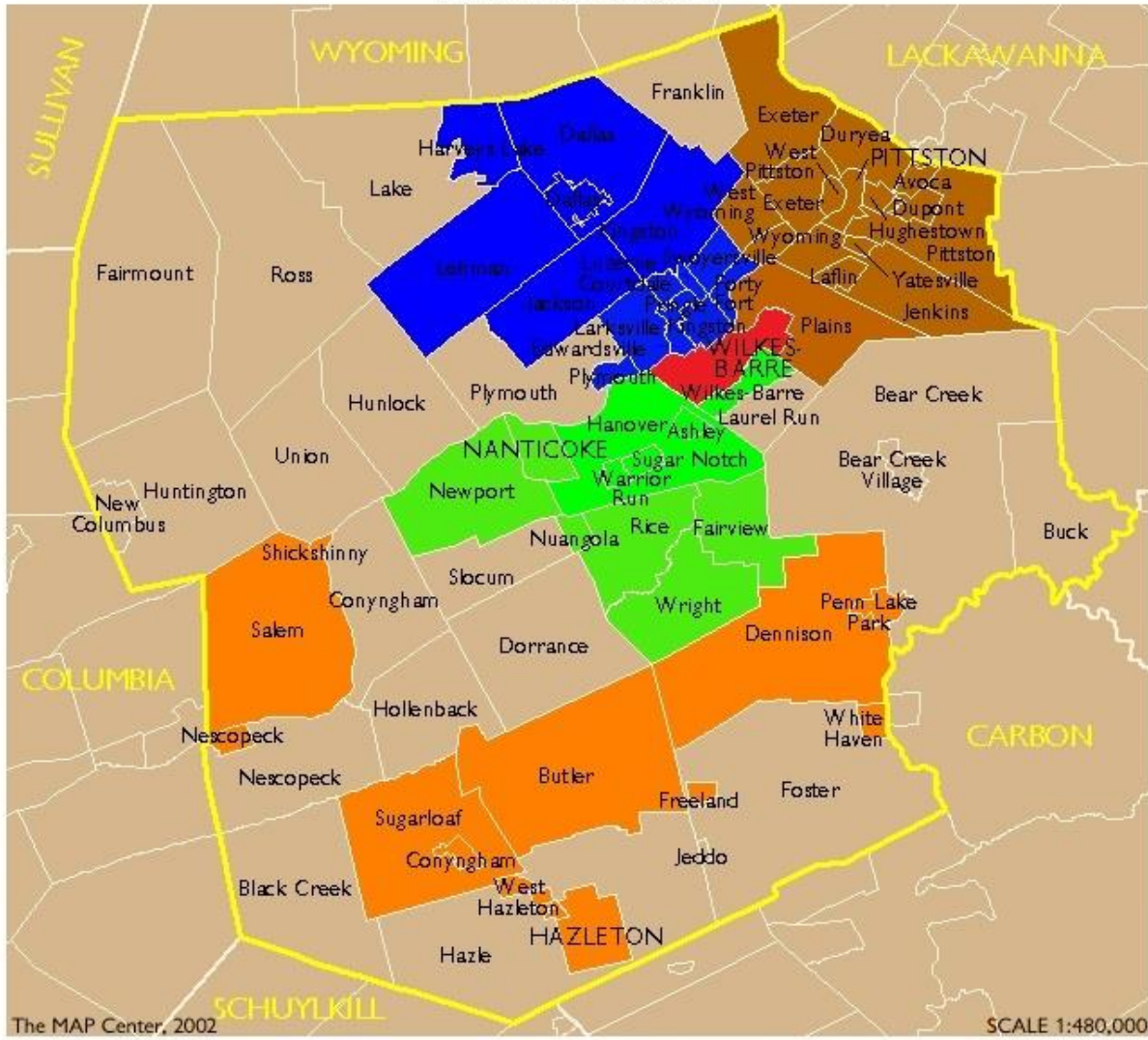17. Look at ROI on rental versus new tower builds and county ownership.

Notes:
1. New microwave system needed:
   (a) To eliminate single site failure that now exists with Mountain Top.
   (b) To gain additional bandwidth allowing for site monitoring.
   (c) To support simulcast operations.

Referring to the maps below; it is recommended that the county will be divided into 5 operational zones for police, with the City of Wilkes-Barre being a zone unto themselves. For fire, the county would be divided into 6 operational zones with the City of Wilkes-Barre being a zone unto themselves. Each zone would have sufficient tower sites that would allow a "transmitted" signal to cover the zone on a 95% level to mobiles and portables in buildings. Receive signal levels from the portables can be enhanced with voting receivers. Sites picked for the zones could also be the same sites used for county-wide coverage.
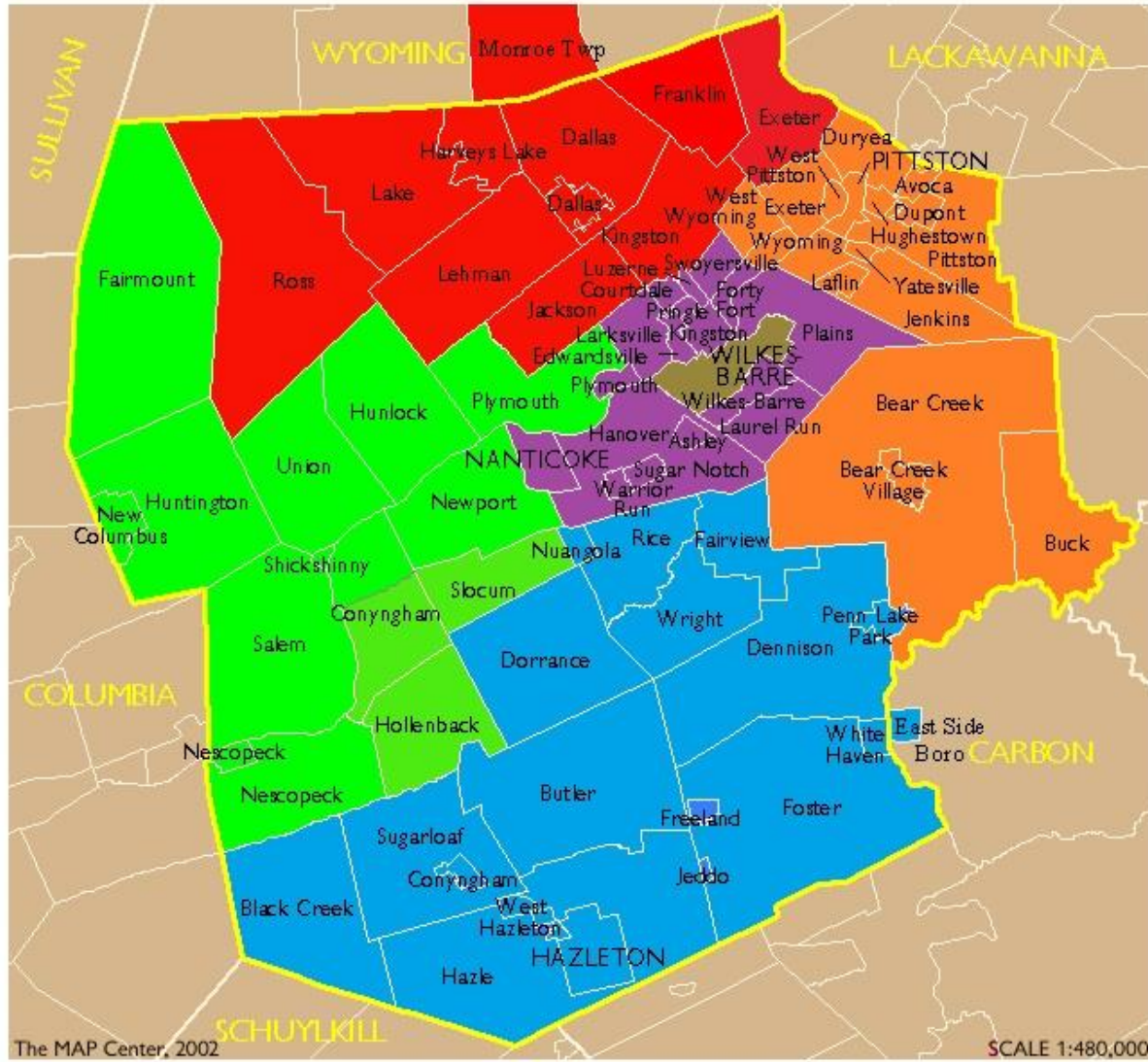
Police Zones

LUZERNE COUNTY

The MAP Center, 2002

SCALE 1:480,000

Zone A (blue)
Zone B (green)
Zone C (orange)
Zone D (brown)
Wilkes Barre City (red)

Fire Zones
LUZERNE COUNTY

SULLIVAN
WYOMING
Monroe Twp
Franklin
LACKAWANNA
Exeter
Duryea
Dallas
West Pittston
PITTSTON
Harveys Lake
Avoca
West Exeter
Dupont
Lake
Wyoming
Hughestown
Kingston
Wyoming
Pittston
Fairmount
Lehman
Luzerne Swoyersville
Yatesville
Ross
Courtdale
Forty Fort
Laflin
Jackson
Pringle
Jenkins
Larksville Kingston
Edwardsville
WILKES-
Plains
BARRE
Plymouth
Bear Creek
Hunlock
Plymouth
Wilkes-Barre
Hanover Ashley
Laurel Run
NANTICOKE
Union
Sugar Notch
Bear Creek
Newport
Warrior
Village
Huntington
Run
New
Columbus
Rice Fairview
Shickshinny
Nuangola
Buck
Slocum
Wright
Conyngham
Penn Lake
Salem
Dennison
Park
Dorrance
COLUMBIA
Hollenback
White East Side
Nescopeck
Haven Boro
CARBON
Nescopeck
Butler
Foster
Freeland
Sugarloaf
Jeddo
Black Creek
Conyngham
West
Hazleton
HAZLETON
Hazle
SCHUYLKILL

The MAP Center, 2002
SCALE 1:480,000

🟧 **Fire East**	🟩 **Fire West**	🟪 **Fire Central**
🟥 **Fire North**	🟦 **Fire South**	◼️ **Wilkes Barre City**

The complete county-wide analog simulcast VHF coverage would include the following:

Police

1. 1 City of Wilkes-Barre repeated simulcast dispatch channel
2. 1 City of Wilkes-Barre repeated simulcast operation channel
3. 1 County-wide repeated simulcast dispatch channel
4. 1 County-wide repeated simulcast operations channel
5. 4 Zoned repeated simulcast operation channels
6. Portable and mobile equipment will have at least 2 low power encrypted channels to conduct on the ground operations. There is no plan to monitor these channels at the 911 center.

Fire

7. 1 City of Wilkes-Barre repeated simulcast dispatch channel
8. 1 City of Wilkes-Barre repeated simulcast operation channel
9. 1 County-wide fire simulcast VHF dispatch channel
10. 1 County-wide repeated operations channel
11. 5 Zoned repeated simulcast operation channels
12. Portable and mobile equipment will have at least 2 low power encrypted channels to conduct on the ground operations. There is no plan to monitor these channels at the 911 center.

EMS

13. 1 County-wide fire simulcast VHF dispatch channel
14. 1 County-wide repeated operations channel
15. Portable and mobile equipment will have at least 2 low power encrypted channels to conduct on the ground operations. There is no plan to monitor these channels at the 911 center.

EMA

16. 1 County-wide repeated operations channel
17. Portable and mobile equipment will have at least 2 low power encrypted channels to conduct on the ground operations. There is no plan to monitor these channels at the 911 center.

Phase II – 2018 - 2021

MCM Consulting Group, Inc. is recommending based on the availability of VHF frequencies, that the county make the long term plan of migrating to a VHF, IP based, P25 phase II (for spectrum capacity) "trunked" (for spectrum efficiency) multi zone "simulcast" (for coverage)" configuration.

VHF can be justified as it is already in use by the City of Wilkes-Barre and county agencies. Luzerne County is already FCC licensed, and there are a number of agencies in the county that have VHF pairs they are willing to allow the county to use in a new system.

MCM also recommends that the current ACOM radio console system be upgraded to the ACOM Novus IP based console system that is warrantied to be compatible with the new radio system equipment.

VHF IP P25 Radio System

Our recommendation creates a common platform of operation by locating all agencies into a single band of VHF radio frequencies.

The preliminary "conceptual" plan would be an IP based, VHF P25 Phase II trunked / simulcast configuration. P25 is digital so two VHF "analog" channels will be needed for paging.

Phase II allows two conversations at the same time on one channel which increases the capacity of the system, and trunking which increases the efficiency of the system by making use of idle channels.

Simulcast allows the broadcasted signal to be heard over the entire county at one time or simultaneously.

The system should be designed to provide 95% "portable" coverage over the entire county and within urban and suburban structures and including certain geographical areas, providing a minimum DAQ (delivered audio quality) of 3.4. This is to be achieved without the use of in vehicle repeaters.

Referring to the previous maps, the county will be divided into 5 operational zones for police, with the City of Wilkes-Barre being a zone unto themselves. For fire,

the county would be divided into 6 operational zones with the City of Wilkes-Barre being a zone unto themselves. Each zone would have sufficient tower sites that would allow a "transmitted" signal to cover the zone on a 95% level to mobiles and portables in buildings. Receive signal levels from the portables can be enhanced with voting receivers. Sites picked for the zones could also be the same sites used for county-wide coverage.

Most likely the sites picked for the zones would also be the same sites used for county-wide coverage.

The complete county-wide trunked simulcast VHF coverage would include the following:

Police

1. 1 City of Wilkes-Barre repeated trunked simulcast dispatch channel
2. 1 City of Wilkes-Barre repeated trunked simulcast operation channel
3. 1 County-wide trunked repeated simulcast dispatch channel
4. 1 County-wide repeated simulcast operations channel
5. 4 Zoned repeated trunked simulcast* operation channels
6. Portable and mobile equipment will have at least 2 low power encrypted channels to conduct on the ground operations. There is no plan to monitor these channels at the 911 center.

Fire

7. 1 City of Wilkes-Barre trunked repeated simulcast dispatch channel
8. 1 City of Wilkes-Barre trunked repeated simulcast operation channel
9. 1 County-wide repeated trunked operations channel
10. 1 County-wide fire "analog" simulcast VHF dispatch channel
11. 5 Zoned repeated trunked simulcast* operation channels
12. Portable and mobile equipment will have at least 2 low power encrypted channels to conduct on the ground operations. There is no plan to monitor these channels at the 911 center.

EMS

    13.1 County-wide fire "analog" simulcast VHF dispatch channel

    14.1 County-wide repeated trunked operations channel

15. Portable and mobile equipment will have at least 2 low power encrypted channels to conduct on the ground operations. There is no plan to monitor these channels at the 911 center.

EMA

16. 1 trunked repeated simulcast EMA channel
17. Portable and mobile equipment will have at least 2 low power encrypted channels to conduct on the ground operations. There is no plan to monitor these channels at the 911 center.

In addition, the system should be configured as to permit "direct" interfacing to other non-county entities such as local municipal public works departments, federal and state communications systems, schools, colleges, airport facilities and neighboring county communications systems.

It is also required that the system be of a robust design that failure of single component of the system "will not" render the system inoperable and access time for a channel must be minimal. Reliability and redundancy are key aspects of the systems operation.

MCM recommends that the county purchase the initial portable and mobile radios and pagers for the public safety agencies following the formula listed below:

Law Enforcement

1 Patrol Vehicle = 1 Mobile, 2 Portables

EMS

1 Ambulance = 1 Dual-head Mobile, 2 Portables

Pagers = # of employees, per agency

Fire

Fire Chief = 1 Mobile, 1 Portable
Assistant Chief = 1 Mobile, 1 Portable
Deputy Chief = 1 Mobile, 1 Portable
Engine = 1 Dual-head Mobile, 4 Portables
Aerial = 1 Dual-head Mobile, 4 Portables
Rescue = 1 Mobile, 4 Portables
Tanker = 1 Mobile, 2 Portables
Brush = 1 Mobile, 2 Portables
Pagers = 25 per department (Average)

Additional mobile and portable radios as well as pagers could be purchased by the individual departments at the discounted "bid" rate the county obtains from the winning system vendor.

Several grant opportunities exist for funding for the mobiles, portables and pagers, including the Federal Assistance to Fire Fighters Grant and the COPS More Technology Grant. MCM recommends that the fire, EMS and law enforcement agencies collectively apply for these grants. Revenue received from the grants can offset the total cost incurred by the county.

One final source of revenue could come from the Luzerne Gaming Revenue Authority.

Note: No fire or EMS service should receive more pagers or portable radios than they currently have members.

Microwave Network

Multiprotocol Label Switching (MPLS) is a standards-approved technology for speeding up network traffic flow and making it easier to manage. MPLS involves setting up a specific path for a given sequence of packets, identified by a label put in each packet, thus saving the time needed for a router to look up the address to the next node to forward the packet to. MPLS is called multiprotocol because it works with the Internet Protocol (IP), Asynchronous Transport Mode (ATM), and frame relay network protocols. With reference to the standard model for a network (the Open Systems Interconnection, or OSI model), MPLS allows most packets to

be forwarded at the layer 2 (switching) level rather than at the layer 3 (routing) level. In addition to moving traffic faster overall, MPLS makes it easy to manage a network for quality of service (QoS).

We also recommend that any future expansion of the system be prepared for now to save cost and allow for faster expansion of the system if needed. The 150 mbps bandwidth will allow the county to address all current needs, with additional capacity for future needs including:

- Additional Voice Radio Channels
- Data Channels
- Video
- Next Generation 911 (NG911)
- Integrating into a State-wide Emergency Services IP network (ESInet)
- Private/Public Partnerships

Our surveys and interviews with the public safety users of the system clearly indicate a desire for additional repeated voice radio channels as well as a move towards a data centric type of communications in the future. Our recommendations have taken this into account.

Radio Console System

MCM recommends that the current Zetron ACOM radio console system be upgraded to the Zetron ACOM Novus IP based console system that is warrantied to be compatible with the new radio system equipment.

Budgetary Estimate

MCM scheduled vendor presentations during December 2015 and January 2016. Each vendor was able to present on the products and services that they provided.

Each vendor was presented with the current and future needs of Luzerne County's radio system and was asked to provide via a presentation, solutions to improve the current radio, microwave and radio console network/systems and provide information on a VHF, IP based, P25 Phase II "trunked", multi zone "simulcast", network/system and a 6 GHz, 150 mbps, MPLS, with Ethernet capabilities digital microwave system, along with a new radio console system.

MCM reviewed each response and asked questions of the vendors when necessary.

The budgetary estimate below is based on a design of 15 transmit/receive sites, including paging.

Listed below are the budgetary costs of each system, including maintenance:

Phase I - Budgetary Cost Estimate

Grounding/ Maintenance/ Remediation - $250,000.00

Installations/Equipment Upgrades - $450,000.00

Security - $75,000.00

Microwave System $2,275,000.00

MCM also recommends that the county budget include sufficient funds to build 2 tower sites, one to replace the White Haven tower; and one in the Hunlock Creek area to augment coverage for the Lehman Township PD and to complete the microwave path between the new state site LUZE06 and the Dallas tower.

Initial capital cost for radio towers - $**840,000.00**

Please see the tower site cost spreadsheet in Appendix 8.

Consulting, Engineering & Project Management/Contingency

In addition to the above cost, MCM recommends the following items be budgeted for:

Consulting, Engineering & Project Management Services: **$75,000.00**

Totals:

Grounding/ Maintenance/ Remediation **- $250,000.00**

Installations/Equipment Upgrades **- $450,000.00**

Security **- $75,000.00**

Consulting, Engineering & Project Management Services – **$75,000.00**

Grand Total $850,000.00

Additional Phase I Totals (if funds are available):

Microwave Systems – **$2,275,000.00**
Two Radio Towers – **$840,000.00**

Phase II

Initial Infrastructure Capital Cost: $**9,150,000.00**

Subscriber Units: **$8,310,000.00**

One Year Warranty $ Included in above cost.

Years Two & Three System Maintenance Included in above cost.

Estimate Years Four & Five Maintenance Cost is $**900,000.00**.

Estimate Years Six through Ten Maintenance Cost is $**2,460,000.00.**

Estimate Years Eleven through Twenty Maintenance Cost is $**4,700,000.00.**

Estimate Hardware refresh at 8 years is **$750,000.00,** and at 16 years is **$900,000.00.**

Consulting, Engineering & Project Management Contingency

In addition to the above cost, MCM recommends the following items be budgeted for:

Consulting, Engineering & Project Management Services: **$887,500.00.**

5% Contingency of infrastructure cost: **$917,375.00.**

Totals:

Capital **$9,150,000.00.**
Subscriber Units **$8,310,000.00.**
Project Management **$887,500.00.**
Contingency **$917,375.00.**

Grand Total $19,264,875.00.

Implementation Timeline

Phase I

Grounding/ Maintenance/ Remediation – 7/2016 – 12/2016

Installations/Equipment Upgrades – 7/2016 – 6/2017

Security – 7/2016 – 12/2016

Microwave System – 7/2016 – 6/2017*

Phase II

July 2017 – September 2018 - FCC Licensing
July 2017 – September 2018 - Tower Location Scouting, Prepare for Acquisition
of Land or Leases
January 2017 – December 2018 – IFB for Radio System/Award Contracts
January 2017 – December 2018 – IFB for Towers & Shelters/Award Contracts*
January 2017 – December 2018 – IFB for Tower Construction Services/Award
Contracts*
January 2019 – December 2020 – Project Implementation

* Based on funding, can be completed in phase I or phase II.