Section 5
Summary of Options and Costs

Introduction

The previous sections of this report have provided a review of the Cass County agencies existing radio system equipment; an evaluation of the performance of the existing systems, recommendations for the upgrade or replacement of equipment, and the estimated costs of these replacements. Also provided are reviews of the numerous technical and industry issues affecting the public safety radio communications industry, and how they might impact the county's systems and operations. The core intent of this activity is to determine the benefits and challenges of the county migrating to the 800 Mhz ARMER radio system.

In Section 5, we will provide an overview of our recommendations along with estimated costs.

Options and Recommendations

It is our opinion that the County has two primary options for future public safety radio communications, as follows:

1. **Remain operating on VHF radio system and frequencies.**

   If VHF radio system operation is to be retained as the primary form of communications, several options exist in terms of what type of system configuration may be desired. However, any option will require the replacement of most of the existing VHF radio system infrastructure equipment (except for the newer multi-site Fire/EMS paging system), additional tower site equipment, and the replacement of a significant amount of existing VHF mobile, portable and paging radio equipment. Much of this is driven by the requirement for compliance with the FCC's year 2013 narrowband channel mandates, along with the need for improved overall system coverage and capacity.

   Cass County's existing VHF system infrastructure, while having been a good system when installed in the early 1990's, has become obsolete, and does not provide the level of coverage or capacity needed for reliable public safety communications. This equipment is also NOT capable of being converted to narrowband operation.

   While several system configuration options can be considered if VHF operations are retained, we recommend the following actions:

   - Conversion of all law enforcement to VHF APCO 25 digital operations. This will require the replacement of the existing Walker and Pillager VHF main repeaters with new APCO 25 digital stations. However, since these two existing tower sites are not capable of providing reliable county-wide coverage, additional tower sites will be needed. We recommend utilizing the new State tower sites at Ball Club, Cass Lake, Draper, and Backus in addition to the Walker and Pillager sites.

- The addition of a new tower site in the Federal Dam/Boy River area.
- The addition of a county-wide Law TAC digital operations repeater system channel, again using multiple tower sites
- The addition of a county-wide Fire/EMS TAC analog repeater operations channel, using multiple tower sites
- Upgrades to the new 7-site County Fire/EMS repeater system to provide improved range from the tower sites, through increased tower heights in the same general locations.
- Some consideration to be given to choosing between the "Tone & Voice" radio paging technology, or the conversion of all Fire/EMS paging to the Roger's 2-Way Alpha-numeric system
- The implementation of VHF TAC on-scene simplex channels for both Law and Fire/EMS operations.

As noted, our long-term VHF system recommendations include APCO 25 digital technology for law enforcement operations, which carries a higher cost than if analog technology were utilized. A move to digital operations is not mandatory, and the county could choose instead to utilize VHF analog narrowband systems, which would result in a lower cost than what is shown here. We expect that the overall VHF system costs would be reduced by approximately $400,000 if digital operation is not implemented.

However, even if analog operation is used, a significant amount of the county's existing VHF infrastructure will require replacement, along with the expansion needed for reliable coverage and operations.

Retaining VHF operations will require the implementation of some 800 Mhz Interoperability resources, as the State of Minnesota agencies and other local agencies begin using the 800 Mhz ARMER radio system. Itasca County is in the process of implementing an 800 Mhz Trunked system, and Cass County will need to plan for some level of Interoperability with Itasca agencies.

2. Migration from VHF to the 800 Mhz ARMER radio system.

This option would utilize the eight new ARMER tower sites planned for the Cass County area, but would also require the county to purchase and install additional 800 Mhz repeater system equipment, and develop a new tower site, as follows:

- 800 Mhz repeater site equipment at the Leech Lake TV tower in Walker
- The construction of a new tower site near Federal Dam, along with 800 Mhz system equipment for this tower (since the State has now chosen not to implement a tower site in the Federal Dam area).

Depending on the number of radios Cass County agencies would bring into the ARMER system, the installation of one or two additional 800 Mhz RF channels at the ARMER tower sites to handle the expected radio traffic loads that would result from a large number of radio users joining the system.

An ARMER migration by Cass County agencies will also require the replacement of all VHF mobile and portable public safety radios within the county with new 800 Mhz radios.

The ARMER system implementation outlined for Cass County would utilize the standard ARMER system Multicast configuration, which would provide a good level of service for the county, and make the overall project costs more manageable.

The costs shown for an ARMER implementation for Cass County include a "Low End Cost" and a "High End Cost". The differences between these costs will ultimately be based on a number of factors as shown in the cost table, including tower site needs and channel capacity. In the "Subscribers" section, the cost differences are based on the model/type of mobile and portable radios chosen for Fire/EMS operations, as discussed in the text of Section 4 of the report, with the Motorola XTS/XTL1500 series costing less, and the XTS/XTL 2500 series costing more, but including more features and capabilities. We would recommend the 2500-series radio for all public safety operations (Law, Fire, EMS), and the 1500-series for Public Works operations.

Our recommendations for creating or improving public safety communications operations and interoperability in the Cass County area are based on current and future radio needs in Cass County.

Developing an 800 Mhz Trunked radio system, while an expensive and intensive undertaking, is made more feasible through the joint efforts of the State of Minnesota and the ARMER project infrastructure. 800 Mhz frequency allocations are available to Cass County for whatever level of system is desired.

All VHF radio system operators are required to comply with the FCC's 2013 VHF narrowband mandate, and the County must consider their options for dealing with this requirement. "Doing nothing" is not an option in this environment. Some amount of funding will need to be expended for the replacement of VHF radio equipment to meet these mandates. Should the funding that would be spent for these replacements be better spent on funding the purchase of 800 Mhz radios? It is true that the new 800 Mhz digital radios are often more expensive than analog VHF radios, but the digital equipment is far more rugged and technologically advanced, assuring a long operational life cycle.

An important point to make when considering these options are the numerous operational benefits that the ARMER trunked system brings to the agencies using the system. Beyond the obvious improvements in overall radio coverage, a Trunked system resolves the "Channel capacity" issues currently experienced the County's Fire and EMS agencies.

As described in Section 3, the number radio channels available to the radio users in a Trunked system far exceed what is available with any conventional radio system.

Since these Trunked radio channels (now known as “Talk Groups”) are computer-generated (“virtual” channels), any number of these “channels” can be added to the system without major infrastructure changes or upgrades.

Of course, the managers and users of the radio system must ensure that the balance between the number of 800 Mhz repeaters in the system and the number of radio users and talk groups is properly managed to ensure efficient radio traffic management, but the overall capacity far exceeds any conventional radio system.

All of the actions included in the VHF system recommendations, with the exception of paging, can be accomplished through a migration to the ARMER system.

The costs provided here should generally be considered budgetary, and may be somewhat “generous” in some areas. The pricing used in preparing our cost estimates are based on the pricing experienced by some of our customers on recent projects, information obtained from the State of Minnesota, as well as budgetary estimates obtained directly from Motorola.

The cost of the project equipment and services listed could very likely change if any significant changes are made to the system plan, or any significant changes are made in the overall ARMER implementation plan. Nonetheless, we believe that the costs shown are accurate enough to provide the County with a good understanding of the cost structure associated with this type of project.

Options and Costs Summary

Option 1: Retain VHF Operation with Digital Upgrades

Item No.	Item/Category	Item	Item Cost
1.1	System Equipment	Walker Tower Site Improvements	$ 20,000
1.2		New Federal Dam Tower Site (180-ft)	$100,000
1.3		7-site VHF Digital Repeater System – Law Enforcement	$350,000
1.4		VHF Digital TAC Repeater System – Law	$250,000
1.5		Upgrades to Existing Fire/EMS Repeater System	$105,000
1.6		VHF TAC Repeater System – Fire/EMS	$190,000
1.7		2-Site VHF Repeater System – County Highway	$ 40,000
1.8		FCC Licensing	$10,000
1.9		800 Mhz Interoperability Equipment	$75,000
1.10		State of MN Sales Tax (est.) all equipment	$81,500
1.11		Project Management Services	$100,000
1.12		10% Contingency	$114,000
		Total Estimated Cost (Infrastructure)	**$1,435,500**
	Agency Equipment	Law Enforcement VHF Digital Mobile Radios	$239,400
		Law Enforcement VHF Digital Portable Radios	$237,500
		Law Enforcement VHF Digital Base Radios	$55,000
		Fire/EMS Agency VHF Analog Mobile Radios	$77,000
		Fire/EMS Agency VHF Analog Portable Radios	$84,750
		Fire/EMS Agency VHF Analog Base Radios	$17,500
		VHF Pager Replacements	$40,000
		County Highway VHF Radios	$22,500
		City of Walker VHF Radios	$1,500
		Total Estimated Cost (Subscribers)	**$775,150**
		Total Estimated Project Cost – VHF	**$2,210,650**

Option 2: Full 800 Mhz/ARMER Implementation

This option includes all radio system equipment identified in the report for implementation of the State ARMER radio system for all Cass County agencies, Multicast operation.

Item No.	Category	Description	Low End Cost	High End Cost
2.1	System Equipment	Walker Tower Site – Building Improvements	$60,000	$60,000
2.2		New tower for Federal Dam area (350-ft, optional)		**$250,000**
2.3		One additional 800 RF channel to be added at seven ARMER tower sites	$350,000	$350,000
2.4		One additional 800 RF channel to be added at seven ARMER tower sites (optional – see section 4 text)		**$525,000**
2.5		6-Channel ISR 800 Mhz Rptr Equipment for Walker site	$400,000	$400,000
2.6		6-Channel ISR 800 Mhz RPTR Equipment for Federal Dam tower site (optional)		**$400,000**
2.7		PSAP console equipment and services	$295,000	$295,000
2.8		Microwave Equipment for Walker & Federal Dam sites	$150,000	$150,000
2.9		Microwave system equipment – PSAP	$125,000	$125,000
2.10		VHF Paging System Upgrades	$287,000	$287,000
2.11		Interop Equip (VHF)	$175,000	$175,000
2.12		FCC Licensing	$5,000	$5,000
2.13		State of MN Sales Tax (est.) all equipment	$195,000	$195,000
2.14		Project Management Fees	$150,000	$150,000
2.15		10% Contingency	$450,000	$450,000
		Total Estimated Cost (Infrastructure)	**$2,642,000**	**$3,817,000**
2.15	Subscriber Equipment	Law Enforcement 800 Mhz Mobile Radios	$334,950	$ 334,950
2.16		Law Enforcement 800 Mhz Portable Radios	$237,500	$ 237,500
2.17		Law Enforcement 800 Mhz Base Radios	$55,000	$ 55,000
2.18		Fire/EMS Agency 800 Mhz Mobile Radios	$213,150	$ 261,000
2.19		Fire/EMS Agency 800 Mhz Portable Radios	$334,900	$ 492,500
2.20		Fire/EMS Agency 800 Mhz Base Radios	$31,000	$ 35,000
2.21		VHF Pager Replacements – Fire/EMS	$40,000	$ 40,000
2.22		County Highway 800 Mhz Mobile, Portable and Base Radios	$152,150	$ 152,150
2.23		City of Walker Public Works 800 Mhz Mobile, Portable and Base Radios	$15,700	$ 15,700
		Total Estimated Cost (Subscribers)	**$1,414,350**	**$1,623,800**
		Total Estimated Project Cost	**$4,056,350**	**$5,440,800**

Conclusion

A significant amount of the radio system equipment now used by the agencies of Cass County have become outdated, and will require replacement in the next few years. With the forthcoming implementation of the ARMER system tower sites in the county, and the potential for some equipment funding through grants to the customer agencies, it is a critical time to review and consider the future plans for public safety communications in the county.

We recognize that the Cass County area agencies will need to review, discuss and consider the options and recommendations that have been incorporated into the report before any specific actions are taken within any next phase of this project. Many of the options presented here will require additional research and review by both GeoComm and the Cass project group prior to a final decision on implementation. Refinement of recommendations, implementation planning, and any implementation would occur in a next phase of the project.

This will allow for a more clear understanding of the items to be implemented now, along with a list of items for future implementation as funding becomes available. With that in mind, the agencies in Cass County with the involvement of the County Board of Supervisors and local municipalities governing bodies will need to make decisions on which items will be funded under the current or existing budgets, any grants that can be identified and applied for, and which items will need to wait until additional funding is received.

Not all of the recommendations may need to be implemented immediately. However, should the County decide to move forward with an implementation of an 800 Mhz/ARMER system, or an upgrade and expansion of the VHF radio system (either of which would often be considered as “Phase 2” of the process, with this study and report being considered “Phase 1”), GeoComm would welcome the opportunity to again work with the County and staff on this project. GeoComm has actively managed the design, procurement and implementation of numerous 800 Mhz systems throughout the upper Midwest, and several in Minnesota.

A migration to the 800 Mhz ARMER system, and implementation of a Multicast Trunked radio subsystem for Cass County, if desired by the County, would ensure a long-term commitment to Interoperability with other public safety and public service agencies within the State of Minnesota, utilizing state-of-the-art radio communications technology.