# NO SIRN 20/20 ANALYSIS

NO-SIRN 20/20 OPTION

**Contract Deliverable #12: Alternative Solution Analysis**

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## DOCUMENT OVERVIEW

The SIRN 20/20 Feasibility Report put forth a recommendation that an integrated statewide radio system was a desired and feasible evolution of public radio systems in the State of North Dakota. This document provides a brief qualitative and financial analysis of a "No-SIRN" alternative—a scenario in which the status quo of individual, disparate radio networks is sustained by at the State, County, Municipal and Agency levels.

## HIGH LEVEL TECHNOLOGY OVERVIEW AND ASSUMPTIONS

Land mobile voice and paging systems in the State are currently comprised of hundreds of disparate networks with varying degrees of capability and sophistication (See "Status Quo" in Figure 1). Collectively almost 700 transmit locations—radio towers, water towers, silos, roof top repeaters, "consolettes", etc.—provide radio service to 20,000 public safety and public service end users. The SIRN 20/20 plan proposes a single, integrated solution which streamlines service by namely reducing the number of transmit locations through a standardized and shared statewide solution (See "SIRN 20/20" in Figure 1).

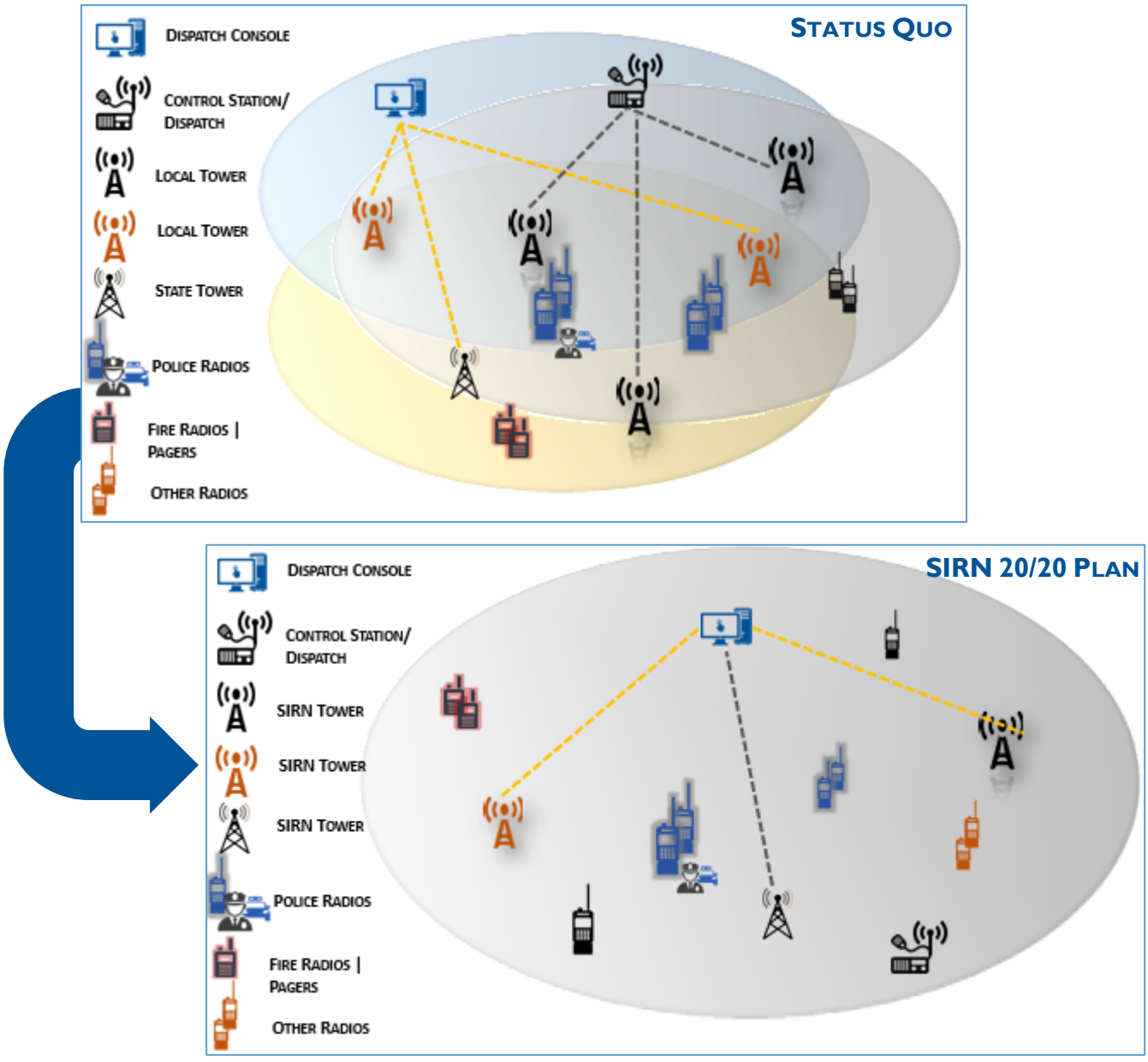


*Figure 1: Planned Migration: Disparate Legacy Systems to Integrated Modern SIRN 20/20*

The No-SIRN analysis provides high level cost estimates of perpetuating the status quo of individual, disparate systems under a similar configuration for a period of 15 years. While various entities may elect to pursue different

paths in evolving their radio systems and equipment, fundamentally, the financial analysis assumes that all components of the current ecosystem of legacy radio systems will be replaced once over the 15 years—the estimated lifespan of SIRN 20/20.[1] The analysis groups transmit locations or "systems" into the following four categories; further details are provided later in the report.

- **State Radio System**: The 43-site State Radio System that provides primary service to State agencies and 24 Counties. This analysis assumes the legacy equipment with be replaced with similar technology and a small expansion of the system over the next several years.
- **Urban Radio Systems**: The analysis assumes that over the next 15 years, the six largest metro areas in the State will elect to enhance their systems by implementing standardized trunked systems.[2]
- **Other Major Infrastructure**: Other primary systems in all 53 counties that serve voice and paging needs of primarily local as well as State agencies. Infrastructure in this category is typically comprised of radio sites over 60 ft.
- **Other Minor Infrastructure**: Other local and agency specific equipment typically comprised of roof-mounted equipment, paging systems, local relays, consolettes, and similar systems providing localized service.

## QUALITATIVE ANALYSIS

Previous reports[3] compare and contrast the ecosystem of disparate systems against the integrated SIRN 20/20 providing technical and operational perspectives. While this analysis focuses on the financial analysis of the No-SIRN alternative, it is relevant to briefly recall some key drawbacks of perpetuating the status quo that were discussed in the previous reports:

- **End of Life Risk**: A majority of the radio systems in the State are facing critical end-of-life risks—the serviceable lifespan of the equipment and termination of vendor support are quickly approaching. The timeline of the individual modernization/replacement (under the status quo) will depend on the budgetary ability of the jurisdiction and the vintage of the equipment. Counties with critical need and the population base to fund these systems will likely upgrade their systems; however, in the absence of SIRN 20/20 or coordinated state guidance, various rural entities are likely to have no actionable plan to avert this risk. (Some survey participants anticipate "they'll run their devices to the ground.")
- **Lack of Interoperability Improvements**: Improving interoperability was a primary impetus of integrating the State's radio systems into a single statewide—SIRN 20/20. Simply modernizing the existing equipment under the current disparate and independent configuration will yield little to no improvements to interoperability.
- **Omission of the Competitive Marketplace**: A competitive bulk statewide procurement will almost certainly yield significant price reductions over independent counties and municipalities sole-sourcing or even competing acquisitions. Although SIRN 20/20 is generally a more sophisticated and costly technology, a review of records and invoices indicates that several entities have incurred costs equivalent to SIRN technology for equipment that delivers less features and services.

[1] Typical serviceable lifespans of land mobile radio systems range between 12 – 18 years.
[2] The six Urban Area networks include Fargo, Bismarck/Mandan, Grand Forks, Minot, Dickinson and Williston.
[3] Refer to "SIRN 20/20 Feasibility Study Final Report" (June 2016) and "North Dakota Statewide Radio Systems Assessment and Evolution Study" (Dec. 15, 2014)

- **Suboptimal State Radio System Configuration**: State Radio employs a configuration referred to as "frequency reuse of one" which has documented operational drawbacks in the form of interference and lack of automated resource management.
- **Lack of Centralized Direction:** A byproduct of a centralized system is centralized direction and guidance which yield consistent technologies and procedures statewide. Various drawbacks of the status quo, including interoperability shortcomings, relatively high device costs, widely ranging system technologies are characteristic of independently implemented systems.

It is indeed true, as pointed by a few rural counties, that SIRN 20/20 is overly sophisticated for the day-to-day operations of sparsely populated counties in the State; however, SIRN 20/20 would provide much needed efficiencies and interoperability to all, and a baseline for mid and large sized counties to incorporate added features.

## FINANCIAL ANALYSIS

### HIGH LEVEL DESIGN ASSUMPTIONS

Multiple permutations potentially exist for migrating the large ecosystem of radio networks in the State. A variety of factors including population, radio coverage needs, geography and budget influence the technology and implementation strategy selected by the individual jurisdiction. Nonetheless, this analysis employs certain baseline assumptions:

1. *All existing legacy equipment is replaced once*: For simplicity the costs are based on a replacement in the next two to four years, rather than employing inflation and other monetary or accounting aspects of a long-term phased approach.

2. *SIRN 20/20 Equivalence*: If a given piece of equipment, such as an antenna, combiner or other potentially reusable asset, was assumed to be replaced in the SIRN 20/20 cost estimates, it is similarly assumed to be replaced in the No-SIRN scenario.

3. *Adoption of Public Safety Grade "Hardening" Best Practices*: Several public safety sites currently operate without critical backup power systems or robust equipment shelters; this analysis assumes that these key elements are "hardened" to public safety standards. Therefore, while certain operators may not have elected to do so in the past, a nominal level of emergency power, robust backhaul connectivity, and shelters are assumed at all critical locations.[4]

In addition, various assumptions ranging from conservative to moderate were used depending on the marketplace for a given component. Although there are approximately 700 "transmit locations" in the State, the total number of sites assumed (see Table 1) is 568. Therefore, this analysis assumes some reduction in transmit locations during upgrade. In addition, as the subscriber device marketplace becomes increasingly competitive, it is expected that some agencies will pay more competitive prices compared to recent acquisitions. On the other hand, as stated in (3) above, the costs estimates include nominal public safety "hardening" enhancements to sites although several counties have historically elected to forgo such equipment.

[4] The National Public Safety Telecommunications Council has formalized a set of best practices for public safety grade operation and facilities in their report *NPSTC/APCO Defining Public Safety Grade Systems and Facilities – May 2014*. The objective of these best practices is to delineate technical and physical measures/redundancies commensurate with the high availability public safety systems.
http://www.npstc.org/download.jsp?tableId=37&column=217&id=3066&file=Public_Safety_Grade_Report_140522.pdf

## Infrastructure Elements

Table 1 provides an overview of the assumptions for the four categories of sites previously discussed.

*Table 1: Overview of Infrastructure Assumptions*

| Category | Description |
|---|---|
| State Radio System | ▫ 50 Site 4-channel Conventional System<br>▫ 3 P25 Conventional, 1 Analog<br>▫ DCN Fiber Lease<br>▫ 5 New Towers<br>▫ 50 % New Shelters; 50% Generators<br>▫ All new UPS and Battery Plants |
| Urban Area Systems | ▫ 6 Trunked Systems of 3 sites by 6-channels<br>▫ No New Towers<br>▫ Microwave Backhaul<br>▫ Shelter and Power upgrades, as required<br>▫ All new UPS and Battery Plants |
| Other Major Infrastructure | ▫ 225 Sites with 2.5 channels<br>▫ 1 P25 Conventional, 1.5 Analog<br>▫ Medium Capacity: 65% Generators; 40% Shelters<br>▫ Medium Capacity: All new UPS and Battery Plants<br>▫ Low to Medium Capacity: New Microwave Backhaul<br>▫ Mix of owned and rented sites<br>▫ 15 New Towers (@ 50% of cost of State Towers) |
| Other Minor Infrastructure | ▫ 275 sites with 1.5 channels<br>▫ 0.75 P25 Conventional, 0.75 Analog<br>▫ Mix of roof top mounted and tower mounted<br>▫ Limited structural modifications<br>▫ Low capacity UPS and Battery Plant equipment<br>▫ No to Limited backhaul |

**Other Assumptions Include:**

- PSAP Elements
  - 75 ***Mid-Tier*** Dispatch Consoles
  - Interfaces to logging recorders, CAD applications and integration support
- In-building Solutions
  - @ 50 buildings (Only ***half of SIRN 20/20*** assumed)
- Paging Layer and Related Interfaces
- Fire Station Interfaces and Integration @ 380 Fire stations (Less cost for localized paging systems)
- Vendor Services (Note: Although the overall "radio ecosystem" under the No-SIRN analysis is significantly larger, "vendor services" as detailed below have been ***reduced to approximately 60% of SIRN 20/20***)

- A&E, Site Prep, Structural Analysis, R56 Test
- Site Engineering/Design
- Channel Planning, Coordination, Acquisition
- System Engineering — Optimization, Documentation, DDR/Engineering
- Project Management Services
- Construction/Site Management Services
- Acceptance Testing, Functional Testing, Other
- Project Coordination/Administration
- Device Provisioning and Coordination
- Fleetmap Services and Design
- System Decommission

- Government Employee Project Management (Note: Although the overall "radio ecosystem" under the No-SIRN analysis is significantly larger, "vendor services" as detailed below have been ***reduced to approximately 60% of SIRN 20/20***)
  - Construction and Field QA/Management Services
  - Independent Certification/Validation Services
  - Engineering, Network Planning, Deployment
  - Project Management/Leadership
  - Technical and Senior Management
  - Expenses (office, travel, vehicle, equipment, etc.)

- 7.5% Contingency

- Only 50% of the discount assumed in SIRN 20/20

- Technical, engineering and management consulting fees expected to be required by some counties for planning and other support

## Subscriber Devices

Table 2 illustrates high level device type assumptions for radios. Unit pricing employed a range of prices including prices from various recent State and County agencies invoices. However, on average, the cost analysis assumes lower device costs in comparison to recent invoices. It should be noted that analog devices for various agencies are considered in the analysis; however, as some vendors begin "sunsetting" their analog product line, it is possible that the more costly P25 conventional devices may be the sole option for certain entities.

*Table 2: Overview of Subscriber Device Assumptions*

| SUBSCRIBER CATEGORY | Qty | Device Type Assumptions |
|---|---|---|
| State LE Mobile* | 258 | High Tier P25 Conventional |
| State LE Portable* | 270 | 100% Analog |
| County LE Mobile* | 800 | High Tier P25 Conventional |
| County LE Portable* | 1,042 | 75 % Mid-Tier P25 Conventional<br>25 % Analog |

| SUBSCRIBER CATEGORY | Qty | Device Type Assumptions |
|---|---|---|
| County FD-AMB Mobile | 2,380 | High Tier P25 Conventional |
| County FD-AMB Portable | 4,448 | 50% Mid-Tier P25 Conventional<br>50% Analog |
| Urban FD-AMB Mobile | 378 | Mid-Tier P25 Trunked |
| Urban FD-AMB Portable | 692 | Mid-Tier P25 Trunked |
| Urban LE Mobile* | 404 | Mid-Tier P25 Trunked |
| Urban LE Portable* | 1,006 | Mid-Tier P25 Trunked |
| State DOT Mobile | 800 | High Tier P25 Conventional |
| State DOT Portable | 150 | High Tier P25 Conventional |
| Other Public Safety Mobile | 253 | High Tier P25 Conventional |
| Other Public Safety Portable | 410 | High Tier P25 Conventional |
| Public Service (County and Urban) Mobile | 5258 | 50% Mid-Tier P25 Conventional<br>50% Analog |
| Public Service (County and Urban) Portable | 1075 | 50% Mid-Tier P25 Conventional<br>50% Analog |
| VRS Units | 1350 | Analog Device |

*All law enforcement devices assumed to have encryption.

## ESTIMATED CAPITAL COSTS

Based on the assumptions detailed above, the Capital Expenditure (CapEx) for the No-SIRN 20/20 Option is $ 185 M. The SIRN 20/20 Feasibility Report outlined various integrated solutions ranging in cost from $ 144 M to $ 186 M, with the most suitable option expected to be approximately $ 172.

*Table 3: No-SIRN Capital Cost Estimates*

| INFRASTRUCTURE ELEMENTS | Estimated Cost (in Millions) | |
|---|---|---|
| 01_Fixed Radio Networks | $ | 85.52 |
| 02_Subsystems/Interfaces | $ | 1.48 |
| 03_Civil and Power Infrastructure | $ | 37.74 |
| 04_Professional Services | $ | 12.89 |
| 05_PMO | $ | 5.43 |
| L01_PSAP Subsystems | $ | 3.38 |
| L02_In-Building Solutions | $ | 2.31 |
| L03_Station Alerting Subsystems** | $ | 2.51 |
| INFRASTRUCTURE TOTAL | **$** | **151.25** |

| | | |
|---|---|---|
| 7.5% DISCOUNT | $ | 140.31 |
| **SUBSCRIBER DEVICES** | $ | 44.59 |
| **TOTAL CAPITAL EXPENDITURE** | $ | 184.91 |

## ESTIMATED OPERATIONAL COSTS

Operational expenses comprise annual software support, maintenance, technology upgrades, utilities, connectivity costs, and various management and operations personnel and activities. A range of 10% - 15% of the *capital cost of equipment* is a well-accepted rule of thumb for *annual* cost of operations for large technology infrastructure systems. Based on this approximation and the estimated equipment cost[5] of the No-SIRN Option ($ 95 - $100 M), estimated annual costs are expected to range between $ 9.5 M - $ 15 M. In contrast the estimated SIRN OpEx is between $ 9.8 and $ 13 M.

Various factors affect these estimates:

- ***Rent, Utilities, Leased Lines***: Historically, local business have extended these goods and services to counties and public safety at lower rates that may be available to the State; however, No-SIRN comprises over 3-times the number of sites which likely offsets these local savings.
- ***Public Safety Grade Maintenance***: As with the capital estimates, the operational framework assumes that the disparate systems will be maintained at public safety grade levels with the requisite design, vendor support and local personnel to sustain the system.

[5] Excludes all engineering, installation, design and management services.