



# **Puget Sound Emergency Radio Network Project: Facing Challenges With In- Building Coverage and Falling Behind Schedule**

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**February 2, 2017**

## **Executive Summary**

Uncertainty about coverage inside buildings and delays in tower site construction are increasing risks to the Puget Sound Emergency Radio Network. Replacing the aging system is a vital and complex public safety effort estimated to cost \$273 million in levy funds. We recommend moving forward with planned analysis of coverage, increasing engagement with building owners, and evaluating alternatives to the aggressive construction effort planned for the first half of 2017.



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## Puget Sound Emergency Radio Network Project

## Report Highlights

February 2, 2017

### Project Status

Replacing King County's aging emergency radio system, the Puget Sound Emergency Radio Network (PSERN), is a vital and complex public safety effort that involves working with a wide range of stakeholders. We identify scope, schedule, and budget risks to King County's \$273 million levy funded project to upgrade its emergency radio network, including unresolved stakeholder concerns about delivery of improved coverage for buildings by the new system, schedule delays with delivering radio tower sites, and project reporting based on potentially unrealistic assumptions.

### ▼ Scope

The PSERN project team is performing additional analysis to address stakeholder concern about coverage within buildings. Potential response to results of the analysis has not been fully developed but could range from no change in scope to adding additional radio sites.

### ▼ Schedule

Longer than anticipated lease negotiations and approvals are adding to prior delays in starting radio tower site development. The County was initially held back from starting lease negotiations from late 2015 through mid-2016 until its vendor, Motorola, provided adequate technical information and identified suitable sites. Once lease negotiations were begun in 2016, additional problems related primarily to landlord engagement led to further delays. Overall delay is now impacting planned sequencing for development, increasing risks associated with shortened construction timelines. Cumulatively these delays could impact major project milestones if lease completion issues continue.

### ▼ Budget

Project information regarding site development costs is not yet baselined in the county's Project Information Center, weakening Council's ability to provide oversight.

### Recommendations

We recommend increasing planning for engagement with building owners regarding in-building coverage. We also recommend evaluating reorganizing the project's work breakdown and schedule to address site development schedule delays and entering the project baseline information in the county's Project Information System to allow strengthened oversight.

● = No Current Concerns

▼ = Attention Needed

◆ = Corrective Action Needed

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# I. Building Coverage

## Section Summary

**The Puget Sound Emergency Radio Network (PSERN) project team’s response to increased concerns about emergency coverage for buildings could lead to expanded project scope.** Project stakeholders’ concerns regarding the new system’s impact on in-building coverage have caused the project team to pursue additional design analysis. Outcomes of additional analysis could range from no change to changing the radio tower sites layout and design, including possibly adding tower sites late in the project. Changing or adding tower sites at this stage could add project cost and time.

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**Stakeholders are concerned that the new system may not improve coverage for buildings**

**King County promoted improved coverage as one of the benefits of the new emergency radio network.** However, project stakeholders, represented by the PSERN Joint Board,<sup>1</sup> have raised concerns about uncertainty that the new radio system will improve emergency radio coverage inside public and private buildings compared to the current system.

**The new system’s signal strength and accessibility are key elements that building owners will rely upon to assure required emergency communication within their buildings.** The new system, like the existing radio network, will provide a signal that allows emergency response personnel to use portable radios to communicate both outside and within buildings and structures.<sup>2</sup> Within buildings and structures, construction types and materials can interfere with the emergency signal, so building owners are usually required to assure that the signal is available at key locations within their structures. The extent of changes to the external signal strength and type, such as those being made by the PSERN project, can affect the way owners will need to modify their in-building systems to continue to provide an adequate internal emergency communication signal.

When PSERN’s contractor, Motorola, modeled system replacement, it did not specifically focus on how the new system might affect radio coverage inside buildings, as it was only required to model signal coverage at street or ground level. Without additional modeling, the project team and its partners will not have much information on in-building coverage until after the new system is initially activated.

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<sup>1</sup> The multi-jurisdiction project is overseen by the PSERN Joint Board, per interlocal agreement among King County, Auburn, Bellevue, Federal Way, Issaquah, Kent, Kirkland, Mercer Island, Redmond, Renton, Seattle, and Tukwila. The Joint Board includes four voting representatives from King County, City of Seattle, Valley Communications, Eastside Public Safety Communications Agency, and non-voting police and fire representatives.

<sup>2</sup> Structures, as used here, include tunnels and other below ground areas such as those operated by Sound Transit, City of Seattle, King County, and private parties.

## I. Building Coverage

The PSERN project team has acknowledged the Joint Board's concerns and its technical team has outlined a plan with Motorola to analyze coverage for buildings. The team presented a preliminary schedule for completing the analysis by late January 2017 to the PSERN Joint Board at its December meeting. Results of the analysis are being reviewed by the project technical team and have not yet been presented to the Joint Board.

If results of the analysis show that the new system is likely to improve coverage for buildings, the project team may not have to consider any design changes now. However, if results show a likelihood of decreased coverage, the project team might recommend to the Joint Board that it consider options ranging from acceptance of coverage as modeled to adding transmission sites. The project could face increased delay and cost if improving coverage requires additional work, such as adding or changing tower sites.

**Building owners may not be aware of the potentially costly changes they may need to make**

**Building owners may not have the information they need to adequately prepare to adapt to the new system.** When the new radio system is in place, some building owners may need to adapt their internal systems that pick up, distribute, and amplify the outside radio signal to meet internal coverage required by fire and public safety codes.<sup>3</sup> Regulations for in-building coverage vary among local agencies and continue to evolve, but typically cover new or recently remodeled high-rise buildings. The PSERN project team is beginning to assess the number of buildings with in-building radio equipment that may need to be adapted for the new radio system. Costs for building owners are not known but may be significant for some building owners.<sup>4</sup>

**The project's current communications planning does not specifically identify a detailed, proactive approach for outreach to building owners on this issue.** While the cost of modifying in-building systems is not the responsibility of the PSERN project, the project team should provide adequate notice to building owners to allow them to prepare for changes they will need to make to adapt to the new system.

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<sup>3</sup> Building owners, as used here, include not only the legal owner of a public or private building, but also may include building operators or tenants who may be required by local codes to provide emergency radio signal coverage inside their buildings. The project team has not determined the number of buildings that are currently required to provide internal coverage (requirements vary by jurisdiction and when the building was constructed). The PSERN project director estimates that the PSERN service area includes about 65,000 buildings and a recent City of Seattle estimate identified about 50 buildings in its jurisdiction that currently have radio augmentation systems. The actual number of buildings that need internal coverage within the radio system area has not been determined.

<sup>4</sup> The cost of augmenting radio signal for these buildings will vary greatly as each building's structure and uses are unique. As an example, King County recently upgraded augmentation of radio signal for its jail building at a cost of approximately \$4 million.

## I. Building Coverage

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**Recommendation I** The Puget Sound Emergency Radio Network (PSERN) project team should expand its outreach and communications plans to identify detailed, proactive engagement with building owners to allow them time to evaluate their systems and prepare for any needed changes. The completed updates should be presented at the first quarter 2017 PSERN project briefing to the Law and Justice Committee.

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## 2. Site Development

### Section Summary

**Lease acquisition difficulties are adding to prior delays in starting radio tower site construction. The PSERN project team is now facing a tighter time window for site construction, increasing risk to cost, schedule, and quality control.** The PSERN project team had planned to construct all Primary Bounded Area (PBA) tower sites between early 2016 through July 2017.<sup>5</sup> However, delays in identifying sites, receiving technical information, and obtaining leases means the County was unable to begin construction as planned in 2016. By the end of 2016, the County had only made significant construction progress on four of 29 PBA tower sites. Unless it revises its plan to deliver all PBA sites in 2017, the County now needs to obtain leases and construct more sites simultaneously than anticipated during the first half of 2017.

### **The County is slipping behind completion of the Primary Bounded Area tower sites**

**The County and its vendor, Motorola, are responsible for developing or improving 55 radio transmission sites throughout the radio service area.** Out of the 55 sites, the County is responsible for delivering 45 sites. Of the county's 45 sites, 29 sites serve the PBA and are needed for early system installation and testing to begin in 2017. To deliver these 29 sites in coordination with Motorola's work, the project team had scheduled to begin site construction in early 2016 and complete all PBA sites before August 2017. Delays have caused start of construction for most sites to slip into 2017. Completion of several of these sites now appears to be slipping past the August 2017 milestone, and the last site would not be complete until late October 2017.

**Tower site completion delays could impact the overall system replacement schedule and costs if significant delays continue.** When the project director reported that the project is still on schedule at Council's November 29, 2016 Law and Justice Committee meeting, he explained that the milestones included in the "overall project status" are still achievable, but that there is increasing risk associated with site development delays. His position that overall project schedule is not currently behind plan is based on the PSERN project team having adequate flexibility to work around delays with site development delays in the remaining schedule. However, working around site development delays means revising the project's work breakdown and may increase risks associated with costs and quality.

<sup>5</sup> The "Primary Bounded Area" is the core service area of the system, including lowland urban areas below an elevation of 1,250 feet above sea level.



## 2. Site Development

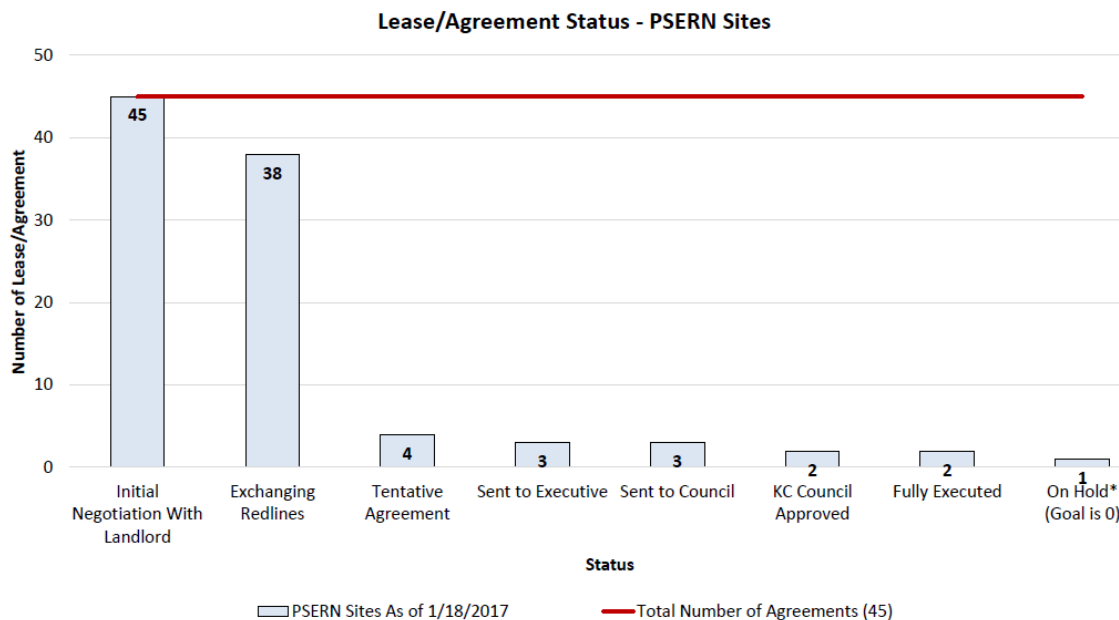
**Delay in obtaining site leases is ongoing and timing of completed negotiations is still uncertain**

**Lease delays mean site construction cannot start when planned.** The County or Motorola must, in most cases, get a lease or agreement with a property owner before beginning construction on a site. Lease negotiations, however, are uncertain and have been much slower than anticipated.

A primary cause of lease delays cited by the PSERN project team was the difficulty in getting property owners to engage in negotiations. Both the County and Motorola have limited tools to compel uninterested or unwilling property owners to negotiate within timeframes planned by the project. This issue creates a difficult challenge for the PSERN project team as it develops and updates project reports and schedules.

As of January 18, 2017, PSERN has received fully signed lease/agreement documentation for two of the 45 sites that are its responsibility.<sup>6</sup> See Exhibit A. One more lease is currently planned for Council consideration in early 2017. Motorola indicates it has obtained seven out of its 10 required sites as of January 17, 2017.

**Exhibit A: PSERN lease completion is minimal as of January 18, 2017.**



Notes: \* Clearview (Land): This site is on hold to determine whether a document is needed from the Fire District 7.

Source: PSERN project Joint Board Meeting materials for January PSERN Lease Agreement Progress Report.

<sup>6</sup> The number of leases/agreements needed by PSERN does not exactly match the number of sites it is developing because some sites require multiple agreements while others do not require agreements.

## 2. Site Development

While progress in completing leases has been slow, the PSERN project team hopes to move forward with many leases soon. This optimism is partly based on having 19 of the remaining leases controlled by only three parties: Washington State Department of Natural Resources (eight sites), United States Forest Service (eight sites), and Washington Department of Transportation (three sites). The other remaining leases, however, are being negotiated with 18 different property owners.

At least one site lease negotiation, King Lake, has delayed to the extent that an alternate site is being designed and processed in parallel. Development of the alternate site would likely delay site completion past fall 2017. As demonstrated by the King Lake site, no radio tower site schedule is certain until leasing is complete. If the PSERN project team is unable to negotiate leases on other sites, alternatives to those sites could take a year or more to find, secure, and develop.

**Site construction is now bottlenecked into the first half of 2017**

**The site construction time window is now compressed and this could strain the capacity of project staff and resources.** Delay in obtaining leases is leaving less time than planned for site construction. In early 2016, the PSERN project team planned to spread out site construction from early 2016 through the first half of 2017 to allow the team to focus on completing a limited number of sites at any time. This would have allowed the team to effectively track and manage individual site construction activities and issues.<sup>7</sup>

**During the second quarter of 2017, the County could have as many as 15 sites under construction at the same time.** With the delays experienced thus far, the team will now need to construct the majority of PBA sites during the first half of 2017 if it is to meet its milestone of delivering PBA sites to Motorola in 2017. See Exhibit B. This level of effort could strain the PSERN project team and its contractors, resulting in increased risks associated with cost, schedule, and quality control.

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<sup>7</sup> Construction on individual sites varies from minor changes to existing equipment to development of entirely new tower sites.

## 2. Site Development

**Impacts of delays are uncertain.** Impacts of site development delay on the overall project have not been fully addressed. This is partly because the extent of delay continues to be unpredictable due to uncertain lease negotiations. To some extent, the PSERN project team may be able to work around individual site construction delays. For example, Motorola may be able to install equipment on individual sites or groups of sites as they are completed, so a minor overall site development delay may not impact overall project schedule. However, a lengthy delay in completion of sites could delay Motorola's plans to activate, tune, and test the replacement system.

**PSERN has not presented alternatives to its aggressive construction plans**

**The current site development work breakdown may not be an optimum approach to completing the site development phase of the project.** The aggressive construction schedule increases risk by leading to possibly unnecessary focus on too many sites at the same time. The PSERN team indicates they are working with Motorola to coordinate site development with Motorola's equipment installation scheduling. However, the team has not formally re-organized the site development schedule in a way that demonstrates this coordination. The current site development schedule dated January 12, 2017, now shows six PBA sites slipping past the August 2017 construction completion milestone, and still shows as many as 16 sites will be under construction at the same time in June 2017.

Revising the site development scheduling to provide a larger window of time for construction and sequencing of sites, coordinated with Motorola's equipment installation schedule, could reduce risk potential of working on a large number of sites at the same time. An analysis of benefits and costs of revising the PBA site completion milestone could include assessment of impacts of a revised schedule on the overall project delivery timeline.

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**Recommendation 2**

The Puget Sound Emergency Radio Network (PSERN) project team should evaluate and compare the impacts on contract requirements, schedule, and costs for 1) the current plan of simultaneously constructing Primary Bounded Area sites, versus 2) extending the Primary Bounded Area site development schedule to allow construction of sites in sequence. Results of the evaluation should be presented at the first quarter 2017 PSERN project briefing to the Law and Justice Committee.

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### 3. Project Reporting Needs Improvement

#### Section Summary

**PSERN’s site development cost and schedule reporting are not formalized in a way that allows effective Council oversight.** Sufficient project information is available at this stage in project development to provide reliable cost and schedule information, but the PSERN project team has not formally baselined the project.<sup>8</sup> The team now knows the tower site locations and preliminary construction needs for most sites. However, the team has not entered a project baseline into the county’s Project Information Center system as recommended in the November 10, 2015, King County Auditor’s report on PSERN.<sup>9</sup>

#### Construction costs based on outdated estimates

**Site development cost reporting available to Council is still unreliable.** Site development costs should be more certain and quantifiable at this stage in the project. Initially, very little site-specific information was available, so rough costs were estimated using six categories of sites. As the project progressed and the PSERN project team completed preliminary design evaluations for each site, cost estimates should have become more refined. However, results of the first round of work order contract negotiations show site development costs are significantly different from what was originally estimated and bid.

**Lack of access to reliable site development cost estimates limits Council’s ability to track that actual costs are fair and reasonable.** At this stage in the project, construction costs should now be within a range of -30% to +50 percent.<sup>10</sup> However, actual negotiated work order contract costs for the first four sites are nearly double the bid estimates and over four times as much as the contractor’s bid.<sup>11</sup> See Exhibit B. The PSERN project team has begun steps to improve cost estimates by developing more detailed designs for sites and approving the hire of an additional engineering estimate consultant to develop improved estimates. The results of this effort have not yet been provided or used to create a project cost baseline.

<sup>8</sup> Lease progress will continue to be uncertain due to the need to negotiate with external parties over which the project team has little control.

<sup>9</sup> Recommendation 3, Page 4, Puget Sound Emergency Radio Network: Project Schedule and Cost Risks, King County Auditor’s Office, Capital Projects Oversight Program, November 10, 2015.

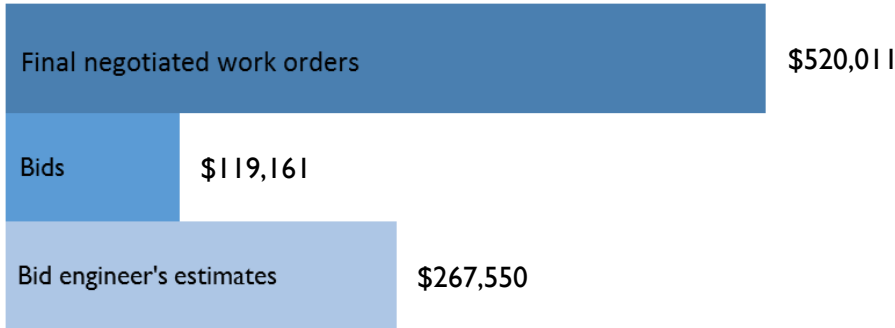
<sup>10</sup> Table 4-1, Cost Estimating Manual for Projects, Washington State Department of Transportation, April 2015.

<sup>11</sup> Although the first four work orders are significantly higher than the engineer’s estimate and bid amounts, site improvement costs are tracking less than amounts used for initial budgeting of the project. The initial budget used categories of sites that are proving to not be representative of actual improvements that have been determined needed for selected sites.

### 3. Project Reporting Needs Improvement

*Exhibit B: Initial negotiated site cost vary widely from estimates and bids.*

#### First Four Work Orders



Source: King County Auditor’s Office analysis of PSERN project documents.

**Site development schedules show potentially unrealistic timeframes.** Site development schedules presented by the PSERN project team do not appear to show reasonable presentation of project progression. The team developed the overall site schedule based on sequential development of sites, consistent progress on lease negotiations, and spread-out lease processing. None of these conditions currently exist on the project.

**The schedule appears to present overly optimistic assumptions of lease negotiations and processing times.** To stay on schedule, the project will now need to process 15 or more lease agreements simultaneously in the first half of 2017. For all these leases to be completed to the level necessary for Council review, most negotiations with property owners will need to be complete early in the first quarter of 2017. So far, experience has shown lease processing through negotiations and King County approval takes much more time than allowed in the current project schedule. The project schedule does not reflect any additional time to process a large number of leases simultaneously.

**The project is still not formally baselined**

**The project is not baselined in the county’s Project Information Center (PIC).** The project is now at a stage when baselining is appropriate and will provide useful information for monitoring and oversight. In early stages of the project, the team chose not to baseline schedule and cost, because it recognized there were too many unknowns regarding site needs and property acquisition time. To deal with the uncertainty, the PSERN project team used a “rolling wave” planning approach that allowed the team to address only details that were relatively certain within a near-term planning horizon. The team now knows site locations and development needs with enough certainty to establish formal cost and schedule baselines, which should allow the team to prepare meaningful earned value management information.

### 3. Project Reporting Needs Improvement

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**Recommendation 3** The Puget Sound Emergency Radio Network (PSERN) project team should complete updated site development cost estimates based on current information, should update the overall project costs based on this information, and enter the project baseline costs into the county's Project Information Center prior to the first quarter 2017 PSERN project briefing to the Law and Justice Committee.

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**Recommendation 4** The Puget Sound Emergency Radio Network (PSERN) project team should refine the schedule to reflect realistic site development milestone achievement dates and should enter the project baseline schedule into the county's Project Information Center prior to the first quarter 2017 PSERN project briefing to the Law and Justice Committee.

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**Conclusion** Replacing King County's aging emergency radio system is a vital public safety effort. It is an expensive and complex project that involves working with a number of stakeholders. This report provides timely recommendations to help the project move forward with system design and site construction in the next few months. Our future reports will continue to cover our oversight on the full scope of the PSERN project including progress on installation and delivery of the radio equipment by Motorola.