Statewide NG911 GIS Strategic Plan

Commonwealth of Pennsylvania

Adopted: December 2023

pennsylvania
EMERGENCY MANAGEMENT AGENCY

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1. Introduction and Defining Purpose

Chapter 53 of Title 35 of the Pennsylvania Consolidated Statutes (Chapter 53) requires PEMA to establish, in consultation with the 911 Advisory Board, a Statewide 911 Plan that prepares Pennsylvania for Next Generation 911 (NG911) service and sets priorities for 911 systems across the Commonwealth. Recognizing the critical role that GIS plays in NG911 service, the Statewide NG911 GIS Strategic Plan has been developed as a supplement to the Statewide 911 Plan. This Statewide NG911 GIS Strategic Plan updates the vision, strategy and guidance outlined in the 2019 plan to help prepare our 911 system stakeholders for evolving standards and capabilities related to NG911 service.

The updated strategy in this Plan focuses on identifying and providing PEMA's 911 system stakeholders with guidance around two mission-critical areas:

- Support ongoing GIS data development and maintenance to sustain accurate GIS-based 911 call routing.
- Support GIS data enrichment so that PSAPs can utilize their GIS data to readily adopt new mapping technologies, including the integration of existing map-based systems (e.g., Computer Aided Dispatch (CAD)) with 3-dimensional (3D) mapping platforms and the incorporation of z-axis (vertical) data with location services to enhance 911 caller location intelligence and related capabilities.

The plan is organized into three sections:

- **Section 1** gives an overview of Pennsylvania's NG911 project and describes how GIS is currently used to support NG911 call delivery. This section further outlines what full end-state i3 call delivery will look like and describes how GIS data will remain a core component.
- **Section 2** restates the vision outlined above and provides a corresponding set of goals, action steps, and anticipated outcomes to help reach this vision. These action steps are designed to be tactical, and the anticipated outcomes are intended to provide indicators of success.
- **Section 3** summarizes the goals and action steps up into a visual roadmap and includes a projected timeline for completing each goal.

Additionally, this plan includes an appendix that provides a brief overview of key GIS milestones that were critical for advancing the statewide migration to NG911 service.

1.1. A brief history of NG911 GIS data development in Pennsylvania

Chapter 53 requires counties to develop and share GIS data with PEMA necessary for supporting GIS-based call routing for NG911 service[1]. This legislation formalized and accelerated work that had already been underway between PEMA and its county partners. Pennsylvania's talented and dedicated county GIS partners have come together to achieve many critical GIS milestones that have enabled the migration to NG911 service. Throughout the migration to NG911 service, collaboration between PEMA and the counties has been a core value.

[1] Pa C.S. § 5304 (c) (10)

PEMA has worked closely with its county partners in developing and sharing resources and providing technical support, where needed, to identify and close remaining GIS data gaps. Our collaborative efforts have resulted in the development of authoritative, accurate, and current county-built datasets that are now supporting 911 call delivery. Geospatial call routing has been enabled at the time of cutover for all PSAPs that have been migrated to NG911 service to date.

Regional Approach

Migrating Pennsylvania to NG911 service has been a complex endeavor. A regional approach has been taken to address logistical challenges and efficiently manage a statewide migration. Pennsylvania's 67 counties were grouped into one of seven (7) NG911 service regions and PEMA applied the same approach for migrating each region. Figure 1 below shows these regions and their corresponding total populations (as of the 2020 US Census). Table 1, beneath the map, compares these regions to other states and jurisdictions to provide a sense of scale.

Figure 1 - Map of Pennsylvania's NG911 regions and their populations

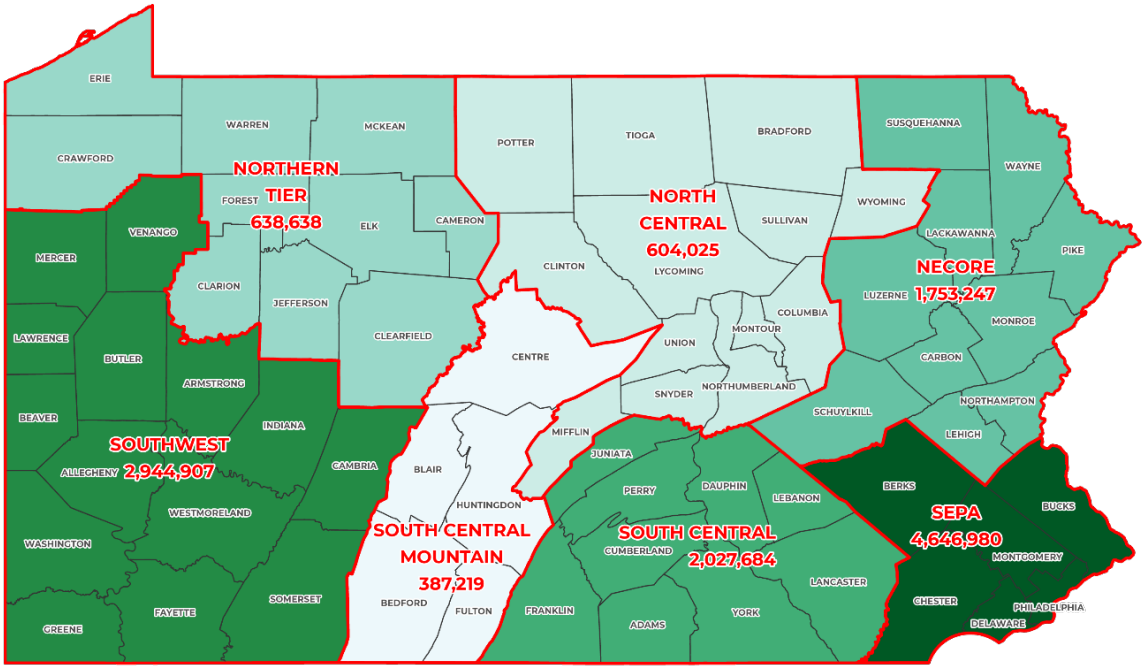


Table 1 - Population comparisons (by region) to other states and nations

South Central Mountain	387,219	*Comparable to **Iceland** (366,463)*
North Central	604,025	*Comparable to **Wyoming** (576,851)*
Northern Tier	638,638	*Comparable to **Vermont** (643,077)*
NECORE	1,753,247	*Comparable to **Hawaii** (1,455,271)*
South Central	2,027,684	*Comparable to **Nebraska** (1,961,504)*
Southwest	2,944,907	*Comparable to **Kansas** (2,937,880)*
SEPA	4,646,980	*Comparable to **Kentucky** (4,505,836)*

PEMA deployed a high touch onboarding and engagement strategy with each service region focused on building strong relationships and cultivating trust with and among GIS data stewards. These efforts have supported the successful development of high quality, county-derived, GIS data to support NG911 GIS-based call routing. Our approach in preparing each region's GIS data for migration is generalized into five distinct phases in Table 2 below:

Table 2 - Phased approach for reaching regional GIS data readiness

PHASED APPROACH FOR REACHING REGIONAL GIS DATA READINESS
Phase 1: Pre-Onboarding Phase This involved primarily behind the scenes work that included getting county GIS users credentialed for our statewide spatial interface platform, GIS Data Hub (GDH), and scheduling regional training sessions for the platform.
Phase 2: Data Hub Training Phase Regional GIS Data Hub trainings sessions were provided to county partners. Most of these were in-person. These training sessions were designed to be hands-on, with counties accessing their own GDH accounts and utilizing their own data to get familiar with the system.
Phase 3: GIS Checkpoint Calls Following the GDH regional training, we scheduled monthly regional GIS Checkpoint Calls, which are ongoing in non-migrated regions. Each region's calls follow the same format, which includes providing an update on each jurisdiction's current critical error count and ALI to GIS synchronization rates. The update is followed by recommendations for resolving critical errors. Time is also set aside for discussion.
Phase 4: NG9-1-1 Ready Data During this phase all counties within a region have data that has become critical error free, potential gaps and overlaps between polygons have been identified and addressed, and their GIS to ALI synchronization rates are deemed acceptable by local 911 authorities (typically 98% or greater).
Phase 5: Data Coalescing With GIS data from a region now ready to support geospatial call routing, the data is passed into Next Generation Core Services (NGCS) to support the geospatial call routing function.

1.2. GIS and transitional state NG911 call delivery

The Pennsylvania NG911 system's current call routing process reflects a transitional state between legacy-based and full i3 call delivery. To support call delivery today, Pennsylvania's NG911 system consumes county built and maintained GIS data to validate a 911 caller's location and geospatially route their call to the appropriate PSAP. Counties share their GIS data via a

cloud-hosted statewide spatial interface solution, GeoComm GIS Data Hub (GDH), where it undergoes a robust set of rigorous quality control (QC) checks to ensure that it meets NG911 standards. Once data passes these QC checks, it is considered *NG911-ready,* and capable of supporting geospatial call routing – a core component of the NG911 system. After becoming NG911-ready, GDH aggregates corresponding GIS layers from across the Commonwealth to construct a standardized set of statewide layers to support geospatial call routing.

Note: *If a county provisions data that passes QC, and later uploads data that fails QC, the newer data* ***does not*** *get passed into the statewide NG911 system. Instead, the system will continue to use the last dataset that passed QC.*

Unlike an Enhanced 911 PSAP, a NG911-migrated PSAP no longer needs to maintain a tabular MSAG. However, because the entirety of the 911 industry has not completely moved to a NG911 system, the incorporation of Spatial MSAGs is a necessary transitional step that allows a NG911-migrated PSAP to still engage with legacy network providers. The Spatial MSAGs utilized in Pennsylvania's NG911 system must be updated regularly to ensure ongoing accuracy. PEMA strongly recommends that counties provision their data to GDH every two weeks and *requires* data to be provisioned once-per-month to keep data used to support geospatial call routing current.

Prior to being passed into Next Generation Core Services (NGCS), where geospatial call routing occurs, the NG911-ready GIS data undergoes a process called spatial attribution. During this process a county's Site/Structure Address Point (SSAP) layer and Road Centerline (RCL) layer features are appended with relevant call routing information from each feature's geographically corresponding PSAP and Emergency Service layers to build two Spatial MSAGs: one corresponding to attribution within the SSAP layer, and the other corresponding to attribution within the RCL layer. The Spatial MSAGs are like the legacy tabular MSAG they are replacing, except the data is derived directly from current, authoritative, and NG911-ready GIS data. *(**Note**: Spatial MSAGs are automatically updated to reflect GIS changes, typically within one business day of a county uploading critical error free GIS data to GIS Data Hub.)*

Compared to the legacy call routing processes that geospatial call routing replaces, the overall accuracy and speed of 911 call delivery is greatly improved and results in fewer call transfers stemming from misrouted calls. The workload on the PSAP is also reduced. Due to more accurate call routing resulting from enabling geospatial call routing of 911 call traffic, telecommunicators should experience a reduction in misrouted calls and will spend less time rerouting them. Additionally, the tabular MSAG is being decommissioned and after migration the PSAP only needs to maintain its GIS data. This should result in less administrative work for the PSAP.

Both the SSAP and RCL derived Spatial MSAGs are synchronized against a Comtech-hosted ALI database (Comtech being the Commonwealth's NG911 service provider), which is populated and maintained by Originating Service Providers (OSPs). The ALI database and Spatial MSAGs are hosted on the Comtech ALI Location Data Platform (ALI LDP), which helps maintain the high GIS to ALI synchronization rate required to support accurate and efficient geospatial call routing. The

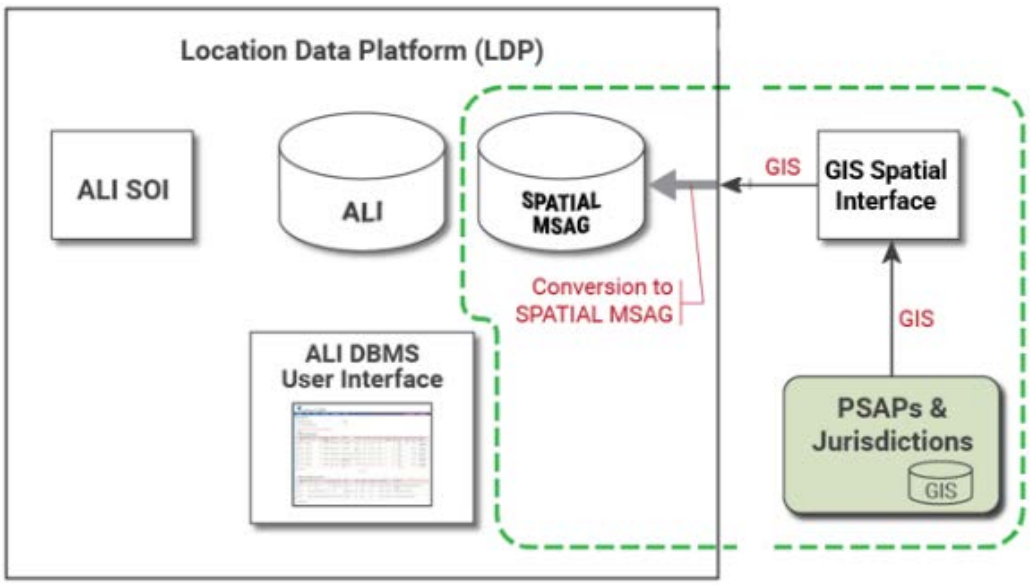
following attributes outlined in Table 3, defined by *the NENA Standard for NG9-1-1 GIS Data Model (NENA-STA-006.2a-2022)*, are used to build the Spatial MSAGs:

Table 3 - Attributes used to build the GIS-derived MSAG

Road Centerline (RCL)	Site/Structure Address Point	Emergency Service Layers
• Date Updated • NGUID • Left/Right To and From • Left/Right Parity • Legacy Street Pre-Directional • Legacy Street Name • Legacy Street Type • Left/Right MSAG Community • Left/Right ESN • Left/Right State	• Date Updated • NGUID • Address Number • Address Number Suffix • Legacy Street Pre-Directional • Legacy Street Name • Legacy Street Type • MSAG Community • ESN	• Display Name • Service URI • Service URN

With regards to system behavior for validating a 911 caller's location and routing their call to the appropriate PSAP, the SSAP-derived Spatial MSAG is queried first. This is premised on the assumption that SSAPs can more precisely provide civic location intelligence on sites that otherwise may not geocode correctly using the RCL layer and additionally can help accurately identify locations where non-standard addressing exists. If a match is not found against the SSAP-derived Spatial MSAG, the system defaults to the RCL-derived Spatial MSAG to validate the caller's location and route the call accordingly. This all takes places in a matter of milliseconds and is faster and more accurate than the legacy call routing processes it is replacing.

Figure 2 - Overview of the Comtech ALI Location Data Platform. This represents how the Spatial MSAGs are created using county built and maintained GIS data.



It is important to reiterate that this call routing process, while more accurate and efficient than the legacy call routing processes it is replacing, is not end state NG911. The NENA i3 Standard for Next Generation 911, which Pennsylvania's NG911 system is based on, describes end state i3 call delivery as being one where "SRs (Selective Routers) and existing ALI systems are decommissioned, and all 9-1-1 calls are routed using the Emergency Call Routing Function (ECRF) and arrive at the ESInet/NGCS via Session Initiation Protocol (SIP)" (pages 2-3)[2]. At that point, the spatial MSAG and ALI components of the NG911 system will go away. These will be replaced by a Location Validation Function (LVF) that will query an OSP-hosted Location Information Server (LIS), which replaces ALI, to validate 911 caller locations and route calls via SIP. GIS data will continue to drive the location validation and call routing processes, feeding directly into the LVF. As of this publication, the timeline for completing the transition to full i3 call delivery is unknown and difficult to estimate.

2. Pennsylvania's NG911 GIS Goals and Priorities

This plan envisions an end state of NG911 GIS for the Commonwealth where accurate GIS-based routing of 911 call traffic is maintained and where PSAPs can efficiently adopt emerging mapping technologies that utilize geospatial data to enhance location intelligence and further improve 911 service. Below are six specific, measurable, attainable, realistic, and timely goals to help achieve this vision. Each goal includes background information to provide readers with relevant context and history. Following the background section is a list of action steps. These steps are tactical in nature and are intended to help 911 system stakeholders accomplish each goal. Finally, under each set of action steps is a summary of anticipated outcomes. These provide indicators of success to help determine when a goal has been reached.

2.1. Goal: Promote addressing in alignment with NG911 standards

Background:

GIS data plays a pivotal role in NG911 service delivery. Accurate, current, and authoritative GIS data layers, built and maintained by PEMA's county partners, are essential for enabling and sustaining accurate NG911 geospatial call routing. PEMA worked with the Pennsylvania GIS community, including the State Geospatial Coordinating Board, other state agency partners, the County GIS Professionals Association of Pennsylvania (commonly referred to as The County GIS Pros), and other county GIS stakeholders to develop the required GIS data layers and processes to support NG911. This work has enabled Pennsylvania to be among the few states to utilize geospatial call routing as part of its initial migration to NG911 service.

The NENA NG9-1-1 GIS Data Model Standard (NENA-STA-006.2a-2022)[3], which serves as the NG911 GIS data model standard for Pennsylvania, requires a Site/Structure Address Point (SSAP) layer. However, the NENA standard states that there is *currently* no requirement for the completeness of SSAP data (see page 31 of the referenced standard). Within Pennsylvania's

[2] https://www.nena.org/resource/resmgr/standards/nena-sta-010.3d-2021_i3_stan.pdf
[3] https://www.nena.org/resource/resmgr/standards/nena-sta-006.2a_ng9-1-1_gis_.pdf

statewide SSAP layer, data attribution gaps are present within its sub-addressing fields (e.g., building, floor, unit, room, seat, and additional location information (such as Pediatric Wing or Concourse B, etc.)). While the NENA standard identifies these values as “Optional”, PEMA’s NG911 GIS Data Model and Best Practices Guide classifies these fields as “Strongly Recommended”. This is to encourage counties to focus on populating these layers, as they will likely become required fields in the future. Accomplishing this will necessitate county 911 authorities and GIS data stewards to engage with their local addressing authorities. PEMA recognizes that this will take time and resources to complete.

There are approximately 1,200 addressing authorities across Pennsylvania who are responsible for issuing addresses to homes, structures, etc. A critical need moving forward is to ensure the addressing authorities are issuing addresses according to NG911 standards and are working with county 911 authorities and GIS resources to identify and populate sub-addressing data, where currently missing, into their local SSAP layers – which will then be reflected in the statewide layer. More complete sub-addressing data will support more accurate 911 call delivery and assist first responders with identifying the location of the caller.

Action Steps:

- Develop an education and outreach plan to engage with Pennsylvania’s addressing authorities.
- Continue to develop, in partnership with county & state stakeholders, statewide sub-addressing standards and best practices for GIS data maintenance.
- PEMA and county stakeholders to engage with the United States Postal Service (USPS) and other governmental partners on address validation and related issues.
- Publish best practices that promote coordination between county and local addressing stakeholders, such as tools that support coordination between counties and municipalities or developing a model 911 addressing ordinance that establishes roles and responsibilities for addressing within a county.
- Define requirements, roles, and responsibilities for addressing in legislation or regulation.
- Identify and address existing gaps and inconsistencies in attribute standardization across all fields within required NG911 layers and promote attribute standardization at the local level. Examples of inconsistencies in the statewide dataset include, but are not limited to, the following: non-standard casing for populated data elements; differences in including or not including municipality type; abbreviating municipality type (e.g., borough vs boro); the inclusion of county after a county name, etc.
- The PEMA 911 office to continue to provide NG911-related GIS funding opportunities with 15% Funds to support 911-related addressing initiatives.

Anticipated Results:

- New addresses are issued according to NG911 standards across Pennsylvania, complete with sub-addressing data, where applicable.
- As NG911 standards evolve and new requirements are introduced, Pennsylvania will keep pace to meet the needs and expectations of the public and first responders.

2.2. Goal: Operationalize 3D mapping technology and vertical elevation data

Background:

According to NENA, *"Introducing three-dimensional (3D) location and mapping to 9-1-1 operations represents a massive sea change in how caller location is conveyed and how callers are located. It is the largest shift in location for 911 since wireless Phase II was introduced in the late 1990s. Though many of the underlying technical capabilities already exist to operationalize 3D location for 9-1-1, they are not currently being leveraged for routine operations and there are gaps in understanding, implementation, and standardization.[4]"* The focus of this goal is to begin addressing these gaps and standardize data, schemas, and processes among public safety applications to operationalize 3D location data for NG911 and other PSAP systems.

Vertical elevation data, also known as z-value or z-axis data, is being formally recognized across the industry as a vital part of the NG911 environment – and Pennsylvania seeks to be on the cutting edge with this lifesaving technology. The Federal Communications Commission (FCC) also recognizes this need and in 2019 published a vertical accuracy benchmark as part of the Fifth Report and Order FCC-19-124[5]. This report outlines the accuracy requirements for vertical locations equating to within three meters above or below the handset of wireless callers.

As of 2023, several jurisdictions within Pennsylvania have already begun receiving vertical elevation data as part of the automatic location identification (ALI) feed from wireless providers. At this time Pennsylvania's PSAPs are not fully prepared to ingest and operationalize this data, since sophisticated software algorithms are needed to properly convert this data into actionable location intelligence that can be readily utilized by 911 telecommunicators.

The following action steps are intended to assist Pennsylvania's PSAPs with preparing to be able to support the integration of 3D mapping technology and vertical elevation data.

Action Steps:

- Identify gaps in schemas, data, technology, and workflows to operationalize 3D mapping and vertical elevation data, including integrating 3D mapping and z-axis location information into the NG911 system and other related PSAP systems.
- Define a plan and benchmarks to guide efforts in addressing these gaps.
- Monitor updates from NENA regarding new standards for GIS and 3D mapping and the inclusion of z-axis data.
- Publish best practices that are aligned to these national standards and provide training to assist counties with meeting anticipated 3D mapping and z-axis related data requirements. *Note: while it is important that new Commonwealth published guidance and best practices be aligned to national standards, these standards are still being developed.*
- Define imagery needs and formalize a strategy with other state agencies and GIS

[4] https://cdn.ymaws.com/www.nena.org/resource/resmgr/standards/nena-req-003.1-2022_3d_gis_2.pdf
[5] https://docs.fcc.gov/public/attachments/FCC-19-124A1.pdf

stakeholders to jointly obtain, fund, and share imagery among stakeholders to support NG911 and 3D GIS data development and maintenance.

- Provide continued financial support with 15% Funds for local GIS data development:
    - For 15% Funding: Define requirements, eligibility criteria, and required outcomes to ensure projects accomplish expectations to operationalize 3D mapping and vertical elevation data for 911.
    - Where applicable, develop detailed models for complex multistory structures of interest, such as those in densely populated areas or those expected to be densely occupied.

Anticipated Results:

- NGCS and supporting applications within PSAPs can leverage 3D mapping technology and vertical elevation data to provide telecommunicators with additional accessible and actionable location intelligence.

2.3. Goal: Maintain NG911-ready GIS data; Keep pace with evolving standards

Background:

PEMA's county partners have played a crucial role in developing high quality, standardized statewide GIS data layers to support geospatial call routing for NG911. These layers include:

- Public Safety Answering Point (PSAP) Boundaries
- Provisioning Boundaries
- Emergency Service Boundaries for Law Enforcement, Fire, and EMS
- Road Centerlines
- Site/Structure Address Points

These layers have been provided to PEMA for inclusion in the NGCS. Now that these initial statewide GIS layers have been built, it is essential that they stay current and keep pace with evolving NG911 standards and technology. PEMA will continue to collaborate with its county partners to maintain current, accurate, and authoritative data for NG911. It is of equal importance that the Pennsylvania GIS community monitor and respond to evolving standards and technology related to NG911 service. Additionally, PEMA, working with our county and state government partners, will continue to promote the sharing of NG911 GIS data layers for disaster response and other important needs.

Action Steps:

- PEMA will socialize and publish guidance on data provisioning schedules, to ensure data remains current for geospatial call routing.
- Conduct outreach and training as turnover drives need at the county level and as systems, workflows, and standards evolve.
- Continue to provide financially support counties by using 15% Funds in support of building, maintaining, and sharing GIS data for NG911.

- Support counties in identifying potential gaps in their road centerline data for segments not maintained by municipalities, counties or PennDOT, and engage with other governmental partners to ensure road centerline data is complete, current, and accurate. Partners may include the US Forest Service, The Pennsylvania Department of Conservation and Natural Resources (DCNR), the Pennsylvania Game Commission (PGC) and others.
- Continue to host regular Pennsylvania NG911 GIS Working Group sessions and represent the Pennsylvania 911 program at local, state, and national events.
- Monitor and respond to updates to relevant NENA standards, applicable state and federal legislation, and policy actions that impact NG911 GIS data development, maintenance and sharing.
- Working with county partners and stakeholders from other state agencies, develop a plan for sharing NG911 data after removing any potentially sensitive data or personally identifiable information (PII).

Anticipated Results:

- Counties have adequate technical support and resources to meet NG911 GIS data building, maintenance, and provisioning requirements.
- Statewide GIS datasets remain current and capable of supporting geospatial call routing across the Commonwealth. Additionally, these layers are updated to meet new requirements as standards and technology evolve.
- Statewide data is readily accessible to key stakeholders to support emergency response and public safety.

2.4. Goal: Support county NG911 GIS professional recruitment and retention

Background:

GIS skills are in high demand across multiple industries, and companies and governments are competing for a limited workforce. This coincides with a moment where GIS is becoming critical to sustaining PSAP operations as authoritative, accurate, and current GIS data is a dependency for NG911 service. PSAPs are increasingly relying on GIS professionals to meet the GIS data needs of NG911. PEMA is committed to supporting the efforts of county partners in attracting and retaining the geospatial talent required for sustaining NG911 operations.

Action Steps:

- Survey PSAPs regarding their 911 GIS staffing retention needs and concerns.
- Inventory national, state, and local efforts aimed at training, recruiting, and retaining NG911 GIS professionals and identify best practices.
- PEMA to collaborate with county stakeholders to study and compare salary and benefit packages for NG911 GIS staff across the state to better inform the development of initiatives aimed at recruitment and retention of NG911 GIS professionals.
- Develop resources to support PSAPs in recruiting, onboarding, and retaining NG911 GIS professionals.

- Incentivize efforts to regionalize GIS resources or leverage technology to share workload among GIS resources for NG911.
- Where possible, develop and implement strategies with partners to educate and train individuals interested in the 911 industry to create a pipeline approach of potential candidates.

Anticipated Results:

- PSAPs across the Commonwealth are better prepared to attract, train, and retain 911 GIS professionals.

2.5. Goal: GIS data supports interstate interoperability

Background:

The 2023 Statewide 911 Program Plan includes a goal to deploy additional NG911 functionality (Goal 3.3.1), and under this goal includes the following action item: "*Develop a complete strategy for transfers to surrounding states with location information including governance and funding responsibilities*" (Page 10). To support this work, PEMA will engage with PSAPs that share a border with out-of-state jurisdictions and assist in ensuring data is free of unintentional gaps and overlaps and is capable of supporting interstate interoperability.

Action Steps:

- Affected county and state governments must agree on a state boundary dataset for NG911 service to facilitate NG911 GIS data alignment with jurisdictions in New York, New Jersey, Delaware, Maryland, West Virginia, and Ohio. Confirm an authoritative boundary dataset for the United States/Canada International Maritime Boundary between Pennsylvania and Ontario over Lake Erie and ensure existing relevant NG911 boundaries are snapped to this border.
- PEMA will engage with its county stakeholders to collaborate on formalizing a policy that supports GIS data governance and boundary change management.
- Obtain NG911 GIS data from jurisdictions in neighboring states and compare topology against Pennsylvania PSAPs to ensure boundaries remain free of unintentional gaps and/or overlaps. ***(Note:** This affects 29 counties.)*
- Work with the counties that share a border with another state to review boundaries and support efforts to resolve gaps or overlaps between interstate PSAP boundaries.

Anticipated Results:

- Pennsylvania has seamless NG911 polygons consistent with corresponding polygons in neighboring out-of-state jurisdictions; All NG911 GIS data is aligned to support NG911 interoperability between states.

2.6. Goal: Encourage adoption of the NG911 GIS Data Model Standard across PSAP mapping platforms

Background:

Pennsylvania's PSAPs rely on Computer Aided Dispatch (CAD) and related mapping technologies to support and enhance 911 response. There are multiple CAD and related PSAP mapping solutions deployed throughout the Commonwealth that consume locally built GIS data. These systems often require local GIS data to conform to vendor specific data structures, which limits this data's potential for supporting additional functions. With the migration to NG911 service, Pennsylvania's counties are required to build and maintain NG911 GIS datasets that are aligned to the NENA NG9-1-1 GIS Data Model Standard. This has facilitated the development of accurate and current standardized statewide NG911 GIS datasets. However, many PSAPs are caught between competing needs to build and maintain GIS data that meets the NENA standard while also meeting CAD and mapping technology vendor-specific data structure requirements. This has led to jurisdictions maintaining multiple variants of the same GIS data layers or maintaining duplicative fields within layers. This is inefficient and adds to the possibility that errors could accidentally be introduced, creating discrepancies between ostensibly duplicate datasets.

The NENA standard provides a robust international standard that fosters efficiency and interoperability. The focus is to incorporate use of this standard in CAD systems and related PSAP mapping systems to facilitate greater efficiency, ease the overall GIS data stewardship burden placed on counties and PSAPs, and mitigate the possibility of new errors being introduced.

Action Steps:

- PEMA to conduct a statewide inventory of CAD and related PSAP mapping technologies and determine whether their data structure requirements conform to the NENA NG9-1-1 GIS Data Model Standard.
- Develop 911 program policies, in consultation with the 911 Advisory Board and GIS stakeholders, to promote adoption of the NENA NG9-1-1 GIS Data Model Standard across various PSAP systems where applicable.
- Provide education and conduct outreach on NG911 GIS standards to discuss benefits and promote adoption to enable efficient GIS efforts within the counties.

Anticipated Results:

- Symmetry is achieved in the GIS data supporting all CAD and related PSAP mapping technologies operating within Pennsylvania PSAPs.
- County/PSAP GIS data stewards have a reduction in overall data development and maintenance workloads.
- The potential for errors being accidentally introduced is mitigated.

3. NG911 GIS Strategic Goals Roadmap

Goal	Action Step	Estimated Completion
2.1 – Promote addressing in alignment with NG911 standards and close gaps in the Site/Structure Address Point layer's sub-addressing fields	Develop an education and outreach plan to engage with Pennsylvania's addressing authorities.	2024
	Continue to develop, in partnership with county and state stakeholders, statewide sub-addressing standards and best practices for GIS data maintenance.	2026
	PEMA and county stakeholders to engage with the United States Postal Service (USPS) and other governmental partners on address validation and related issues.	2026
	Publish best practices that promote coordination between county and local addressing stakeholders, such as tools that support coordination between counties and municipalities or developing a model 911 addressing ordinance that establishes roles and responsibilities for addressing within a county.	2026
	Define requirements, roles, and responsibilities for addressing in legislation or regulation.	2026
	Identify and address existing gaps and inconsistencies in attribute standardization across all fields within required NG911 layers and promote attribute standardization at the local level. Examples of inconsistencies in the statewide dataset include, but are not limited to, the following: non-standard casing for populated data elements; differences in including or not including municipality type; abbreviating municipality type (e.g., borough vs boro); the inclusion of county after a county name, etc.	2026
	Continue to provide NG911-related GIS funding opportunities with 15% Funds from the PEMA 911 office to support 911 related addressing initiatives.	Ongoing
2.2 – Operationalize 3-dimensional (3D) mapping technology and vertical elevation (z-axis) data to support and enhance NG911 services	Identify gaps in schemas, data, technology, and workflows to operationalize 3D mapping and vertical elevation data, including integrating 3D mapping and z-axis location information into the NG911 system and other related PSAP systems.	2024
	Define a plan and benchmarks to guide efforts in addressing these gaps.	2024

	Monitor updates from NENA regarding new standards for GIS and 3D mapping and the inclusion of z-axis data. Publish best practices that are aligned to these national standards and provide training to assist counties with meeting anticipated 3D mapping and z-axis related data requirements. Note: While it is important that new Commonwealth published guidance and best practices be aligned to national standards, these standards are still being developed.	2026
	Define imagery needs and formalize a strategy with other state agencies and GIS stakeholders to jointly obtain, fund, and share imagery among stakeholders to support NG911 and 3D GIS data development and maintenance.	2026
	Provide continued financial support using 15% Funds for local GIS data development: define requirements, eligibility criteria, and required outcomes to ensure projects accomplish expectations to operationalize 3D mapping and vertical elevation data for 911. Where applicable, develop detailed models for complex multistory structures of interest, such as those in densely populated areas or those expected to be densely occupied.	Ongoing
2.3 – Maintain NG911-ready statewide GIS datasets and stay aligned with evolving standards and technology	PEMA will socialize and publish guidance on data provisioning schedules, to ensure data remains current for geospatial call routing.	2023
	Conduct outreach and training as turnover drives need at the county level and as systems, workflows, and standards evolve.	Ongoing
	Continue to provide financial support from the 15% Fund to counties in support of building, maintaining, and sharing GIS data for NG911.	Ongoing
	Support counties in identifying potential gaps in their road centerline data for segments not maintained by municipalities, counties or PennDOT, and engage with other governmental partners to ensure road centerline data is complete, current, and accurate. Partners may include the US Forest Service, The Pennsylvania Department of Conservation and Natural Resources (DCNR), the Pennsylvania Game Commission (PGC) and others.	Ongoing
	Continue to host regular Pennsylvania NG911 GIS Working Group sessions and represent the Pennsylvania 911	Ongoing

	program at local, state, and national conferences and events.	
	Monitor and respond to updates to relevant NENA standards, applicable state and federal legislation, and policy actions that impact NG911 GIS data development, maintenance and sharing.	Ongoing
	Working with county partners and stakeholders from other state agencies, develop and promote a plan for sharing NG911 data, after removing any potentially sensitive data or personally identifiable information (PII).	2024
2.4 – Support county NG911 GIS professional recruitment and retention efforts	Survey PSAPs regarding their 911 GIS staffing retention needs and concerns.	2024
	Inventory national, state, and local efforts aimed at training, recruiting, and retaining NG911 GIS professionals and identify best practices.	2025
	PEMA to collaborate with county stakeholders to study and compare salary and benefit packages for NG911 GIS staff across the state to better inform initiatives aimed at recruitment and retention of NG911 GIS professionals.	2025
	Develop resources to support PSAPs in recruiting, onboarding, and retaining NG911 GIS professionals.	2026
	Incentivize efforts to regionalize GIS resources or leverage technology to share workload among GIS resources for NG911.	2026
	Where possible, develop and implement strategies with partners to educate and train individuals interested in the 911 industry to create a pipeline approach of potential candidates.	2026
2.5 – GIS data supports interstate interoperability	Affected county and state governments must agree on a state boundary dataset for NG911 service to facilitate NG911 GIS data alignment with jurisdictions in New York, New Jersey, Delaware, Maryland, West Virginia, and Ohio. Confirm an authoritative boundary dataset for the United States/Canada International Maritime Boundary between Pennsylvania and Ontario over Lake Erie and ensure existing relevant NG911 boundaries are snapped to this border.	2024

	PEMA will engage with its county stakeholders to collaborate on formalizing a policy that supports GIS data governance and boundary change management.	2025
	Obtain NG911 GIS data from jurisdictions in neighboring states and compare topology against Pennsylvania PSAPs to ensure boundaries remain free of unintentional gaps and/or overlaps. *(Note: This affects 29 counties.)*	2028
	Work with the counties that share a border with another state to review boundaries and support efforts to resolve gaps or overlaps between interstate PSAP boundaries.	Ongoing
2.6 – Encourage the adoption of the NENA NG9-1-1 GIS Data Standard across Computer Aided Dispatch (CAD) and related PSAP mapping technology platforms	PEMA to conduct a statewide inventory of CAD and related PSAP mapping technologies and determine whether their data structure requirements conform to the NENA NG9-1-1 GIS Data Model Standard.	2024
	Develop 911 Program policies, in consultation with the 911 Advisory Board and county partners, to promote adoption of the NENA NG9-1-1 GIS Data Model Standard across various PSAP systems where applicable.	2024-2025
	Provide education and conduct outreach on NG911 GIS standards to discuss benefits and promote adoption to enable efficient GIS efforts within the counties.	2025

Appendix A: Summary of NG911 GIS accomplishments, 2016-2023

Key NG911 GIS Milestones in Pennsylvania: 2016 - 2023	
2016	Published the first iteration of the Pennsylvania Statewide NG911 GIS Strategic Plan, bringing key stakeholders together to begin planning for NG911 GIS needs.
2017	PEMA stood up the GIS Working Group, a body comprised of county GIS professionals and representatives from state government entities. The group advises PEMA on GIS matters related to NG911 deployment.
2017	PEMA expanded eligibility guidelines for its 15% Funds (also known as Interconnectivity Funds) to include NG911-related GIS projects. Between 2017 and 2022 PEMA awarded counties more than $12 million to support NG911 GIS efforts.
2018-2023	Completed a statewide aerial imagery project, providing counties with high resolution, leaf-off, and georeferenced aerial imagery intended for validating road centerline and site/structure address point data.
2019	Adopted the NENA Standard for NG9-1-1 GIS Data Model for Pennsylvania and drafted two best practices guides. These guides were developed to assist counties in building NG911 data that meet the needs of NG911.
2019	Completed a statewide GIS data gap analysis and shared results with counties. This provided a baseline indicator of a county's overall geospatial data readiness and identified areas that needed to be worked on.
2019	Act 17 of 2019 formalized the work PEMA and its county partners were already engaged in regarding developing and sharing NG911 GIS data. This legislation requires counties to regularly share with PEMA the GIS data needed to support geospatial call routing for NG911.
2020	After an exhaustive search, PEMA executed a contract with Comtech to provide NG911 service for the Commonwealth. Comtech brought on GeoComm to build and maintain a single statewide Spatial Interface solution, GIS Data Hub (GDH).
2021	Established GIS data provisioning and maintenance policies and procedures.
2021-2022	Deployed GIS Data Hub, Pennsylvania's statewide spatial interface (SI) solution, which works to QC a county's data, aggregates NG911-ready layers from various sources, and passes those aggregated layers into Next Generation Core Services (NCGS) to support geospatial call routing.
2022-2023	Pennsylvania PSAPs are actively being migrated to NG911 service. Geospatial call routing is enabled at the time of a PSAP's migration to NG911.