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# Madison County, MT NG9-1-1 Analysis November 2018

## Important Information

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### Other Relevant Documents

- Data Management
  - Synchronizing Geographic Information System Databases with MSAG & ALI Information Document (NENA 71-501)
- Data Development
  - Development of Site/Structure Address Point GIS Data for 9-1-1 (NENA-INF-014.1-2015)
- Data Structure
  - Standard Legacy Data Formats For 9-1-1 Data Exchange GIS Mapping (NENA-STA-015.10)
- NextGen 9-1-1 Civic Location Data Exchange Format (CLDXF)
  - NENA-STA-004.1.1-2014\_CLDXF
- Nena Standard for NG9-1-1 GIS Data Model
  - NENA-STA-006.1-2018

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## Introduction

### Purpose

In 2009, the National Emergency Number Association (NENA) established and published a transitional plan for reviewing and using GIS data in Next Generation 9-1-1 (NG9-1-1). The expected audience are local agencies who maintain or participate in the GIS operations of the entity.

The goal of the published information is to bring awareness of possible negative impacts from out of sync data to the new system. Outlined in **NENA 71-501<sup>1</sup>** are guided examples to synchronizing the Master Street Address Guide (MSAG) and the Automatic Location Information (ALI) databases to Geographic Information System (GIS) road centerline and site / structure address points. This synchronization process will improve the accuracy of the GIS data, the MSAG and ALI databases, aid in preparing PSAPs for NG9-1-1 and improve the accuracy of the GIS data currently used by PSAPs for mapping calls.

DDTi Quality Control (QC) measures as outlined in this document and performed on your data adhere and go beyond the NENA document. The QCs can ensure there will be no loss of 9-1-1 service to the public after transition is complete to NG9-1-1 and improve E9-1-1 call routing.

It is important to note that experience levels and capacity play large parts in the QC plan. A clear maintenance plan is strongly recommended for optimal remediation.

### Scope

It is within the scope of this work to analyze and report layer consistency and synchronization between the MSAG, ALI, and GIS. Quality control results rely heavily on layer availability. Some checks may not be possible with incomplete data.

Delivery includes this PDF document report and accompanying QC results along with the original data received from each PSAP.

## Next Steps

This report is delivered and to be used as a tool to improve current 9-1-1 capabilities and to prepare the GIS data for NG9-1-1, and to track metrics over time if the report is performed again. It is recommended that before modification to either the GIS Data or Service Provider Data that a clear understanding exists of the data relationships and maintenance of each dataset.

The complex nature of service provider data acquisition and remediation time may pose issues with turnaround time.

To fix the delivered discrepancies a knowledge of GIS and visual map comprehension is highly recommended. Because the service provider data editing may fall under a different department than the 9-1-1 GIS, a working relationship between the two is highly recommended.

## *Future Work*

This report contains specific cases and records where ALI, MSAG, and GIS layers require modification. After modification, additional iterations of these tests are recommended to ensure all discrepancies are resolved. For explanations of the data delivered, see Appendix B.

## Getting Started

### Data Identification

#### *Required GIS Data Layers*

- Address Points
- Road Centerlines
- Emergency Service Zone Boundaries
- Political Boundaries

#### *Required Service Provider Data*

- ALI
- MSAG

## Data Schema (GIS)

The data schema outlined below is a minimum requirement to perform applicable QCs. *Please note that this schema is not a fully compatible NG9-1-1 schema.*

Presence of specific fields is a requirement for analysis, but standardized field naming is not. If minimum requirements are not met then analysis will be incomplete.

### Road Centerlines at a minimum must have fields for...

- Street Name Components parsed into
  - Prefix Direction
  - Street Name
  - Street Type
  - Suffix Direction
- Address Range Components
  - Left From
  - Left To
  - Right From
  - Right To
- MSAG Community
  - Left Community
  - Right Community

### Address Points at a minimum must have fields for...

- House Number
  - Numeric values only
- Street Name Components parsed into
  - Prefix Direction
  - Street Name
  - Street Type
  - Suffix Direction
- MSAG Community

### Emergency Service Zones at a minimum must have fields for...

- Emergency Service Number

*The data may be edited to meet parsing requirements and noted in the report.*

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The following shows the Schema mapping from PSAP’s original data to DDTI analysis as well as the requirements of the data schema for Next Generation 9-1-1. NOTE: the schema mapping below highlights MANDATORY fields that are possibly missing or have possible issues that need to be corrected. There are likely other CONDITIONAL fields that need to be populated, possibly with information in existing fields (for example, “highways” need to be parsed from the Street Name into the Street Name Pre Type field). PSAPs are encouraged to familiarize themselves with the NENA NG9-1-1 GIS Data Model Standard to determine how their existing fields crosswalk to the NENA standard, and any new fields that may need to be populated. For further information on NENA Standards refer to other relevant documents noted on page i.

### Site/Structure Address Point Schema

Descriptive Name	Field Name	M/C/O	Type	Field Width	POSSIBLE FIELD NAME	Type	Field Width	ANALYSIS
Discrepancy Agency ID	DiscrpAgID	M	P	75	N/A	-	-	
Date Updated	DateUpdate	M	D	-	DATEUPDATE	D	8	
Effective Date	Effective	O	D	-	EFFECTIVE	D	8	
Expiration Date	Expire	O	D	-	EXPIRE	T	254	
Site NENA Globally Unique ID	Site_NGUID	M	P	254	OBJECTID	N	10	GLOBALID FIELD IS BLANK
Country	Country	M	P	2	COUNTRY	T	254	
State	State	M	P	2	STATE	T	254	
County	County	M	P	40	COUNTY	T	254	
Additional Code	AddCode	C	P	6	ADDCODE	T	254	
Additional Data URI	AddDataURI	C	U	254	ADDDATAURI	T	254	
Incorporated Municipality	Inc_Muni	M	E	100	INC_MUNI	T	254	
Unincorporated Community	Uninc_Comm	O	E	100	UNINC_COMM	T	254	
Neighborhood Community	Nbrhd_Comm	O	E	100	NBRHD_COMM	T	254	
Address Number Prefix	AddNum_Pre	C	P	15	ADDNUM_PRE	T	254	
Address Number	Add_Number	C	N	6	ADD_NUMBER	N	10	
Address Number Suffix	AddNum_Suf	C	P	15	ADDNUM_SUF	T	254	
Street Name Pre Modifier	St_PreMod	C	E	15	ST_PREMOD	T	254	
Street Name Pre Directional	St_PreDir	C	P	9	ST_PREDIR	T	254	
Street Name Pre Type	St_PreTyp	C	E	50	ST_PRETYPE	T	254	
Street Name Pre Type Separator	St_PreSep	C	E	20	ST_PRESEP	T	254	
Street Name	St_Name	C	E	60	STREETNAME	T	254	
Street Name Post Type	St_PosTyp	C	E	50	ST_POSTYP	T	254	
Street Name Post Directional	St_PosDir	C	P	9	ST_POSTDIR	T	254	
Street Name Post Modifier	St_PosMod	C	E	25	ST_POSMOD	T	254	
Legacy Street Name Pre Directional*	LSt_PreDir	C	P	2	LST_PREDIR	T	254	
Legacy Street Name*	LSt_Name	C	P	75	LST_NAME	T	254	
Legacy Street Name Type*	LSt_Type	C	P	4	LST_TYPE	T	254	
Legacy Street Name Post Directional*	LSt_PosDir	C	P	2	LSTPOSTDIR	T	254	
ESN*	ESN	C	P	5	ESN	N	10	
MSAG Community Name*	MSAGComm	C	P	30	MSAGCOMM	T	254	
Postal Community Name	Post_Comm	O	P	40	POST_COMM	T	254	
Postal Code	Post_Code	O	P	7	POST_CODE	N	10	
ZIP Plus 4	Post_Code4	O	P	4	POST_CODE4	N	10	
Building	Building	O	P	75	BUILDING	T	254	
Floor	Floor	O	P	75	FLOOR	T	254	
Unit	Unit	O	P	75	UNIT	T	254	
Room	Room	O	P	75	ROOM	T	254	
Seat	Seat	O	P	75	SEAT	T	254	
Additional Location Information	Addtl_Loc	O	E	225	ADDTL_LOC	T	254	
Complete Landmark Name	LandmkName	C	E	150	LANDMKNAME	T	254	
Mile Post	Mile_Post	C	P	150	MILE_POST	T	254	
Place Type	Place_Type	O	P	50	PLACE_TYPE	T	254	
Placement Method	Placement	O	P	25	PLACEMENT	T	254	
Longitude	Long	O	F	-	LONGITUDE	N	19	
Latitude	Lat	O	F	-	LATITUDE	N	19	
Elevation	Elev	O	N	6	ELEVATION	N	10	

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## Road Centerline Schema

Descriptive Name	Field Name	M/C/O	Type	Field Width	POSSIBLE FIELD NAME	Type	Field Width	Analysis
Discrepancy Agency ID	DiscrAgID	M	P	75	N/A	-	-	
Date Updated	DateUpdate	M	D	-	UPDATED	D	8	
Effective Date	Effective	O	D	-	N/A	-	-	
Expiration Date	Expire	O	D	-	N/A	-	-	
Road Centerline NENA Globally Unique ID	RCL_NGUID	M	P	254	N/A	-	-	
Left Address Number Prefix	AdNumPre_L	C	P	15	N/A	-	-	
Right Address Number Prefix	AdNumPre_R	C	P	15	N/A	-	-	
Left FROM Address	FromAddr_L	M	N	6	FRADDL	N	10	
Left TO Address	ToAddr_L	M	N	6	TOADDL	N	10	
Right FROM Address	FromAddr_R	M	N	6	FRADDR	N	10	
Right TO Address	ToAddr_R	M	N	6	TOADDR	N	10	
Parity Left	Parity_L	M	P	1	N/A	-	-	
Parity Right	Parity_R	M	P	1	N/A	-	-	
Street Name Pre Modifier	St_PreMod	X	E	15	N/A	-	-	
Street Name Pre Directional	St_PreDir	C	P	9	DIRPRE	T	43	
Street Name Pre Type	St_PreTyp	C	E	50	PREFIX	T	15	
Street Name Pre Type Separator	St_PreSep	C	E	20	N/A	-	-	
Street Name	St_Name	M	E	60	ROADNAME	T	41	3777 BLANK RECORDS ASSOCIATED W/ DRIVEWAYS
Street Name Post Type	St_PosTyp	C	E	50	ROADTYPE	T	43	
Street Name Post Directional	St_PosDir	C	P	9	DIRSUF	T	43	
Street Name Post Modifier	St_PosMod	C	E	25	N/A	-	-	
Legacy Street Name Pre Directional*	LSt_PreDir	C	P	2	N/A	-	-	
Legacy Street Name*	LSt_Name	C	P	75	N/A	-	-	
Legacy Street Name Type*	LSt_Type	C	P	4	N/A	-	-	
Legacy Street Name Post Directional*	LSt_PosDir	C	P	2	N/A	-	-	
ESN Left*	ESN_L	C	P	5	ESNL	T	10	
ESN Right*	ESN_R	C	P	5	ESNR	T	10	
MSAG Community Name Left*	MSAGComm_L	C	P	30	COMMUNITY	T	30	SHOULD DIFFERENTIATE LEFT FROM RIGHT
MSAG Community Name Right*	MSAGComm_R	C	P	30	COMMUNITY	T	30	SHOULD DIFFERENTIATE LEFT FROM RIGHT
Country Left	Country_L	M	P	2	N/A	-	-	
Country Right	Country_R	M	P	2	N/A	-	-	
State Left	State_L	M	P	2	STATE	T	15	
State Right	State_R	M	P	2	STATE	T	15	
County Left	County_L	M	P	40	COUNTY	T	10	
County Right	County_R	M	P	40	COUNTY	T	10	
Additional Code Left	AddCode_L	C	P	6	N/A	-	-	
Additional Code Right	AddCode_R	C	P	6	N/A	-	-	
Incorporated Municipality Left	IncMuni_L	M	E	100	N/A	-	-	
Incorporated Municipality Right	IncMuni_R	M	E	100	N/A	-	-	
Unincorporated Community Left	UnincCom_L	O	E	100	N/A	-	-	
Unincorporated Community Right	UnincCom_R	O	E	100	N/A	-	-	
Neighborhood Community Left	NbrhdCom_L	O	E	100	N/A	-	-	
Neighborhood Community Right	NbrhdCom_R	O	E	100	N/A	-	-	
Postal Code Left	PostCode_L	O	P	7	N/A	-	-	
Postal Code Right	PostCode_R	O	P	7	N/A	-	-	
Postal Community Name Left	PostComm_L	O	P	40	COMMUNITY	T	30	
Postal Community Name Right	PostComm_R	O	P	40	COMMUNITY	T	30	
Road Class	RoadClass	O	P	15	ROADCLASS	T	43	
One-Way	OneWay	O	P	2	ONEWAY	T	5	
Speed Limit	SpeedLimit	O	N	3	SPEEDLIMIT	N	5	
Validation Left	Valid_L	O	P	1	N/A	-	-	
Validation Right	Valid_R	O	P	1	N/A	-	-	

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## Emergency Service Boundary Schema

Descriptive Name	Field Name	M/C/O	Type	Field Width	POSSIBLE FIELD NAME	Type	Field Width	ANALYSIS
Discrepancy Agency ID	DiscrpAgID	M	P	75	N/A	-	-	
Date Updated	DateUpdate	M	D	-	N/A	-	-	
Effective Date	Effective	O	D	-	N/A	-	-	
Expiration Date	Expire	O	D	-	N/A	-	-	
Emergency Service Boundary NENA Globally Unique ID	ES_NGUID	M	P	254	N/A	-	-	
State	State	M	P	2	N/A	-	-	
Agency ID	Agency_ID	M	P	100	N/A	-	-	
Service URI	ServiceURI	M	U	254	N/A	-	-	
Service URN	ServiceURN	M	P	50	N/A	-	-	
Service Number	ServiceNum	O	P	15	ESN	T	15	
Agency vCard URI	AVcard_URI	M	U	254	N/A	-	-	
Display Name	DsplayName	M	P	60	N/A	-	-	

## QA/QC Plan Development

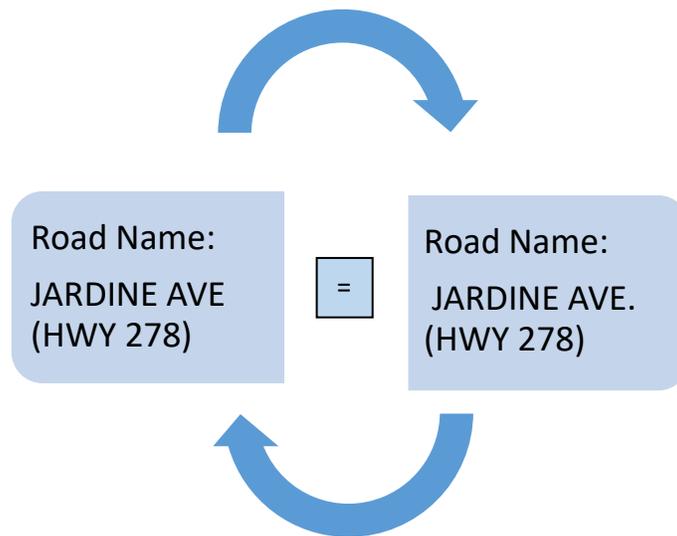
### Data Review

It is expected that 9-1-1 authorities will perform QA/QC processes prior to provisioning the data into the Spatial Interface thus minimizing the errors and resolution timeframe for the provisioning process.<sup>2</sup>

With this in mind, a detailed QA/QC plan describing the approach and communicating the deliverables effectively with the client is important.

### ***Internal Checks (Data Consistency)***

Internal checks make comparisons and check the quality control within a single layer.



One example of an internal check is reviewing Name Spelling Consistency as seen in the example above. Two forms of a name or abbreviations show the data is not consistent (Full list available on page 14.)

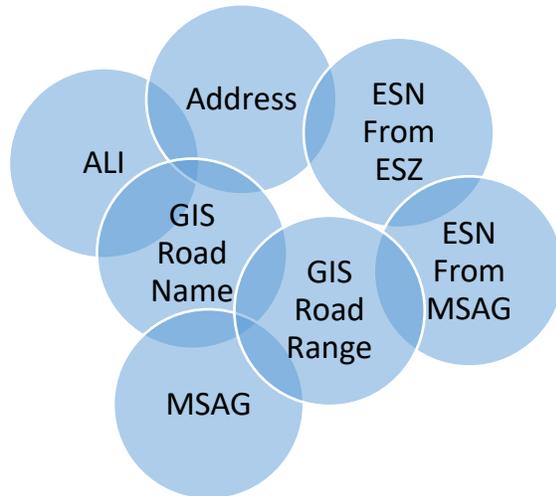
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<sup>2</sup> NENA Next Generation 9-1-1 Data Management Requirements

### **External Checks (Data Synchronization)**

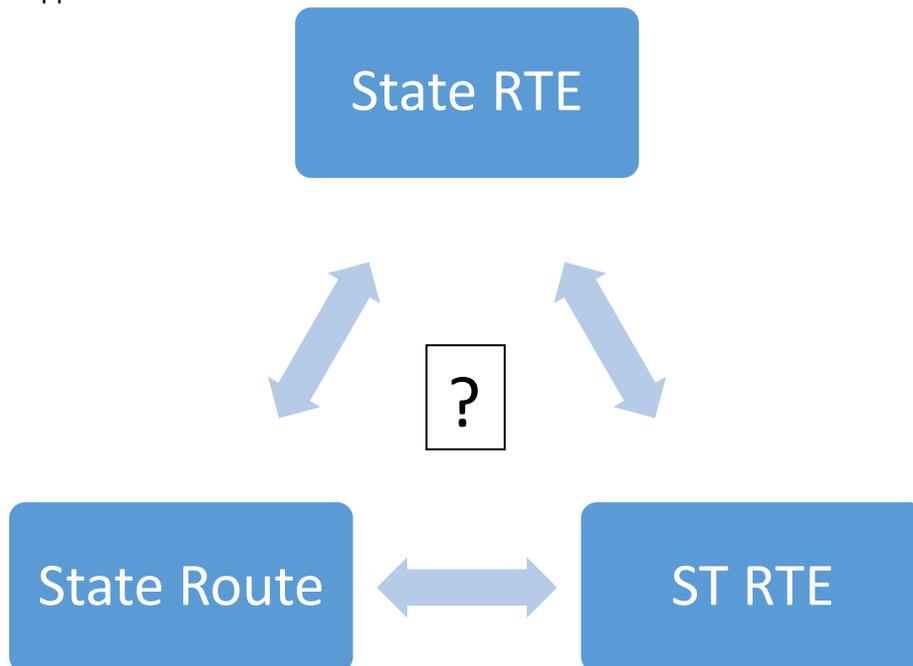
External checks make comparisons and check the quality control within multiple layers to show where the various GIS layers, ALI, and MSAG are and are not synchronous with each other. This includes information regarding Address, Name, Community, Address Range, and Location.

This mimics E9-1-1 AND NG9-1-1 functionality and reports errors and areas of concern where data doesn't match.



### **Data Modification (Data Conforming)**

Please see Appendix A for results.



## Source Layers

### Madison County GIS Data

Files utilized from Madison County:

- NG911\_Structures (2018-11-08)
- Roads (2018-10-09)
- ESN\_Zone\_042308 (2018-10-09)
- FireDistricts (2018-10-09)

#### Data Projection

Projection: NAD 1983 StatePlane Montana FIPS 2500 (Meters).

### Service Provider Data

MSAG

- MADISON COUNTY MSAG (received 2018-10-10)

ALI

- MADISON COUNTY MT TN (received 2018-10-10)

### State of Montana GIS

Files utilized from State of Montana

- MontanaIncorporatedCitiesTowns
- TransportationFramework

**Data QC Areas**

MSAG COMMS

MSAG COMM	COUNT
ALDER	66
CAMERON	145
CARDWELL	32
ENNIS	289
GLEN	8
HARRISON	35
MCALLISTER	73
MELROSE	6
NORRIS	17
PONY	53
SHERIDAN	140
SILVER STAR	36
TWIN BRIDGES	137
VIRGINIA CITY	79
WHITEHALL	34

ALI COMMS

ALI COMM	COUNT
ALDER	211
CAMERON	351
CARDWELL	95
ENNIS	1200
GLEN	17
HARRISON	136
MCALLISTER	238
MELROSE	6
NORRIS	71
PONY	93
SHERIDAN	840
SILVER STAR	63
TWIN BRIDGES	455
VIRGINIA CITY	178
WHITEHALL	81

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Delivered Layers

## Spatial

Layers to show specific problem areas.

FeatureClasses

- [-]  MadisonCounty.gdb
  -  ADDRESS\_POINTS\_IN\_WRONG\_BOUNDARY\_
  -  ADDRESS\_POINTS\_WITH\_MULTI\_MATCHING\_ADDRESS\_RANGE\_
  -  ADDRESS\_POINTS\_WITH\_NO\_MATCHING\_ADDRESS\_RANGE\_
  -  ADDRESS\_POINTS\_WITH\_NO\_MATCHING\_STREET\_NAME\_
  -  Addresses\_External\_QC
  -  Addresses\_External\_Roads\_QC
  -  Addresses\_Internal\_QC
  -  ALI\_External\_QC
  -  ALI\_WITH\_ADDRESS\_MATCH\_ROUTED\_TO\_WRONG\_ESZ\_
  -  ALI\_WITH\_MULTI\_MATCHING\_ADDRESS\_RANGE\_
  -  ALI\_WITH\_NO\_ADDRESS\_MATCH\_
  -  ALI\_WITH\_NO\_ADDRESS\_MATCH\_ROUTED\_TO\_WRONG\_ESZ\_
  -  ALI\_WITH\_NO\_MATCHING\_ADDRESS\_RANGE\_
  -  ALI\_WITH\_NO\_MATCHING\_STREET\_NAME\_
  -  CountyVsState
  -  ESB\_Internal\_QC
  -  FireBoundary\_Internal\_QC
  -  MSAG\_External\_QC
  -  MSAG\_Internal\_QC
  -  MSAG\_Roads\_ESN\_QC
  -  NEXTGENDATAMODEL\_ADDRESSES
  -  NEXTGENDATAMODEL\_ROADS
  -  Roads\_External\_QC\_Lines
  -  Roads\_Internal\_QC\_Lines
  -  Roads\_Internal\_QC\_Points

Notes:

- Data Delivered to Madison County and Montana State Library November 2018
- Projection: NAD 1983 StatePlane Montana FIPS 2500 (Meters).

## Synchronization Results

It is recommended that a minimum match rate of **98%** be set prior to using the GIS data in the Emergency Routing Data Base (ERDB) or the Location to Service Translation (LoST) Protocol services.<sup>3</sup>

### Summary

Synchronization Test	Match %
ALI to MSAG	100.00%
MSAG to Roads (Name)	88.17%
MSAG to Roads (Range)	65.92%
Addresses to MSAG	56.18%
ALI to Road Centerlines	54.42%
ALI to Addresses	70.29%

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<sup>3</sup> NENA Information Document for Synchronizing Geographic Information System databases with MSAG & ALI  
NENA 71-501, Version 1.1, September 8, 2009

**ALI to MSAG**

COMMUNITY	ALI RECORDS	MATCHING MSAG NAME & RANGE	%MATCH
ALDER	211	211	100.00%
CAMERON	351	351	100.00%
CARDWELL	95	95	100.00%
ENNIS	1200	1200	100.00%
GLEN	17	17	100.00%
HARRISON	136	136	100.00%
MCALLISTER	238	238	100.00%
MELROSE	6	6	100.00%
NORRIS	71	71	100.00%
PONY	93	93	100.00%
SHERIDAN	840	840	100.00%
SILVER STAR	63	63	100.00%
TWIN BRIDGES	455	455	100.00%
VIRGINIA CITY	178	178	100.00%
WHITEHALL	81	81	100.00%
<b>TOTAL</b>	<b>4035</b>	<b>4035</b>	<b>100.00%</b>

**MSAG to Roads- Range**

COMMUNITY	TOTAL MSAG RANGE	ROAD CENTERLINE RANGE MATCH	%MATCH
ALDER	28378	25726	90.65%
CAMERON	28956	18896	65.26%
CARDWELL	6763	3737	55.26%
ENNIS	43538	31942	73.37%
GLEN	3476	1542	44.36%
HARRISON	8551	5253	61.43%
MCALLISTER	9317	7671	82.33%
MELROSE	4486	447	9.96%
NORRIS	5876	3562	60.62%
PONY	12258	7882	64.30%
SHERIDAN	25256	18504	73.27%
SILVER STAR	4997	3565	71.34%
TWIN BRIDGES	47097	35130	74.59%
VIRGINIA CITY	31591	9059	28.68%
WHITEHALL	7029	3459	49.21%
<b>TOTAL</b>	<b>267569</b>	<b>176375</b>	<b>65.92%</b>

**MSAG to Roads- Name**

COMMUNITY	TOTAL ROAD NAMES	MSAG NAME MATCHES	%MATCH
ALDER	66	58	87.88%
CAMERON	145	126	86.90%
CARDWELL	32	25	78.13%
ENNIS	289	271	93.77%
GLEN	8	7	87.50%
HARRISON	35	31	88.57%
MCALLISTER	73	66	90.41%
MELROSE	6	4	66.67%
NORRIS	17	13	76.47%
PONY	53	47	88.68%
SHERIDAN	140	124	88.57%
SILVER STAR	36	32	88.89%
TWIN BRIDGES	137	125	91.24%
VIRGINIA CITY	79	65	82.28%
WHITEHALL	34	20	58.82%
<b>TOTAL</b>	<b>1150</b>	<b>1014</b>	<b>88.17%</b>

**Address Points to MSAG**

COMMUNITY	ADDRESSES	MATCHING MSAG NAME AND RANGE	%MATCH
	18	0	0.00%
59735	1	0	0.00%
Alder	321	280	87.23%
Big Sky	20	0	0.00%
BigSky	1998	0	0.00%
Cameron	524	516	98.47%
Cardwell	163	142	87.12%
Dillon	17	0	0.00%
Ennis	1912	1692	88.49%
Glen	57	46	80.70%
Harrison	297	224	75.42%
McAllister	399	394	98.75%
Norris	114	109	95.61%
Pony	208	169	81.25%
Sheridan	1135	1050	92.51%
SilverStar	171	0	0.00%
TWIN BRIDGES	4	4	100.00%
TwinBridges	716	0	0.00%
VirginiaCity	287	0	0.00%
Whitehall	211	190	90.05%
<b>TOTAL</b>	<b>8573</b>	<b>4816</b>	<b>56.18%</b>

***ALI to Roads***

COMMUNITY	ALI RECORDS	MATCHING ROAD NAME AND RANGE	%MATCH
ALDER	211	108	51.18%
CAMERON	351	149	42.45%
CARDWELL	95	42	44.21%
ENNIS	1200	707	58.92%
GLEN	17	10	58.82%
HARRISON	136	80	58.82%
MCALLISTER	238	123	51.68%
MELROSE	6	3	50.00%
NORRIS	71	25	35.21%
PONY	93	47	50.54%
SHERIDAN	840	442	52.62%
SILVER STAR	63	22	34.92%
TWIN BRIDGES	455	296	65.05%
VIRGINIA CITY	178	128	71.91%
WHITEHALL	81	14	17.28%
<b>TOTAL</b>	<b>4035</b>	<b>2196</b>	<b>54.42%</b>

***ALI to Address Points***

COMMUNITY	ALI RECORDS	ADDRESS MATCH	%MATCH
ALDER	211	156	73.93%
CAMERON	351	272	77.49%
CARDWELL	95	58	61.05%
ENNIS	1200	1058	88.17%
GLEN	17	12	70.59%
HARRISON	136	127	93.38%
MCALLISTER	238	198	83.19%
MELROSE	6	0	0.00%
NORRIS	71	59	83.10%
PONY	93	66	70.97%
SHERIDAN	840	773	92.02%
SILVER STAR	63	0	0.00%
TWIN BRIDGES	455	5	1.10%
VIRGINIA CITY	178	0	0.00%
WHITEHALL	81	52	64.20%
<b>TOTAL</b>	<b>4035</b>	<b>2836</b>	<b>70.29%</b>

## Detailed Review Summary

### Internal Checks

#### MSAG

QC Description	Tested Y/N	Count
Duplicate record	Y	0
House number range is invalid	Y	0
Zero mix in range	Y	9
Range low greater than high	Y	0
Range overlap	Y	0
Parity Invalid	Y	0
Parity does not match range	Y	0
Low high difference > 10,000	Y	1
Range not numeric	Y	0

#### ALI

QC Description	Tested Y/N	Count
House Number not a numeric value*	Y	0
Wireless/VoIP Records (Removed)*	Y	128

\* See appendix A

### Emergency Service Boundary

POLYGON	GAPS	OVERLAPS	FILE
ESZ	0	0	ESB_INTERNAL_QC
Fire	21	30	FireBoundary_INTERNAL_QC

**Road Centerlines**

Road Checks	Number of Records	FILE
NENA prefix	0	Roads_Internal_QC_Lines
NENA type	179	Roads_Internal_QC_Lines
NENA suffix	0	Roads_Internal_QC_Lines
Intersection not snapped	1819	Roads_Internal_QC_Points
Road cross with no intersection	316	Roads_Internal_QC_Points
Address range flows against directional arrows	6	Roads_Internal_QC_Lines
Overlap in address range	522	Roads_Internal_QC_Lines
Gap in address range & direction errors	471	Roads_Internal_QC_Lines
Duplicate road geometry	3	Roads_Internal_QC_Lines
Geometry is a MultiLineString	1	See Appendix A
Sharp Angle in line	51	Roads_Internal_QC_Lines
Segment is too short	416	Roads_Internal_QC_Lines
Coincident with PSAP boundary	*	PSAP Boundary was not provided
Not Covered by PSAP boundary	*	PSAP Boundary was not provided
Parity compare between address point and associated road segment - Possible flip	391	Addresses_External_Roads_QC
No matching roads segment to address point within specified distance (120m)	*5108	Addresses_External_Roads_QC
Flow of Addresses range	80	Addresses_External_Roads_QC
Invalid road geometry	1	
Null Geometry	0	

\*Naming is inconsistent between Address Points, Roads, and MSAG/ALI (US HIGHWAY 287)

**Address Points**

Address Internal Error	Count	File Location
NENA prefix	1	Addresses_Internal_QC
NENA type	7	Addresses_Internal_QC
NENA suffix	0	Addresses_Internal_QC
Street name blank	182	Addresses_Internal_QC
Address geometry duplicate of another	10	Addresses_Internal_QC
Address attributes duplicate of another	1029	Addresses_Internal_QC
Address attributes duplicate of another (different locations)	1021	Addresses_Internal_QC
House Number not contained by closest segment address range	887	Addresses_External_Roads_QC
Address with no matching street name	*4097	ADDRESS_POINTS_WITH_NO_MATCHING_STREET_NAME_
Parity compare between address and associated road segment - Possible flip	391	Addresses_External_Roads_QC
No matching roads segment to address within specified distance (120m)	*5108	Addresses_External_Roads_QC
Flow of Addresses range	80	Addresses_External_Roads_QC

\*Naming is inconsistent between Address Points, Roads, and MSAG/ALI (US HIGHWAY 287)

## External Checks

**Legend:** Based on team decisions, severity levels will be customized and coded to indicate priority of remediation.

**HIGH** = will negatively influence the ECRF call routing and should be reviewed as an error.

**MEDIUM** = may cause secondary routing issues and can be reviewed as a warning.

**LOW** = no impact to ECRF call routing and can be reviewed as a warning. May negatively influence Map Display functions.

### ALI to MSAG

QC Result	QC Description	Notes	Count	Severity
No Match Name	ALI Record without MSAG name match		0	LOW
No Range Match	ALI Record does not have matching MSAG range		0	LOW

### MSAG to Roads

QC Result	QC Description	Notes	Count	Severity
No match Name	MSAG nameset matches a Road record		136	Low
No Matching Range	MSAG range not contained by Roads		28	Low
Partial Range Match	Some of the MSAG range is contained by the roads but not all		407	Low
Matching Name and Range but no ESN Match	MSAG Valid but not in correct ESZ		19	Low

**Address Points to MSAG**

QC Result	QC Description	Notes	Fallout	Severity
No Match Name	Address Record does not match MSAG name	*	3581	LOW
No Matching Range	Address matches MSAG name but does not match MSAG range	*	3757	LOW
Multi Range Match	Address matches more than one segment		1571	LOW

\*Naming is inconsistent between Address Points, Roads, and MSAG/ALI (US HIGHWAY 287)

**ALI to Road Centerlines**

Results returned if no address points are present.

QC Result	QC Description	Notes	Count	Severity
No Match Name	ALI Records does not match ONE Road segment		506	HIGH
No Match Range	ALI Record matches a primary street name but no matching range		199	HIGH
Multi Range Match	ALI Record matches more than one segment (side)		1134	HIGH

***ALI to Address Points***

<b>QC Result</b>	<b>QC Description</b>	<b>Notes</b>	<b>Count</b>	<b>Severity</b>
No Match	ALI Record geocoded but does not match any address record		696	MEDIUM
Multi-Range Match	ALI Record has more than one matching segment and no matching address point		254	HIGH
No Matching Name	ALI Record has no matching Road or Address		192	HIGH
No Match Range	ALI Record has matching Road name but no matching address range and no address point		57	HIGH
Address only Match	ALI record matches only an address point and no road centerline		314	MEDIUM

***ALI to ESZ Boundary***

<b>QC Result</b>	<b>QC Description</b>	<b>Notes</b>	<b>Count</b>	<b>Severity</b>
Contained in wrong polygon (without address point)	ALI Record geocodes to wrong polygon and no address located		37	High
Contained in wrong polygon (with address point)	ALI record and address record are in wrong ESZ		30	High

### ***Emergency Service Boundaries***

<b>POLYGON</b>	<b>Road Crosses with no break</b>	<b>FILE</b>
Incorporated Municipalities	2	Roads_External_QC_Lines
FIRE	75	Roads_External_QC_Lines
ESZ	69	Roads_External_QC_Lines

### ***Gaps in Data***

Data gaps were found by comparing the Roads provided from the PSAP to the TransportationFramework from the Montana State Library and is in [CountyVsState.shp](#)

## QC Prioritization & Workflow

### Recommended Remediation Process Order

1. Review of NG9-1-1 Analysis QCs.
2. Migrate GIS datasets to NG9-1-1 GIS Data Model Standard
  - a. Coordinate with 9-1-1 service providers, PSAP software vendors, GIS users, and others to ensure changes to the GIS data will not impact existing 9-1-1 systems
3. ALI & MSAG
  - a. MSAG Internal Checks
  - b. ALI internal Checks
  - c. MSAG with no matching Road Centerline street name
  - d. MSAG with no matching address range on Road Centerlines
  - e. MSAG with partial matching address range on Road Centerlines
  - f. ALI with no Matching MSAG Name
    - i. Requires modification of MSAG/ALI Shadow Copies or direct service provider edits
  - g. ALI with no Matching MSAG Range
    - i. Requires modification of MSAG/ALI Shadow Copies or direct service provider edits
4. ALI & Road Centerlines
  - a. ALI with multi matching address range
  - b. ALI with no matching street name
  - c. ALI with no matching address range
5. ALI & Address Points
  - a. ALI with no matching address
6. ALI & ESZ
  - a. ALI with address match in wrong ESZ
  - b. ALI with no address match in wrong ESZ
7. Develop PSAP Boundary
  - a. Boundary encompasses the entire PSAP area

In NG9-1-1 GIS will become the authoritative source for emergency call routing, eventually replacing the MSAG and ALI. Therefore, it is imperative that GIS datasets are accurate, and information is not lost when transitioning from legacy E9-1-1 to NG9-1-1. A logical remediation approach will aid in achieving synchronous and accurate data between the datasets during this transitional period.

Since GIS data will drive NG9-1-1, referencing NENA's NG9-1-1 GIS data model is a good first step and will help jurisdictions discover where information may be lacking in current GIS datasets. For example, meeting the NG9-1-1 data model standard to include "Left/Right" attributes in the road centerlines may help better represent the data currently in the MSAG. This is especially true when the MSAG contains two separate records referencing the same street but with separate community values.

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Along with data schema, the Internal Checks are typically easy to remedy and can increase match rates between the datasets along with reducing gaps and overlaps in geometry and address ranges. External QC checks, such as the “ALI and MSAG to Road” QC can find areas where roads may need added, deleted, or modified. The “ALI and MSAG to Road” check will also identify where the ALI or MSAG may need updated to include, as an example, a larger address range in the MSAG or change in ESZ to accompany new construction and development in the PSAP. Another external QC, “ALI to Address points” may find a civic location that is not currently represented within the address layer or indicate where a record may need modified for synchronization.

Synchronization and remediation is an important step when refining NG9-1-1 datasets. Following the approach outlined above should make the process smoother.

## Appendix A

### Data Modification Notes

To produce accurate results from the QC process, DDTi may need to modify service provider data and/or GIS data. This will not affect the source layers but signals records that could be edited to remove discrepancies in the data. The following list contains changes made to the translated datasets.

### MSAG

Original File - MADISON COUNTY MSAG.txt (1157 Records)

#### Deletes

Delete from MSAG	COUNT
AT&T WIRELESS CALLER	1
MTPCS WIRELESS CALLER	1
SPRINT VOIP MADISON COUNTY SHERIFF	1
TRDO	1
VOIP CALL	1
WIRELESS CALL	1
WIRELESS CALLER	1

#### Modifications

- N/A

#### Miscellaneous

- *Recommended Action: compare and try to sync the community names on the ALI/MSAG and GIS*

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## ALI

Original File - MADISON COUNTY MT TN.txt (6631 Records)  
Received on 10/10/2018 from CenturyLink

### Deletes

ALI RECORD	COUNT
AT&T WIRELESS CALLER	15
MTPCS WIRELESS CALLER	24
VOIP CALL	18
WIRELESS CALL	36
WIRELESS CALLER	25
TRDO	10
REMAINING RECORDS	4035

### Modifications

- N/A

### Miscellaneous

- *Recommended Action: compare and try to sync the ALI/MSAG and GIS community fields*

## Address Points

Original File - NG911\_Structures (8573 Records)

### Deletes

- N/A

### Modifications

- N/A

### Miscellaneous

- Points located at structure

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## Roads

Original File - Roads (11614 Records)

### Deletes

- N/A

### Modifications

- HARRIS CREEK RD in the community of SHERIDAN - MultiLineString Geometry was made single part

### Miscellaneous

- Big Sky Roads were separate data layer and not included in analysis

## ESZ

Original File – ESN\_Zone\_042308 (21 Records)

### Deletes

- N/A

### Modifications

- N/A

### Miscellaneous

- N/A

## FIRE

Original File – FireDistricts (22 Records)

### Deletes

- N/A

### Modifications

- N/A

### Miscellaneous

- N/A

## Appendix B

Delivered Feature Layers and a description of the files. This is to help end users understand what the feature layer looks for and how to use the feature layer to alleviate errors in the GIS and MSAG.

Understanding the QC layers delivered is very important for resolution. In general, there are a number of fields and situations the user should be aware of:

QC's that compare the ALI or MSAG to the GIS contain what appear to be repeated fields. The only difference between these fields are some have a leading 'I\_' while the others do not. The "I" in this case represents input and provides a snap shot of the original ALI, MSAG, or GIS layer when the datasets first received by DDTi. The other fields can be edited to alleviate errors and the input data is still intact. An example of this can be seen in cases where the Street Name field (RD) includes Direction (PRD or POD) and Street Type (STS) and needs parsed into separate fields. The 'I\_' field will show the original name and the non 'I\_' field will show the data parsed into separate fields for direction and type.

Other important fields to note are those that contain a '1' or a '0'. This can be thought of as 'yes' or 'no' respectively. For example, In **ALI\_External\_QC** layer a record may contain this information:

- **MatchingMSAGName =1**
- **MatchingMSAGRange=1**
- **MatchingESN=0**

In this example, the ALI record's information matches an MSAG record on name and range but not the ESN (**ESN\_FromALI** and **ESN\_FromMSAG** are not equal). In most cases a '1' value in a field represents a yes and that there is a match. The only time a '1' represents an error in the data is the MSAG Internal QC. While '1' still mean yes, it points to the fact that a MSAG Range may be a duplicate record or have a zero in the address range. These are '1' values that need modified for a better MSAG.

It is important to understand the interrelation between different discrepancies. For example, if an MSAG record is unable to find a Road Centerline name match then that same MSAG record will not find an address range match. In this case **MatchingMSAGName** and **MatchingMSAGRange** will both contain a '0' value. After resolving the name mismatch between the MSAG and Road Centerlines there is a good chance that MSAG record's house number range will match to a Road Centerline address range.

Another thing to note is the systematic effects one correction can have on many discrepancies. For example, one of the name matching criteria is community values. If one of these datasets is missing the community field or value, then it could cause a lot of fallout. Fixing this issue can have a positive systematic effect on multiple QC layers.

These improved results assume changes are made to the data and checks are run again.

## Madison County, MT – NG9-1-1 Analysis – November 2018

<b>File Name</b>	<b>File Type</b>	<b>Description</b>
ADDRESS POINTS IN WRONG BOUNDARY	Point Features	Geocoded ALI points with conflicting ESN to Address Points/MSAG
ADDRESS POINTS WITH MULTI MATCHING ADDRESS RANGE	Point Features	Address point fits within multiple road centerline address ranges. Assumes street name match.
ADDRESS POINTS WITH NO MATCHING ADDRESS RANGE	Point Features	Address house number does not fit within a road centerline's address range. Assumes street name match.
ADDRESS POINTS WITH NO MATCHING STREET NAME	Point Features	Address point unable to match road centerline based on street naming elements (ex. street name, street type, prefix direction, community) - shows what matches to ALI/MSAG and GIS attributes
Addresses External QC	Point Features	Address layer imported into DDTI - shows what records match to ALI/MSAG and ESN layers. Other Address checks are a subset of the Addresses External QC
Addresses External Roads QC	Point Features	Address layer imported into DDTI - shows Address to Road QC errors
Addresses Internal QC	Point Features	Address layer errors - errors within address layer dataset including naming elements, attributes, and geometry checks
ALI External QC	Point Features	ALI imported into DDTI and comparisons to GIS and MSAG - Geocodes to road centerline if naming elements match. Other ALI checks are a subset of the ALI External QC
ALI WITH ADDRESS MATCH ROUTED TO WRONG ESZ	Point Features	ALI finds an address point but there are ESN discrepancies between GIS and ALI/MSAG
ALI WITH MULTI MATCHING ADDRESS RANGE	Point Features	ALI entry geocodes to multiple centerline segments. Assumes street name match.
ALI WITH NO ADDRESS MATCH	Point Features	ALI unable to match the street naming attributes on GIS address points.

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ALI WITH NO ADDRESS MATCH ROUTED TO WRONG ESZ	Point Features	ALI can't find an address point but there are ESN discrepancies between GIS and tables
ALI WITH NO MATCHING ADDRESS RANGE	Point Features	ALI can't find address range on the name matched centerlines for geocoding.
ALI WITH NO MATCHING STREET NAME	Point Features	ALI unable to match the street naming attributes on GIS road centerline.
CountyVSState	Line Features	Compares Roads from PSAP to State Road data - Looking for potential roads to be added to PSAP data.
EMSBoundary Internal QC	Polygon	Compares EMS polygons to find gaps and overlaps of polygons within PSAP
ESB Internal QC	Polygon	Compares ESB polygons to find gaps and overlaps of polygons within PSAP
FireBoundary Internal QC	Polygon	Compares Fire polygons to find gaps and overlaps of polygons within PSAP
LawBoundary Internal QC	Polygon	Compares Law polygons to find gaps and overlaps of polygons within PSAP
MSAG External QC	Point Features	Geocoded location of MSAG records. Indicates name match, address range match percentage, and ESN match. If MSAG entry can't match street naming elements on road centerline, it can't be located on the map.
MSAG Internal QC	Table	MSAG imported into DDTI - shows Internal errors within the MSAG. 1=error, 0=no error
MSAG Roads ESN QC	Point Features	Geocoded Valid MSAG Address range to ESZ Polygons. Lengths of matched (name + community) Road Centerlines that fall in a different ESN according to the address range in the MSAG and the ESB Polygon
NextGenDataModel Addresses	Point Features	Imported Address Points in Next Gen format and are for reference only.
NextGenDataModel Roads	Line Features	Imported Road Centerlines in Next Gen format. Useful for uniqueid references in QCs and are for reference only.
Roads External QC Lines	Line Features	Location of External Road checks where Roads are not broken at boundaries

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Roads Internal QC Lines	Line Features	Internal Road QCs - address range, NENA naming, and geometry errors.
Roads Internal QC Points	Point Features	Location of Internal Road Geometry Checks