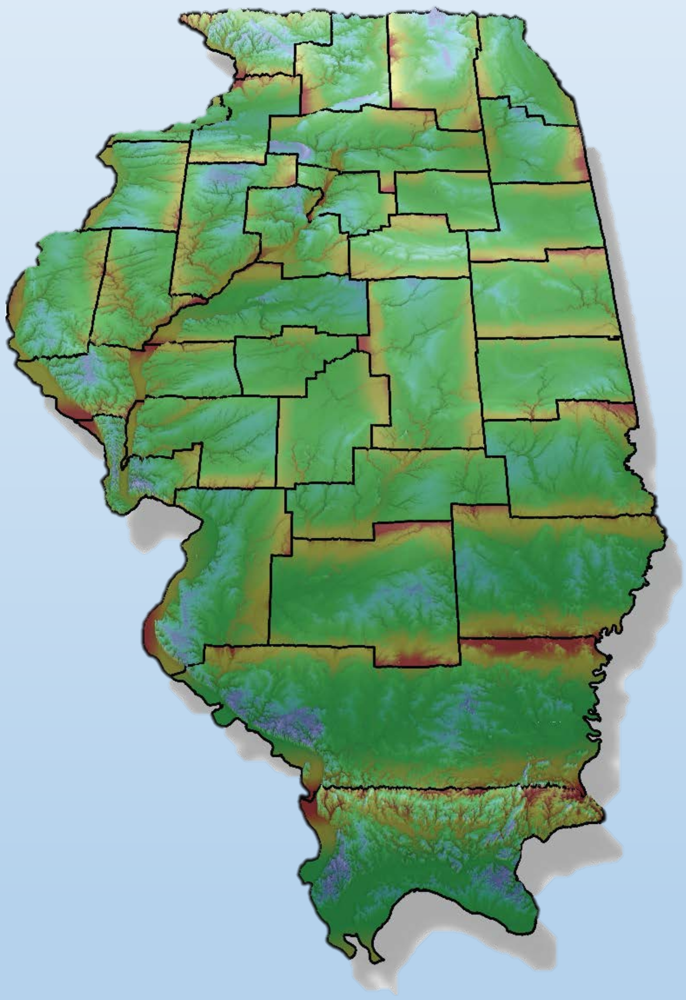
Illinois State Plane Coordinate System Committee

Guide to the

Illinois Coordinate System



By: John Higginbotham, PE, PLS
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Preface

For the many who will hopefully find this information and use it to further their individual contributions to society, I feel a brief explanation and history of myself as the main author is due. I graduated from Athens High School in 1990, Springfield College in Illinois in 1992, and the University of Illinois Urbana-Champaign in 1995. These institutions deserve recognition for their part in teaching me how to learn new things which this project requires. In 1995, I started working full time for John L. Raynolds, Jr. (PLS2254) in Springfield, Illinois, performing surveying and engineering mostly related to land development. John allowed me to perform a wide range of functions related to surveying and engineering and always encouraged me to learn new things. Duane Weiss (PLS2142) gets the credit for my first real introduction to the State Plane Coordinate System and the realization of its limitations particularly in the age of GPS surveying. In 2007, I attended the joint ACSM-IPLSA-MSPS Conference in St. Louis, Missouri, and for the first time heard about low distortion projections (LDPs) from Michael Dennis, Ph.D., P.E., R.L.S., M.ASCE. Since that presentation I have talked about the need for LDPs to anyone that would listen, even many that didn't want to listen or more commonly listen again. In 2012, I started work for the City of Springfield, Illinois. One fall day in 2018, I had finally worn down my coworker Riley Potts and he put together a low distortion projection for Sangamon County. This started the ball rolling on this project, eventually leading to all that is included below and more that is to come. While I feel I can take the credit (or blame) for instigating this project, all the real heavy lifting was accomplished by others bringing their various talents and expertise to the table. It still amazes me how this committee grew and always seemed to find the right person for the job exactly when it was needed. To all those who have participated in this project a deep thank you is deserved.

Comments, questions, and participation in this project is welcomed and encouraged. If you would like to contribute, feel free to contact myself or any other committee member as listed in the Charter document.

John Higginbotham

John Higginbotham, PE, PLS

Acknowledgements

To all of those who participated in the many hours of discussions and behind the scenes work on this project, a great thanks and acknowledgement is due. Illinois State Plane Coordinate System Committee (ISPCSC) members as listed in the Charter document and participants from other organizations volunteered their time and effort to be part of this endeavor and offered their talents, insight, opinions, and experiences to create systems that will hopefully serve the public for many years to come.

Dan Mlacnik, PE (IDOT) – Chairman of the Committee who kept the project moving through emails, meetings, agendas, minutes and calls throughout the process.

Chris Poetschner (IDOT) – Technical Committee member who did the heavy lifting of building the tools to calculate and analyze and work with the projection systems.

John Mellor, GISP (IDOT) – Technical Chairman who questioned everything always in search of a better process or solution.

Glen Schaefer, PE, PLS (Wisconsin, retired) – Glen offered his knowledge and experience from years of involvement in Wisconsin's Low Distortion Projections to help the ISPCSC along a similar journey. Glen also served as a contributing editor for this document.

Michael Dennis, Ph.D., P.E., R.L.S., M.ASCE (NGS) – Michael's passion for all things related to the National Spatial Reference System is easily recognized through his publications, presentations, phone calls and emails on the subject. He has thoroughly answered every question the committee has posed to him and provided direction often when it was not even known direction was required.

Abstract

During the work of producing updates to coordinate systems in Illinois, it was acknowledged that some form of documentation of the work involved, and the results of that work would be required. It was also acknowledged that a single source of information related to coordinate systems in Illinois would be desirable. This document attempts to provide that source.

This document is not intended to be a text on geodesy, but rather a useful resource to provide an understanding of various coordinate systems used throughout Illinois. As such this document addresses more than just new projections. Projections deemed significant have also been included in this document.

It is the hope that after reviewing this document, users will have a clear understanding of the various coordinate systems prevalent in Illinois and be able to appropriately identify or select a projection that meets the needs of their individual project(s).

Introduction

In 2019, the Illinois State Plane Coordinate System Committee (ISPCSC), made up of various stakeholders, was formed to be the voice of Illinois to respond to the National Geodetic Survey (NGS) Policies and Procedures related to the State Plane Coordinate System of 2022 (SPCS2022). The Committee adopted a Charter for the organization which can be found in Appendix A.

When NGS releases the 2022 Terrestrial Reference Frames (TRF), the National Spatial Reference System (NSRS) will be updated with SPCS2022. In Illinois, the North American Terrestrial Reference Frame of 2022 (NATRF2022) will replace the North American Datum of 1983 (NAD 83).

One of the goals of these datum and coordinate system updates is to minimize the distortion that has always been present in the NAD 83 and SPCS. With the widespread use of the Global Navigation Satellite System (GNSS), the distortion present in NAD 83 is easy to detect and now can be considered a significant source of error. Once considered "low distortion," the existing 2 zone Illinois Coordinate System (ICS), made up of the East Zone and the West Zone, also contains a significant amount of easily detectible distortion using modern measurement techniques.

Utilizing the NGS guidelines for updates to the State Plane Coordinate System (SPCS), the ISPCSC has requested that NGS develop a statewide single-zone projection and the ISPCSC produced a collection of what are now considered low distortion projections for the State. This collection is made up of 33 zones covering the entire state with 99 percent of the state having less than ±20 ppm distortion (0.10 foot per mile) between the grid and ground surfaces. This collection of 33 zones is intended to replace the existing 2-zone ICS when SPCS2022 is released.

Because the sense of what constitutes a low distortion projection has changed and likely will change over time, this document will lean away from referring to various projections or collections of projections as low distortion projections. NGS refers to these various projections or collections of projections as layers. In SPCS2022 each state will by default have one statewide single-zone layer and will be allowed one statewide multi-zone layer. The ISPCSC has determined the collection of 33 low distortion projection zones will be Illinois' statewide multi-zone layer. This collection will simply be known as the 33-zone layer.

The guidelines the ISPCSC has followed in developing the parameters for the 33-zone layer are:

1. All zone boundaries will conform to county boundaries. Multiple counties may be contained within a zone.
2. All projection latitude and longitude definitions will have arc-minute values evenly divisible by 3.
3. All projections parameters will be defined in meters.
4. The false northing value for all Transverse Mercator projections will be exactly zero.
5. The value for a northing coordinate and an easting coordinate within a zone will be significantly different.
6. To the greatest extent practical, coordinate values will not be similar to coordinate values of other projections.
7. Coordinates when expressed in feet are unique within the 33-zone layer and identify the zone number by inspecting the millions values of the coordinate pair. For details see Appendix C.

8. Within each zone either all northing values will be larger than easting values, or all easting values will be larger than northing values.

> The main purpose of the selected pattern of coordinate values resulting from the zone parameters was to allow for identification of the projection datum and zone used to derive coordinate values by inspecting the coordinate values themselves, thus reducing the misuse of position information when metadata is absent.

During this design process the NGS announced significant delays in the rollout of the updates to the NSRS. For this reason, the ISPCSC has developed a parallel collection, or layer, of zones intended for use while accessing the NAD 83. This layer is referred to at the Illinois Coordinate System of 1983: 33 Zone or ICS83: 33 Zone. Except for item number 3 above, all design guidelines for this parallel layer are valid and apply across both the NATRF2022 intended layer and the NAD 83 intended layer. The ICS83: 33 Zone layer uses the U.S. survey foot (US feet) in its projection definitions. The two parallel layers will be easily differentiated from one another by considering their coordinate pairs. For more information refer to the Illinois Coordinate System Grid Value Map in Appendix C and the appropriate appendices relative to the ICS83: 33 Zone and ICS2022: 33 Zone layers.

Naming Conventions

The ISPCSC has determined that all projections described in this document deserve to fall under the umbrella title of the Illinois Coordinate System or ICS. Projections within the ICS will either be a part of the NSRS through inclusion in the SPCS, as identified and supported by the NGS or will not be a part of the NSRS as they are not included in the SPCS.

Inclusion in the NSRS SPCS results in projections that are available within NGS geodetic tools including the NGS Coordinate Conversion and Transformation Tool (NCAT). Projections that are not recognized within the SPCS are not supported or available within NGS geodetic tools.

Projections within the ICS that are a part of, or intended to be a part of, the NSRS (and thus supported by NGS geodetic tools) are identified in the Illinois Coordinate System Naming Convention Graphic found in Appendix D with SPCS 27, SPCS 83, or SPCS2022 tags as appropriate. These projections should be included in the Illinois Coordinate System Act. Projections which are not part of the NSRS will not be included in the Illinois Coordinate System Act.

The term “statewide single-zone” refers to a layer with only one zone having only one set of projection parameters to cover the entire state. The term “multi-zone” refers to a layer with more than one zone, each zone with a unique set of projection parameters. Illinois has both “statewide multi-zone” layers, with collections of zones covering the extents of the state, and non-statewide “multi-zone” layers, where the collection of zones cover less than the entire state.

The State Plane Coordinate System of 1927 (SPCS 27) and the State Plane Coordinate System of 1983 (SPCS 83) contain statewide multi-zone layers that group the 102 counties in Illinois into 2 zones. The Illinois Department of Transportation (IDOT) District 8 has a multi-zone layer that groups the 11 counties in District 8 into 9 zones. The ISPCSC produced a statewide multi-zone layer that groups the 102 counties in Illinois into 33 zones. Zone extents for all described layers coincide with county boundary lines or the boundary created by merging a group of adjacent counties.

Data based on ICS projections should be accompanied by a standard format naming convention concatenating the zone designation and the project specific details into a metadata statement.

> The metadata statement should include information about the datum, adjustment (if appropriate), projection zone, and measurement unit.

Illinois Coordinate System

The Illinois Coordinate System Act (765 ILCS 225/) defines the Illinois Coordinate System (ICS). This Act defines parameters and extents to use to obtain positions relative to the North American Datum of 1927 (NAD 27) and the North American Datum of 1983 (NAD 83). The Act appears to follow a combination of the "Proposed Model Act for State Coordinate System" section on page 54 of the referenced *Special Publication No. 235* and "Appendix B. Model Act for State Plane Coordinate Systems" on page 73 of the referenced *NOAA Manual NOS NGS 5*. While the Act specifically defines the term Illinois Coordinate System as suggested in *Special Publication 235*, it fails to define what should be considered subsystems of the Illinois Coordinate System as suggested in *NOAA Manual NOS NGS 5*, namely the Illinois Coordinate System of 1927, which defines positions on NAD 27, and the Illinois Coordinate System of 1983, which defines positions on NAD 83.

This is relevant given the anticipated future release of the NATRF2022 by the NGS. With the release of this new datum by NGS there will become a third subsystem in Illinois expected to be referred to as the Illinois Coordinate System of 2022 (ICS2022), which will define positions on the NATRF2022.

The following sections provide details and suggest proper references for each of these subsystems of the Illinois Coordinate System. Although these subsystem names are not defined within the Act, the ISPCSC has determined that these names are appropriate given the widespread use of the model language within the current Act. Section 2 of (765 ILCS 225/) states that positions established by the NGS are "to be known and designated as the Illinois Coordinate System."

It is acknowledged a Datum, State Zone Code format (ex. NAD 83, IL WEST 1202) similar to what is listed in Appendix A on page 63 of *NOAA Manual NOS NGS 5* is the prevalent naming format used for SPCSs.

Illinois Coordinate System of 1927 (SPCS 27)

The first of two inferred subsystems contained in the Illinois Coordinate System Act (765 ILCS 225/) is the Illinois Coordinate System of 1927 (ICS27). ICS27 contains a 2-zone layer and should be commonly referred to as the Illinois Coordinate System of 1927: 2 Zone or ICS27: 2 Zone. There is an East Zone and a West Zone within the ICS27: 2 Zone, with data derived on the NAD 27. These zones are part of the SPCS 27 and thus are a part of the NSRS. For more information about these zones, refer to the Illinois Coordinate System Act included in Appendix B and the referenced NOAA Publications.

Data derived from this information should be accompanied by a metadata statement similar to: Illinois Coordinate System of 1927: {zone name} Zone {unit} or ICS27-{zone name}{unit}. Example: Illinois Coordinate System of 1927: East Zone (US survey foot) or the shortened format ICS27-East (US feet).

The terminology "Illinois Coordinate System of 1927" or "ICS27" is a combination of stating the datum is NAD 27 and the projection zone is defined for Illinois.

Illinois Coordinate System of 1927 (Non-SPCS 27)

The Illinois State Geological Survey (ISGS) produced a statewide single-zone projection for Illinois in 1970, and the original authors named it ILLIMAP. This projection is not a part of the SPCS 27 and thus not a part of the NSRS. Details about this projection can be found in the referenced ISGS Circular 451 and in Dr. Christopher Pearson's 2002 document in Appendix E.

Data derived from this information should be accompanied by a metadata statement similar to: Illinois Coordinate System of 1927: ILLIMAP (US survey foot) or the shortened format ICS27-ILLIMAP (US feet) to reflect the name designation of ILLIMAP as given by the original authors.

Illinois Coordinate System of 1983 Adjustments

In order to discuss the ICS projections on the NAD 83, it must be recognized that there have been several adjustments of NAD 83 data.

To help understand the concepts presented here, it needs to be mentioned that there is only one NAD 83. The datum has never changed. Our understanding of where we are on that datum has changed over time. Mostly through new measurement techniques, our understanding of where we are, and the confidence we have in our understanding of location relative to the datum has improved over time. The adjustments named below reflect significant milestones in our understanding of our location on the NAD 83.

Data, which can be point positions or any spatial features, such as aerial photographs, can be moved around or adjusted to fit our current or past understanding of where we are on the NAD 83.

This document will discuss four adjustments of NAD 83 data performed by NGS. Technically there are more than four adjustments to NAD 83, but for most users all adjustments fit into the four descriptions presented below. Additionally, it appears these adjustments were not rigorously documented in NGS publications. Page 14 of *NOAA Special Publication NOS NGS 13* states "*Given the changes in SPCS 83 and other activities on projected coordinate systems, it is unclear why NGS stopped publishing on the subject and why Stem's 1990 manual was not updated.*" Stem's 1990 manual (NOAA Manual NOS NGS 5) appears to be considered the last formal publication on NAD 83 SPCS. For this reason, the following information should not be considered as definitive on the subject of updates made to NAD 83 data, but rather a short description of each adjustment to make the user aware of the changes that have occurred to NAD 83 data over the years and hopefully provide for a consistent vocabulary by which to refer to these adjustments within the context of the definitions presented here. The examples presented are commonly used nomenclature for differentiating between the various adjustments of NAD 83 data. For more information related to the following adjustments, the user is encouraged to research on their own. Several of the *Additional References* cited offer additional details on adjustments.

The **first adjustment** of NAD 83 data is most often currently referred to as the North American Datum of 1983, 1986 Adjustment or NAD 83(1986). It is also common for this adjustment to simply be referred to as NAD 83, especially for early datasets prior to any subsequent adjustments. In the current setting, using the NAD 83 nomenclature without specifying the adjustment year can be misleading as most data collected is likely being derived using the most current adjustment of NAD 83 data. It is possible to access NAD 83(1986) positions, but most users will have to make very intentional efforts for that to happen. For that reason, it is recommended to refer to the first adjustment with the (1986) indicator attached to the name. This 1986 adjustment is the first published data of NAD 83 and was released in 1986. This adjustment relied mostly on the same terrestrial observations used in NAD 27, but those observations were applied to a new geodetic datum, NAD 83.

Data derived from this information should be accompanied by a metadata statement similar to: Illinois Coordinate System of 1983, 1986 Adjustment: {zone name} Zone [unit} or ICS83(1986)-{zone name} {unit}. Example: Illinois Coordinate System of 1983, 1986 Adjustment: East Zone (US survey foot) or the shortened format ICS83(1986)-East (US feet).

The **second adjustment** of NAD 83 data has several different names. The following nomenclatures all reference similar adjustments for Illinois; NAD 83(1997); NAD 83(HPGN); NAD 83(HARN); NAD 83(HARN/FBN) along with the multitude of various combinations of similar designations. The second adjustment was the first effort to incorporate new high-accuracy GPS baseline observations and positions into NAD 83 data. Various observation datasets used contributed to the various naming conventions. As this work was accomplished on a state-by-state basis, different states refer to this adjustment by different names. In Illinois, it appears that this adjustment is most often referred to as the HARN Adjustment, although other designators are also used and may be appropriate.

Data derived from this information should be accompanied by a metadata statement similar to: Illinois Coordinate System of 1983, HARN Adjustment: {zone name} Zone {unit} or ICS83(HARN)-{zone name} {unit}. Example: Illinois Coordinate System of 1983, HARN Adjustment: East Zone (US survey foot) or the shortened format ICS83(HARN)-East (US feet).

The **third adjustment** of NAD 83 data is commonly referred to as the NAD 83(NSRS2007) or NAD 83(2007) adjustment. Terrestrial observations were not included in this adjustment, it relied solely on GPS observations and positions. This made it possible to align the adjustment to the NOAA Continuously Operating Reference Station (CORS) Network (NCN). References to NAD 83(CORS96) are also prevalent and while not technically the same adjustment, the results are essentially the same as NAD 83(NSRS2007). The CORS96 adjustment was performed closer to the 2007 adjustment than the name implies. For these reasons, this document will make no distinction between the NSRS2007 and the CORS96 adjustments.

Data derived from this information should be accompanied by a metadata statement similar to: Illinois Coordinate System of 1983, 2007 Adjustment: {zone name} Zone {unit} or ICS83(2007)-{zone name} {unit}. Example: Illinois Coordinate System of 1983, 2007 Adjustment: East Zone (US survey foot) or the shortened format ICS83(2007)-East (US feet).

The **fourth adjustment** (the most recent and likely the last adjustment) of NAD 83 data is consistently referred to as NAD 83(2011). This adjustment relied solely on GPS observations that were constrained to the NCN.

Data derived from this information should be accompanied by a metadata statement similar to: Illinois Coordinate System of 1983, 2011 Adjustment: {zone name} Zone {unit} or ICS83(2011)-{zone name} {unit}. Example: Illinois Coordinate System of 1983, 2011 Adjustment: East Zone (US survey foot) or the shortened format ICS83(2011)-East (US feet).

There are a seemingly infinite variety of abbreviations, permutations, and combinations of words, letters and numbers that could relay the source of data used. The notations in this text are highly suggested to eliminate confusion and should provide enough background information to associate differing nomenclature contained throughout various software and vendor platforms to accurately identify and assign the source of data used.

As previously elaborated, named projections should be properly identified by the adjustment used. For brevity, not every permutation of nomenclature is expounded upon. It is assumed users can accurately supplement the proper names with an appropriate adjustment, if required.

For perspective on the various adjustments and to quantify the necessity to properly identify the adjustment used, the following table lists the generally accepted relative horizontal shift in position resulting from different adjustments.

DATUM / ADJUSTMENT	GENERAL TIME SPAN	NETWORK ACCURACY	LOCAL ACCURACY	APPROXIMATE HORIZONTAL SHIFT IN POSITION
NAD 27	1927-1986	10 meters	(1:100,000)	
NAD 83(1986)	1986-1998	1 meter	(1:100,000)	10 to 100 meters
NAD 83(HARN)	1998-2007	0.1 meter	(1:1,000,000)	0.2 to 1.0 meter
NAD 83(2007)	2007-2011	0.01 meter	0.01 meter	0.01 to 0.03 meter
NAD 83(2011)	2011-	0.01 meter	0.01 meter	0.02 meter

As can be seen by the approximate horizontal shift in position (which is relative to the previously listed adjustment), for many applications properly identifying the specific adjustment used may not be critical to obtaining usable position information. These shifts are only horizontal shifts, not 3-dimensional shifts.

Illinois Coordinate System of 1983 (SPCS 83)

The second of two inferred subsystems contained in the Illinois Coordinate System Act (765 ILCS 225/) is the Illinois Coordinate System of 1983 (ICS83). ICS83 contains a 2-zone layer and should be commonly referred to as the Illinois Coordinate System of 1983: 2 Zone or ICS83: 2 Zone. There is an East Zone and a West Zone within the ICS83: 2 Zone, with positions on the NAD 83. These zones are part of the SPCS 83 and thus are a part of the NSRS. For more information about these zones, refer to the Illinois Coordinate System Act included in Appendix B and the referenced NOAA Publications.

Data derived from this information should be accompanied by a metadata statement similar to: Illinois Coordinate System of 1983 {adjustment year}: {zone name} Zone {unit} or ICS83{adjustment year}-{zone name} {unit}. Example: Illinois Coordinate System of 1983, 2007 Adjustment: East Zone (US survey foot) or the shortened format ICS83(2007)-East (US feet).

The terminology “Illinois Coordinate System of 1983” or “ICS83” is a combination of stating the datum is NAD 83 and the projection zone is defined for Illinois.

Illinois Coordinate System of 1983 (Non-SPCS 83)

The ISPCSC has determined that the following projections on NAD 83 deserve mention within this document and within the context of the ICS. These projections are not a part of the SPCS 83 and thus not a part of the NSRS. This means users will not find these projections within any of the geodetic tools published by NGS. Additionally, since these projections are not a part of the NSRS they will not appear in the Illinois Coordinate System Act. These projections are still mathematically relatable to the NSRS. The ISPCSC has developed the Illinois Coordinate Conversion and Transformation Tool (ILCAT) to easily transform between the various SPCS and non-SPCS projections based on NAD 83. For information on this tool see Appendix J. Users should determine if these non-SPCS projections are appropriate or allowed for their individual project use.

Illinois Coordinate Systems of 1983: Illinois

In 2002, a statewide single-zone projection on NAD 83 was developed and documented by Dr. Christopher Pearson. Dr. Pearson was the NGS Geodetic Advisor for Illinois at the time of development. This projection has been widely used by various state agencies for many years, and thus deserves mention within this document. This projection is well known to many as the “Pearson Projection.” More information on this projection can be found in Appendix E.

Data derived from this information should be accompanied by a metadata statement similar to: Illinois Coordinate System of 1983: Illinois Zone (US survey foot) or the shortened format ICS83-Illinois (US feet).

Supplementing the proper name with an appropriate adjustment is likely unnecessary given the low accuracy typically associated with statewide data. Users should determine if supplemental designations are required. If supplemental designations are not supplied, that should be a clear indication as to the intended accuracy of the data.

Illinois Coordinate System of 1983: 9 Zone

In 2016, the Illinois Department of Transportation (IDOT) District 8 (D-8) had low distortion projections on NAD 83 prepared by Hutson and Associates, Inc. for the 11 counties within the district, which resulted in 9 zones being used for the 11 counties. Two pairs of counties share the same projection parameters. This collection of zones is to be known as the Illinois Coordinate System of 1983: 9 Zone. Adding a District 8 supplemental reference to the name such as Illinois Coordinate System of 1983: 9

Zone (District 8) may be preferrable to users who have always referred to these projections as the District 8 LDPs. These projections have been in use throughout District 8 and thus warrant mention within this document. For information related to these projections, see Appendix F.

As these projections were not developed until after the NAD 83(2011) adjustment, it should be clear that data relative to these projections is based on the NAD 83(2011) adjustment and therefore should not technically require any supplemental designation. It is highly suggested that the supplemental (2011) designation be used to eliminate any question about the adjustment used. Using these projections under any other adjustment will require the use of supplemental designations.

Data derived from this information should be accompanied by a metadata statement similar to: Illinois Coordinate System of 1983, 2011 Adjustment: {county name} Zone {unit} or ICS83(2011)-{county name} {unit}. Example: Illinois Coordinate System of 1983, 2011 Adjustment: Calhoun Zone (US survey foot) or the shortened format ICS83(2011)-Calhoun (US feet).

Illinois Coordinate System of 1983: 33 Zone

The ISPCSC has developed a collection of 33 low distortion projection zones on NAD 83. This collection of zones is to be known as the Illinois Coordinate System of 1983: 33 Zone or ICS83: 33 Zone. These 33 zones share the same boundaries as the zones intended for the NATRF2022 SPCS. For information related to these projections, see Appendix G.

As these projections were not developed until after the NAD 83(2011) adjustment, it should be clear that all data relative to these projections is based on the NAD 83(2011) adjustment and therefore should not technically require any supplemental designation. It is highly suggested that the supplemental (2011) designation be used to eliminate any question about the adjustment used. Using these projections under any other adjustment will require the use of supplemental designations.

Data derived from this information should be accompanied by a metadata statement similar to: Illinois Coordinate System of 1983, 2011 Adjustment: {largest city in zone} Zone {unit} or ICS83(2011)-{largest city} {unit}. Example: Illinois Coordinate System of 1983, 2011 Adjustment: Freeport Zone (US survey foot) or the shortened format ICS83(2011)-Freeport (US feet).

Illinois Coordinate System of 2022 (SPCS2022)

With the release of the modernized NSRS by the NGS, new projections on the NATRF2022 will be available in Illinois as a part of the nationwide SPCS2022. It is anticipated the Illinois Coordinate System Act will be modified to include the SPCS2022. These projections will become a part of the NSRS, SPCS2022, and the ICS and be referred to as the Illinois Coordinate System of 2022 or ICS2022.

The ICS2022 will include a statewide single-zone projection developed by the NGS. The NGS designed statewide single-zone projection should be referred to as the Illinois Coordinate System of 2022: Illinois Zone or ICS2022-Illinois. Appendix H is reserved for the NGS designed statewide single-zone layer.

The ICS2022 will include a statewide multi-zone layer consisting of a collection of 33 zones developed by the ISPCSC. This collection of 33 zones is to be known as the Illinois Coordinate System of 2022: 33 Zone or ICS2022: 33 Zone. Parameters for these projections will be published once SPCS2022 is released by the NGS.

These individual projections should be referred to as the Illinois Coordinate System of 2022: {largest city in zone} Zone {unit} or ICS2022-{largest city} {unit}. Example: Illinois Coordinate System of 2022: Freeport Zone (international feet) or the shortened format ICS2022-Freeport (iFT). It is anticipated that ICS2022 projection references will also include an epoch designation as assigned to NATRF2022 by NGS. This guide should be updated to include assigned designations when appropriate. Appendix I is reserved for the 33-zone layer intended for use with the NATRF2022.

Units of Measure

All the various datums, adjustments, and projections also require units to be defined. The common units often encountered for data in Illinois are U.S. survey foot (aka: survey foot, US survey feet, US feet, sFT), international foot (aka: international feet, iFT) and meters (M). For most data knowing the units is a significant factor in obtaining accurate positions. Given the large coordinate values in use for most projections, there can be several feet of difference between the positions realized when using sFT and iFT units. The terms “foot” and “feet” should not be used alone unless it is clear the reference is to either the survey foot or international foot. For example, data for a NAD 27 project in Illinois is most likely to be in US feet.

The National Institute of Standards and Technology (NIST) along with the National Geodetic Survey (NGS) have co-issued a Federal Register Notice (FRN) to retire the U.S. survey foot as a part of modernizing the National Spatial Reference System (NSRS) related to the North American Terrestrial Reference Frame of 2022 (NATRF2022). More information about this unit of measure can be found in the referenced FRN notice.

The ISPCSC has determined that U.S. survey feet (US feet) be used for projection parameters and projection data in Illinois on the NAD 83. The ISPCSC has determined that meters (M) be used for SPCS2022 projection parameters in Illinois for projections intended to be on the NATRF2022. Projection data tied to SPCS2022 usually will be expressed in international feet although meters may be used on select projects. US survey feet shall **not** be used with SPCS2022.

Suggested format, as shown in previous examples, is to list the units used after the zone designation.

Legislative Considerations

The previously referenced Illinois Coordinate System Act (765 ILCS 225/) will need to be updated once the NGS modernizes the NSRS with the release of the NATRF2022. When updated, it is suggested the revised Act clearly define subsystems of the Illinois Coordinate System. Namely the Illinois Coordinate System of 1927 (ICS27), the Illinois Coordinate System of 1983 (ICS83), and the Illinois Coordinate System of 2022 (ICS2022). Furthermore, it is suggested that within the Act specific language be included to identify all existing and proposed datums and projections that are or will be a part of the NSRS. The various systems described in this document that are not intended to be a part of the NSRS should not be included in the Illinois Coordinate System Act. The Act should not preclude the use of any mathematically or transformational relatable system so long as it meets the accuracy requirements of the intended use of the data.

Cited References

Reference documents listed should be easily retrievable by users through an internet search and as such are not included in this document.

NOAA Special Publication NOS NGS 13; *The State Plane Coordinate System History, Policy, and Future Directions;* Michael L. Dennis; March 6, 2018

NOAA Manual NOS NGS 5; *State Plane Coordinate System of 1983;* James E. Stem; January 1989

Special Publication No. 235; *The State Coordinate Systems (A Manual for Surveyors);* By Hugh C. Mitchell and Lansing G. Simmons; Reprinted August 1987

Federal Register Notice (FRN); https://www.federalregister.gov/documents/2019/10/17/2019-22414/deprecation-of-the-united-states-us-survey-foot ; Vol. 84, No. 201, Thursday, October 17, 2019

Illinois State Geological Survey Circular 451; *ILLIMAP – A Computer-Based Mapping System for Illinois;* Swann, DuMontelle, Mast, Van Dyke; April 1970

Additional References

Additional References listed were often consulted as examples and models by the ISPCSC. Users interested in more in-depth information related to coordinate system projection development and history are encouraged to review these references.

Indiana Department of Transportation; *Indiana Geospatial Coordinate System (InGCS) Handbook and User Guide, Version 1.05;* September 1, 2016;
https://www.in.gov/indot/files/InGCS_HandbookUserGuide_20160901.pdf

Kansas Department of Transportation; *The Kansas Regional Coordinate System. A Statewide Multi-Zone Low-Distortion Projection Coordinate System for the State of Kansas*; Prepared by Michael L Dennis, RLS, PE; November 1, 2017; http://data.kansasgis.org/catalog/other/KS_LDP/KRCS_report_2017-11-01.pdf

Iowa Department of Transportation; *Iowa Regional Coordinate System Handbook and User Guide*, Version 2.10, September 16, 2014.
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Wisconsin State Cartographer's Office; *Wisconsin Coordinate Reference Systems, Second Addition;*
https://www.sco.wisc.edu/wp-content/uploads/2017/07/WisCoordRefSys_June2015.pdf

Appendix A – Illinois State Plane Coordinate System Committee Charter

Following is the Illinois State Plane Coordinate System Committee Charter document.

Charter

for the

Illinois State Plane Coordinate System Committee

dated

May 13, 2019

By: John Higginbotham, PE PLS

Approved by Committee May 13, 2019

Document Revision History

Date	Revision	Author
6/3/2019	Added Tollway members, added municipal contact, updated Tech committee members	JMH
1/12/2021	Added IDOA to voting structure, removed retired/ inactive members, updated Tech committee members/ chair, updated contact info and standard meeting time.	DFM
5/10/2021	Updated Goals and Scope to include development of any other coordinate systems and related work deemed necessary by the Committee. Updated the process for Committee disbandment to include passing a formal motion when the Committee deems it appropriate.	DFM
1/10/2022	Updated various items to be consistent with terms used in the ICS Guide	JMH

This document is an attempt to draft a framework for the development of map projections to be utilized in the State of Illinois. Dual Zone projections (similar to current East and West Zones), Single Statewide Projection, Low Distortion Projections (LDP) and other updates will be discussed with the goal to have them ultimately adopted by the National Geodetic Survey (NGS) as coordinate system “layers” available and supported by the NGS.

BACKGROUND

In the fall of 2018, the City of Springfield began investigating the development of a LDP to facilitate accurate, consistent and repeatable coordinates for projects throughout the city. In the process of development the city contacted the Illinois NGS advisor for guidance on NGS's position on LDPs. The most important advice from NGS was to involve the Illinois Department of Transportation (IDOT), as NGS has historically relied on DOTs for geodetic issues and is typically partial to accepting systems or data developed and or acknowledged by DOTs. To that end, the city contacted IDOT District 6 and discussed the possibility of LDP development and use. This conversation led to a broader conversation with IDOT Central Office and included interested representatives from most other IDOT Districts throughout the state in late 2018. These conversations brought to light that District 8 had previously developed LDPs for the District and has been using them. Additionally IDOT expressed interest in pursuing development of LDPs for the entire State. To that end, IDOT organized a conference with NGS on February 5, 2019 in Springfield during their annual District Surveyors meeting. During this conference, NGS articulated their position and expectations for states that wish to make changes to existing projections including the development of LDPs and how these systems can been incorporated into the upcoming North American Terrestrial Reference Frame of 2022 (NATRF2022).

BUSINESS CASE

This topic of updates to State Plane Coordinate Systems (SPCS) throughout the United States is fueled by NGS 2022 SPCS Policy Changes. A deadline has been set by NGS of December 31, 2019 for States to communicate what their preference and/or plan is for updates to published projections that are acknowledged and supported by NGS. Additionally NGS has a deadline of December 31, 2020 for the States projection definitions to be completed. These deadlines for updates to SPCS have been set by NGS as a part of the transition to the 2022 Terrestrial Reference Frames.

Related to this are statute updates that may be required. Current statutes (**(765 ILCS 225/) Illinois Coordinate System Act**) reference the North American Datum of 1983 (NAD 83) and the North American Datum of 1927 (NAD 27). The North American Terrestrial Reference Frame of 2022 (NATRF2022) will replace NAD 83. This change may need to be reflected in the statute.

This potential statute update may affect county GIS Administrators as they operate largely under State statute.

Given the deadlines set by NGS for changes to the State's coordinate systems, stakeholders throughout Illinois should initiate discussions concerning the matter and formally respond to NGS through a single unified voice. If this can not be accomplished by the State, NGS will implement changes to coordinate system projections in Illinois as they deem appropriate. This will ***not*** include development and implementation of LDPs for the State.

BENEFITS

Existing State Plane Coordinate Systems

NGS has plans to provide the State with updates to SPCSs that minimize distortion relative to the topographic surface versus the previously defined projections that based distortion relative to the ellipsoid surface. This will serve to reduce the magnitude of distortion present in the measurements made on the surface of the earth with respect to the reference frame. It is anticipated that Illinois will continue to have an East and a West Zone coordinate system with the same boundaries that currently exist.

Proposed Coordinate Systems

The process for updates to SPCSs developed by NGS is allowing for stakeholders to propose and develop coordinate systems that each State values. For Illinois there appears to be two types of systems that are of interest. The first is a Single Zone Statewide Projection and the second is a system of Statewide Low Distortion Projections.

Single Zone Statewide Projection

There is already a developed and published Illinois Single Zone Statewide Projection that was completed by Chris Pearson. This projection has been in use, but not officially recognized. This projection type is beneficial to many organizations that rely on and develop position data on features throughout the entire State.

Proposed Low Distortion Projection

This document is not intended to fully explain the development of LDPs. In general the purpose of an LDP is to minimize the distortion that is inherently present when converting from a spherical coordinate system (latitude, longitude, height) to a cartesian coordinate system (northing, easting, elevation).

Currently published projections such as IL State Plane East and West Zones have distortion magnitudes that are easily detectable by current survey technology. Typical methods to account for these distortions are to either ignore them or compute a scale factor to attempt to make the distortion manageable. This scale factor application is commonly referred to as modified state plane. Both of these methods create issues for accuracy, repeatability, scalability and for accurate transformations between other datums.

LDPs attempt to minimize distortions to the point that they are either undetectable or insignificant and without the use of the scale factors associated with modified state plane. LDPs create a grid distance that is approximately equal to ground based distances.

Another benefit of LDPs is that they are defined and have typically published projections that can be used to transform between datums. Data in a LDP can be transformed to other published datums and vice versa.

GOALS

The following goals have been developed regarding SPCS updates in Illinois:

1) To develop a single unified response by Illinois to the NGS concerning the States preferred SPCS changes by December 31, 2019.
2) To approve any changes made to existing SPCSs and to cause to be developed Single Zone and Low Distortion Projections by December 31, 2020, as well as other coordinate
3) systems and related work deemed necessary by the Committee that may extend the Committee's scope.
4) To provide direction for Statutory changes required as a result of changes to the SPCS.

AUTHORITY

The Illinois Department of Transportation has assumed authority of this SPCS update process. First through the general recognition by NGS as the lead organization in the State for such geospatial issues, and second through the Departments Statewide Initiative to utilize model based systems for design and construction projects. The completion of the goals contained in this Charter are an essential element of effectively implementing this Statewide Initiative.

SCOPE

In order to accomplish these Goals the following process outline is defined:

1) Organize an Illinois SPCS Committee with members from the following stakeholder groups. It is intended that all stakeholders are represented by a delegate identified within the stakeholder list which has representation on the Illinois SPCS Committee.
    a) Illinois Department of Transportation
    b) Illinois Department of Natural Resources

c) Illinois State Toll Highway Authority
d) Illinois Department of Agriculture
e) Prairie Research Institute
f) Illinois Professional Land Surveyors Association
g) Illinois GIS Association
h) College or Universities (with surveying or GIS curriculum)
i) County / Municipal Group
j) National Geodetic Survey
k) National Society of Professional Surveyors

2) The Illinois SPCS Committee is to prepare submittals to NGS outlining the preferred changes to or development of the following projection types (these are referred to as “Layers”). It is anticipated that NGS will have a formal submittal application for this process in early 2019. This step only includes articulating the preferences of Illinois and does not include the actual development or finalization of the proposed changes. SPCSs to be considered by the committee are as follows:
    a) Existing statewide 2-zone layer
        i) East Zone
        ii) West Zone
    b) Proposed statewide single-zone layer
    c) Proposed low distortion projection, statewide multi-zone layer

3) The Illinois SPCS Committee will respond to any questions or clarifications the NGS has about the SPCS submittal.

4) The Illinois SPCS Committee will identify the development group or groups for each of the proposed layers that are to be considered.
    a) Existing statewide 2-zone layer
        i) It is understood that NGS will develop a 2-zone layer if requested by Illinois. However, NGS will only allow two statewide layers.
    b) Proposed statewide single-zone layer
        i) It is anticipated that the existing Single Zone Projection will be formally recognized, submitted and adopted by NGS.
    c) Proposed low distortion projection, statewide multi-zone layer
        i) It is anticipated that resources from the stakeholder groups will be organized into an Illinois SPCS Technical Subcommittee to undertake the development and verification of a low distortion projection layer for the State of Illinois.
    d) Any other projections deemed necessary by the Committee.

5) The Illinois SPCS Committee will formally adopt the layers and provide proposed Statutory changes as needed.

6) The Illinois SPCS Committee will formally submit all SPCS changes to the NGS.

7) The Illinois SPCS Committee will disband after:
    a) Statutory changes if required have been adopted.
    b) SPCS changes have been adopted by NGS.
    c) A formal motion is passed when the Committee deems it appropriate.

BY LAWS

1) The Illinois State Plane Coordinate System Committee shall consist of the following positions:
    a) One Chairman (1 vote)
    b) One Secretary (1 vote)
    c) Two Committee Members representing each of the following groups:
        i) Illinois Department of Transportation (2 votes)
        ii) Illinois Department of Natural Resources (2 votes)
        iii) Illinois State Toll Highway Authority (2 votes)
        iv) Prairie Research Institute (2 votes)
        v) Illinois Professional Land Surveyors Association (2 votes)
        vi) Illinois GIS Association (2 votes)
        vii) University Group (2 votes)
        viii) County / Municipal Group (2 votes)
        ix) Illinois SPCS Technical Subcommittee (1 vote)
        x) Illinois Department of Agriculture (1 vote)
    d) One Committee Advisor representing each of the following organizations:
        i) National Geodetic Survey (non-voting)
        ii) National Society of Professional Surveyors (non-voting)
2) All positions identified in 1) a through c are considered voting class members with 1 vote each.
3) The Chairman of the Illinois SPCS Committee shall be the last vote cast to decide any ties.
4) All decisions will be by a majority vote of the voting class members, when a majority of the voting class members are present.
5) Meetings will be set for the first Monday of the month at 10:00 am. Unless otherwise agreed upon.
6) Advisors shall be non-voting members.
7) Illinois SPCS Committee members are tasked with:
    a) Representation of their identified stakeholder group.
    b) Communication with NGS related to Illinois SPCSs.
    c) Initiation of legislative changes if required.
8) There shall be named an Illinois SPCS Technical Subcommittee established under the Illinois SPCS Committee.
    a) The Illinois SPCS Technical Subcommittee is tasked with the development and verification of proposed coordinate systems in Illinois.
    b) The Illinois SPCS Technical Subcommittee shall be considered as a voting class to the Illinois SPCS Committee
    c) The Illinois SPCS Technical Subcommittee shall be granted one vote.

RESOURCES

National Geodetic Survey (NGS)
https://www.ngs.noaa.gov/

NGS 2022 Terrestrial Reference Frames
https://www.ngs.noaa.gov/datums/newdatums/naming-convention.shtml#reference-frames

NGS 2022 SPCS Policy
https://www.ngs.noaa.gov/SPCS/draft-policy.shtml

Illinois Coordinate System Statute
http://www.ilga.gov/legislation/ilcs/ilcs3.asp?ActID=2173&ChapterID=62&Print=True

Illinois Single Zone Projection
http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.122.4961&rep=rep1&type=pdf

MEMBERSHIP

Name and Contact Information	Illinois SPCS Committee Role
Dan Mlacnik, P.E. Engineer of Surveys, Mapping and Modeling Illinois Department of Transportation Bureau of Design & Environment 2300 S. Dirksen Parkway, Room 003 Springfield, IL 62764 Work Phone: (217) 558-2436 Work Cell: (217) 993-1041 Email: Dan.Mlacnik@illinois.gov	Illinois SPCS Committee Chairman IDOT Legislative Resource
John Higginbotham, P.E., P.L.S. Assistant District Engineer Sangamon County Water Reclamation District 3000 North 8th Street Road Springfield, Illinois 62707 Office: (217) 993-7360 Work cell: (217) 761-0275 john.higginbotham@springfield.il.us	Illinois SPCS Committee Secretary Illinois SPCS Technical Subcommittee Member
Jeff Emrick, P.E., P.L.S. IDOT Region 4 / District 6 / Land Acquisition Illinois Department of Transportation 126 E. Ash Street Springfield, Illinois 62703 (217) 524-0208 Jeffrey.Emrick@Illinois.gov	Illinois SPCS Committee Member IDOT Representative Illinois SPCS Technical Subcommittee Member
John Mellor, GISP Surveys, Mapping and Modeling Illinois Department of Transportation (217) 785-9389 john.mellor@illinois.gov	Illinois SPCS Committee Member Illinois SPCS Technical Subcommittee Chairman
Chris Poetschner Bureau of Information Processing Illinois Department of Transportation Hanley Building, Rm 101 Work Phone: 217-558-6895	Illinois SPCS Technical Subcommittee Member

Cell: (217) 891-7929 Christopher.Poetschner@illinois.gov	
Brad Duzan, P.L.S. Chief of Surveys IDOT Region 4/District 6 126 E. Ash St. Springfield, IL 62704 (217) 782-8707 Brad.Duzan@illinois.gov	Illinois SPCS Committee Member IDOT Representative Illinois SPCS Technical Subcommittee Member IDOT Field Verification Lead
Lee Woodward, P.L.S. Illinois Department of Natural Resources Office of Water Resources One Natural Resources Way Springfield, IL 62702-1271 Lee.Woodward@illinois.gov	Illinois SPCS Committee Member IDNR Representative
Donald Moles, P.L.S. Professional Land Surveyor Illinois Department of Natural Resources Realty Division One Natural Resources Way Springfield, IL, 62702 Phone: (217) 558-6023 Don.Moles@illinois.gov	Illinois SPCS Committee Member IDNR Representative IDNR Legislative Resource
Elliot Lagacy Illinois Department of Agriculture 2118 W Park Ct. Champaign, IL 61821 217- 353 6603 Elliot.Lagacy@illllinois.gov	Illinois SPCS Committee Member IDOA Representative
Mark Yacucci Section Head Geoscience Information Stewardship Illinois State Geological Survey Prairie Research Institute 217-265-0747 Yacucci@illinois.edu	Illinois SPCS Committee Member Prairie Research Institute Representative
Terry Macke, P.L.S.	Illinois SPCS Committee Member

IDOT Region 4/District 6 126 E. Ash St. Springfield, IL 62704 (217) 524-7046 Terry.Macke@illinois.gov	Illinois SPCS Technical Subcommittee Member
Norman D. Ellerbrock, P.L.S. Four Points Land Surveying & Engineering, Inc. 17 Northport Plaza Hannibal, MO. 63401 Phone: (573) 406-5533 Mobile: (573) 406-3002 Email: norm@fourpointssurvey.com Website: www.fourpointssurvey.com Licensed in Missouri, Illinois & Iowa	Illinois SPCS Committee Member IPLSA Representative
Aaron Hutson, PS Indiana Operations Manager Volkert, Inc. |9880 Westpoint Dr., Suite 500, Indianapolis, IN 46256 (Cell) 618.402.8410 aaron.hutson@volkert.com	Illinois SPCS Committee Member IPLSA Representative
Chad Sperry Director, WIU GIS Center 305B Tillman Hall Macomb, IL 61455 ce-sperry@wiu.edu 309.255.5584 (text and cell) 309.298.1566 (office) 309.298.3003 (fax)	Illinois SPCS Committee Member ILGISA Representative
Micah Williamson 309-733-4285 @micahwilli mwilliamson@cloudpointgeo.com	Illinois SPCS Committee Member ILGISA Representative
Todd Horton Agriculture/Engineering Science &	Illinois SPCS Committee Member

Technologies Associate Professor, Construction Management Office: M115 thorton@parkland.edu 217-373-3785	Illinois SPCS Technical Subcommittee College/University Representative
Kory Allred Program Director, Land Surveying Parkland College Construction Management Office: M115 kallred@parkland.edu Office: (217) 351-2401 Cell: (618) 201-5984	Illinois SPCS Committee Member College/University Representative
Tracy L. Garrison, GIS Manager, PLS, GISP Sangamon County GIS 200 S. 9th St., Room 312 Springfield, IL 62701 39°48'00" North - 89°38'35" West Tracy.Garrison@co.sangamon.il.us 217/535-3137	Illinois SPCS Committee Member County / Municipal Group Representative
Janna Baker 414 Court St. Suite 204 Pekin, IL 61554 309-478-5695 JBaker@tazewell.com	Illinois SPCS Committee Member County / Municipal Group Representative
Mustafa I Hassan P.L.S, P.E. Illinois Tollway – Executive Project Manager 2700 Ogden Avenue Downers Grove, IL 60515 N 41° 48’ 18.39”, W 88° 3’ 42” office: (630)241.6800 ext. 4936 Direct: (331)238-4936 mobile: (630)399-0489 mhassan@getipass.com	Illinois SPCS Committee Member Illinois Tollway Representative
Sheena K. Beaverson Program Manager, Illinois Height Modernization Illinois State Geological Survey Prairie Research Institute University of Illinois at Urbana-Champaign	Illinois SPCS Committee Member Prairie Research Institute Representative

615 East Peabody Drive Champaign, Illinois 61820 sbeavers@illinois.edu (217) 244-9306	
Brad Hodor, P.E., SIT Civil Engineer / CIM Support Illinois Tollway GEC Project Office | 2200 Western Court Suite 120 Lisle, IL 60532 B.Hodor@AmericanSurvey.com	Illinois SPCS Committee Member Illinois Tollway Representative
Jacob Heck, Ph. D. NOAA's National Geodetic Survey (NGS) Regional Geodetic Advisor Great Lakes Region (MI-IN-IL-WI) Cell: (202) 306-6904 email: jacob.heck@noaa.gov	Illinois SPCS Committee Advisor National Geodetic Survey
Tim Burch NSPS - Secretary SPACECO, Inc. 9575 West Higgins Road, Suite 700 Rosemont, IL 60018 Phone: (847) 696-4060 Email: tburch.iplsa@gmail.com	Illinois SPCS Committee Advisor National Society of Professional Surveyors

Appendix B – Illinois Coordinate System Act

The Illinois Coordinate System Act can be found online at:
https://www.ilga.gov/legislation/ilcs/ilcs3.asp?ActID=2173&ChapterID=62

The Act included below may contain slight deviations in formatting as compared to the Official Act due to differences and/or limitations in various electronic mediums utilized in this publication.

(765 ILCS 225/1) (from Ch. 133, par. 101)

Sec. 1. This Act shall be known and may be cited as the "Illinois Coordinate System Act".
(Source: P.A. 83-742.)

(765 ILCS 225/2) (from Ch. 133, par. 102)

Sec. 2. The system of plane coordinates which has been established by the United States Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, National Geodetic Survey for defining and stating the positions or locations of points on the surface of the earth within the State of Illinois is hereinafter to be known and designated as the "Illinois Coordinate System".
(Source: P.A. 92-311, eff. 8-9-01.)

(765 ILCS 225/3) (from Ch. 133, par. 103)

Sec. 3. For the purpose of the use of the Illinois Coordinate System, the State is divided into an "East Zone" and a "West Zone".

The area now included in the following counties constitutes the "East Zone": Boone, Champaign, Clark, Clay, Coles, Cook, Crawford, Cumberland, DeKalb, DeWitt, Douglas, DuPage, Edgar, Edwards, Effingham, Fayette, Ford, Franklin, Gallatin, Grundy, Hamilton, Hardin, Iroquois, Jasper, Jefferson, Johnson, Kane, Kankakee, Kendall, Lake, LaSalle, Lawrence, Livingston, McHenry, McLean, Macon, Marion, Massac, Moultrie, Piatt, Pope, Richland, Saline, Shelby, Vermilion, Wabash, Wayne, White, Will and Williamson.

The area now included in the following counties constitutes the "West Zone": Adams, Alexander, Bond, Brown, Bureau, Calhoun, Carroll, Cass, Christian, Clinton, Fulton, Greene, Hancock, Henderson, Henry, Jackson, Jersey, Jo Daviess, Knox, Lee, Logan, McDonough, Macoupin, Madison, Marshall, Mason, Menard, Mercer, Monroe, Montgomery, Morgan, Ogle, Peoria, Perry, Pike, Pulaski, Putnam, Randolph, Rock Island, St. Clair, Sangamon, Schuyler, Scott, Stark, Stephenson, Tazewell, Union, Warren, Washington, Whiteside, Winnebago and Woodford.
(Source: P.A. 98-756, eff. 7-16-14.)

(765 ILCS 225/4) (from Ch. 133, par. 104)

Sec. 4. As established for use in the East Zone, the

Illinois Coordinate System is named, the "Illinois Coordinate System, East Zone".

As established for use in the West Zone, the Illinois Coordinate System is named, the "Illinois Coordinate System, West Zone".

(Source: P.A. 83-742.)

(765 ILCS 225/5) (from Ch. 133, par. 105)

Sec. 5. The plane coordinates of a point on the earth's surface, used in expressing the position or location of that point in the appropriate zone of this system, consists of 2 distances, expressed in units of U.S. survey feet and decimals of a foot. One of these distances, known as the "x-coordinate", gives the position in an east-and-west direction; the other, known as the "y-coordinate", gives the position in a north-and-south direction. These coordinates depend upon and conform to the coordinates, on the Illinois Coordinate System, of the monumented survey stations of the United States National Geodetic Survey within the State of Illinois, as those coordinates have been determined by that survey.

(Source: P.A. 92-311, eff. 8-9-01.)

(765 ILCS 225/6) (from Ch. 133, par. 106)

Sec. 6. When any project extends from one into the other of the above coordinate zones, the positions of all points on its boundaries may be referred to either of the two zones, the zone which is used being specifically named for the project.

(Source: P.A. 83-742.)

(765 ILCS 225/7) (from Ch. 133, par. 107)

Sec. 7. For purposes of more precisely defining the Illinois Coordinate System the following definitions by the United States National Geodetic Survey are adopted:

The Illinois Coordinate System, East Zone, is based on the transverse Mercator projection of the North American Datum of 1983 (NAD 83) or the Clarke spheroid of 1866 (North American Datum of 1927) (NAD 27), having a central meridian of eighty-eight degrees and twenty minutes West (88µ =-20'W.) of Greenwich on which meridian the scale is set at one part in 40,000 too small. The origin of coordinates is at the intersection of the meridian eighty-eight degrees and twenty minutes West (88µ =-20'W.) of Greenwich and thirty-six degrees and forty minutes North (36µ =-40'N.) latitude. The origin is given the coordinates x = 300,000 meters (984,250.000 feet) and y = 0 meters for NAD 83 and x = 500,000 feet and y = 0 feet for the NAD 27.

The Illinois Coordinate System, West Zone, is based on the transverse Mercator projection of the North American Datum of 1983 (NAD 83) or the Clarke spheroid of 1866 North American Datum of 1927 (NAD 27), having a central meridian of ninety degrees and ten minutes West (90µ =-10'W.) of Greenwich, on which meridian the scale is set at one part in 17,000 too small. The origin of coordinates is at the intersection of the meridian ninety degrees and ten minutes West (90µ =-10'W.) of Greenwich and thirty-six degrees and forty minutes North (36µ =-40'N.) latitude. The origin is given the coordinates x = 700,000 meters (2,296,583.333 feet) and y = 0 meters for NAD 83 and x = 500,000 feet and y = 0 feet for the NAD 27.

The position of the Illinois Coordinate System is as marked on the ground by monumented survey stations established in conformity with standards adopted by the United States National Geodetic Survey for second and higher order work, whose geodetic positions have been rigidly adjusted on the North American Datum (NAD 1927 or NAD 1983, or both), and whose coordinates have been computed on the system herein defined. Any such stations may be used for establishing a survey connection with the Illinois Coordinate System.
(Source: P.A. 92-311, eff. 8-9-01.)

(765 ILCS 225/8) (from Ch. 133, par. 108)

Sec. 8. The use of the term "Illinois Coordinate System" on any map, report, survey, or other document is limited to coordinates based on the Illinois Coordinate System as defined in this Act.

Any land survey referenced to the Illinois Coordinate System must indicate the Zone and delineate on the plat of survey all geodetic stations, azimuths, angles and distances used for establishing the survey connection.
(Source: P.A. 83-742.)

Appendix C – Illinois Coordinate System Grid Value Map

The Illinois Coordinate System Grid Value Map illustrates coordinate ranges used for the various existing and proposed projections of the Illinois Coordinate System (ICS). All zones described in this document are represented on the ICS Grid Value Map.

Referring to this map, users should be able to determine the projection used for undocumented coordinate pairs. For more information refer to the Grid Value Map.

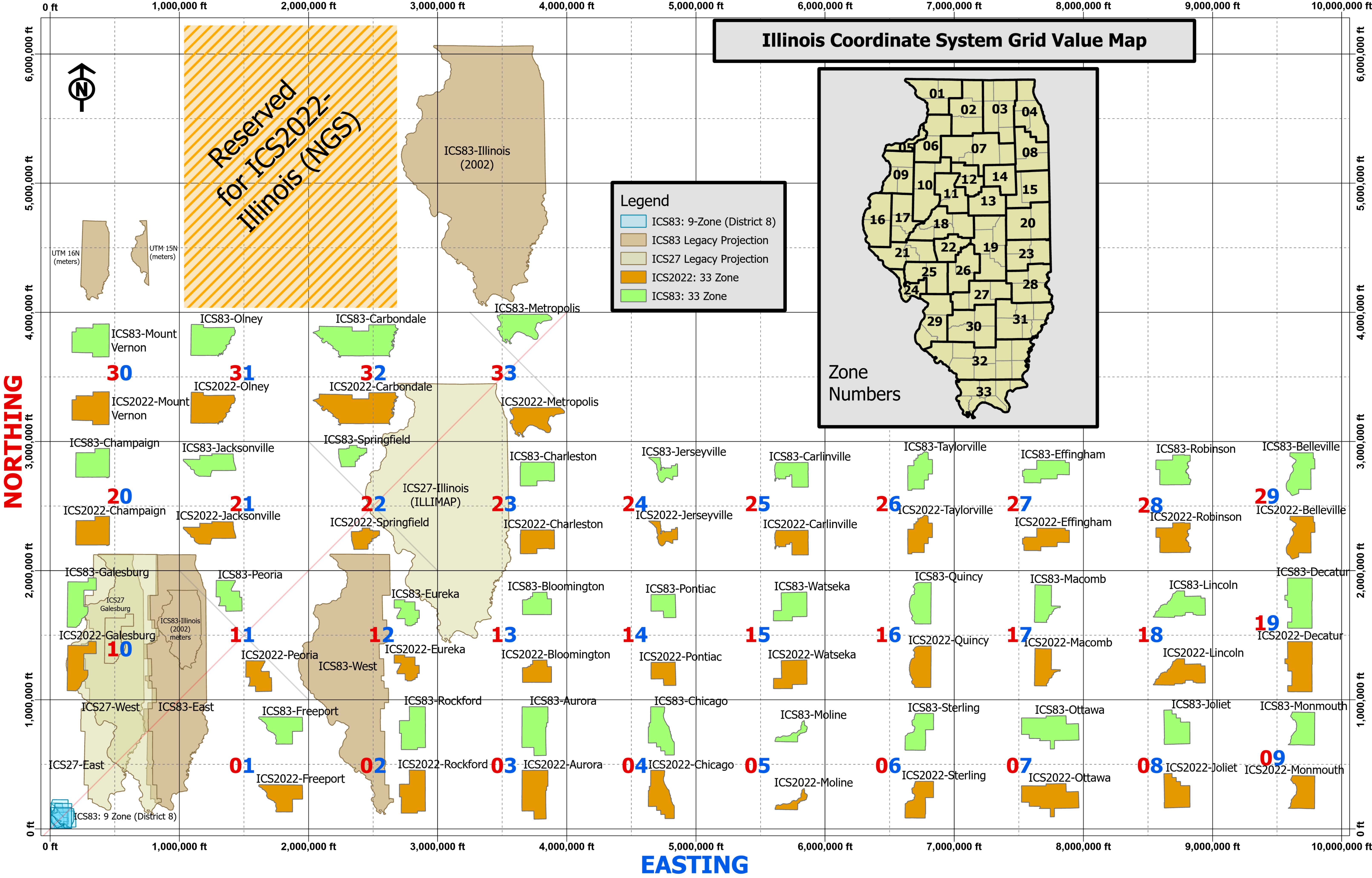
The coordinate ranges for the ICS83: 33 Zone layer and the ICS2022: 33 Zone layer have coordinate ranges assigned to indicate their 2-digit zone number. The tens digit in the zone number is equal to the truncated millions value of the northing when expressed in feet (shown in red). The ones digit is equal to the truncated millions value of the easting when expressed in feet (shown in blue).

To illustrate, any northing in the Freeport zone is in the range 0 to 999,999 feet and any easting in the Freeport zone is in the range of 1,000,000 to 1,999,999 feet. The millions value of all the Freeport northings is 0 and the millions value of all Freeport eastings is 1, hence the zone number 01.

All zones completely to the north of the red, 45-degree diagonal line originating at 0,0 have a northing coordinate value always greater than their corresponding easting coordinate value. All zones completely south of the same line have a northing coordinate value always less than their corresponding easting coordinate value.

The northing in feet for the ICS83: 33 Zone projections are always greater than X,500,000; where X can be any corresponding millions value. The northing in feet for the ICS2022: 33 Zone projections are always less than X,500,000; where X can be any corresponding millions value.

For the same physical location, coordinates in all new projections are over 10,000 meters away from those of legacy projections. Only Galesburg overlaps a legacy zone, but still maintains at least a 10,000-meter difference in coordinate values.



Illinois Coordinate System Grid Value Map
Reserved for ICS2022-Illinois (NGS)
ICS83-Illinois (2002)
UTM 16N (meters)
UTM 15N (meters)
Legend
ICS83: 9-Zone (District 8)
ICS83 Legacy Projection
ICS27 Legacy Projection
ICS2022: 33 Zone
ICS83: 33 Zone
Zone Numbers
NORTHING
EASTING
ICS83-Mount Vernon
ICS2022-Mount Vernon
ICS83-Olney
ICS2022-Olney
ICS83-Carbondale
ICS2022-Carbondale
ICS83-Metropolis
ICS2022-Metropolis
ICS83-Champaign
ICS2022-Champaign
ICS83-Jacksonville
ICS2022-Jacksonville
ICS83-Springfield
ICS2022-Springfield
ICS27-Illinois (ILLIMAP)
ICS83-Charleston
ICS2022-Charleston
ICS83-Jerseyville
ICS2022-Jerseyville
ICS83-Carlinville
ICS2022-Carlinville
ICS83-Taylorville
ICS2022-Taylorville
ICS83-Effingham
ICS2022-Effingham
ICS83-Robinson
ICS2022-Robinson
ICS83-Belleville
ICS2022-Belleville
ICS83-Galesburg
ICS27 Galesburg
ICS83-Illinois (2002) meters
ICS2022-Galesburg
ICS83-Peoria
ICS2022-Peoria
ICS83-Eureka
ICS2022-Eureka
ICS83-West
ICS83-Bloomington
ICS2022-Bloomington
ICS83-Pontiac
ICS2022-Pontiac
ICS83-Watseka
ICS2022-Watseka
ICS83-Quincy
ICS2022-Quincy
ICS83-Macomb
ICS2022-Macomb
ICS83-Lincoln
ICS2022-Lincoln
ICS83-Decatur
ICS2022-Decatur
ICS27-West
ICS83-East
ICS27-East
ICS83-Freeport
ICS2022-Freeport
ICS83-Rockford
ICS2022-Rockford
ICS83-Aurora
ICS2022-Aurora
ICS83-Chicago
ICS2022-Chicago
ICS83-Moline
ICS2022-Moline
ICS83-Sterling
ICS2022-Sterling
ICS83-Ottawa
ICS2022-Ottawa
ICS83-Joliet
ICS2022-Joliet
ICS83-Monmouth
ICS2022-Monmouth
ICS83: 9 Zone (District 8)
0 ft
1,000,000 ft
2,000,000 ft
3,000,000 ft
4,000,000 ft
5,000,000 ft
6,000,000 ft
7,000,000 ft
8,000,000 ft
9,000,000 ft
10,000,000 ft

Appendix D – Illinois Coordinate System Naming Convention Guide

The following graphic illustrates the subsystems of the Illinois Coordinate System discussed in the text of the main body of this document.

Illinois Coordinate System Naming Convention Guide

Illinois Coordinate System (ICS)

Illinois Coordinate System of 1927 (ICS27)

SPCS 27 — US Feet

Single Zone

Illinois Coordinate System of 1927: Single Zone

Zone Name	Zone Designation
ILLIMAP	ICS27-ILLIMAP

2 Zone

Illinois Coordinate System of 1927: 2 Zone

Zone Name	Zone Designation
East	**ICS27-East**
West	**ICS27-West**

Illinois Coordinate System of 1983 (ICS83)

SPCS 83

Adjustments

Adjustment Name	Adjustment Abbreviation
NAD 83 1986 Adjustment	**ICS83(1986)**
NAD 83 HARN Adjustment	**ICS83(HARN)**
NAD 83 2007 Adjustment	**ICS83(2007)**
NAD 83 2011 Adjustment	**ICS83(2011)**

SPCS 83 — US Feet

Single Zone

Illinois Coordinate System of 1983: Single Zone

Zone Name	Zone Designation
Illinois	ICS83-Illinois

2 Zone

Illinois Coordinate System of 1983: 2 Zone

Zone Name	Zone Designation
East	**ICS83-East**
West	**ICS83-West**

9 Zone

Illinois Coordinate System of 1983: 9 Zone (District 8)

Zone Name	Zone Designation
Bond	ICS83-Bond
Calhoun	ICS83-Calhoun
Clinton/Washington	ICS83-Clinton/Washington
Jersey/Greene	ICS83-Jersey/Greene
Madison	ICS83-Madison
Marion	ICS83-Marion
Monroe	ICS83-Monroe
Randolph	ICS83-Randolph
St. Clair	ICS83-St. Clair

33 Zone

Illinois Coordinate System of 1983: 33 Zone

Zone Name	Zone Designation	Zone Name	Zone Designation
Freeport	ICS83-Freeport	Lincoln	ICS83-Lincoln
Rockford	ICS83-Rockford	Decatur	ICS83-Decatur
Aurora	ICS83-Aurora	Champaign	ICS83-Champaign
Chicago	ICS83-Chicago	Jacksonville	ICS83-Jacksonville
Moline	ICS83-Moline	Springfield	ICS83-Springfield
Sterling	ICS83-Sterling	Charleston	ICS83-Charleston
Ottawa	ICS83-Ottawa	Jerseyville	ICS83-Jerseyville
Joliet	ICS83-Joliet	Carlinville	ICS83-Carlinville
Monmouth	ICS83-Monmouth	Taylorville	ICS83-Taylorville
Galesburg	ICS83-Galesburg	Effingham	ICS83-Effingham
Peoria	ICS83-Peoria	Robinson	ICS83-Robinson
Eureka	ICS83-Eureka	Belleville	ICS83-Belleville
Bloomington	ICS83-Bloomington	Mount Vernon	ICS83-Mount Vernon
Pontiac	ICS83-Pontiac	Olney	ICS83-Olney
Watseka	ICS83-Watseka	Carbondale	ICS83-Carbondale
Quincy	ICS83-Quincy	Metropolis	ICS83-Metropolis
Macomb	ICS83-Macomb		

Illinois Coordinate System of 2022 (ICS2022)

SPCS2022 — Meters

Single Zone

Illinois Coordinate System of 2022: Single Zone

Zone Name	Zone Designation
Illinois	**ICS2022-Illinois**

33 Zone

Illinois Coordinate System of 2022: 33 Zone

Zone Name	Zone Designation	Zone Name	Zone Designation
Freeport	**ICS2022-Freeport**	**Lincoln**	**ICS2022-Lincoln**
Rockford	**ICS2022-Rockford**	**Decatur**	**ICS2022-Decatur**
Aurora	**ICS2022-Aurora**	**Champaign**	**ICS2022-Champaign**
Chicago	**ICS2022-Chicago**	**Jacksonville**	**ICS2022-Jacksonville**
Moline	**ICS2022-Moline**	**Springfield**	**ICS2022-Springfield**
Sterling	**ICS2022-Sterling**	**Charleston**	**ICS2022-Charleston**
Ottawa	**ICS2022-Ottawa**	**Jerseyville**	**ICS2022-Jerseyville**
Joliet	**ICS2022-Joliet**	**Carlinville**	**ICS2022-Carlinville**
Monmouth	**ICS2022-Monmouth**	**Taylorville**	**ICS2022-Taylorville**
Galesburg	**ICS2022-Galesburg**	**Effingham**	**ICS2022-Effingham**
Peoria	**ICS2022-Peoria**	**Robinson**	**ICS2022-Robinson**
Eureka	**ICS2022-Eureka**	**Belleville**	**ICS2022-Belleville**
Bloomington	**ICS2022-Bloomington**	**Mount Vernon**	**ICS2022-Mount Vernon**
Pontiac	**ICS2022-Pontiac**	**Olney**	**ICS2022-Olney**
Watseka	**ICS2022-Watseka**	**Carbondale**	**ICS2022-Carbondale**
Quincy	**ICS2022-Quincy**	**Metropolis**	**ICS2022-Metropolis**
Macomb	**ICS2022-Macomb**		

20211129

Appendix E – Illinois Coordinate System of 1983: Single Zone

The following document defines the statewide single-zone projection developed by Dr. Chris Pearson.

Options for a single zone projection for Geographical Information Systems in Illinois

Christopher F. Pearson
National Geodetic Survey
David Mick
Illinois Department of Natural Resources

Biography

Chris Pearson is the National Geodetic Survey, Illinois State Geodetic Advisor working with the Illinois Department of Transportation where he serves as chair of the geodetic layer committee of ILGIC. Before coming to Illinois in June 2001, Chris spent 10 years working on measuring earth deformation in New Zealand as a staff member at the New Zealand National Survey School. Chris has a PhD from the University of Otago, New Zealand.

David Mick works for the Water Resources division of the Illinois Department of Natural Resources where he is a GIS specialist. He is a member of the geodetic layer committee of ILGIC. David has a B.S. from Eastern Illinois University and is a Licensed Professional Geologist in Illinois.

Introduction

The widespread implementation of Geographic Information Systems (GIS) by state governments has caused several states to consider the adoption of a standard projection to facilitate statewide mapping and efficient data management. GIS require a statewide spatial database to be stored in a common projection or coordinate system to properly function. State Plane coordinates (SPCS83) are the best-known system of the standard projections in the United States and enjoy the highest level of vendor support. State plane coordinates however have the disadvantage of dividing states into separate zones with different projections making the existing state plane system impractical for use as the standard projection for statewide databases.

Illinois is in the process of updating the projection for statewide GIS. This paper reviews projections that are currently used by statewide GIS administrators in Illinois and considers options for change.

The basics

Projecting geographical information from the surface of the earth to a plane is a two-stage process. First the points must be projected from the surface of the earth to an ellipsoid and then from the ellipsoid onto a plane. Unfortunately all map projections contain unavoidable distortions which have two distinct causes. The first source of distortions occurs because, when we project points from the surface of the earth to the ellipsoid, the projection lines (which are radial lines from the center) converge. This means that distances between points on the surface of the earth will generally be less than distances between the projections of the points on the ellipsoid. This difference in scale is called the Elevation Factor and is equal to the radius to ellipsoid over the radius to the earth's surface. Secondly the points must be projected from the ellipsoid to a plane which gives rise to a second source of distortion. This distortion is quantified as the grid scale factor (SF), which is the ratio between a distance represented on the grid and its corresponding value when projected onto the ellipsoid. For the Transverse Mercator projection there are usually two lines located symmetrically about the central meridian for which the grid scale factor is exactly one. It is greater than one for regions lying outside these lines of zero distortion and less than one for the region lying between them. The total correction factor, including both grid and elevation terms (CF) is the product of the grid scale factor (SF) and the elevation factor (EF). Multiplying this by the ground distance gives the corresponding distance on the grid. Thus:

CF = EF x SF
Grid distance = ground distance x correction factor

NGS policy on changes to plane coordinate systems

The National Geodetic Survey (NGS) recognizes there may be States that want to implement changes to their existing State Plane Coordinate System. NGS policy is detailed in http://www.ngs.noaa.gov/INFO/Policy/SPCS4.html. The major requirements are summarized below:

1. The State Department of Transportation, State Office of GIS, and state professional land surveyor organizations must approve changes.
2. Projections must be either the Lambert Conformal Conic or the Transverse Mercator defined at the surface of the GRS80 ellipsoid and the current Datum
3. Changes must be adopted by State Law or State Regulation.
4. SPCS changes will ensure that the resulting coordinate differences are sufficiently large to ensure that no confusion will exist with the current NAD 83 coordinate values

Experience of Kentucky

The state of Kentucky has recently adopted a single zone coordinate system for use by both the GIS and engineering communities (Bunch 2002). Their single zone coordinate system was adopted by administrative regulation and has been accepted by NGS as part of the SPCS. It is a Lambert Conformal Conic system, which would be the obvious choice for a state that has a much greater extent in the east-west direction than in the north-south direction. Their system was designed so that the maximum combined scale factor is about 1 part in 5000. One of the major benefits of including the Kentucky single zone in the SPCS is the widespread support that this system enjoys with major GIS and surveying software vendors. Indeed most major vendors currently include Kentucky single zone as a menu selection or intend to in the near future.

Current state wide projections in Illinois

There are currently no officially adopted statewide projections for Illinois. The most commonly used projection is a custom Lambert projections based on the projection USGS uses for the 7.5' Quad Maps in the contiguous 48 states. It has standard parallels 45 North and 33 North, (which pass through Northern Louisiana and Northern Wisconsin. It is defined for the NAD27 datum and the CLARKE1866 ellipsoid. This projection was originally used for the ILLIMAP system, a pioneering GIS systems developed by IDNR (Swann et al 1970). The coordinate system was selected because it facilitates data interchange with USGS quad maps, which was crucial in the days of paper maps and Mylar overlays. While this coordinate system was the obvious choice in 1970, there are two reasons why it is not an ideal candidate for a statewide map projection currently. The first of these is that since 1970, the NAD27 datum has been superseded by NAD83. Ideally transforming between datums is a simple mathematical procedure but some datums are distorted due to survey errors, which result in a spatially variable scale. In this case datum transformation is an approximate procedure involving grid files and linear interpolation and, unfortunately, NAD27 is in this category. As a result, being transformed into the custom Lambert projection will inevitably degrade modern survey data. A second problem with this projection is that the scale distortions are very large because the standard parallels are located hundreds of kilometers outside of the geographical extents of the state. Scale distortions for the Custom Lambert projection are shown in Figure 1.

Some GIS use Illinois West State Plane Coordinates as a statewide system by extending the geographical limits of the zone to cover the limits of the state. This projection has two advantages over the custom Lambert projection. First the projection is defined to be on the NAD83 datum and the GRS80 ellipsoid. Distortions are significantly less than custom Lambert projection with a maximum of approximately 1 part in 1800 in eastern Illinois (see figure 2 for a contour map of combined factors over the state). While this projection is clearly preferable to Custom Lambert projection it has two characteristics that make it less than ideal for a statewide projection. First the projection is currently defined only for the western side of Illinois and extending its coverage over the entire state can cause problems with some software packages. Secondly, the projection is designed to minimize scale distortions only within its zone. By extending the region of use to cover the eastern side of the state also, scale distortions are much greater than they need to be.

Optimized projections for Illinois

As an example of how the NGS guidelines might apply to Illinois, we have developed an optimized single zone projection for the state. Because Illinois is elongated in the north-south direction, a Transverse Mercator projection is the obvious choice for the state. We started by adopting 089:30 W as the central median as it is a convenient even value, which lies very close to the center of the state. Following the methodology used by Kentucky in adopting a statewide single zone projection, we designed our projection to minimize the combined scale factor rather than the grid scale factor. We accomplished this by utilizing tables of elevation statistics created from USGS 7.5-minute Digital Elevation Models (DEM) for all of 7.5-minute quad sheets that wholly or partially lie within the geographical bounds of Illinois. We then calculated elevation and scale factors (Snyder 1987) for the centroids of all of the quad sheets using the mean elevation for each sheet and varied the central median scale factor using a grid search procedure so that the extreme values of the combined scale factors were as close to one as possible. Figure 3 shows a plot of combined scale factors for a projection that is optimized to minimize combined scale factors for the land area of Illinois. The maximum combined scale factor for this projection is 1:5300. The maximum grid scale factor for the projection is 1:4938.

Coordinate analysis

One of the NGS requirements is that the coordinates from any new SPCS projection are distinct from other projections used in the state so it is clear which system we are using. To accomplish this, large constant values are often added to the eastings and northings to insure that the coordinates from one projection will not overlap with coordinates generated from other commonly used projections. As shown in figure 4, if we assign a false origin of 1000000m to east and 1200000m to north coordinates ensures there is no overlap with any of the other commonly used systems in Illinois. Note that there is some degree of overlap between the Custom Lambert and Illinois State Plane West. The zone of overlap for these two projections is considerably greater if Illinois State Plane West is extended east to cover the entire state as is done for some state wide GIS systems. The parameters of the best-fit Transverse Mercator system are listed below in Table 1.

Table 1
Parameters of best fitting Transverse Mercator projection for Illinois

Latitude of origin	36º 40”
Central Meridian	89º 30”
Central Meridian scale factor	1 part in 6800 too small
False origin E m	1000000m
False origin N m	1200000m

Conclusions

The current state plane zones in Illinois are clearly not ideal for statewide GIS systems as they divide the state into two zones. This has caused several non-SPCS coordinate systems to be adopted by statewide GIS administrators. The most commonly used of these is the Lambert Conformal Conic projection, which was designed for the USGS quad sheets. This projection has two undesirable features. Firstly it is defined on NAD27 requiring all modern data to undergo a datum transformation from NAD83, which will result in some loss in precision due to scale distortions in the older datum. Secondly since it was not optimized specifically for Illinois, it has scale distortions as great as 1:195. In contrast, an optimized Transverse Mercator projection would have combined scale distortions including both the effect of the elevation factor and the grid factor of no worse than 1:5300 for all areas within the geographical bounds of Illinois.

If Illinois adopts a new projection to support GIS then consideration must be given as to whether the projection is adopted as part of the SPCS83 system. Including the new coordinate system as part of the SPCS83 system has two advantages. First it increases the probability that major GIS software vendors will support the new system as a preprogrammed coordinate set. Second it ensures that the coordinates of all control points in Illinois which are published by NGS, are available in this projection over the National Geodetic Survey website.

A second issue that needs consideration is whether a new statewide projection replaces or exists in tandem with the existing state plane zones. Having the single zone projection in tandem with the current east and west zones has the clear advantage of avoiding causing large legacy costs for government and engineering users of the two existing state plane zones. In addition, for some engineering applications, the smaller scale distortions associated with the existing state plane zones are still a definite advantage.

Acknowledgements

The authors wish to thank the other members of the geodetic layer committee of the Illinois Geographic Information Committee for their support and encouragement in this project. Thanks also go to Bill Rice of Rice Engineering (ex IDNR) for his encouragement.

References

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Figures

Figure 1. 3 Grid Scale distortions for the Custom Lambert projection (standard parallels 45 North and 33 North)

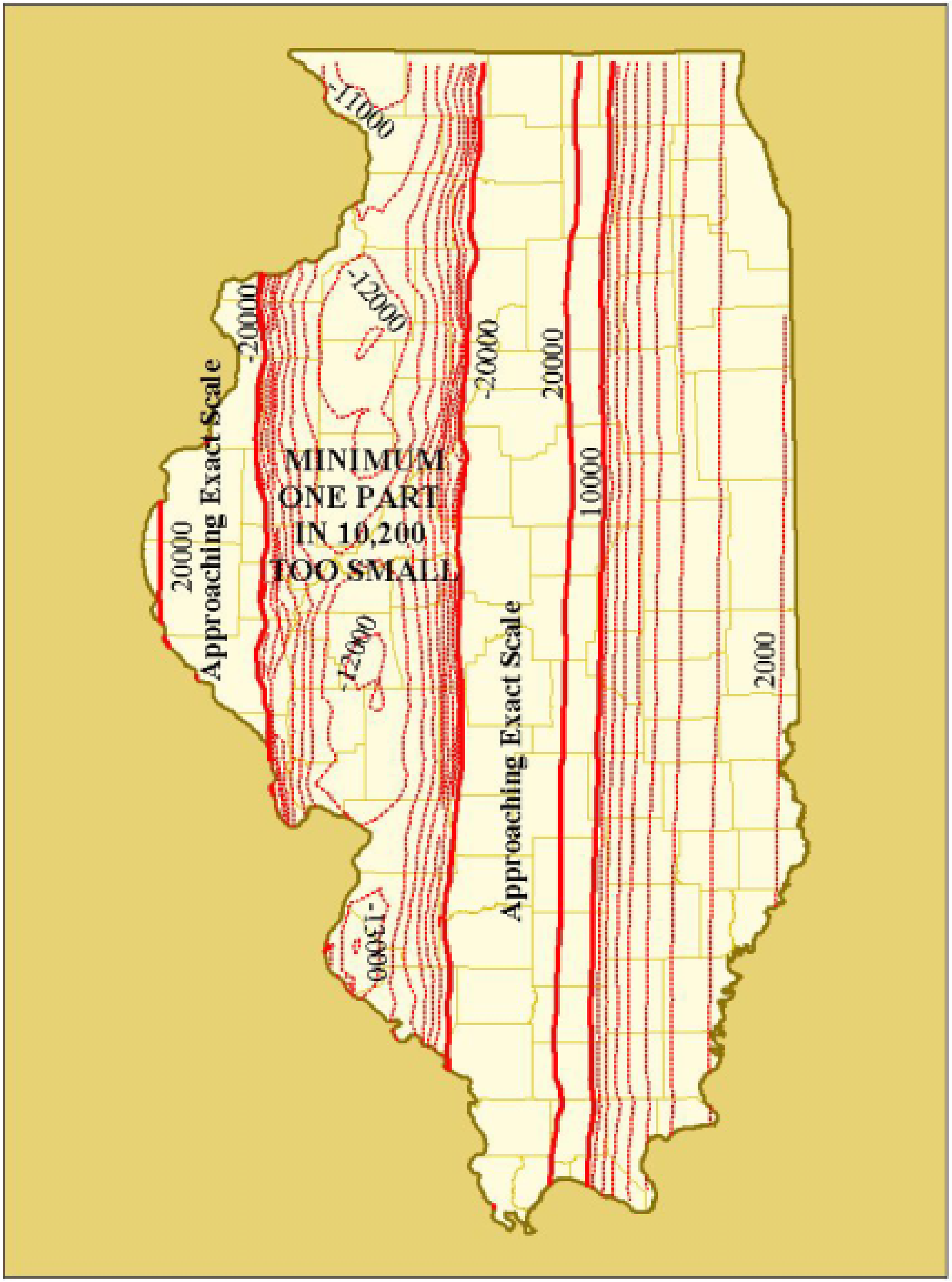


Figure 2 map Combined factor for the Illinois West State Plane Coordinates extended to cover the geographical limits of the state

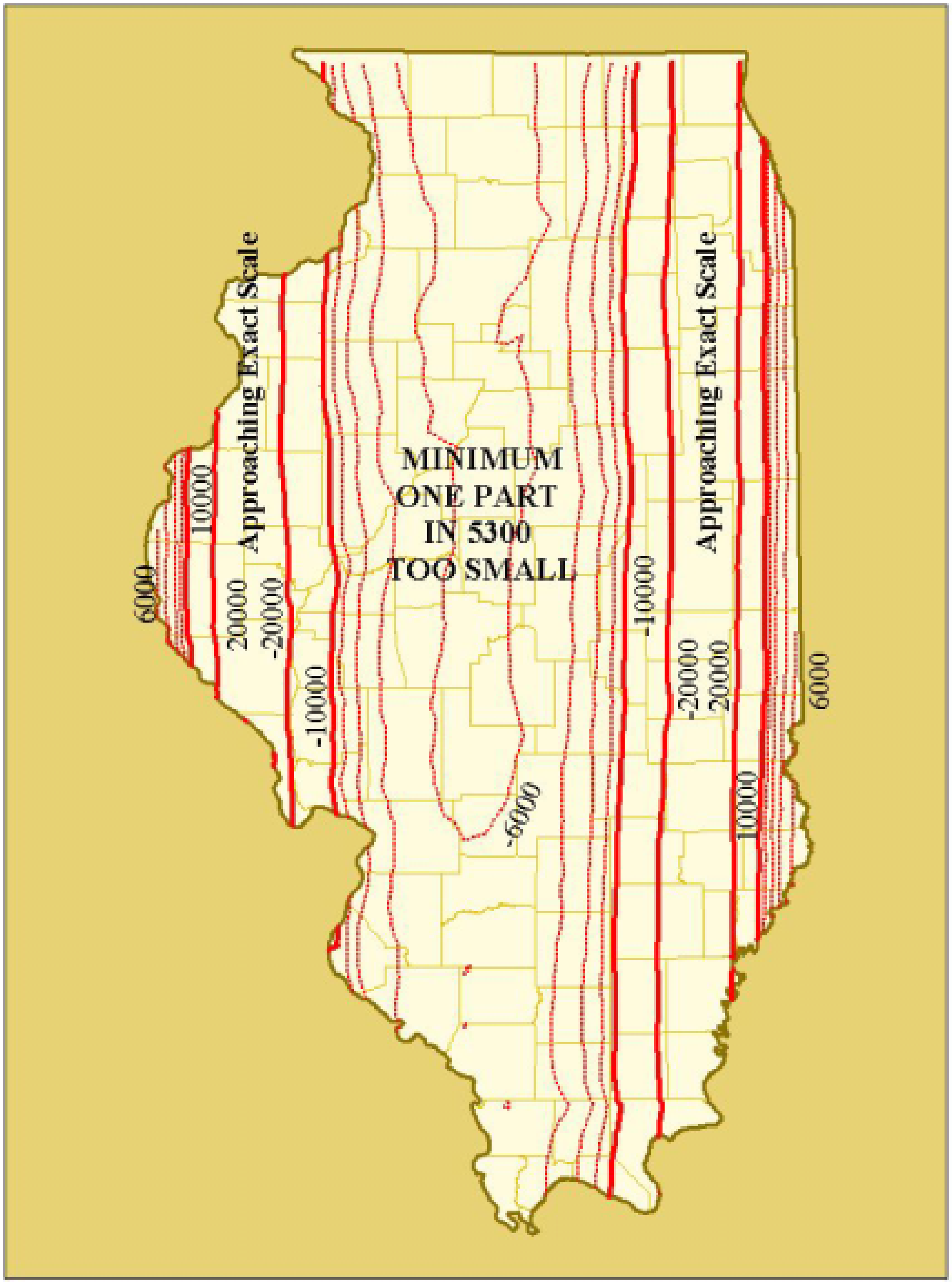


Figure 3 shows a plot of combined scale factors for a projection that is optimized to minimize combined scale factors for the land area of Illinois

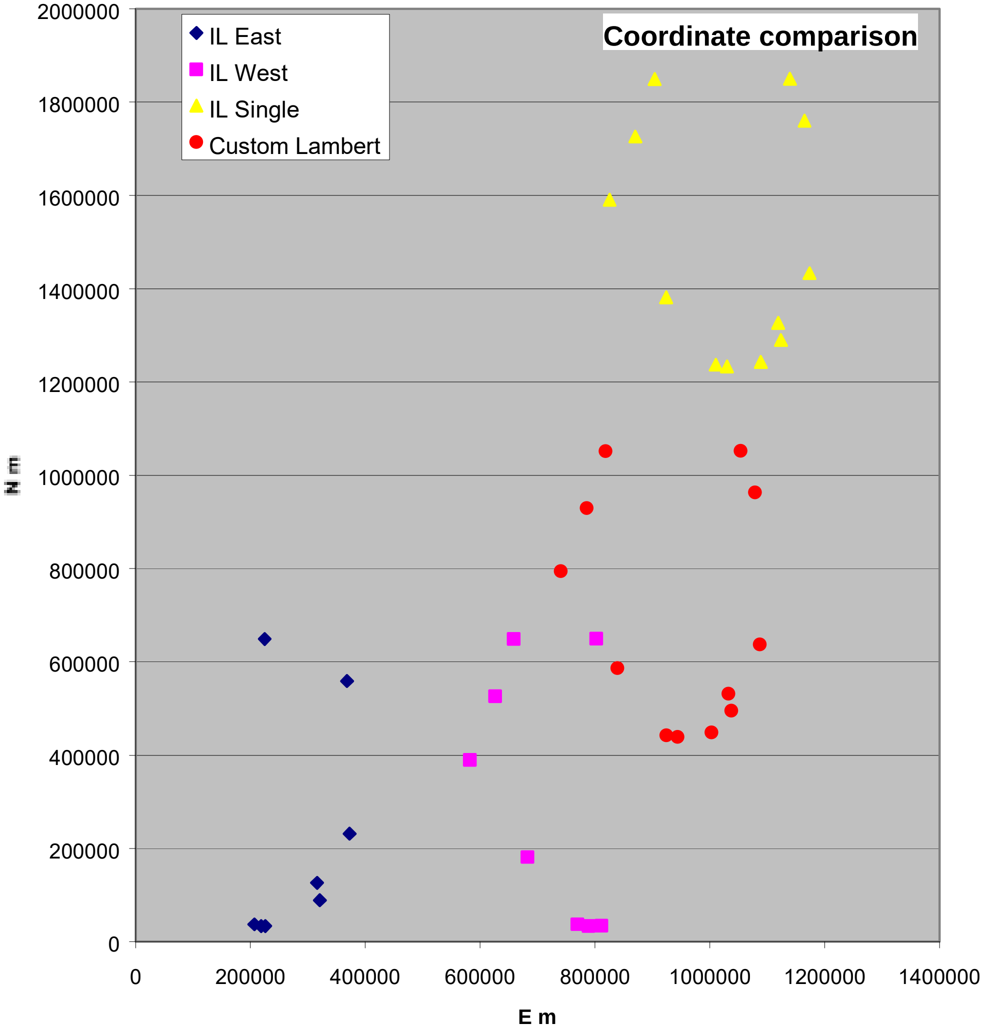


Figure 4 Coordinate Comparison plot for commonly used projections in Illinois showing coordinate ranges achieved within the geographical bounds of the state.

Appendix F – Illinois Coordinate System of 1983: 9 Zone (District 8)

The following document defines the low distortion projections developed by Hutson and Associates, Inc. for IDOT District 8.

LOW DISTORTION PROJECTION REPORT

Prepared For:

ILLINOIS DEPARTMENT OF TRANSPORTATION
DISTRICT EIGHT

PREPARED BY:
HUTSON & ASSOCIATES, INC.
PTB 152-029
JOB NO. P-98-003-09
WORK ORDER 13

ISSUED: April 13, 2016

STATE OF ILLINOIS
AARON PHILLIP
HUTSON, SR.
035-003456
BUNKER HILL
ILLINOIS
PROFESSIONAL LAND SURVEYOR

4/13/16

The purpose of this report is to detail and document the design approach used in creating the county wide Low Distortion Coordinate Systems for the 11 counties located in the Illinois Department of Transportation, District 8.

The following is a general description of the process used to compute the projection parameters from which the Low Distortion Coordinate Systems are based on:

1) Define the project area and choose a representative ellipsoid height.
   a) For the purposes of this project, the project areas are the county boundaries.
   b) As a starting point, the average ellipsoid height for each county was calculated from data obtained from the National Elevation Data Set, which is maintained by the United States Geological Survey. This height is refined in step 4.

2) Choose the projection type and determine the central meridian.
   a) The two types of projections used for this project are the Transverse Mercator projection and the Lambert Conic Conformal, single parallel projection.
   b) The central meridians were place near the centroid of the project areas.

3) Scale the central meridian of the projection to the representative ellipsoid height.
   a) The central meridians were scaled to “ground” using the following mapping equations:

$$k_0 = 1 + \frac{h_0}{R}$$

$$R = \frac{a\sqrt{1-e^2}}{1-e^2 \sin^2 \emptyset}$$

k_0 = Central Meridian Scale Factor

h_0 = Representative Ellipsoid Height

R = Geometric Mean Radius

a = Semi Major Ellipsoid Axis = 20,925,604.474167 (GRS 80 ellipsoid)

e^2= First Eccentricity Squared = 0.0066943800229034 (GRS 80 ellipsoid)

$\emptyset$ = Geodetic Latitude of a Point

4) Check the distortion at regular intervals throughout the project area.
   a) Data points were extracted from the above mentioned National Elevation Data Set at a 3 arc second interval across the entire project area.
   b) Distortion was calculated for each of the above data points using the following mapping equations.

$$\delta = C_f - 1$$

$$C_f = \frac{S}{D} = k[R/(R + h)]$$

$\delta =$ Linear Distortion at a point

C_f = Combined Grid Factor

S = Grid Distance

D = Horizontal Ground Distance

k = Point Scale Factor (See Appendix "A" for mapping equations)

R = Geometric Mean Radius

h = Ellipsoid Height

c) If the distortion resulted in an unacceptably high distortion, a new value for k_0 was calculated and step 4 was repeated until suitable results were achieved.

5) Define the Coordinate System values.
   a) The false easting's and northing's were calculated such that on the south and west tier of the project area the coordinate values would remain positive approximately one mile south and one mile west of the project area.

6) Define the linear units and datum.
   a) The liner units for this project are US survey foot.
   b) The Datum for this project is the North American Datum of 1983.

The following is a list of the project areas (Counties) and the distortion results for each:

Bond County:

Projection: Transverse Mercator
Latitude of Origin: 38°44'00" N
Central Meridian: 89°27'00" W
Ellipsoid Height: 420
CM Scale Factor: 1.000020086
Maximum Negative Distortion: -6.75 ppm
Average Distortion: 0.34 ppm
Maximum Positive Distortion: 7.29 ppm
Number of Points in Data Set: 148,262
Area between -2 ppm and 2 ppm: 65%
Area between -4 ppm and 4 ppm: 93%
Area between -6 ppm and 6 ppm: 100%

Calhoun County:

Projection: Transverse Mercator
Latitude of Origin: 38°51'00" N
Central Meridian: 90°41'00" W
Ellipsoid Height: 520
CM Scale Factor: 1.000024868
Maximum Negative Distortion: -9 ppm
Average Distortion: 4.1 ppm
Maximum Positive Distortion: 14.99 ppm
Number of Points in Data Set: 109,974
Area between -2 ppm and 2 ppm: 17%
Area between -4 ppm and 4 ppm: 36%
Area between -6 ppm and 6 ppm: 54%
Area between -8 ppm and 8 ppm: 63%
Area between -10 ppm and 10 ppm: 82%
Area between -12 ppm and 12 ppm: 95%
Area between -14 ppm and 14 ppm: 100%

Clinton/Washington Counties:

Projection: Transverse Mercator
Latitude of Origin: 38°12'00" N
Central Meridian: 89°25'00" W
Ellipsoid Height: 320
CM Scale Factor: 1.000015304
Maximum Negative Distortion: -8.07 ppm
Average Distortion: -0.02 ppm
Maximum Positive Distortion: 9.6 ppm
Number of Points in Data Set: 411,348
Area between -2 ppm and 2 ppm: 53%
Area between -4 ppm and 4 ppm: 85%
Area between -6 ppm and 6 ppm: 97%
Area between -8 ppm and 8 ppm: 100%

Jersey/Greene Counties:

Projection: Transverse Mercator
Latitude of Origin: 38°54'00" N
Central Meridian: 90°20'00" W
Ellipsoid Height: 450
CM Scale Factor: 1.00002152
Maximum Negative Distortion: -14.04 ppm
Average Distortion: 1.57 ppm
Maximum Positive Distortion: 14.09 ppm
Number of Points in Data Set: 359,778
Area between -2 ppm and 2 ppm: 46%
Area between -4 ppm and 4 ppm: 72%
Area between -6 ppm and 6 ppm: 84%
Area between -8 ppm and 8 ppm: 87%
Area between -10 ppm and 10 ppm: 89%

Area between -12 ppm and 12 ppm: 95%
Area between -14 ppm and 14 ppm: 100%

Madison County:

Projection: Lambert Conformal Conic (One-Parallel)
Latitude of Origin: 38°50'00" N
Central Meridian: 89°56'00" W
Ellipsoid Height: 400
CM Scale Factor: 1.000019129
Maximum Negative Distortion: -5.85 ppm
Average Distortion: 0.93 ppm
Maximum Positive Distortion: 9.92 ppm
Number of Points in Data Set: 286,289
Area between -2 ppm and 2 ppm: 56%
Area between -4 ppm and 4 ppm: 83%
Area between -6 ppm and 6 ppm: 93%
Area between -8 ppm and 8 ppm: 98%
Area between -10 ppm and 10 ppm: 100%

Marion County:

Projection: Lambert Conformal Conic (One-Parallel)
Latitude of Origin: 38°39'00" N
Central Meridian: 88°55'00" W
Ellipsoid Height: 400
CM Scale Factor: 1.00001913
Maximum Negative Distortion: -6.59 ppm
Average Distortion: -0.03 ppm
Maximum Positive Distortion: 7.9 ppm
Number of Points in Data Set: 222,237
Area between -2 ppm and 2 ppm: 68%
Area between -4 ppm and 4 ppm: 95%
Area between -6 ppm and 6 ppm: 99%
Area between -8 ppm and 8 ppm: 100%

Monroe County:

Projection: Transverse Mercator
Latitude of Origin: 38°04'00" N
Central Meridian: 90°08'00" W
Ellipsoid Height: 470
CM Scale Factor: 1.000022479
Maximum Negative Distortion: -9.37 ppm
Average Distortion: 3.86 ppm
Maximum Positive Distortion: 15.06 ppm
Number of Points in Data Set: 152,693
Area between -2 ppm and 2 ppm: 18%
Area between -4 ppm and 4 ppm: 36%
Area between -6 ppm and 6 ppm: 52%
Area between -8 ppm and 8 ppm: 62%

Area between -10 ppm and 10 ppm: 77%
Area between -12 ppm and 12 ppm: 92%
Area between -14 ppm and 14 ppm: 99%
Area between -16 ppm and 16 ppm: 100%

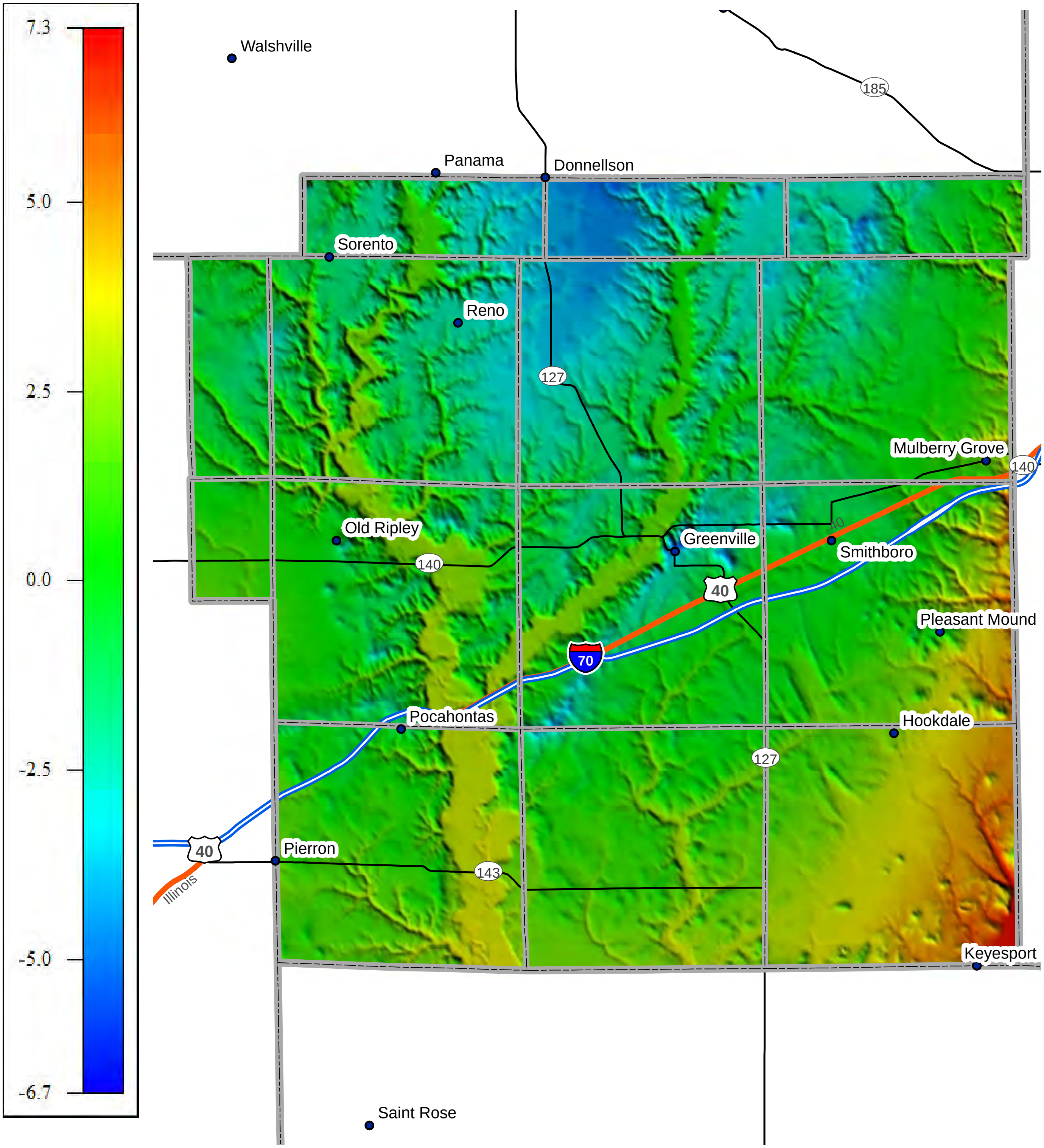
Randolph County:

Projection: Lambert Conformal Conic (One-Parallel)
Latitude of Origin: 38°04'00" N
Central Meridian: 89°49'00" W
Ellipsoid Height: 350
CM Scale Factor: 1.000016739
Maximum Negative Distortion: -12.82 ppm
Average Distortion: 0.6 ppm
Maximum Positive Distortion: 15.52 ppm
Number of Points in Data Set: 227,539
Area between -2 ppm and 2 ppm: 41%
Area between -4 ppm and 4 ppm: 75%
Area between -6 ppm and 6 ppm: 89%
Area between -8 ppm and 8 ppm: 96%
Area between -10 ppm and 10 ppm: 98%
Area between -12 ppm and 12 ppm: 99%
Area between -14 ppm and 14 ppm: 100%

St. Clair County:

Projection: Transverse Mercator
Latitude of Origin: 38°12'00" N
Central Meridian: 89°50'00" W
Ellipsoid Height: 320
CM Scale Factor: 1.000015304
Maximum Negative Distortion: -11.63 ppm
Average Distortion: 0.29 ppm
Maximum Positive Distortion: 19.33 ppm
Number of Points in Data Set: 778,448
Area between -2 ppm and 2 ppm: 56%
Area between -4 ppm and 4 ppm: 78%
Area between -6 ppm and 6 ppm: 88%
Area between -8 ppm and 8 ppm: 92%
Area between -10 ppm and 10 ppm: 95%
Area between -12 ppm and 12 ppm: 97%
Area between -14 ppm and 14 ppm: 98%
Area between -16 ppm and 16 ppm: 99%
Area between -18 ppm and 18 ppm: 100%

Bond County Distortion Map
in Parts Per Million



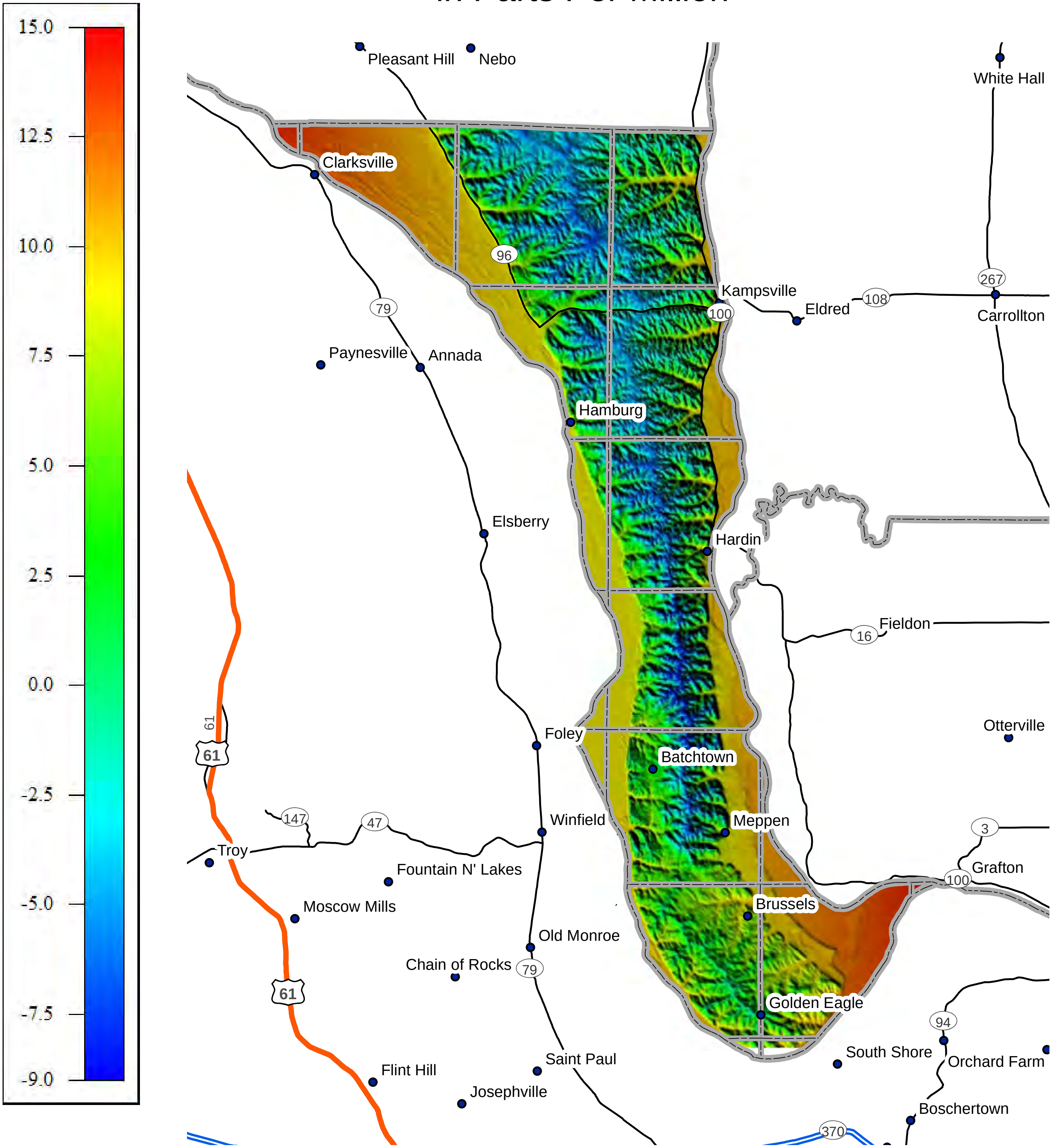
PREPARED BY:

Hutson & Associates
3555 College Avenue
Alton, Illinois 62002
Phone: (618) 433-9229
Design Firm Number: 184-004243

Projection Parameters

Projection: Transverse Mercator
Latitude of Origin: 38°44'00" N
Central Meridian: 89°27'00" W
CM Scale Factor: 1.000020086
False Northing: 0.000 sft
False Easting: 74,000.000 sft

Calhoun County Distortion Map in Parts Per Million



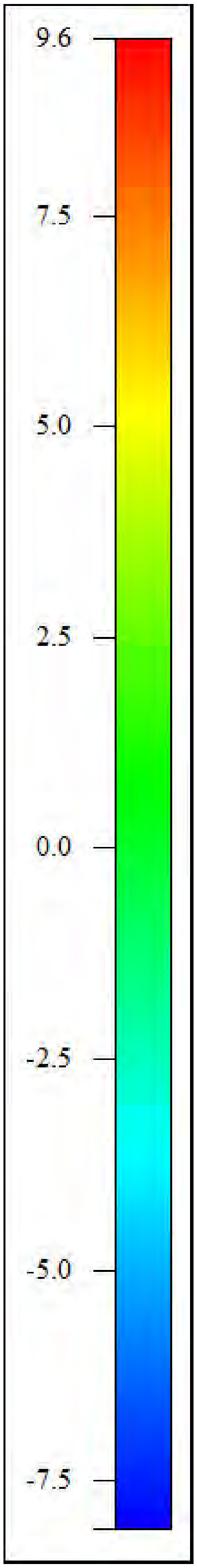
PREPARED BY:

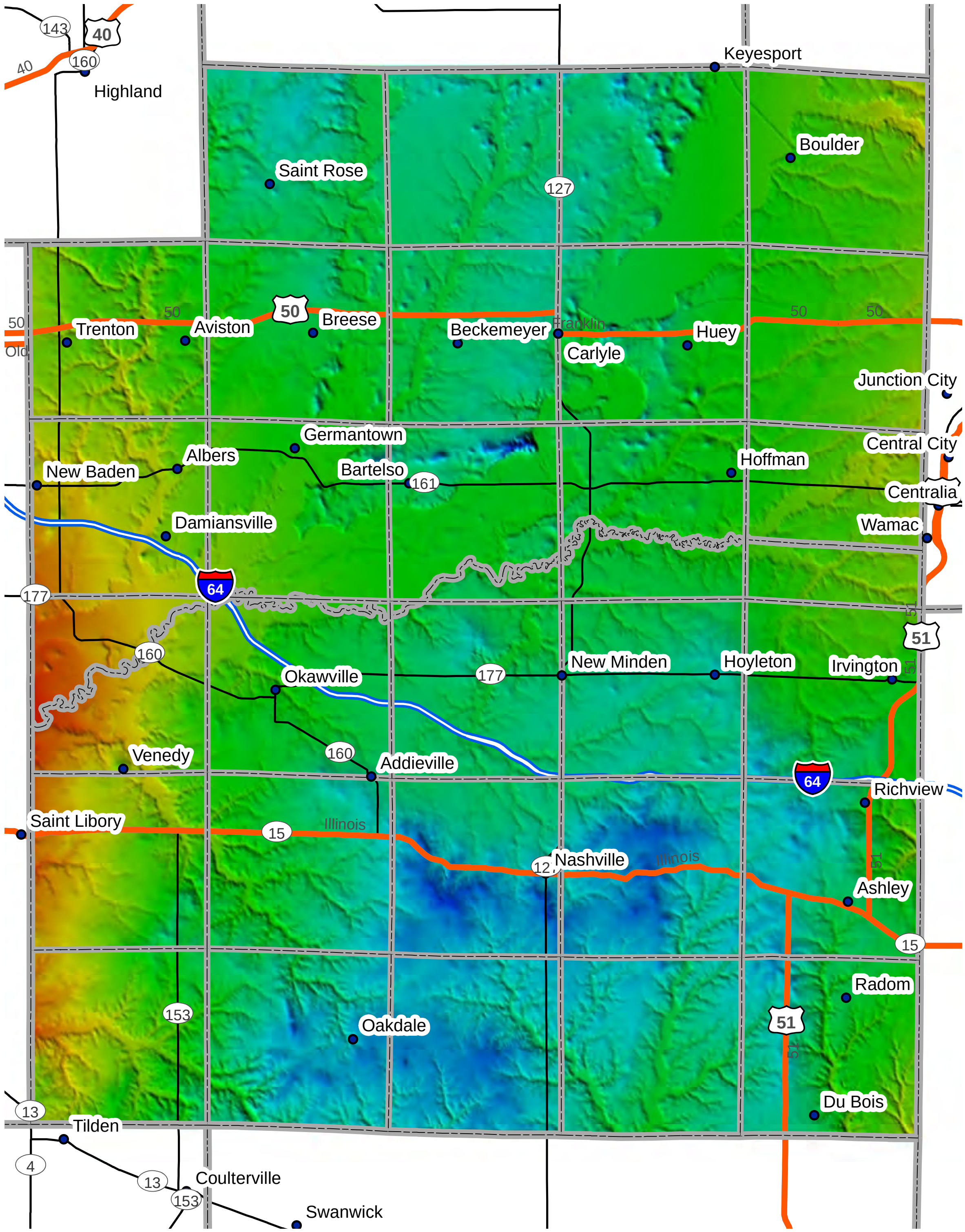
Hutson & Associates
3555 College Avenue
Alton, Illinois 62002
Phone: (618) 433-9229
Design Firm Number: 184-004243

Projection Parameters

Projection: Transverse Mercator
Latitude of Origin: 38°51'00" N
Central Meridian: 90°41'00" W
CM Scale Factor: 1.000024868
False Northing: 0.000 sft
False Easting: 77,000.000 sft

Clinton & Washington County Distortion Map in Parts Per Million





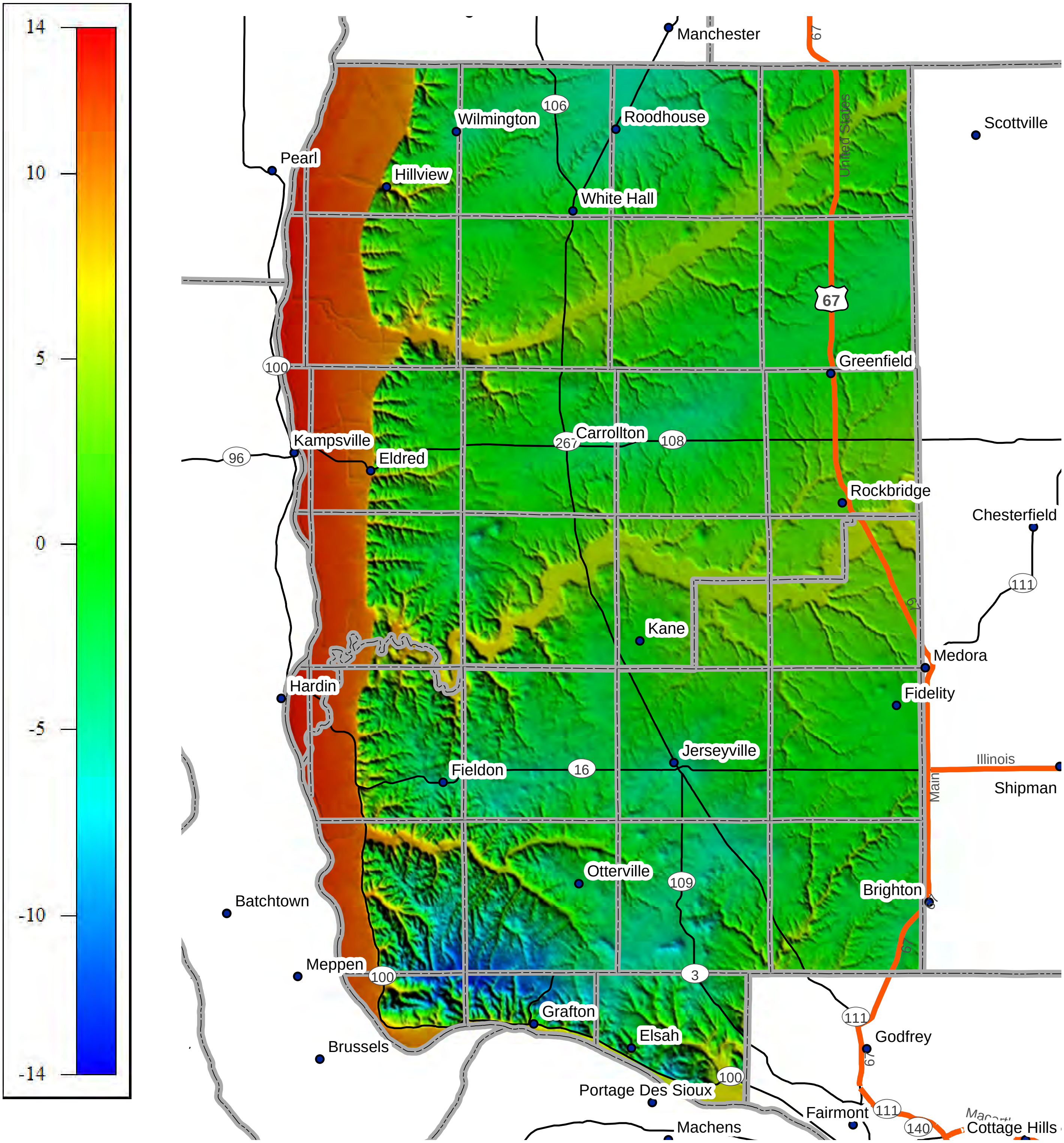
PREPARED BY:

Hutson & Associates
3555 College Avenue
Alton, Illinois 62002
Phone: (618) 433-9229
Design Firm Number: 184-004243

Projection Parameters

Projection: Transverse Mercator
Latitude of Origin: 38°12'00" N
Central Meridian: 89°25'00" W
CM Scale Factor: 1.000015304
False Northing: 0.000 sft
False Easting: 88,000.000 sft

Jersey & Greene County Distortion Map
in Parts Per Million



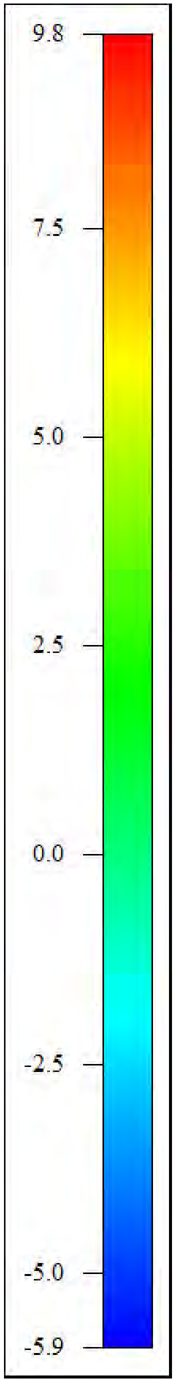
PREPARED BY:

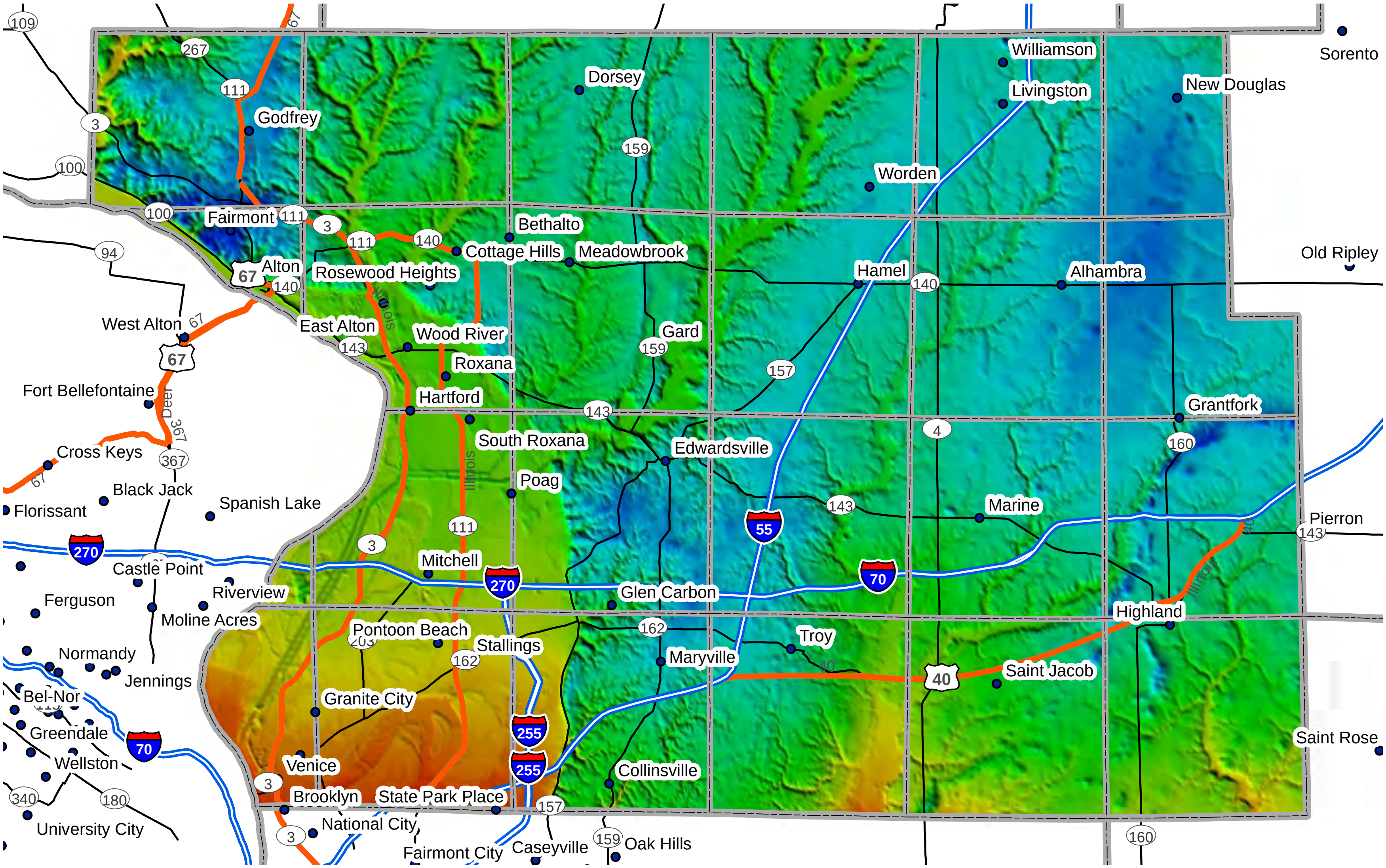
Hutson & Associates
3555 College Avenue
Alton, Illinois 62002
Phone: (618) 433-9229
Design Firm Number: 184-004243

Projection Parameters

Projection: Transverse Mercator
Latitude of Origin: 38°54'00" N
Central Meridian: 90°20'00" W
CM Scale Factor: 1.00002152
False Northing: 0.000 sft
False Easting: 88,000.000 sft

Madison County Distortion Map in Parts Per Million





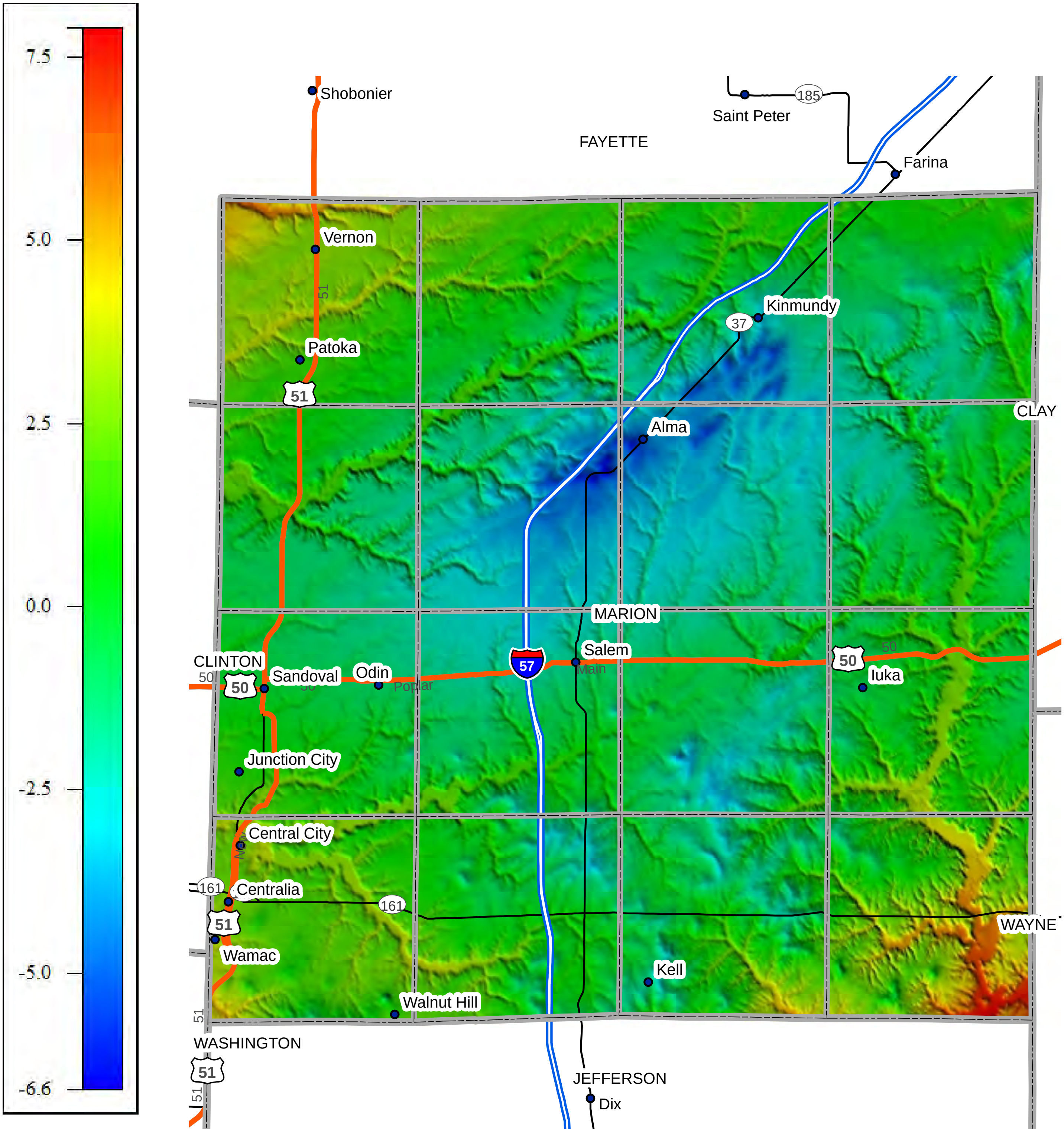
PREPARED BY:

Hutson & Associates
3555 College Avenue
Alton, Illinois 62002
Phone: (618) 433-9229
Design Firm Number: 184-004243

Projection Parameters

Projection: Lambert Confromal Conic (Single Parallel)
Latitude of Origin: 38°50'00" N
Central Meridian: 89°56'00" W
Scale Factor: 1.000019129
False Northing: 79,000 sft
False Easting: 103,000 sft

Marion County Distortion Map in Parts Per Million



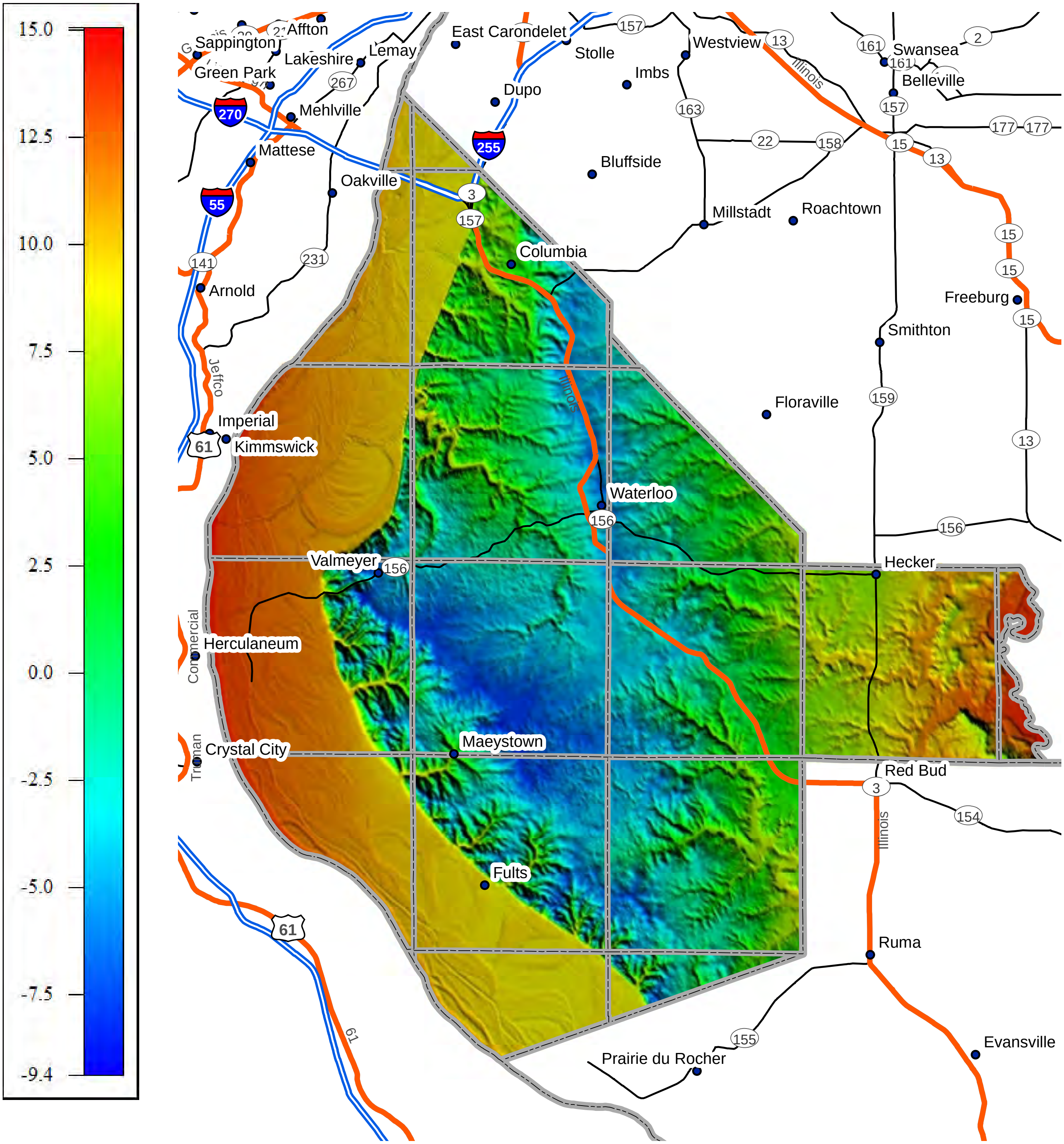
PREPARED BY:

Hutson & Associates
3555 College Avenue
Alton, Illinois 62002
Phone: (618) 433-9229
Design Firm Number: 184-004243

Projection Parameters

Projection: Lambert Conformal Conic (Single Parallel)
Latitude of Origin: 38°39'00" N
Central Meridian: 88°55'00" W
Scale Factor: 1.00001913
False Northing: 65,000 sft
False Easting: 70,000 sft

Monroe County Distortion Map
in Parts Per Million



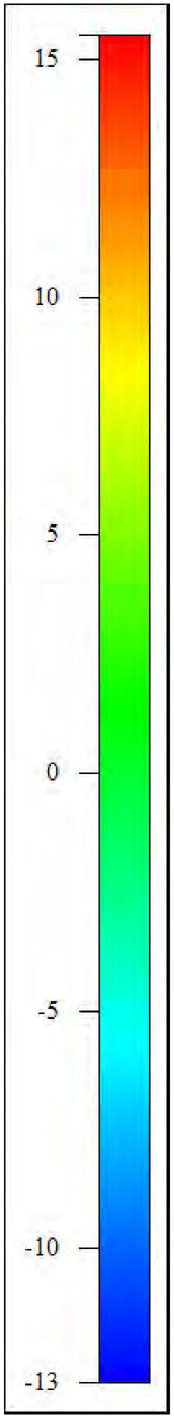
PREPARED BY:

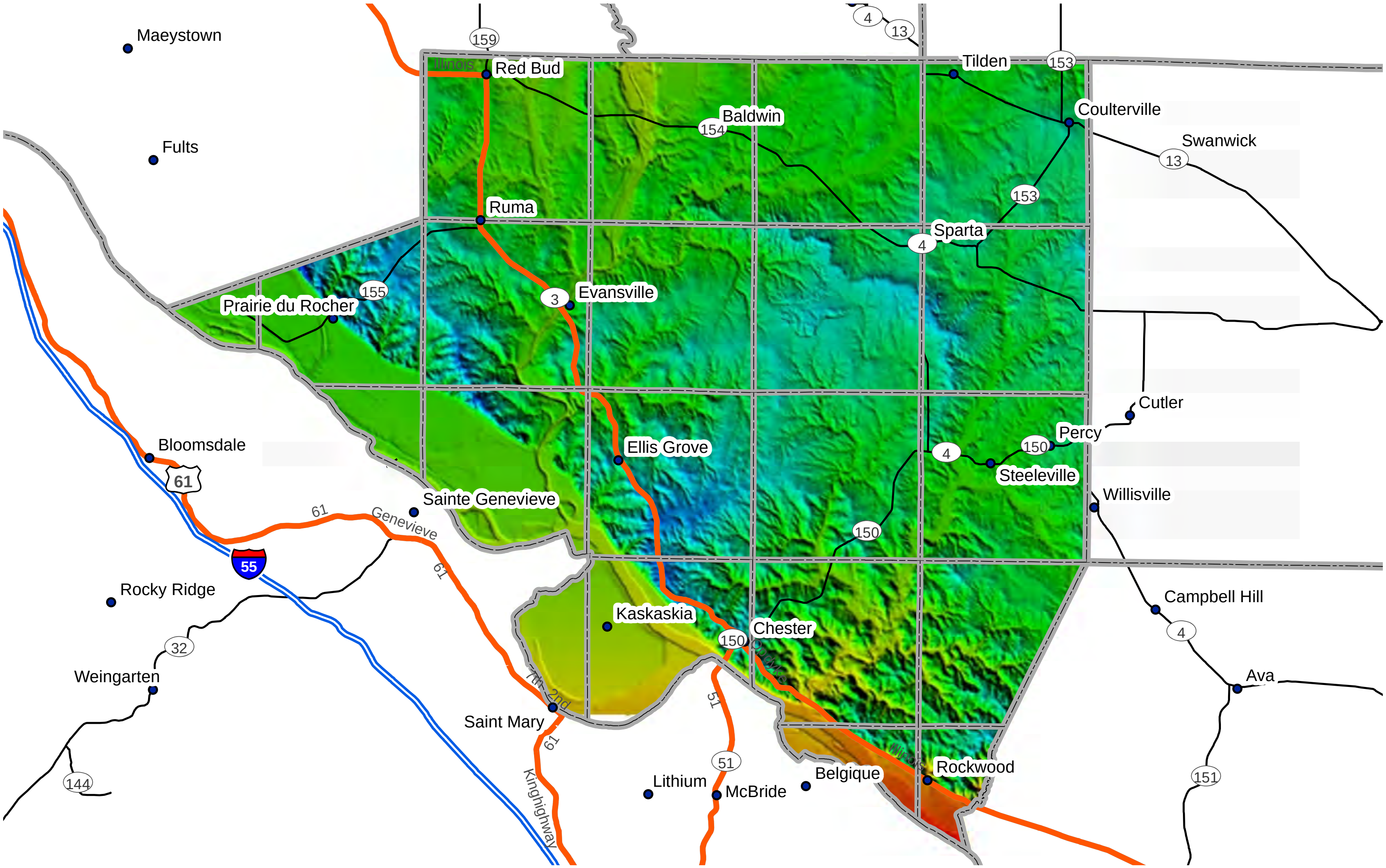
Hutson & Associates
3555 College Avenue
Alton, Illinois 62002
Phone: (618) 433-9229
Design Firm Number: 184-004243

Projection Parameters

Projection: Transverse Mercator
Latitude of Origin: 38°04'00" N
Central Meridian: 90°08'00" W
CM Scale Factor: 1.000022479
False Northing: 0.000 sft
False Easting: 75,000.000 sft

Randolph County Distortion Map
in Parts Per Million





PREPARED BY:

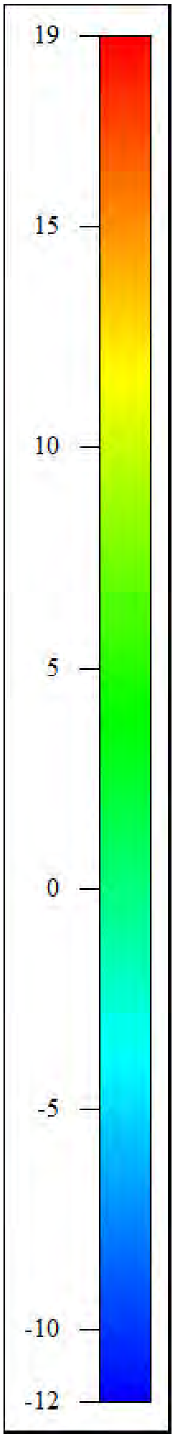
Hutson & Associates

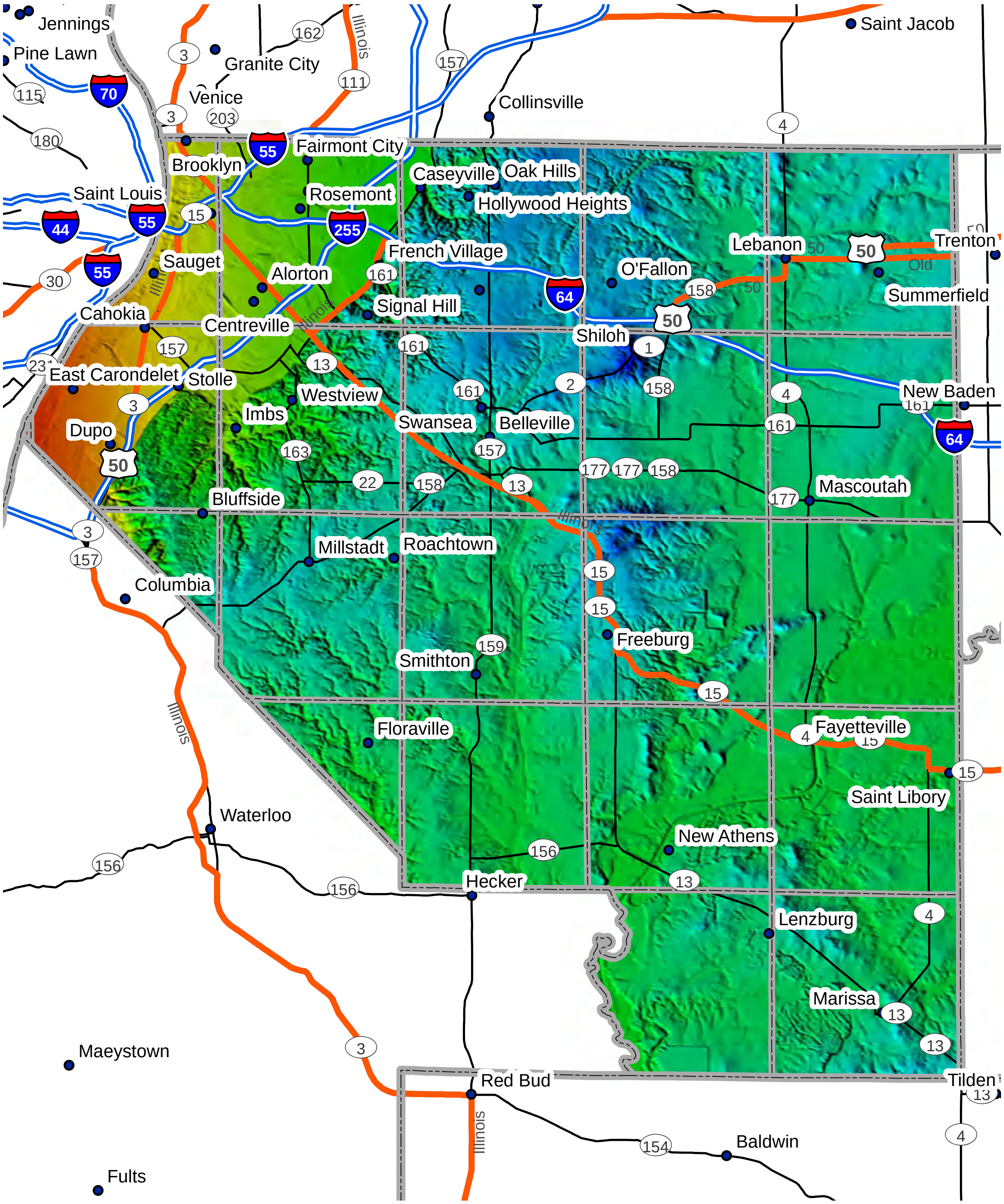
3555 College Avenue
Alton, Illinois 62002
Phone: (618) 433-9229
Design Firm Number: 184-004243

Projection Parameters

Projection: Lambert Confromal Conic (Single Parallel)
Latitude of Origin: 38°04'00" N
Central Meridian: 89°49'00" W
Scale Factor: 1.000016739
False Northing: 101,000 sft
False Easting: 118,000 sft

St. Clair County Distortion Map
in Parts Per Million





PREPARED BY:

Hutson & Associates

3555 College Avenue
Alton, Illinois 62002
Phone: (618) 433-9229
Design Firm Number: 184-004243

Projection Parameters

Projection: Transverse Mercator
Latitude of Origin: 38°12'00" N
Central Meridian: 89°50'00" W
CM Scale Factor: 1.000015304
False Northing: 0.000 sft
False Easting: 129,000.000 sft

APPENDIX "A"

Scale Factor of a point (Transverse Mercator Projection)

$k = k_0[1 + F_2L^2(1 + F_4L^2)]$

$k_0 = 1 + \frac{h}{R}$

$F_2 = \frac{1}{2}\,(1 + n^2)$

$n^2 = e'^2 cos^2 \emptyset$

$e'^2 = e^2/(1 - e^2)$

e^2 = 0.0066943800229034 (GRS 80 ellipsoid)

$\emptyset$ = Latitude of point

$L = (\lambda - \lambda_0)\cos\emptyset$

λ = Longitude of point

λ_0 = Central Meridian

$\emptyset$ = Latitude of point

$F_4 = \frac{1}{12}\,[5 - 4t^2 + n^2(9 - 24t^2)]$

$n^2 = e'^2 cos^2 \emptyset$

$e'^2 = e^2/(1 - e^2)$

e^2 = 0.0066943800229034 (GRS 80 ellipsoid)

$t^2 = \tan\emptyset$

$\emptyset$ = Latitude of point

Scale Factor of a point (Lambert Conic Conformal, Single Parallel Projection)

$$k = k_0\,\frac{cos\emptyset_0}{cos\emptyset}\,\sqrt{\frac{1 - e^2 sin^2\emptyset}{1 - e^2 sin^2\emptyset_0}}\;exp\left\{\frac{sin\emptyset_0}{2}\left[ln\frac{1 + sin\emptyset_0}{1 - sin\,\emptyset_0} - ln\frac{1 + sin\emptyset}{1 - sin\emptyset} + e\left(ln\frac{1 + e\,sin\emptyset}{1 - e\,sin\emptyset} - ln\frac{1 + e\,sin\emptyset_0}{1 - e\,sin\emptyset_0}\right)\right]\right\}$$

k_0 = Standard Parallel Scale Factor

$\emptyset_0$ = Latitude of Standard Parallel

$\emptyset$ = Latitude at a point

e = 0.081819190843044 (GRS 80 ellipsoid)

Appendix G – Illinois Coordinate System of 1983: 33 Zone

The following information defines the Illinois Coordinate System of 1983: 33 Zone.

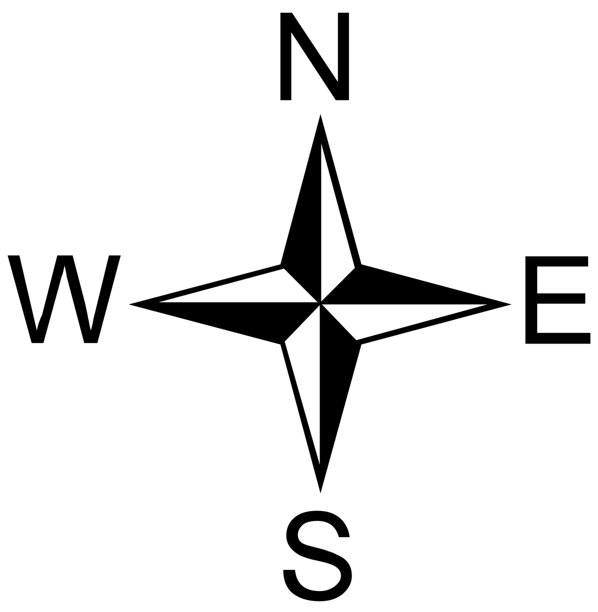
This information is also available on the Illinois Geospatial Data Clearinghouse.

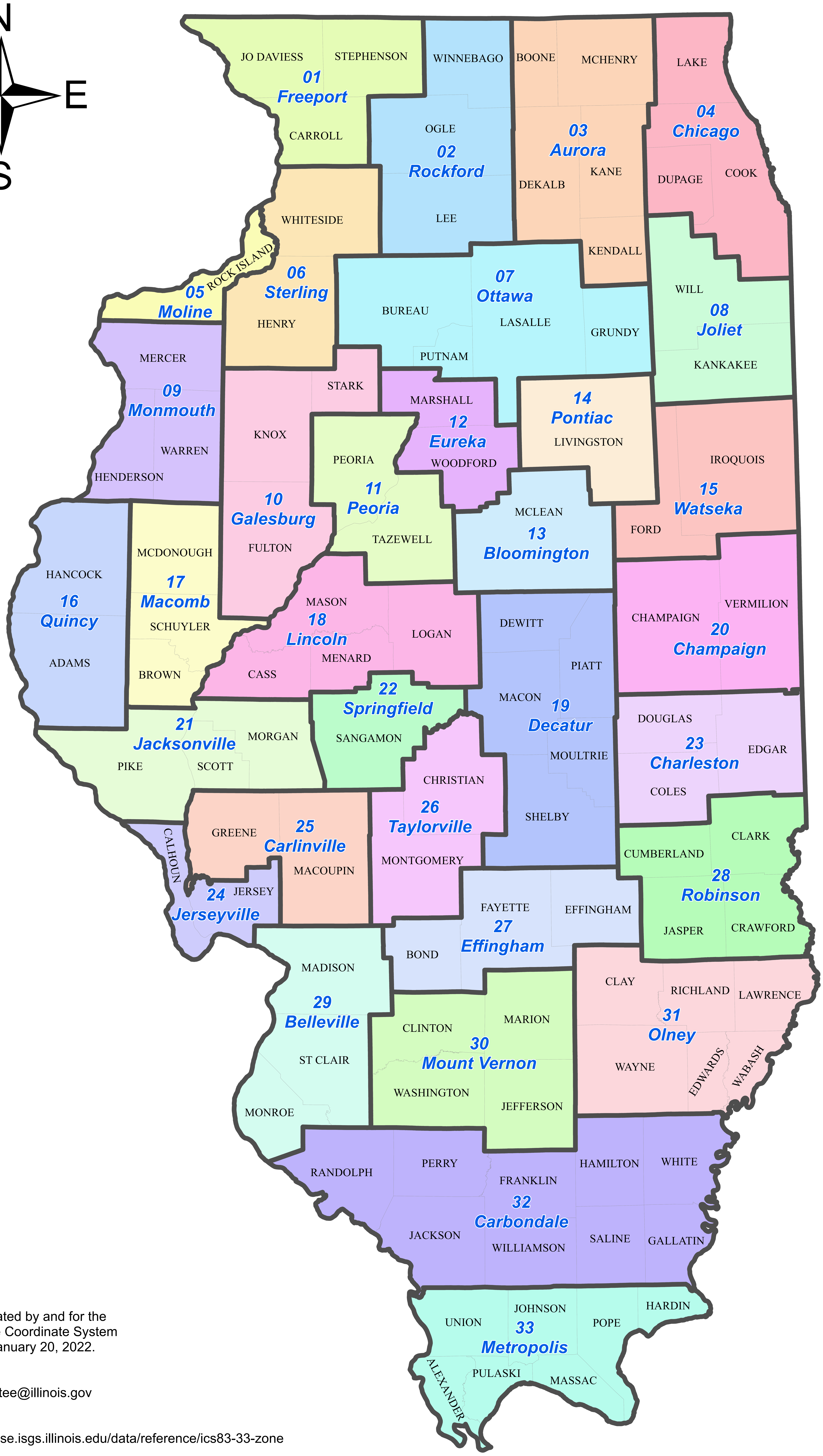
https://clearinghouse.isgs.illinois.edu/

Additional acknowledgment is due to Chris Poetschner for his work in defining the zone extents and parameters that make up this 33-zone layer. Chris developed methods and tools to iterate through many scenarios to arrive at this final 33-zone layer. Chris also produced the graphics that follow to relay the results of his work.

Illinois Coordinate System of 1983: 33 Zone

ICS83: 33 Zone





This map was created by and for the
Illinois State Plane Coordinate System
Commmittee on January 20, 2022.

Committee email;
DOT.ispcs.committee@illinois.gov

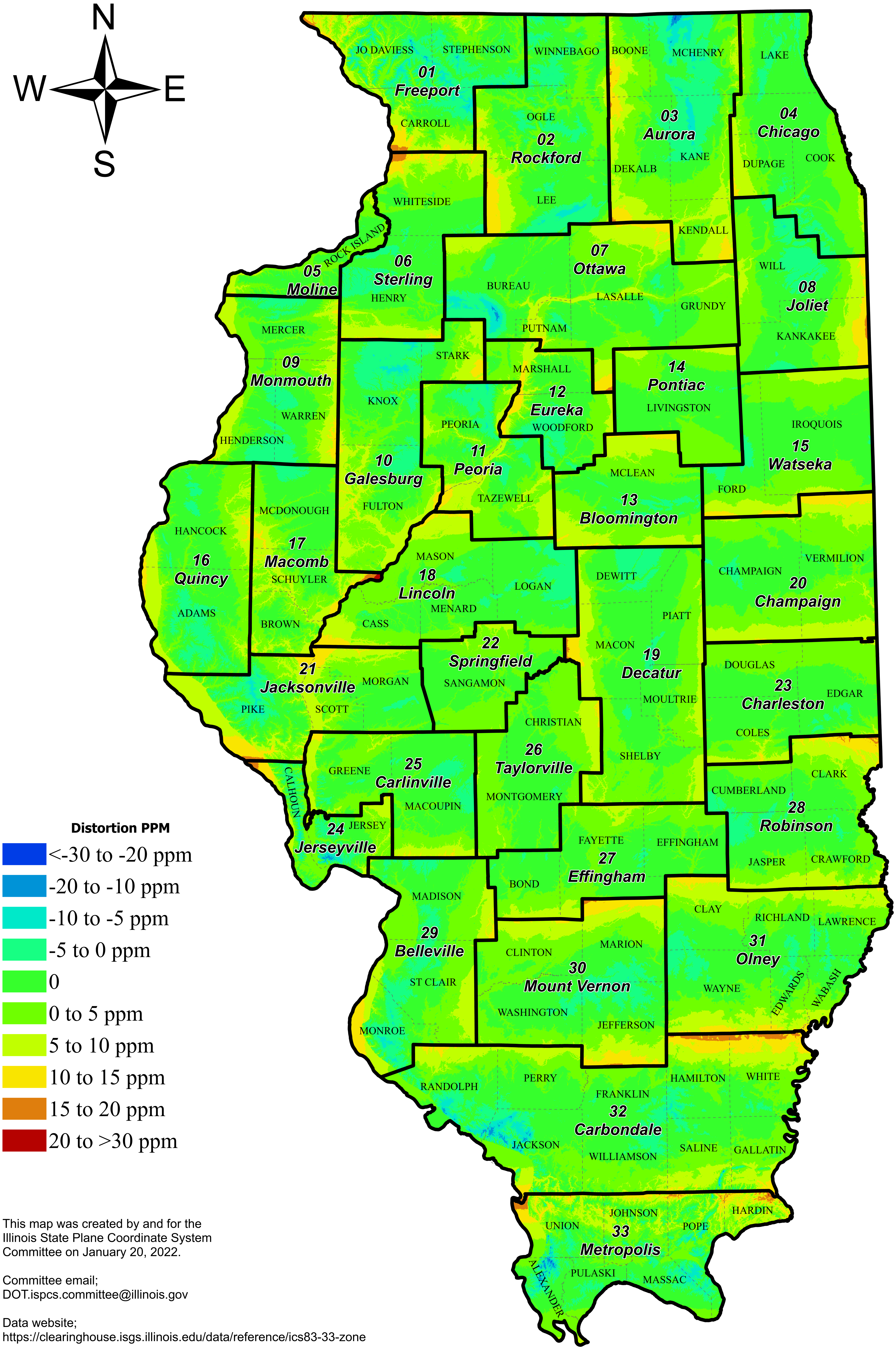
Data website;
https://clearinghouse.isgs.illinois.edu/data/reference/ics83-33-zone

zonesv7_nad83

ISPCS_33zone_v3a1.mxd; ISPCS_33zone_v3a1.pdf; Mellor

Illinois Coordinate System of 1983: 33 Zone

ICS83: 33 Zone



This map was created by and for the Illinois State Plane Coordinate System Committee on January 20, 2022.

Committee email;
DOT.ispcs.committee@illinois.gov

Data website;
https://clearinghouse.isgs.illinois.edu/data/reference/ics83-33-zone

ISPCS_33zone_v4.mxd; ISPCS_33zone_v4.pdf; Mellor

Illinois Coordinate System of 1983: 33 Zone Projection Parameters

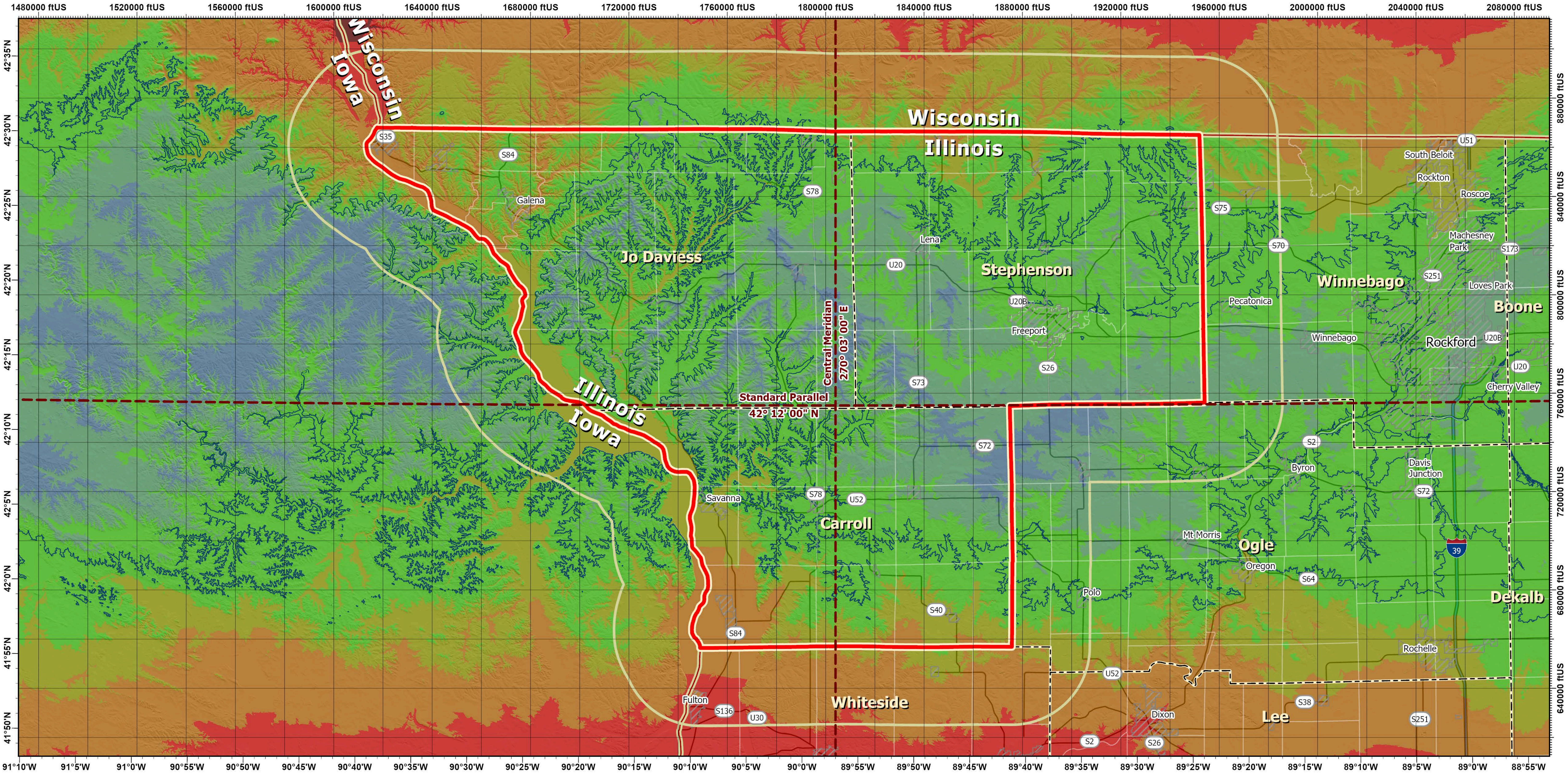
Zone Number	Zone Name	Counties in Zone	Projection Type	Origin Latitude (dms)	Origin Longitude (dms)	Origin Longitude (dms)	Scale Factor (Exact)	False Northing (sft)	False Easting (sft)	Average Elevation of Zone (sft)
01	**Freeport**	CARROLL, JO DAVIESS, STEPHENSON	LCC	42° 12' 00" N	270° 03' 00" E	89° 57' 00" W	1.000029	755,000	1,804,000	827.95
02	**Rockford**	LEE, OGLE, WINNEBAGO	TM	41° 15' 00" N	270° 45' 00" E	89° 15' 00" W	1.000029	492,000	2,822,000	801.32
03	**Aurora**	BOONE, DEKALB, KANE, KENDALL, MCHENRY	TM	41° 15' 00" N	271° 30' 00" E	88° 30' 00" W	1.000030	492,000	3,773,000	816.88
04	**Chicago**	COOK, DUPAGE, LAKE	TM	41° 15' 00" N	272° 12' 00" E	87° 48' 00" W	1.000023	492,000	4,757,000	694.18
05	**Moline**	ROCK ISLAND	LCC	41° 33' 00" N	269° 24' 00" E	90° 36' 00" W	1.000024	755,000	5,741,000	663.95
06	**Sterling**	HENRY, WHITESIDE	LCC	41° 33' 00" N	269° 57' 00" E	90° 03' 00" W	1.000020	755,000	6,726,000	684.88
07	**Ottawa**	BUREAU, GRUNDY, LASALLE, PUTNAM	LCC	41° 18' 00" N	270° 57' 00" E	89° 03' 00" W	1.000023	755,000	7,743,000	655.32
08	**Joliet**	KANKAKEE, WILL	TM	40° 33' 00" N	272° 00' 00" E	88° 00' 00" W	1.000022	492,000	8,694,000	654.98
09	**Monmouth**	HENDERSON, MERCER, WARREN	TM	40° 12' 00" N	269° 09' 00" E	90° 51' 00" W	1.000024	492,000	9,678,000	683.08
10	**Galesburg**	FULTON, KNOX, STARK	TM	37° 15' 00" N	269° 54' 00" E	90° 06' 00" W	1.000023	492,000	230,000	664.40
11	**Peoria**	PEORIA, TAZEWELL	TM	37° 24' 00" N	270° 21' 00" E	89° 39' 00" W	1.000023	622,000	1,378,000	633.33
12	**Eureka**	MARSHALL, WOODFORD	TM	37° 27' 00" N	270° 42' 00" E	89° 18' 00" W	1.000025	427,000	2,756,000	688.82
13	**Bloomington**	MCLEAN	LCC	40° 30' 00" N	271° 09' 00" E	88° 51' 00" W	1.000031	1,739,000	3,773,000	767.17
14	**Pontiac**	LIVINGSTON	LCC	40° 54' 00" N	271° 27' 00" E	88° 33' 00" W	1.000025	1,739,000	4,757,000	683.04
15	**Watseka**	FORD, IROQUOIS	LCC	40° 45' 00" N	272° 03' 00" E	87° 57' 00" W	1.000024	1,739,000	5,741,000	690.87
16	**Quincy**	ADAMS, HANCOCK	TM	36° 45' 00" N	268° 45' 00" E	91° 15' 00" W	1.000023	492,000	6,726,000	646.77
17	**Macomb**	BROWN, MCDONOUGH, SCHUYLER	TM	36° 48' 00" N	269° 24' 00" E	90° 36' 00" W	1.000024	492,000	7,710,000	629.82
18	**Lincoln**	CASS, LOGAN, MASON, MENARD	LCC	40° 09' 00" N	270° 12' 00" E	89° 48' 00" W	1.000018	1,739,000	8,760,000	553.51
19	**Decatur**	DEWITT, MACON, MOULTRIE, PIATT, SHELBY	TM	36° 18' 00" N	271° 12' 00" E	88° 48' 00" W	1.000024	492,000	9,678,000	672.09
20	**Champaign**	CHAMPAIGN, VERMILION	LCC	40° 09' 00" N	272° 00' 00" E	88° 00' 00" W	1.000026	2,822,000	328,000	695.94
21	**Jacksonville**	MORGAN, PIKE, SCOTT	LCC	39° 39' 00" N	269° 24' 00" E	90° 36' 00" W	1.000023	2,822,000	1,247,000	597.21
22	**Springfield**	SANGAMON	LCC	39° 45' 00" N	270° 21' 00" E	89° 39' 00" W	1.000022	2,887,000	2,329,000	600.06
23	**Charleston**	COLES, DOUGLAS, EDGAR	LCC	39° 39' 00" N	272° 00' 00" E	88° 00' 00" W	1.000024	2,756,000	3,773,000	668.38
24	**Jerseyville**	CALHOUN, JERSEY	TM	32° 51' 00" N	269° 30' 00" E	90° 30' 00" W	1.000019	492,000	4,757,000	567.11
25	**Carlinville**	GREENE, MACOUPIN	LCC	39° 18' 00" N	269° 51' 00" E	90° 09' 00" W	1.000020	2,756,000	5,741,000	594.49
26	**Taylorville**	CHRISTIAN, MONTGOMERY	TM	33° 09' 00" N	270° 36' 00" E	89° 24' 00" W	1.000023	492,000	6,726,000	628.51
27	**Effingham**	BOND, EFFINGHAM, FAYETTE	LCC	38° 57' 00" N	271° 00' 00" E	89° 00' 00" W	1.000019	2,756,000	7,710,000	557.24
28	**Robinson**	CLARK, CRAWFORD, CUMBERLAND, JASPER	LCC	39° 06' 00" N	272° 00' 00" E	88° 00' 00" W	1.000017	2,756,000	8,694,000	552.65
29	**Belleville**	MADISON, MONROE, ST CLAIR	TM	32° 21' 00" N	270° 00' 00" E	90° 00' 00" W	1.000016	492,000	9,678,000	498.91
30	**Mount Vernon**	CLINTON, JEFFERSON, MARION, WASHINGTON	LCC	38° 27' 00" N	270° 51' 00" E	89° 09' 00" W	1.000015	3,773,000	328,000	492.25
31	**Olney**	CLAY, EDWARDS, LAWRENCE, RICHLAND, WABASH, WAYNE , WAYNE	LCC	38° 33' 00" N	271° 51' 00" E	88° 09' 00" W	1.000013	3,773,000	1,247,000	454.20
32	**Carbondale**	FRANKLIN, GALLATIN, HAMILTON, JACKSON, PERRY, RANDOLPH, SALINE, WHITE, WILLIAMSON	LCC	37° 54' 00" N	271° 03' 00" E	88° 57' 00" W	1.000012	3,773,000	2,395,000	438.82
33	**Metropolis**	ALEXANDER, HARDIN, JOHNSON, MASSAC, POPE, PULASKI, UNION	LCC	37° 12' 00" N	271° 06' 00" E	88° 54' 00" W	1.000010	3,839,000	3,642,000	457.20

Illinois Coordinate System of 1983: 33 Zone Projection Parameters and Check Point

The check point information in the table below lists a geodetic position for each zone and the resultant coordinate values using the projection parameters. This information can be used to ensure zone parameters are correctly input into software and yeild matching results. The ILCAT tool can also provide a similar check on coordinate results.

Zone Parameters										*Check Point*						
										Input			Output			
Zone Number	Zone Name	Projection Type	Origin Latitude (DMS)	Origin Longitude (DMS)	Origin Latitude (DD)	Origin Longitude (DD)	Scale Factor (Exact)	False Northing (US Survey Ft)	False Easting (US Survey Ft)	Latitude (DD)	Longitude (DD)	Ellipsoid Height (US Survey Ft)	Northing (US Survey Ft)	Easting (US Survey Ft)	Linear Distortion (PPM)	Convergence Angle (DD)
01	**Freeport**	LCC	42° 12' 00" N	270° 03' 00" E	42.20	270.05	1.000029	755,000	1,804,000	42.28556	270.02083	922	786,181.1415	1,796,107.2278	-13.9590	-0.01959409
02	**Rockford**	TM	41° 15' 00" N	270° 45' 00" E	41.25	270.75	1.000029	492,000	2,822,000	42.02444	270.71500	746	774,209.8169	2,812,489.6822	-6.4993	-0.02343596
03	**Aurora**	TM	41° 15' 00" N	271° 30' 00" E	41.25	271.50	1.000030	492,000	3,773,000	42.00444	271.43528	768	766,926.3080	3,755,407.9375	-6.3471	-0.04334338
04	**Chicago**	TM	41° 15' 00" N	272° 12' 00" E	41.25	272.20	1.000023	492,000	4,757,000	41.96056	272.11833	535	750,934.3247	4,734,787.1795	-2.0014	-0.05467355
05	**Moline**	LCC	41° 33' 00" N	269° 24' 00" E	41.55	269.40	1.000024	755,000	5,741,000	41.48972	269.45028	590	733,039.3172	5,754,775.4651	-3.6818	+0.03334939
06	**Sterling**	LCC	41° 33' 00" N	269° 57' 00" E	41.55	269.95	1.000020	755,000	6,726,000	41.54639	269.96306	496	753,684.4124	6,729,573.9302	-3.6823	+0.00866235
07	**Ottawa**	LCC	41° 18' 00" N	270° 57' 00" E	41.30	270.95	1.000023	755,000	7,743,000	41.32361	270.95056	344	763,603.3587	7,743,152.6152	6.6148	+0.00036960
08	**Joliet**	TM	40° 33' 00" N	272° 00' 00" E	40.55	272.00	1.000022	492,000	8,694,000	41.33167	272.07389	578	776,811.7346	8,714,293.6779	-5.1354	+0.04884910
09	**Monmouth**	TM	40° 12' 00" N	269° 09' 00" E	40.20	269.15	1.000024	492,000	9,678,000	40.96972	269.21500	618	772,440.9719	9,695,950.8182	-5.1213	+0.04265283
10	**Galesburg**	TM	37° 15' 00" N	269° 54' 00" E	37.25	269.90	1.000023	492,000	230,000	40.77750	269.90528	512	1,776,831.1699	231,461.7714	-1.4683	+0.00344851
11	**Peoria**	TM	37° 24' 00" N	270° 21' 00" E	37.40	270.35	1.000023	622,000	1,378,000	40.65056	270.36778	340	1,805,961.6043	1,382,933.2079	6.7136	+0.01158339
12	**Eureka**	TM	37° 27' 00" N	270° 42' 00" E	37.45	270.70	1.000025	427,000	2,756,000	40.89611	270.71083	617	1,682,223.6544	2,758,995.1192	-4.4796	+0.00709045
13	**Bloomington**	LCC	40° 30' 00" N	271° 09' 00" E	40.50	271.15	1.000031	1,739,000	3,773,000	40.49722	271.14611	713	1,737,987.9983	3,771,918.3841	-3.0393	-0.00252635
14	**Pontiac**	LCC	40° 54' 00" N	271° 27' 00" E	40.90	271.45	1.000025	1,739,000	4,757,000	40.88222	271.43472	571	1,732,523.0067	4,752,775.2113	-2.2459	-0.01000444
15	**Watseka**	LCC	40° 45' 00" N	272° 03' 00" E	40.75	272.05	1.000024	1,739,000	5,741,000	40.68583	272.02306	552	1,715,622.6427	5,733,527.0554	-1.7288	-0.01758535
16	**Quincy**	TM	36° 45' 00" N	268° 45' 00" E	36.75	268.75	1.000023	492,000	6,726,000	40.19500	268.82194	548	1,746,673.5983	6,746,099.1710	-2.7362	+0.04647681
17	**Macomb**	TM	36° 48' 00" N	269° 24' 00" E	36.80	269.40	1.000024	492,000	7,710,000	40.23333	269.37139	573	1,742,428.4471	7,702,011.3864	-3.3799	-0.01848223
18	**Lincoln**	LCC	40° 09' 00" N	270° 12' 00" E	40.15	270.20	1.000018	1,739,000	8,760,000	40.09639	270.18694	392	1,719,469.7139	8,756,347.3846	-0.3892	-0.00842097
19	**Decatur**	TM	36° 18' 00" N	271° 12' 00" E	36.30	271.20	1.000024	492,000	9,678,000	39.74167	271.17222	582	1,745,357.2585	9,670,188.2530	-3.6983	-0.01776322
20	**Champaign**	LCC	40° 09' 00" N	272° 00' 00" E	40.15	272.00	1.000026	2,822,000	328,000	40.16361	272.02750	570	2,826,959.7915	335,686.2633	-1.2681	+0.01773175
21	**Jacksonville**	LCC	39° 39' 00" N	269° 24' 00" E	39.65	269.40	1.000023	2,822,000	1,247,000	39.66250	269.37861	318	2,826,554.1279	1,240,978.0855	7.8058	-0.01364888
22	**Springfield**	LCC	39° 45' 00" N	270° 21' 00" E	39.75	270.35	1.000022	2,887,000	2,329,000	39.76944	270.38861	476	2,894,085.5398	2,339,853.9342	-0.6905	+0.02468874
23	**Charleston**	LCC	39° 39' 00" N	272° 00' 00" E	39.65	272.00	1.000024	2,756,000	3,773,000	39.64944	271.99306	547	2,755,797.7002	3,771,044.4767	-2.1996	-0.00442839
24	**Jerseyville**	TM	32° 51' 00" N	269° 30' 00" E	32.85	269.50	1.000019	492,000	4,757,000	39.15778	269.48083	432	2,788,323.8101	4,751,564.7090	-1.6761	-0.01210594
25	**Carlinville**	LCC	39° 18' 00" N	269° 51' 00" E	39.30	269.85	1.000020	2,756,000	5,741,000	39.27750	269.83889	416	2,747,804.5978	5,737,854.4588	0.1516	-0.00703686
26	**Taylorville**	TM	33° 09' 00" N	270° 36' 00" E	33.15	270.60	1.000023	492,000	6,726,000	39.41111	270.63083	522	2,771,450.2237	6,734,712.2975	-1.8585	+0.01957706
27	**Effingham**	LCC	38° 57' 00" N	271° 00' 00" E	38.95	271.00	1.000019	2,756,000	7,710,000	38.98444	270.99500	428	2,768,545.6747	7,708,578.6277	-1.2165	-0.00314321
28	**Robinson**	LCC	39° 06' 00" N	272° 00' 00" E	39.10	272.00	1.000017	2,756,000	8,694,000	39.15417	272.07667	447	2,775,738.7064	8,715,742.2106	-3.8921	+0.04835391
29	**Belleville**	TM	32° 21' 00" N	270° 00' 00" E	32.35	270.00	1.000016	492,000	9,678,000	38.59306	270.01667	471	2,764,553.7001	9,682,763.8787	-6.5680	+0.01039909
30	**Mount Vernon**	LCC	38° 27' 00" N	270° 51' 00" E	38.45	270.85	1.000015	3,773,000	328,000	38.47528	270.82944	381	3,782,206.7025	322,114.9670	-3.1040	-0.01278485
31	**Olney**	LCC	38° 33' 00" N	271° 51' 00" E	38.55	271.85	1.000013	3,773,000	1,247,000	38.58444	271.87222	332	3,785,545.4672	1,253,352.5599	-2.6673	+0.01384745
32	**Carbondale**	LCC	37° 54' 00" N	271° 03' 00" E	37.90	271.05	1.000012	3,773,000	2,395,000	37.94833	271.05750	324	3,790,601.1837	2,397,162.7696	-3.1802	+0.00460714
33	**Metropolis**	LCC	37° 12' 00" N	271° 06' 00" E	37.20	271.10	1.000010	3,839,000	3,642,000	37.34611	271.12806	342	3,892,203.1839	3,650,155.9680	-3.0804	+0.01696505

Spreadsheet Author: Christopher Poetschner, IDOT



ICS83: 33 Zone

ICS83-Freeport

Zone 01

Scale: 1:450,000 (When printed on 11" x 17" paper)

Faint white lines delineate townships

Legend

- Central Meridian or Parallel
- 6-Mile Zone Buffer
- Zone Boundary
- State Boundary
- County Boundary
- Municipality

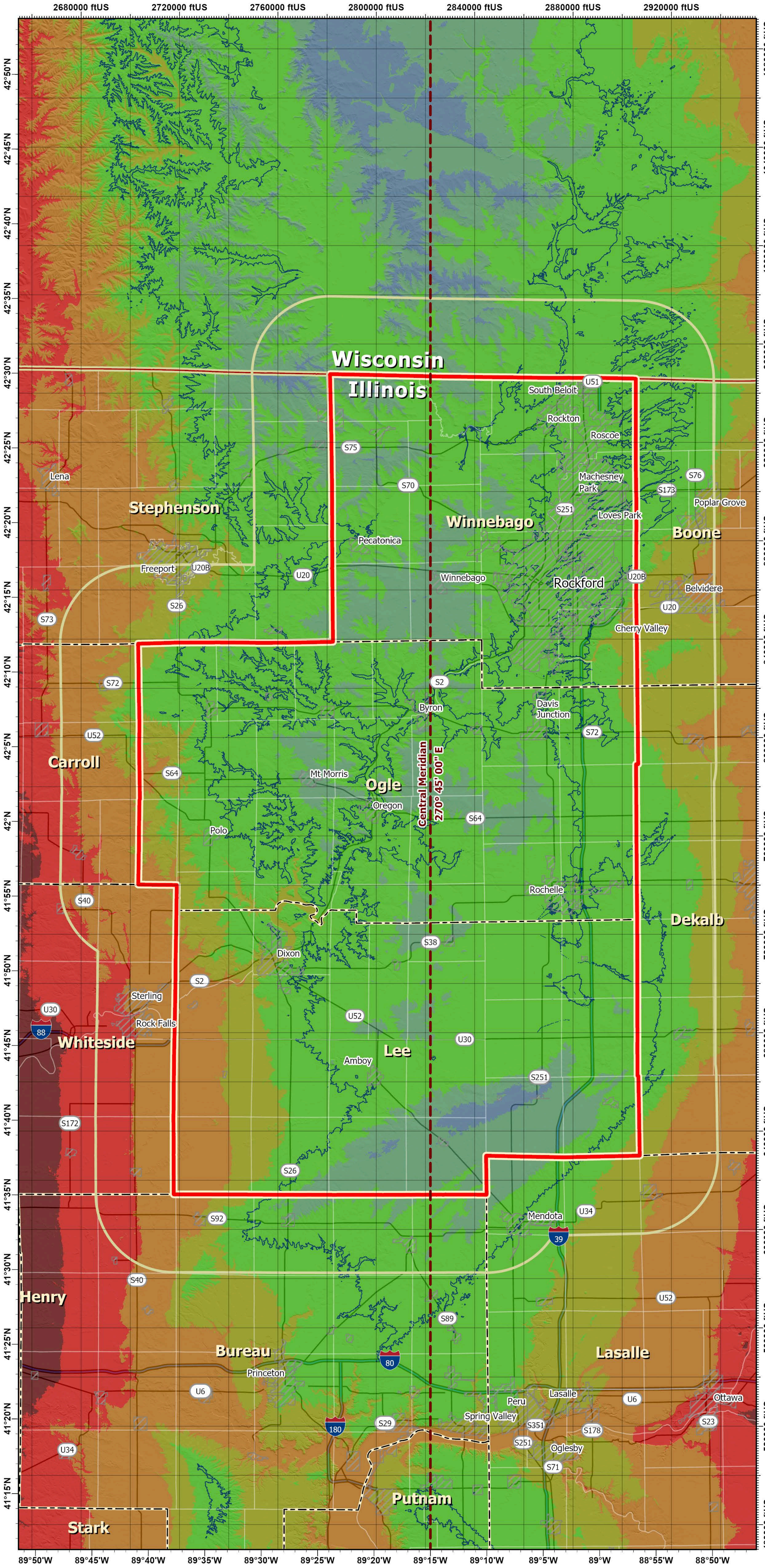
Linear Distortion (parts per million)

- Zero distortion
- ≤ -30 ppm (0.16 ft / mile)
- -30 to -20 ppm
- -20 to -10 ppm
- -10 to -5 ppm
- -5 to 5 ppm (0.025 ft / mile)
- 5 to 10 ppm
- 10 to 20 ppm
- 20 to 30 ppm
- > 30 ppm (0.16 ft / mile)

Projection Type: Lambert Conformal Conic (single parallel)

Standard parallel / grid origin:	42° 12' 00" N
Central meridian:	270° 03' 00" E
Standard parallel scale:	1.000029 (exact)
False northing:	755000 USft
False easting:	1804000 USft
Maximum negative distortion:	-18.7630 ppm
Mean distortion:	-0.7461 ppm
Maximum positive distortion:	20.1559 ppm
Variance of Distortion:	34.3039 ppm²
Area between -5 and 5 ppm:	57.5298% (municipality area: 56.1553%)
Area between -10 and 10 ppm:	91.5063% (municipality area: 84.6179%)
Area between -20 and 20 ppm:	99.9996% (municipality area: 100.0000%)

Map created by Christopher Poetschner based on maps created by Michael Dennis in the Kansas Regional Coordinate System Project Report. (Rendered: 4/22/2021)



ICS83: 33 Zone

ICS83-Rockford

Zone 02

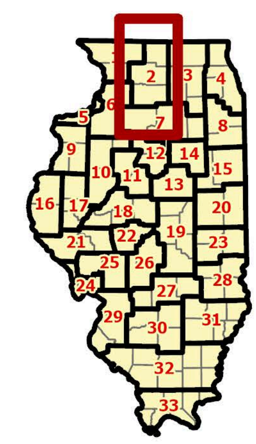
Scale: 1:450,000

(When printed on 11" x 17" paper)

Faint white lines delineate townships

N

0 1.75 3.5 7 10.5 14 Miles



Legend

- Central Meridian or Parallel
- 6-Mile Zone Buffer
- Zone Boundary
- State Boundary
- County Boundary
- Municipality

Linear Distortion (parts per million)

- Zero distortion
- ≤ -30 ppm (0.16 ft / mile)
- -30 to -20 ppm
- -20 to -10 ppm
- -10 to -5 ppm
- -5 to 5 ppm (0.025 ft / mile)
- 5 to 10 ppm
- 10 to 20 ppm
- 20 to 30 ppm
- > 30 ppm (0.16 ft / mile)

Projection Type: Transverse Mercator

Grid origin latitude:	41° 15' 00" N
Central meridian:	270° 45' 00" E
Central meridian scale factor:	1.000029 (exact)
False northing:	492000 USft
False easting:	2822000 USft
Maximum negative distortion:	-12.4332 ppm
Mean distortion:	-0.7154 ppm
Maximum positive distortion:	16.4145 ppm
Variance of Distortion:	23.0111 ppm²
Area between -5 and 5 ppm:	71.5763%
Area between -10 and 10 ppm:	95.1709%
Area between -20 and 20 ppm:	100.0000%

Municipal Distortion Coverage

Area between -5 and 5 ppm (muni):	94.3995%
Area between -10 and 10 ppm (muni):	99.6789%
Area between -20 and 20 ppm (muni):	100.0000%

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(Rendered: 4/22/2021)

ICS83: 33 Zone

ICS83-Aurora

Zone 03

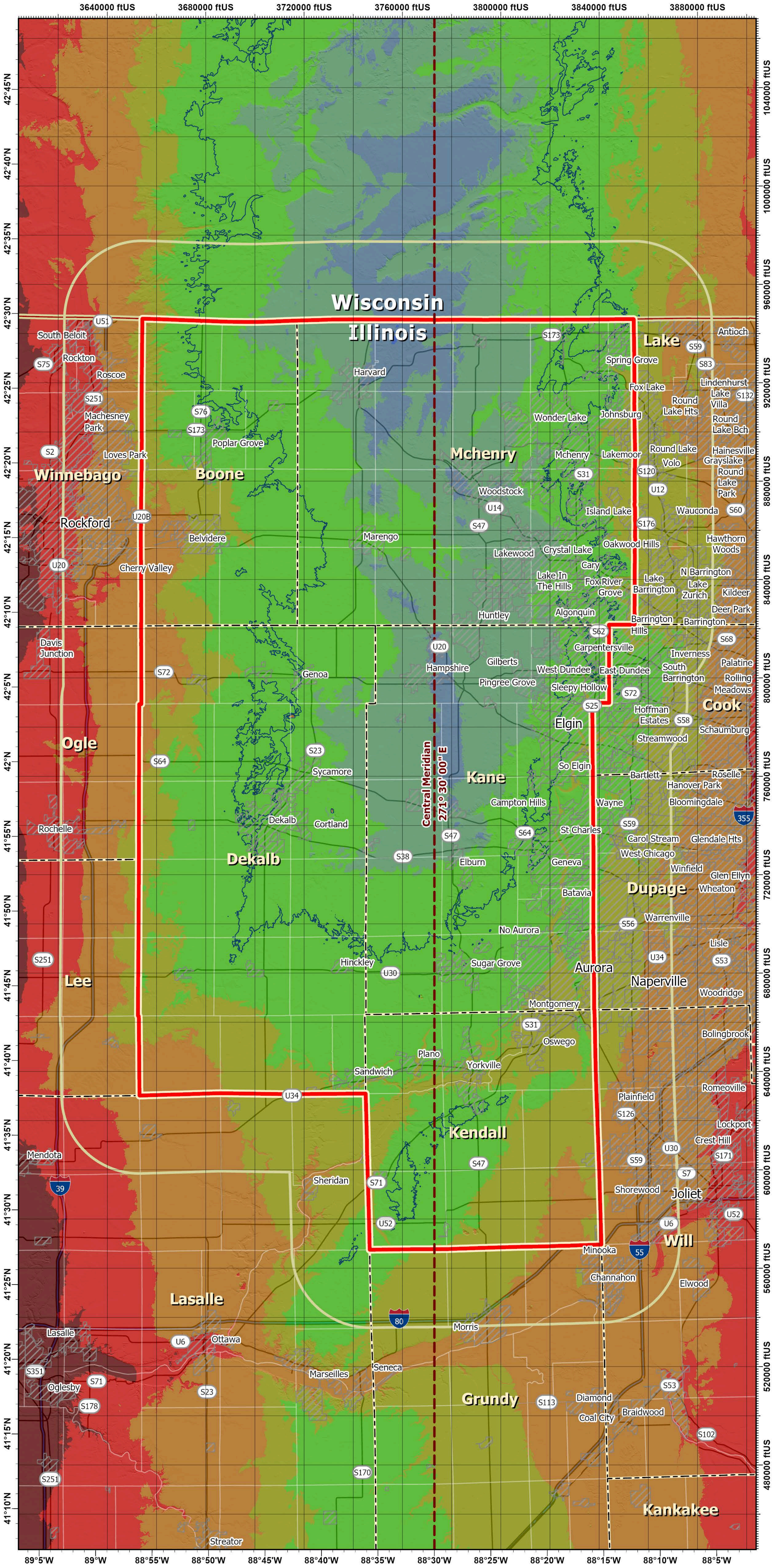
Scale: 1:450,000

(When printed on 11" x 17" paper)

Faint white lines delineate townships

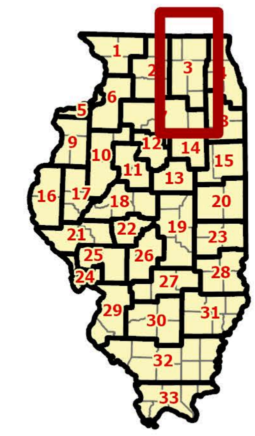
N

0 1.75 3.5 7 10.5 14 Miles



Legend

- Central Meridian or Parallel
- 6-Mile Zone Buffer
- Zone Boundary
- State Boundary
- County Boundary
- Municipality



Linear Distortion (parts per million)

- Zero distortion
- ≤ -30 ppm (0.16 ft / mile)
- -30 to -20 ppm
- -20 to -10 ppm
- -10 to -5 ppm
- -5 to 5 ppm (0.025 ft / mile)
- 5 to 10 ppm
- 10 to 20 ppm
- 20 to 30 ppm
- > 30 ppm (0.16 ft / mile)

Projection Type: Transverse Mercator

Grid origin latitude:	41° 15' 00" N
Central meridian:	271° 30' 00" E
Central meridian scale factor:	1.00003 (exact)
False northing:	492000 USft
False easting:	3773000 USft
Maximum negative distortion:	-21.1894 ppm
Mean distortion:	0.1047 ppm
Maximum positive distortion:	18.0105 ppm
Variance of Distortion:	33.9459 ppm²
Area between -5 and 5 ppm:	56.2662%
Area between -10 and 10 ppm:	92.5933%
Area between -20 and 20 ppm:	99.9795%

Municipal Distortion Coverage

Area between -5 and 5 ppm (muni):	63.4418%
Area between -10 and 10 ppm (muni):	97.5986%
Area between -20 and 20 ppm (muni):	100.0000%

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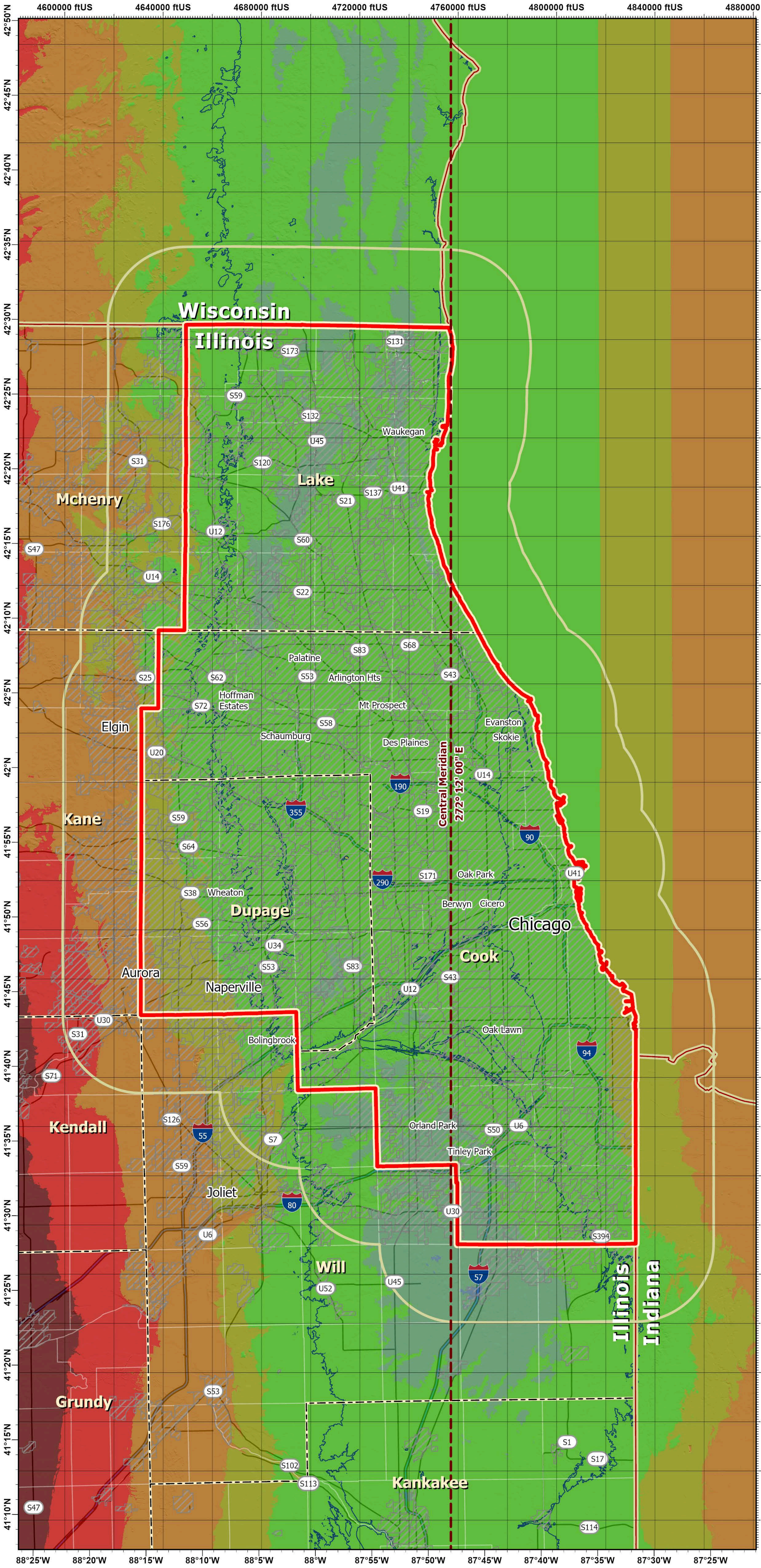
(Rendered: 4/22/2021)



ICS83: 33 Zone

ICS83-Chicago

Zone 04

Scale: 1:450,000

(When printed on 11" x 17" paper)

Faint white lines delineate townships

N

0 1.75 3.5 7 10.5 14 Miles

Legend

- Central Meridian or Parallel
- 6-Mile Zone Buffer
- Zone Boundary
- State Boundary
- County Boundary
- Municipality

Linear Distortion (parts per million)

- Zero distortion
- ≤ -30 ppm (0.16 ft / mile)
- -30 to -20 ppm
- -20 to -10 ppm
- -10 to -5 ppm
- -5 to 5 ppm (0.025 ft / mile)
- 5 to 10 ppm
- 10 to 20 ppm
- 20 to 30 ppm
- > 30 ppm (0.16 ft / mile)

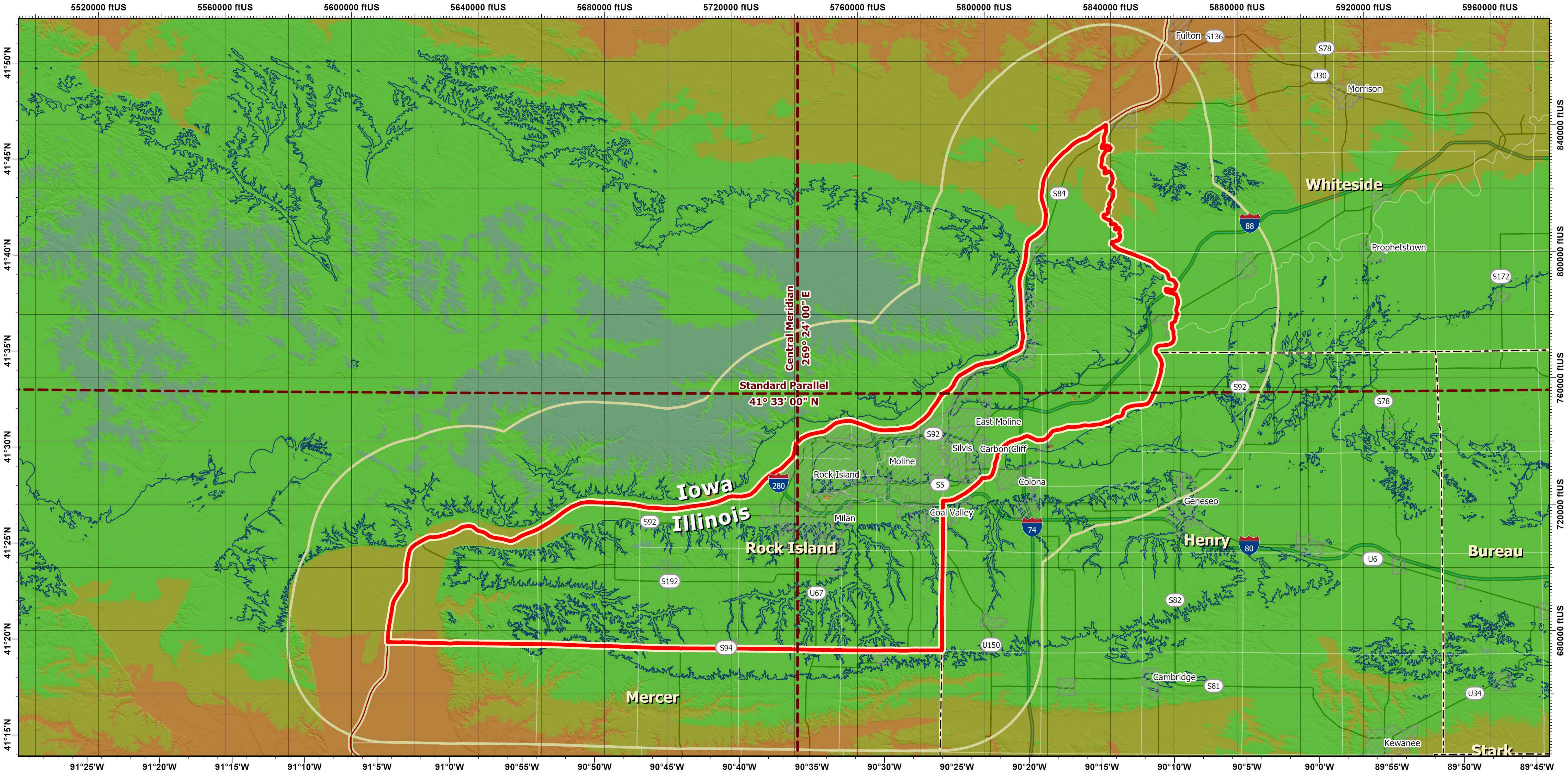
Projection Type: Transverse Mercator

Grid origin latitude:	41° 15' 00" N
Central meridian:	272° 12' 00" E
Central meridian scale factor:	1.000023 (exact)
False northing:	492000 USft
False easting:	4757000 USft
Maximum negative distortion:	-11.5276 ppm
Mean distortion:	-0.8426 ppm
Maximum positive distortion:	14.4877 ppm
Variance of Distortion:	12.1838 ppm²
Area between -5 and 5 ppm:	84.7849%
Area between -10 and 10 ppm:	99.2676%
Area between -20 and 20 ppm:	100.0000%

Municipal Distortion Coverage

Area between -5 and 5 ppm (muni):	85.5592%
Area between -10 and 10 ppm (muni):	99.2127%
Area between -20 and 20 ppm (muni):	100.0000%

Map created by Christopher Poetschner based on maps created by Michael Dennis in the Kansas Regional Coordinate System Project Report.
(Rendered: 4/22/2021)



ICS83: 33 Zone

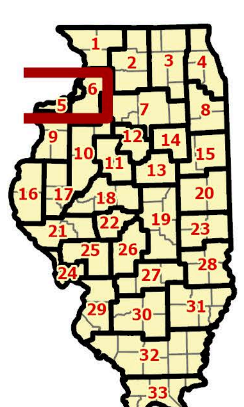
ICS83-Moline

Zone 05

0 2.5 5 10 15 20 Miles

N

Scale: 1:350,000 (When printed on 11" x 17" paper)
Faint white lines delineate townships



Legend

- Central Meridian or Parallel
- 6-Mile Zone Buffer
- Zone Boundary
- State Boundary
- County Boundary
- Municipality

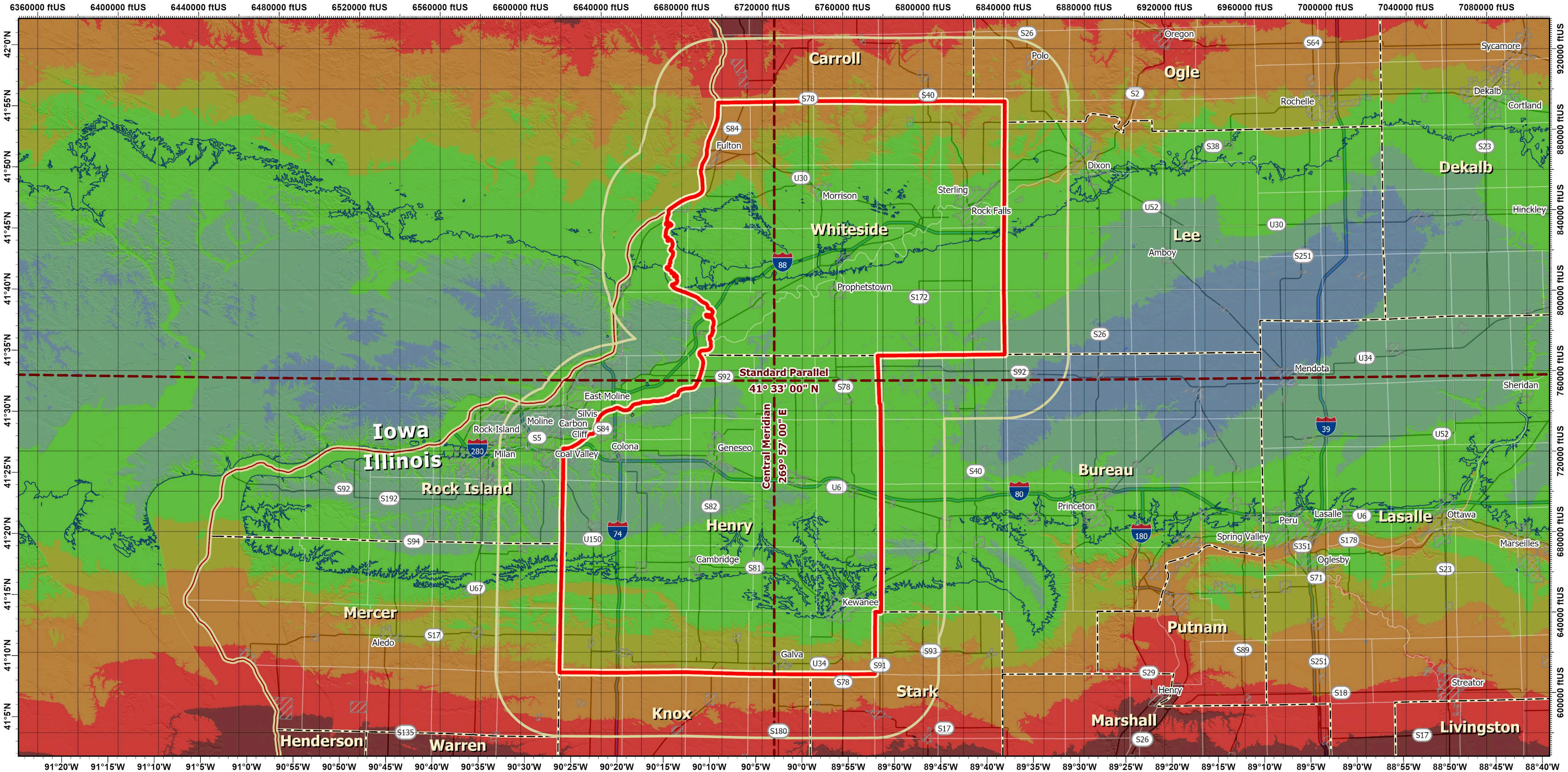
Linear Distortion (parts per million)

- Zero distortion
- ≤ -30 ppm (0.16 ft / mile)
- -30 to -20 ppm
- -20 to -10 ppm
- -10 to -5 ppm
- -5 to 5 ppm (0.025 ft / mile)
- 5 to 10 ppm
- 10 to 20 ppm
- 20 to 30 ppm
- > 30 ppm (0.16 ft / mile)

Projection Type: Lambert Conformal Conic (single parallel)

Standard parallel / grid origin:	41° 33' 00" N
Central meridian:	269° 24' 00" E
Standard parallel scale:	1.000024 (exact)
False northing:	755000 USft
False easting:	5741000 USft
Maximum negative distortion:	-6.7876 ppm
Mean distortion:	0.2785 ppm
Maximum positive distortion:	17.1717 ppm
Variance of Distortion:	10.5840 ppm²
Area between -5 and 5 ppm:	91.5451% (municipality area: 99.5422%)
Area between -10 and 10 ppm:	99.5576% (municipality area: 99.9028%)
Area between -20 and 20 ppm:	100.0000% (municipality area: 100.0000%)

Map created by Christopher Poetschner based on maps created by Michael Dennis in the Kansas Regional Coordinate System Project Report. (Rendered: 4/21/2021)



ICS83: 33 Zone

ICS83-Sterling

Zone 06

0 4 8 16 24 32 Miles

N

Scale: 1:550,000 (When printed on 11" x 17" paper)
Faint white lines delineate townships

Legend

- Central Meridian or Parallel
- 6-Mile Zone Buffer
- Zone Boundary
- State Boundary
- County Boundary
- Municipality

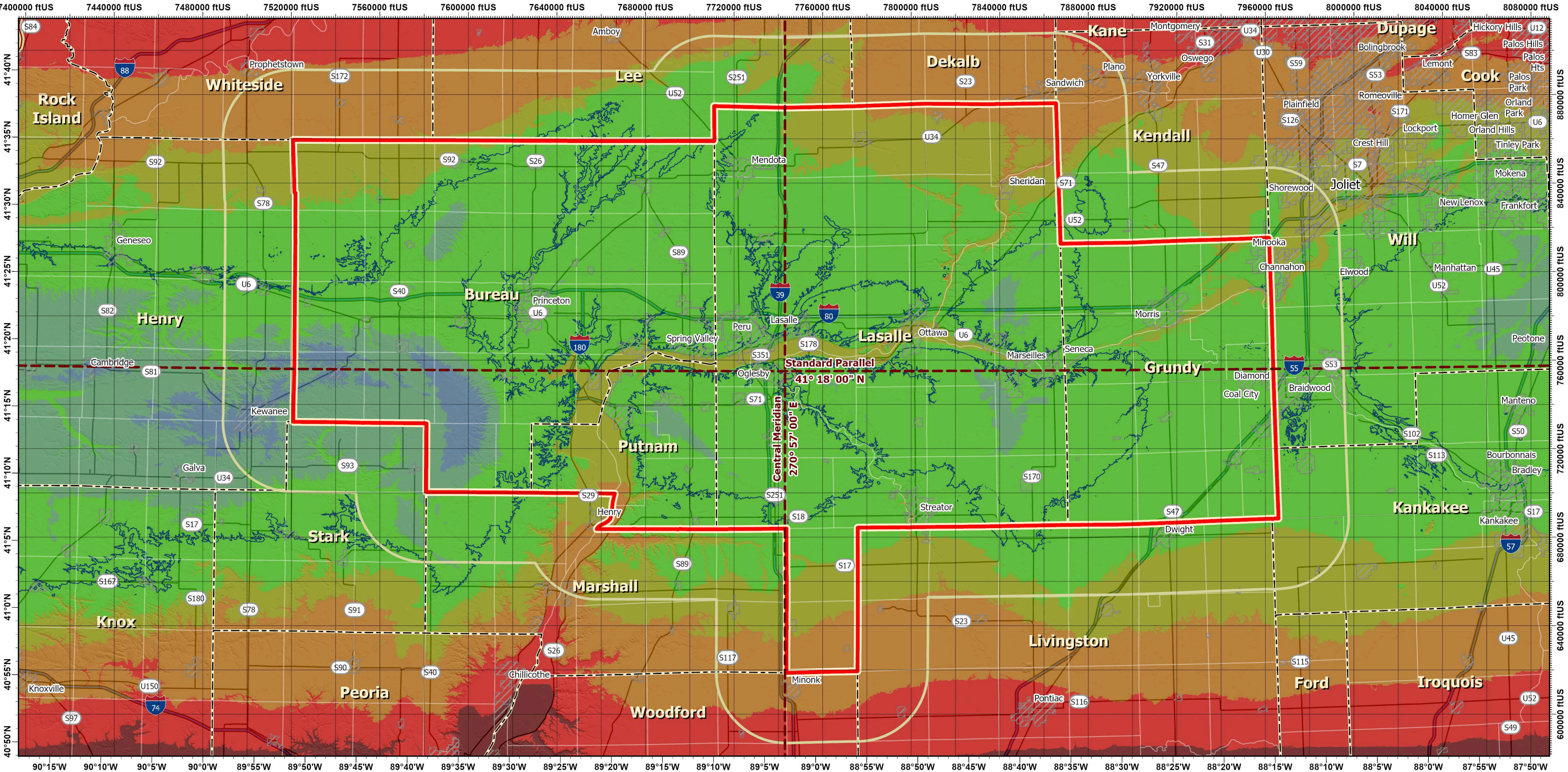
Linear Distortion (parts per million)

- Zero distortion
- ≤ -30 ppm (0.16 ft / mile)
- -30 to -20 ppm
- -20 to -10 ppm
- -10 to -5 ppm
- -5 to 5 ppm (0.025 ft / mile)
- 5 to 10 ppm
- 10 to 20 ppm
- 20 to 30 ppm
- > 30 ppm (0.16 ft / mile)

Projection Type: Lambert Conformal Conic (single parallel)

Standard parallel / grid origin:	41° 33' 00" N
Central meridian:	269° 57' 00" E
Standard parallel scale:	1.00002 (exact)
False northing:	755000 USft
False easting:	6726000 USft
Maximum negative distortion:	-9.8257 ppm
Mean distortion:	0.4007 ppm
Maximum positive distortion:	19.2731 ppm
Variance of Distortion:	24.9943 ppm²
Area between -5 and 5 ppm:	71.3052% (municipality area: 78.1817%)
Area between -10 and 10 ppm:	95.1456% (municipality area: 95.4396%)
Area between -20 and 20 ppm:	100.0000% (municipality area: 100.0000%)

Map created by Christopher Poetschner based on maps created by Michael Dennis in the Kansas Regional Coordinate System Project Report. (Rendered: 4/21/2021)



ICS83: 33 Zone

ICS83-Ottawa

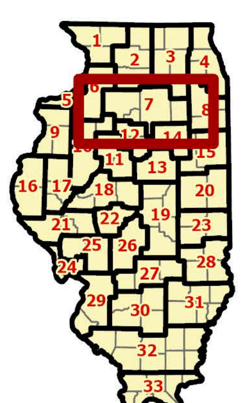
Zone 07

0 3.75 7.5 15 22.5 30 Miles

N

Scale: 1:500,000 (When printed on 11" x 17" paper)

Faint white lines delineate townships



Legend

- Central Meridian or Parallel
- 6-Mile Zone Buffer
- Zone Boundary
- State Boundary
- County Boundary
- Municipality

Linear Distortion (parts per million)

- Zero distortion
- ≤ -30 ppm (0.16 ft / mile)
- -30 to -20 ppm
- -20 to -10 ppm
- -10 to -5 ppm
- -5 to 5 ppm (0.025 ft / mile)
- 5 to 10 ppm
- 10 to 20 ppm
- 20 to 30 ppm
- > 30 ppm (0.16 ft / mile)

Projection Type: Lambert Conformal Conic (single parallel)

Standard parallel / grid origin:	41° 18' 00" N
Central meridian:	270° 57' 00" E
Standard parallel scale:	1.000023 (exact)
False northing:	755000 USft
False easting:	7743000 USft
Maximum negative distortion:	-17.2175 ppm
Mean distortion:	0.4265 ppm
Maximum positive distortion:	16.8990 ppm
Variance of Distortion:	20.3888 ppm²
Area between -5 and 5 ppm:	77.2668% (municipality area: 81.7693%)
Area between -10 and 10 ppm:	95.7689% (municipality area: 98.0173%)
Area between -20 and 20 ppm:	100.0000% (municipality area: 100.0000%)

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ICS83: 33 Zone

ICS83-Joliet

Zone 08

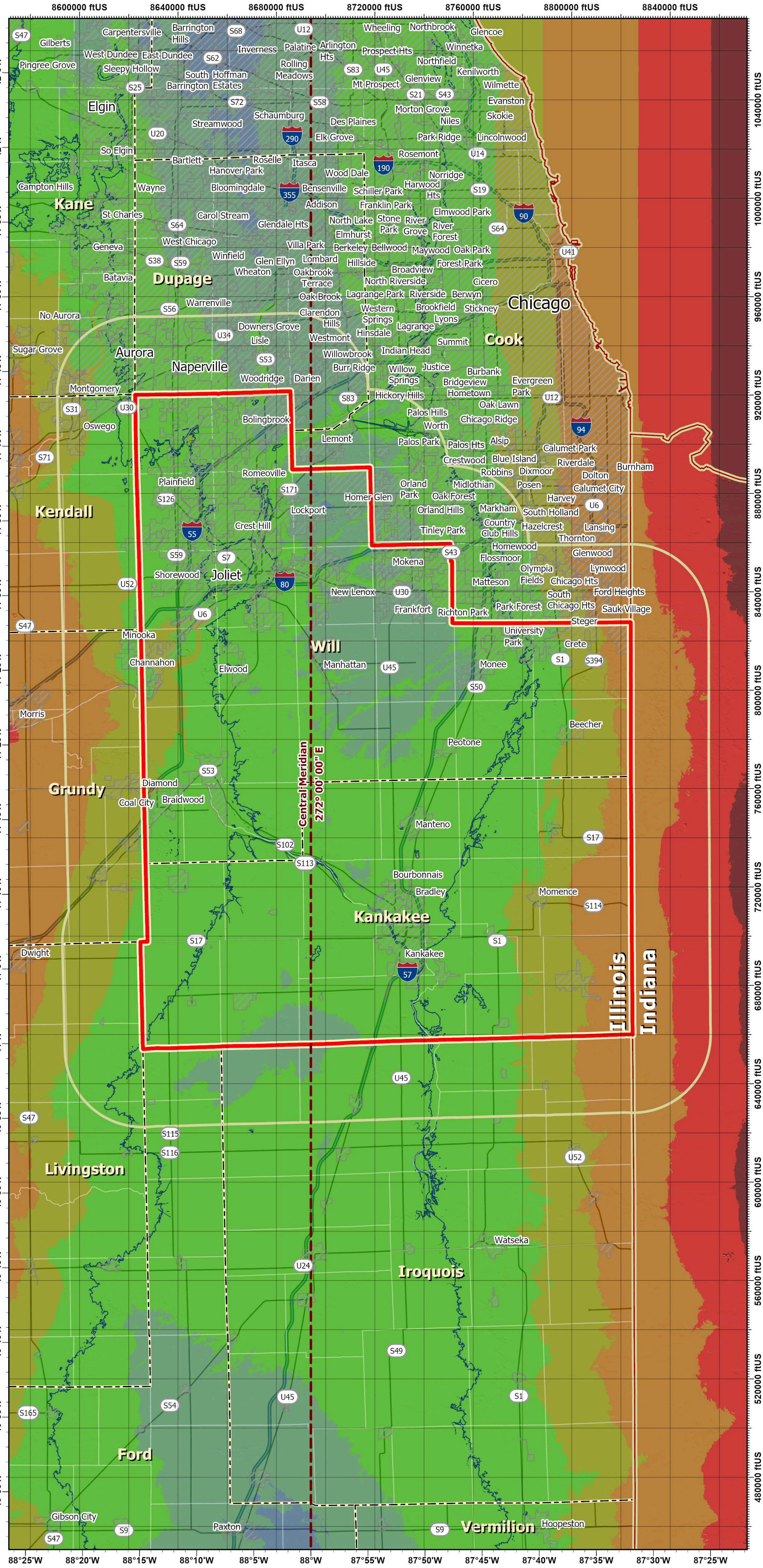
Scale: 1:450,000

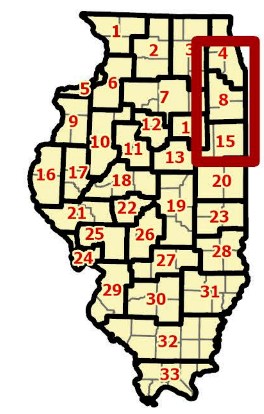
(When printed on 11" x 17" paper)

Faint white lines delineate townships

0 1.75 3.5 7 10.5 14 Miles

N





Legend

- Central Meridian or Parallel
- 6-Mile Zone Buffer
- Zone Boundary
- State Boundary
- County Boundary
- Municipality

Linear Distortion (parts per million)

- Zero distortion
- ≤ -30 ppm (0.16 ft / mile)
- -30 to -20 ppm
- -20 to -10 ppm
- -10 to -5 ppm
- -5 to 5 ppm (0.025 ft / mile)
- 5 to 10 ppm
- 10 to 20 ppm
- 20 to 30 ppm
- > 30 ppm (0.16 ft / mile)

Projection Type: Transverse Mercator

Grid origin latitude:	40° 33' 00" N
Central meridian:	272° 00' 00" E
Central meridian scale factor:	1.000022 (exact)
False northing:	492000 USft
False easting:	8694000 USft
Maximum negative distortion:	-11.6948 ppm
Mean distortion:	0.0153 ppm
Maximum positive distortion:	16.9312 ppm
Variance of Distortion:	25.5428 ppm²
Area between -5 and 5 ppm:	70.2531%
Area between -10 and 10 ppm:	94.2314%
Area between -20 and 20 ppm:	100.0000%

Municipal Distortion Coverage

Area between -5 and 5 ppm (muni):	77.0733%
Area between -10 and 10 ppm (muni):	98.7746%
Area between -20 and 20 ppm (muni):	100.0000%

Map created by Christopher Poetschner based on maps created by Michael Dennis in the Kansas Regional Coordinate System Project Report.
(Rendered: 4/22/2021)

ICS83: 33 Zone

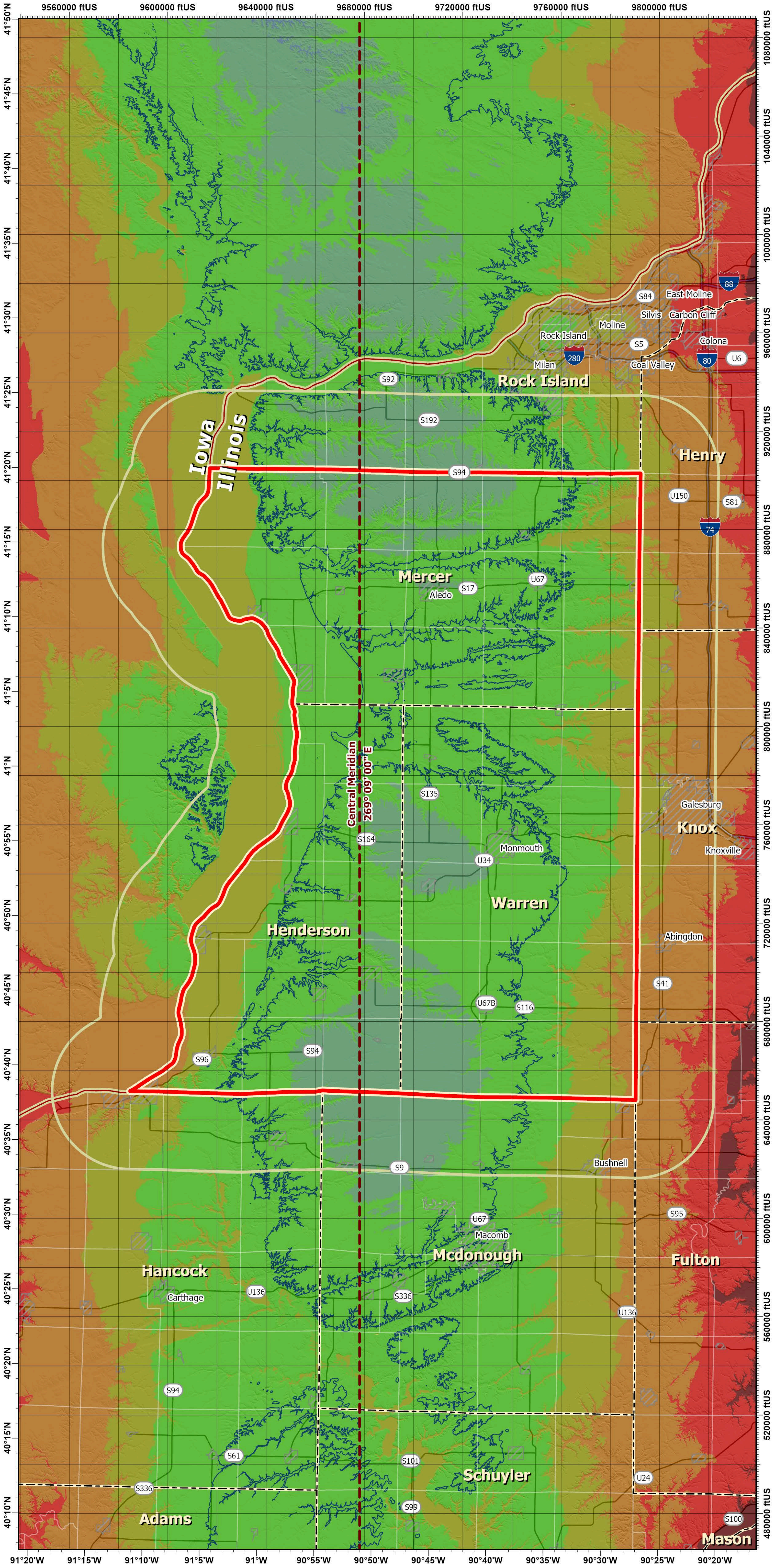
ICS83-Monmouth

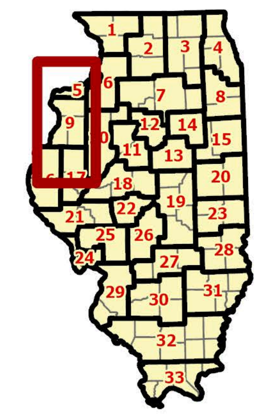
Zone 09

Scale: 1:450,000

(When printed on 11" x 17" paper)

Faint white lines delineate townships





Legend

- Central Meridian or Parallel
- 6-Mile Zone Buffer
- Zone Boundary
- State Boundary
- County Boundary
- Municipality

Linear Distortion (parts per million)

- Zero distortion
- ≤ -30 ppm (0.16 ft / mile)
- -30 to -20 ppm
- -20 to -10 ppm
- -10 to -5 ppm
- -5 to 5 ppm (0.025 ft / mile)
- 5 to 10 ppm
- 10 to 20 ppm
- 20 to 30 ppm
- > 30 ppm (0.16 ft / mile)

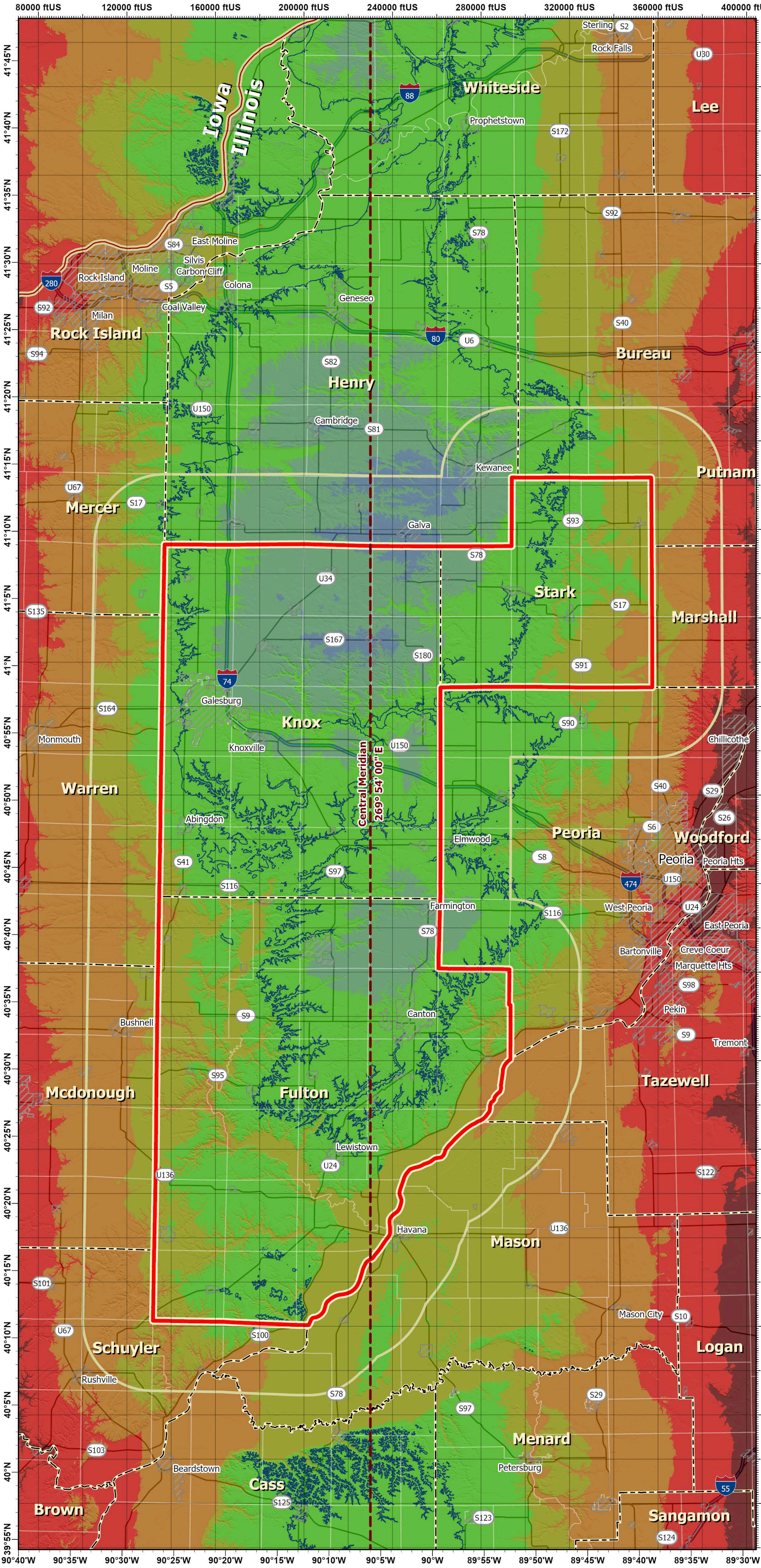
Projection Type: Transverse Mercator

Grid origin latitude:	40° 12' 00" N
Central meridian:	269° 09' 00" E
Central meridian scale factor:	1.000024 (exact)
False northing:	492000 USft
False easting:	9678000 USft
Maximum negative distortion:	-8.7439 ppm
Mean distortion:	0.3275 ppm
Maximum positive distortion:	17.8077 ppm
Variance of Distortion:	22.5513 ppm²
Area between -5 and 5 ppm:	67.0777%
Area between -10 and 10 ppm:	97.7938%
Area between -20 and 20 ppm:	100.0000%

Municipal Distortion Coverage

Area between -5 and 5 ppm (muni):	72.3759%
Area between -10 and 10 ppm (muni):	96.2145%
Area between -20 and 20 ppm (muni):	100.0000%

Map created by Christopher Poetschner based on maps created by Michael Dennis in the Kansas Regional Coordinate System Project Report.
(Rendered: 4/22/2021)



ICS83: 33 Zone

ICS83-Galesburg

Zone 10

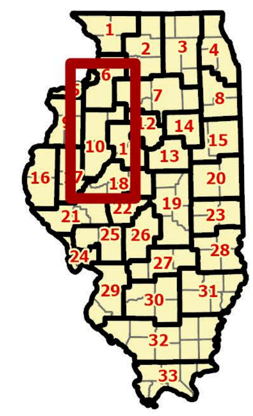
Scale: 1:500,000

(When printed on 11" x 17" paper)

Faint white lines delineate townships

N

0 2 4 8 12 16 Miles



Legend

- Central Meridian or Parallel
- 6-Mile Zone Buffer
- Zone Boundary
- State Boundary
- County Boundary
- Municipality

Linear Distortion (parts per million)

- Zero distortion
- ≤ -30 ppm (0.16 ft / mile)
- -30 to -20 ppm
- -20 to -10 ppm
- -10 to -5 ppm
- -5 to 5 ppm (0.025 ft / mile)
- 5 to 10 ppm
- 10 to 20 ppm
- 20 to 30 ppm
- > 30 ppm (0.16 ft / mile)

Projection Type: Transverse Mercator

Grid origin latitude:	37° 15' 00" N
Central meridian:	269° 54' 00" E
Central meridian scale factor:	1.000023 (exact)
False northing:	492000 USft
False easting:	230000 USft
Maximum negative distortion:	-13.0849 ppm
Mean distortion:	0.1467 ppm
Maximum positive distortion:	16.0091 ppm
Variance of Distortion:	27.4011 ppm²
Area between -5 and 5 ppm:	60.6855%
Area between -10 and 10 ppm:	96.7617%
Area between -20 and 20 ppm:	100.0000%

Municipal Distortion Coverage

Area between -5 and 5 ppm (muni):	76.2329%
Area between -10 and 10 ppm (muni):	98.8502%
Area between -20 and 20 ppm (muni):	100.0000%

Map created by Christopher Poetschner based on maps created by Michael Dennis in the Kansas Regional Coordinate System Project Report.
(Rendered: 4/22/2021)

ICS83: 33 Zone

ICS83-Peoria

Zone 11

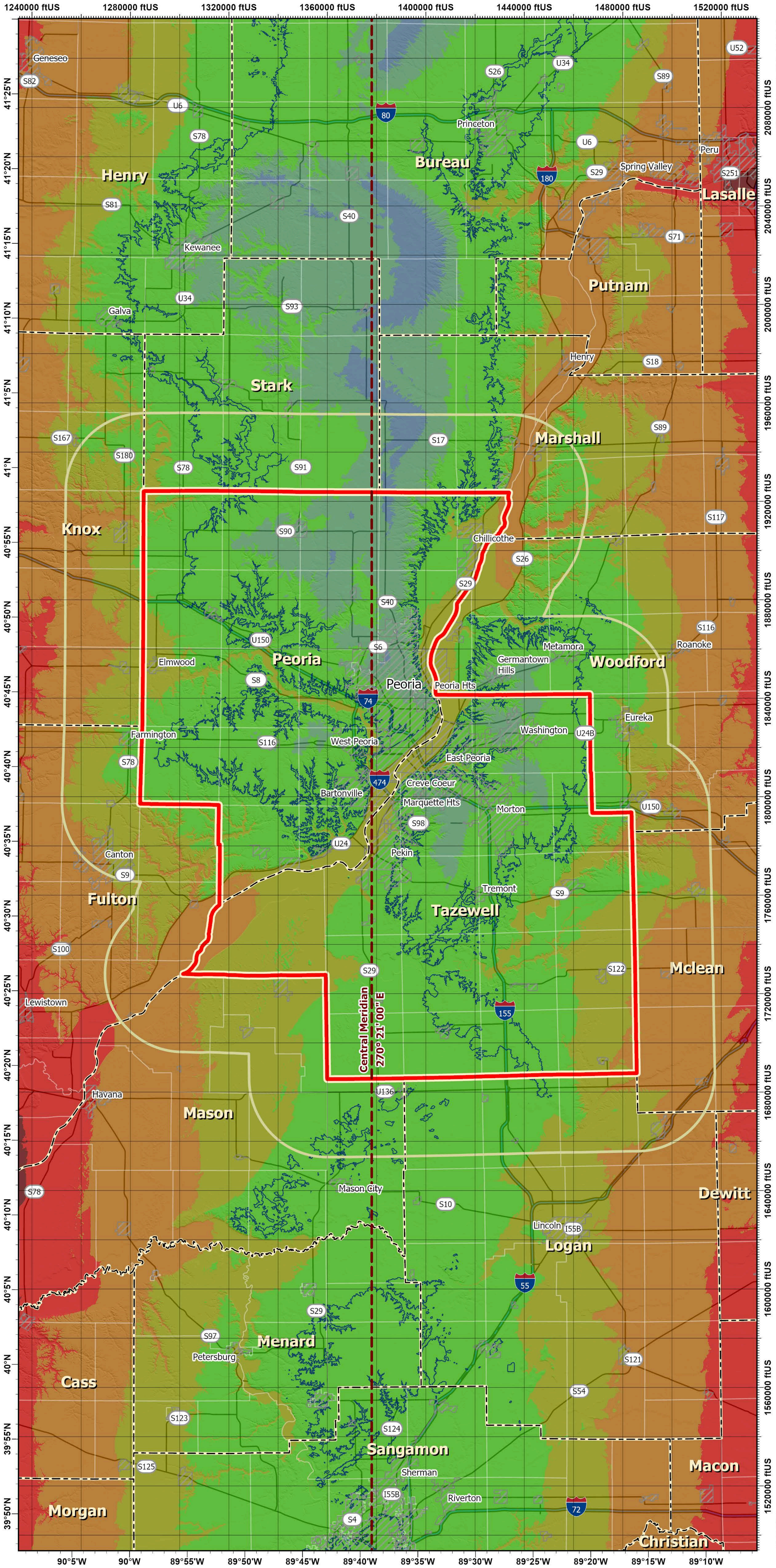
Scale: 1:450,000

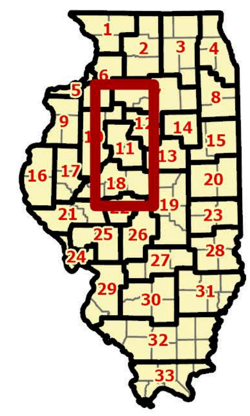
(When printed on 11" x 17" paper)

Faint white lines delineate townships

0 1.75 3.5 7 10.5 14 Miles

N





Legend

- Central Meridian or Parallel
- 6-Mile Zone Buffer
- Zone Boundary
- State Boundary
- County Boundary
- Municipality

Linear Distortion (parts per million)

- Zero distortion
- ≤ -30 ppm (0.16 ft / mile)
- -30 to -20 ppm
- -20 to -10 ppm
- -10 to -5 ppm
- -5 to 5 ppm (0.025 ft / mile)
- 5 to 10 ppm
- 10 to 20 ppm
- 20 to 30 ppm
- > 30 ppm (0.16 ft / mile)

Projection Type: Transverse Mercator

Grid origin latitude:	37° 24' 00" N
Central meridian:	270° 21' 00" E
Central meridian scale factor:	1.000023 (exact)
False northing:	622000 USft
False easting:	1378000 USft
Maximum negative distortion:	-11.6646 ppm
Mean distortion:	0.9553 ppm
Maximum positive distortion:	14.0421 ppm
Variance of Distortion:	21.2523 ppm²
Area between -5 and 5 ppm:	68.1164%
Area between -10 and 10 ppm:	97.7574%
Area between -20 and 20 ppm:	100.0000%

Municipal Distortion Coverage

Area between -5 and 5 ppm (muni):	61.7262%
Area between -10 and 10 ppm (muni):	99.6220%
Area between -20 and 20 ppm (muni):	100.0000%

Map created by Christopher Poetschner based on maps created by Michael Dennis in the Kansas Regional Coordinate System Project Report.
(Rendered: 4/22/2021)

ICS83: 33 Zone

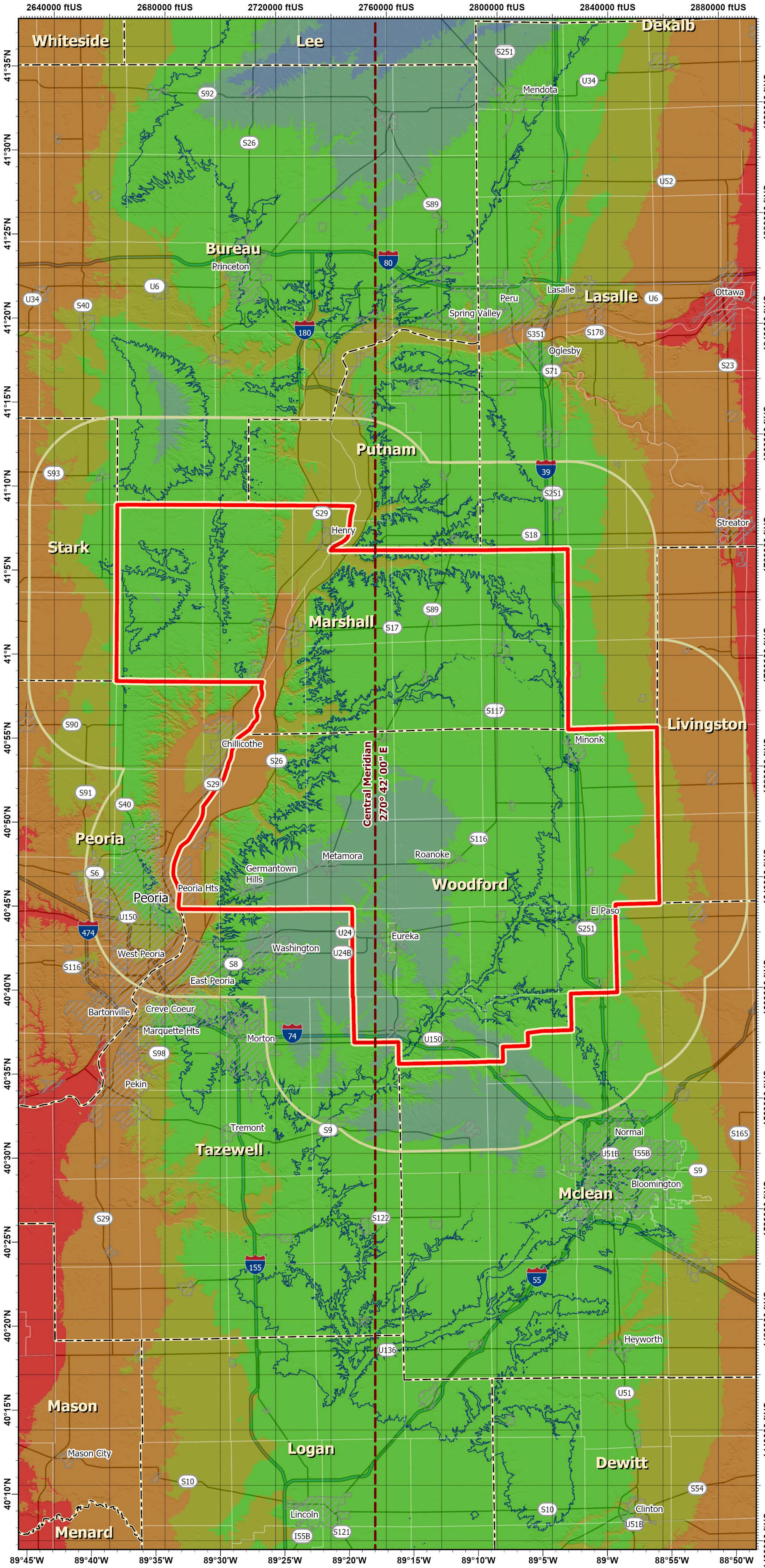
ICS83-Eureka

Zone 12

Scale: 1:400,000

(When printed on 11" x 17" paper)

Faint white lines delineate townships

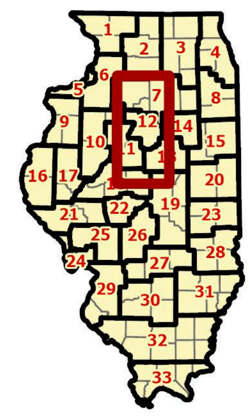


Legend

- Central Meridian or Parallel
- 6-Mile Zone Buffer
- Zone Boundary
- State Boundary
- County Boundary
- Municipality

Linear Distortion (parts per million)

- Zero distortion
- ≤ -30 ppm (0.16 ft / mile)
- -30 to -20 ppm
- -20 to -10 ppm
- -10 to -5 ppm
- -5 to 5 ppm (0.025 ft / mile)
- 5 to 10 ppm
- 10 to 20 ppm
- 20 to 30 ppm
- > 30 ppm (0.16 ft / mile)



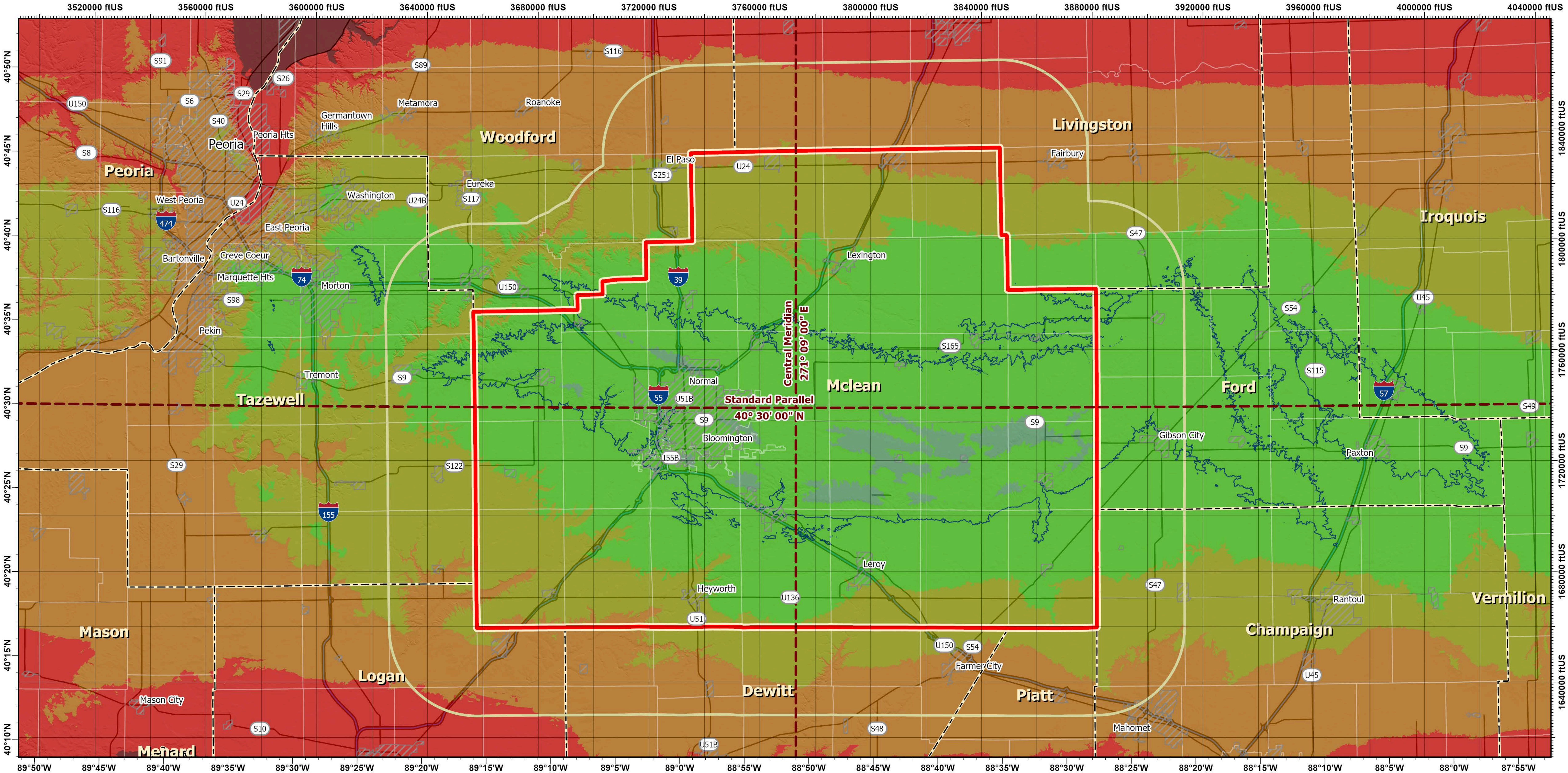
Projection Type: Transverse Mercator

Grid origin latitude:	37° 27' 00" N
Central meridian:	270° 42' 00" E
Central meridian scale factor:	1.000025 (exact)
False northing:	427000 USft
False easting:	2756000 USft
Maximum negative distortion:	-9.6969 ppm
Mean distortion:	-0.0886 ppm
Maximum positive distortion:	15.2252 ppm
Variance of Distortion:	20.2311 ppm²
Area between -5 and 5 ppm:	73.8207%
Area between -10 and 10 ppm:	95.8570%
Area between -20 and 20 ppm:	100.0000%

Municipal Distortion Coverage

Area between -5 and 5 ppm (muni):	48.1600%
Area between -10 and 10 ppm (muni):	78.5630%
Area between -20 and 20 ppm (muni):	100.0000%

Map created by Christopher Poetschner based on maps created by Michael Dennis in the Kansas Regional Coordinate System Project Report.
(Rendered: 4/22/2021)



ICS83: 33 Zone

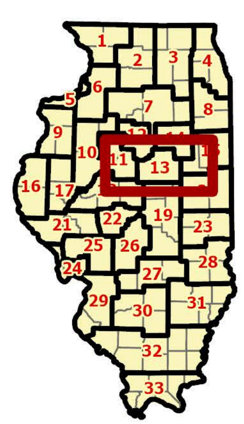
ICS83-Bloomington

Zone 13

0 3 6 12 18 24 Miles

N

Scale: 1:400,000 (When printed on 11" x 17" paper)
Faint white lines delineate townships



Legend

- Central Meridian or Parallel
- 6-Mile Zone Buffer
- Zone Boundary
- State Boundary
- County Boundary
- Municipality

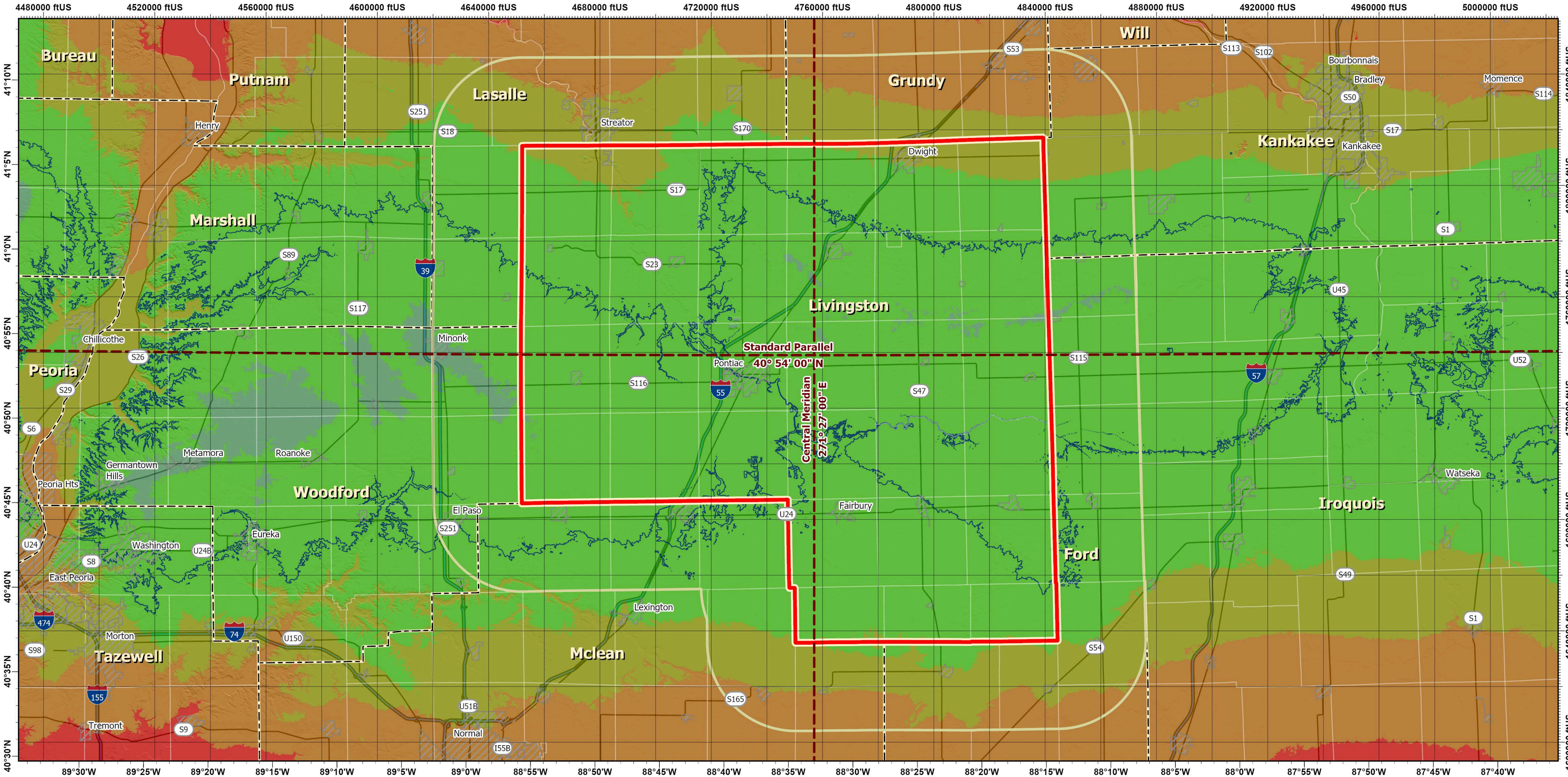
Linear Distortion (parts per million)

- Zero distortion
- ≤ -30 ppm (0.16 ft / mile)
- -30 to -20 ppm
- -20 to -10 ppm
- -10 to -5 ppm
- -5 to 5 ppm (0.025 ft / mile)
- 5 to 10 ppm
- 10 to 20 ppm
- 20 to 30 ppm
- > 30 ppm (0.16 ft / mile)

Projection Type: Lambert Conformal Conic (single parallel)

Standard parallel / grid origin:	40° 30' 00" N
Central meridian:	271° 09' 00" E
Standard parallel scale:	1.000031 (exact)
False northing:	1739000 USft
False easting:	3773000 USft
Maximum negative distortion:	-9.8481 ppm
Mean distortion:	1.7983 ppm
Maximum positive distortion:	13.6548 ppm
Variance of Distortion:	18.5539 ppm²
Area between -5 and 5 ppm:	70.8321% (municipality area: 86.5613%)
Area between -10 and 10 ppm:	97.1854% (municipality area: 97.6663%)
Area between -20 and 20 ppm:	99.9996% (municipality area: 100.0000%)

Map created by Christopher Poetschner based on maps created by Michael Dennis in the Kansas Regional Coordinate System Project Report. (Rendered: 4/22/2021)



ICS83: 33 Zone

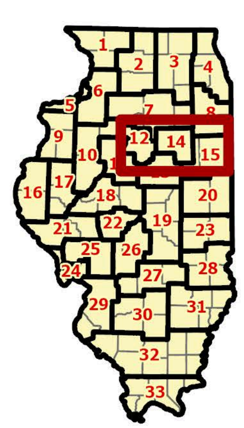
ICS83-Pontiac

Zone 14

0 3 6 12 18 24 Miles

N

Scale: 1:400,000 (When printed on 11" x 17" paper)
Faint white lines delineate townships



Legend

- Central Meridian or Parallel
- 6-Mile Zone Buffer
- Zone Boundary
- State Boundary
- County Boundary
- Municipality

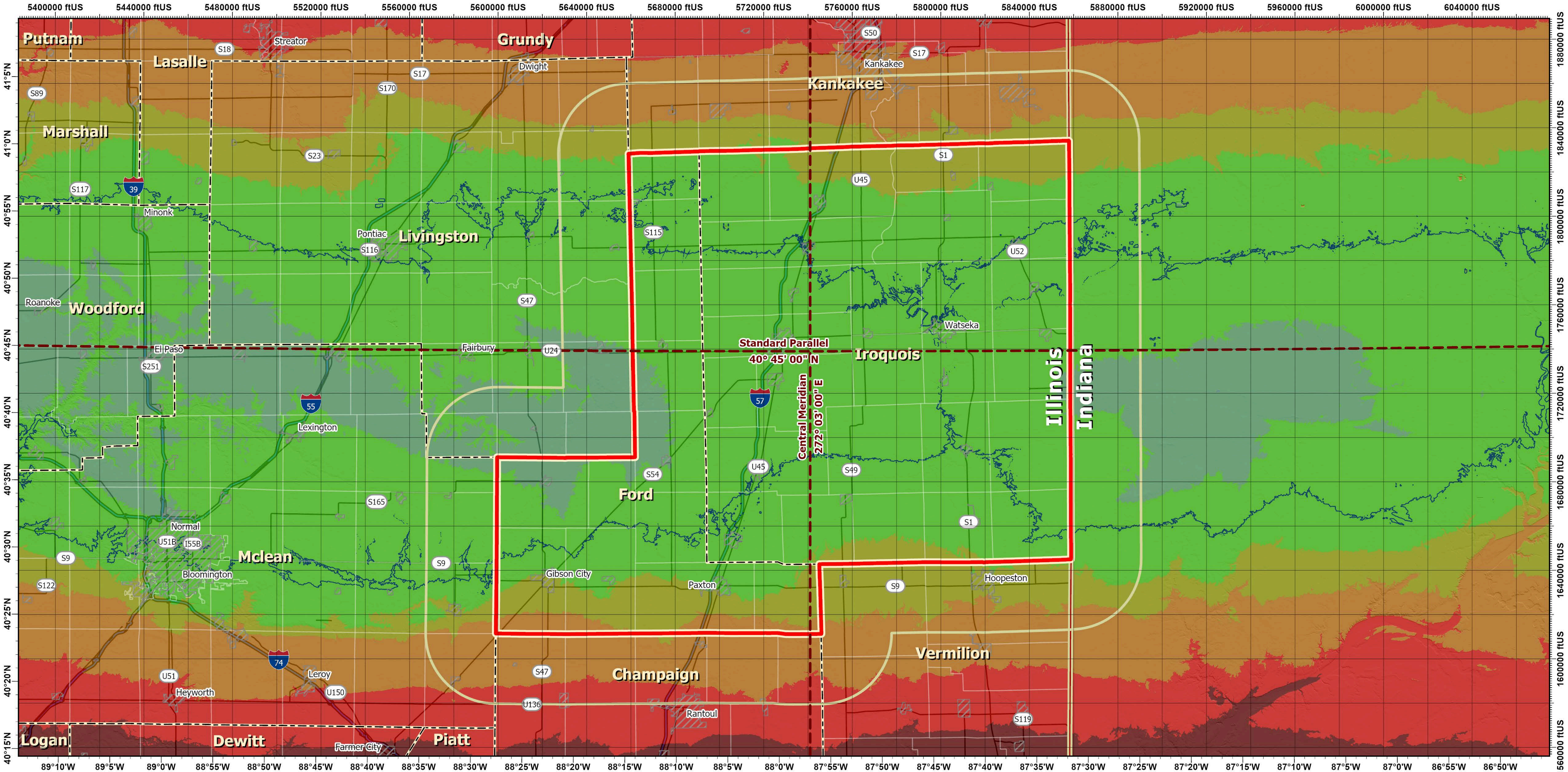
Linear Distortion (parts per million)

- Zero distortion
- ≤ -30 ppm (0.16 ft / mile)
- -30 to -20 ppm
- -20 to -10 ppm
- -10 to -5 ppm
- -5 to 5 ppm (0.025 ft / mile)
- 5 to 10 ppm
- 10 to 20 ppm
- 20 to 30 ppm
- > 30 ppm (0.16 ft / mile)

Projection Type: Lambert Conformal Conic (single parallel)

Standard parallel / grid origin:	40° 54' 00" N
Central meridian:	271° 27' 00" E
Standard parallel scale:	1.000025 (exact)
False northing:	1739000 USft
False easting:	4757000 USft
Maximum negative distortion:	-7.6433 ppm
Mean distortion:	0.0103 ppm
Maximum positive distortion:	9.8714 ppm
Variance of Distortion:	7.0982 ppm²
Area between -5 and 5 ppm:	94.6853% (municipality area: 85.4799%)
Area between -10 and 10 ppm:	100.0000% (municipality area: 100.0000%)
Area between -20 and 20 ppm:	100.0000% (municipality area: 100.0000%)

Map created by Christopher Poetschner based on maps created by Michael Dennis in the Kansas Regional Coordinate System Project Report. (Rendered: 4/22/2021)



ICS83: 33 Zone

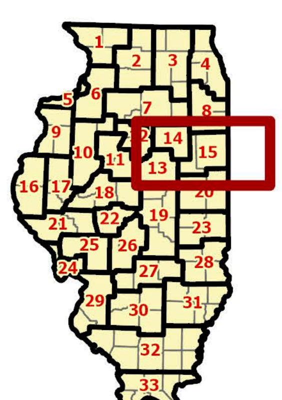
ICS83-Watseka

Zone 15

0 3.75 7.5 15 22.5 30 Miles

N

Scale: 1:500,000 (When printed on 11" x 17" paper)
Faint white lines delineate townships



Legend

- Central Meridian or Parallel
- 6-Mile Zone Buffer
- Zone Boundary
- State Boundary
- County Boundary
- Municipality

Linear Distortion (parts per million)

- Zero distortion
- ≤ -30 ppm (0.16 ft / mile)
- -30 to -20 ppm
- -20 to -10 ppm
- -10 to -5 ppm
- -5 to 5 ppm (0.025 ft / mile)
- 5 to 10 ppm
- 10 to 20 ppm
- 20 to 30 ppm
- > 30 ppm (0.16 ft / mile)

Projection Type: Lambert Conformal Conic (single parallel)

Standard parallel / grid origin:	40° 45' 00" N
Central meridian:	272° 03' 00" E
Standard parallel scale:	1.000024 (exact)
False northing:	1739000 USft
False easting:	5741000 USft
Maximum negative distortion:	-9.1722 ppm
Mean distortion:	0.7635 ppm
Maximum positive distortion:	13.9860 ppm
Variance of Distortion:	13.6502 ppm²
Area between -5 and 5 ppm:	82.9729% (municipality area: 85.6591%)
Area between -10 and 10 ppm:	98.0427% (municipality area: 100.0000%)
Area between -20 and 20 ppm:	100.0000% (municipality area: 100.0000%)

Map created by Christopher Poetschner based on maps created by Michael Dennis in the Kansas Regional Coordinate System Project Report. (Rendered: 4/22/2021)

ICS83: 33 Zone

ICS83-Quincy

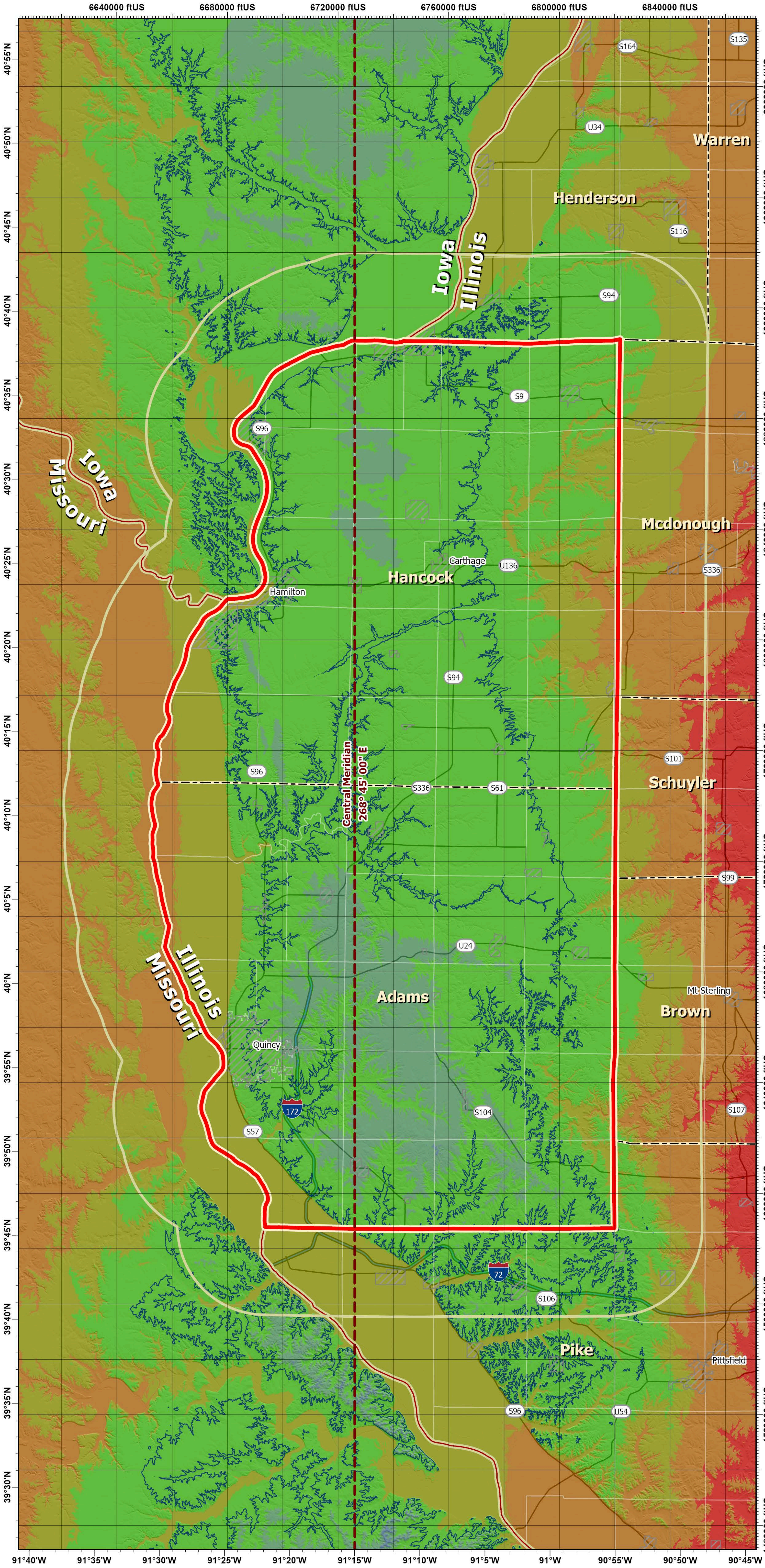
Zone 16

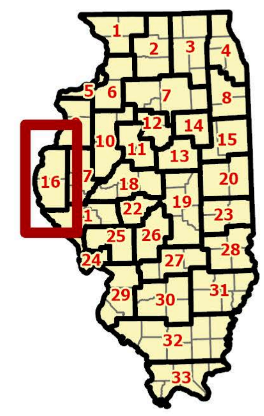
Scale: 1:400,000

(When printed on 11" x 17" paper)

Faint white lines delineate townships

0 1.5 3 6 9 12 Miles





Legend

- Central Meridian or Parallel
- 6-Mile Zone Buffer
- Zone Boundary
- State Boundary
- County Boundary
- Municipality

Linear Distortion (parts per million)

- Zero distortion
- ≤ -30 ppm (0.16 ft / mile)
- -30 to -20 ppm
- -20 to -10 ppm
- -10 to -5 ppm
- -5 to 5 ppm (0.025 ft / mile)
- 5 to 10 ppm
- 10 to 20 ppm
- 20 to 30 ppm
- > 30 ppm (0.16 ft / mile)

Projection Type: Transverse Mercator

Grid origin latitude:	36° 45' 00" N
Central meridian:	268° 45' 00" E
Central meridian scale factor:	1.000023 (exact)
False northing:	492000 USft
False easting:	6726000 USft
Maximum negative distortion:	-11.1661 ppm
Mean distortion:	-0.0896 ppm
Maximum positive distortion:	18.3919 ppm
Variance of Distortion:	20.3164 ppm²
Area between -5 and 5 ppm:	73.9064%
Area between -10 and 10 ppm:	98.0491%
Area between -20 and 20 ppm:	100.0000%

Municipal Distortion Coverage

Area between -5 and 5 ppm (muni):	79.5609%
Area between -10 and 10 ppm (muni):	100.0000%
Area between -20 and 20 ppm (muni):	100.0000%

Map created by Christopher Poetschner based on maps created by Michael Dennis in the Kansas Regional Coordinate System Project Report.
(Rendered: 4/22/2021)

ICS83: 33 Zone

ICS83-Macomb

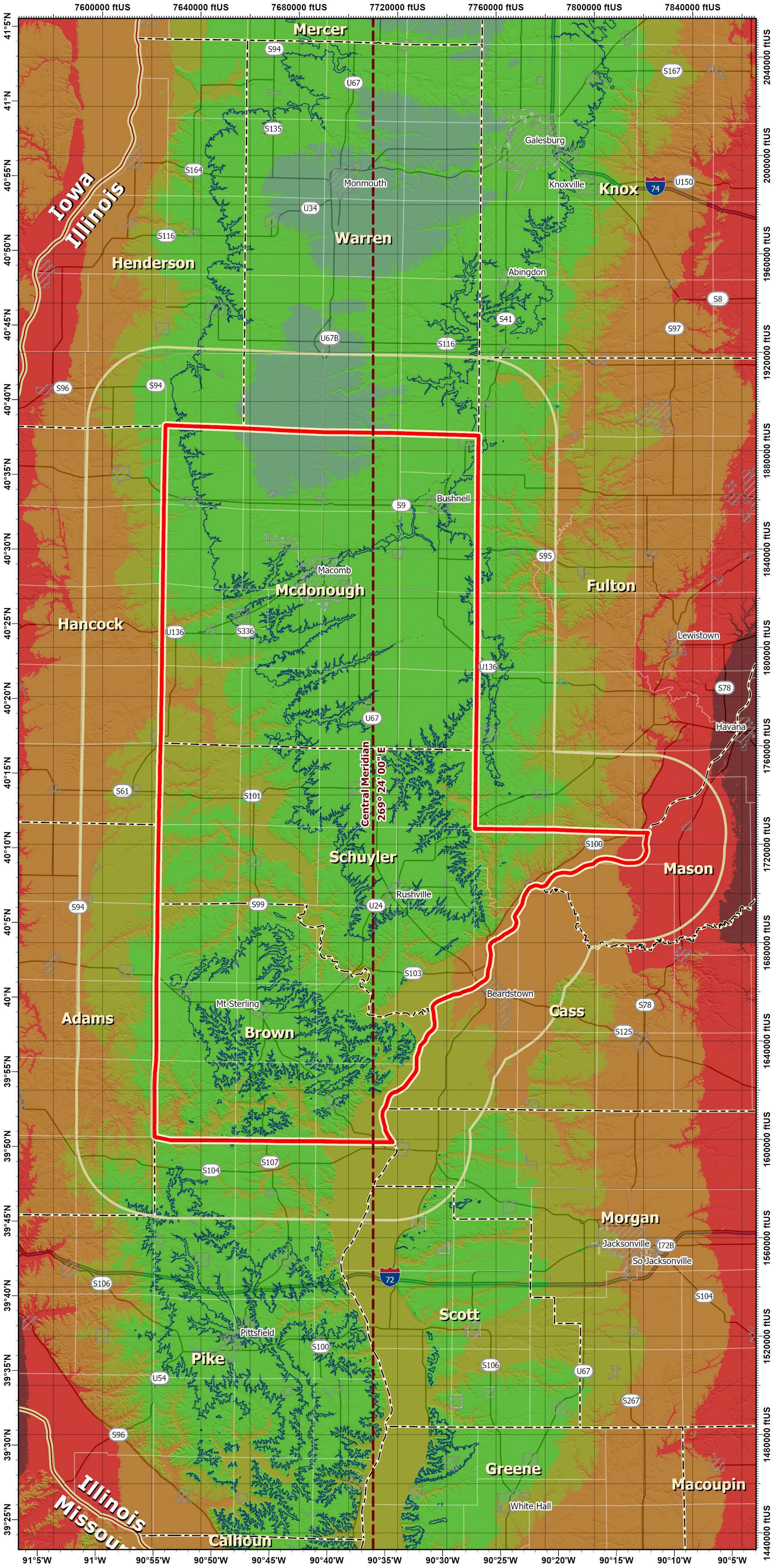
Zone 17

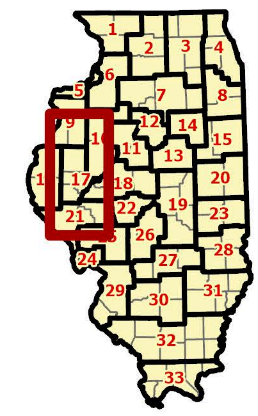
Scale: 1:450,000

(When printed on 11" x 17" paper)

Faint white lines delineate townships

0 1.75 3.5 7 10.5 14 Miles





Legend

- Central Meridian or Parallel
- 6-Mile Zone Buffer
- Zone Boundary
- State Boundary
- County Boundary
- Municipality

Linear Distortion (parts per million)

- Zero distortion
- ≤ -30 ppm (0.16 ft / mile)
- -30 to -20 ppm
- -20 to -10 ppm
- -10 to -5 ppm
- -5 to 5 ppm (0.025 ft / mile)
- 5 to 10 ppm
- 10 to 20 ppm
- 20 to 30 ppm
- > 30 ppm (0.16 ft / mile)

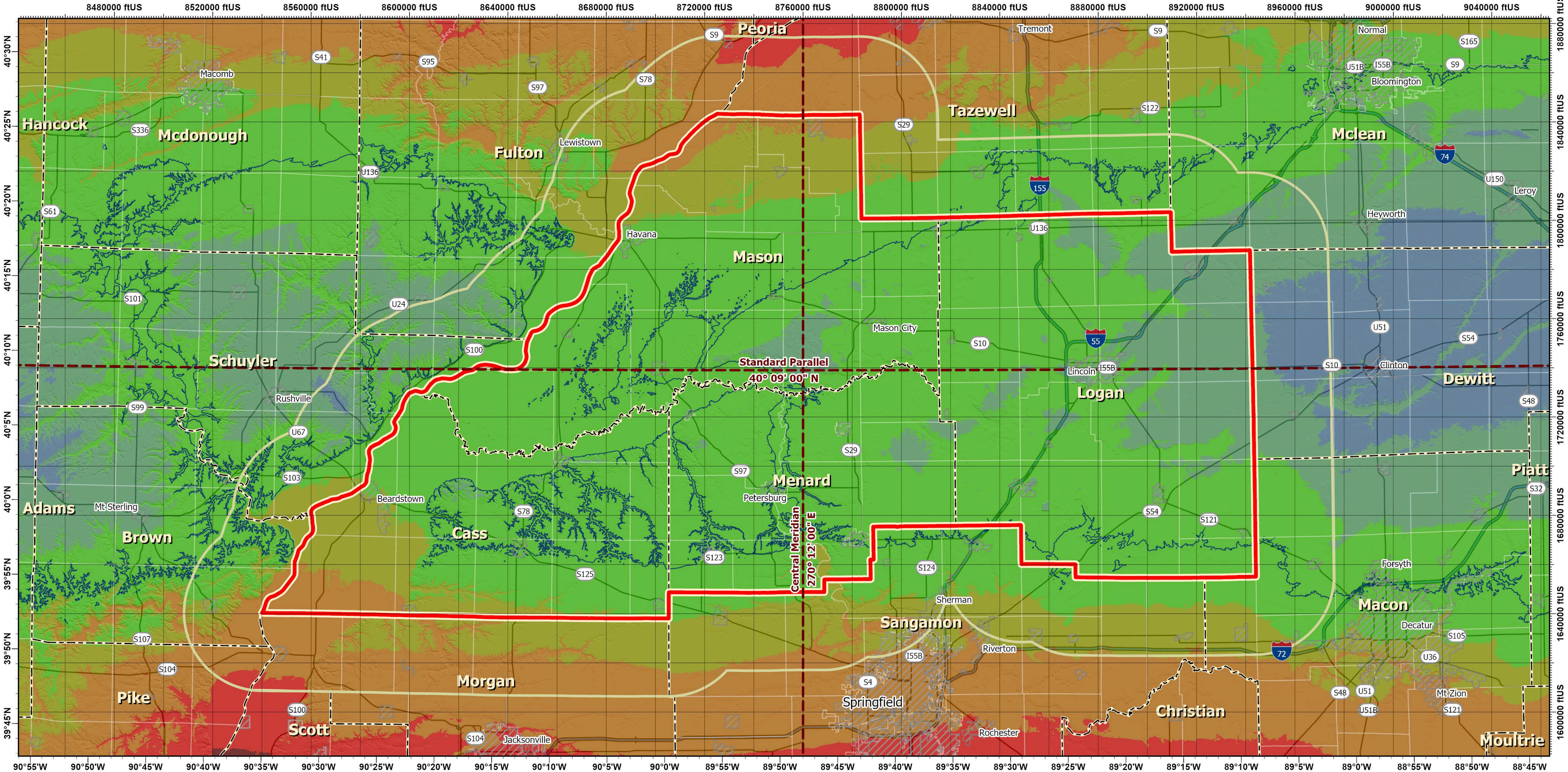
Projection Type: Transverse Mercator

Grid origin latitude:	36° 48' 00" N
Central meridian:	269° 24' 00" E
Central meridian scale factor:	1.000024 (exact)
False northing:	492000 USft
False easting:	7710000 USft
Maximum negative distortion:	-7.7678 ppm
Mean distortion:	1.4253 ppm
Maximum positive distortion:	22.8492 ppm
Variance of Distortion:	18.5588 ppm²
Area between -5 and 5 ppm:	76.7754%
Area between -10 and 10 ppm:	96.8767%
Area between -20 and 20 ppm:	99.6954%

Municipal Distortion Coverage

Area between -5 and 5 ppm (muni):	96.5699%
Area between -10 and 10 ppm (muni):	98.7357%
Area between -20 and 20 ppm (muni):	100.0000%

Map created by Christopher Poetschner based on maps created by Michael Dennis in the Kansas Regional Coordinate System Project Report.
(Rendered: 4/22/2021)



ICS83: 33 Zone

ICS83-Lincoln

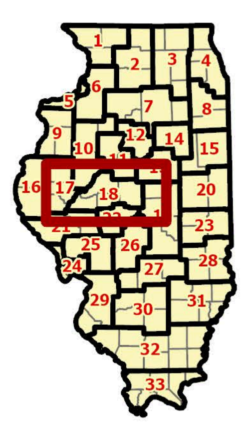
Zone 18

0 3.25 6.5 13 19.5 26 Miles

N

Scale: 1:450,000 (When printed on 11" x 17" paper)

Faint white lines delineate townships



Legend

- Central Meridian or Parallel
- 6-Mile Zone Buffer
- Zone Boundary
- State Boundary
- County Boundary
- Municipality

Linear Distortion (parts per million)

- Zero distortion
- ≤ -30 ppm (0.16 ft / mile)
- -30 to -20 ppm
- -20 to -10 ppm
- -10 to -5 ppm
- -5 to 5 ppm (0.025 ft / mile)
- 5 to 10 ppm
- 10 to 20 ppm
- 20 to 30 ppm
- > 30 ppm (0.16 ft / mile)

Projection Type: Lambert Conformal Conic (single parallel)

Standard parallel / grid origin:	40° 09' 00" N
Central meridian:	270° 12' 00" E
Standard parallel scale:	1.000018 (exact)
False northing:	1739000 USft
False easting:	8760000 USft
Maximum negative distortion:	-11.8851 ppm
Mean distortion:	-0.3612 ppm
Maximum positive distortion:	14.7878 ppm
Variance of Distortion:	17.9323 ppm²
Area between -5 and 5 ppm:	77.9624% (municipality area: 67.9009%)
Area between -10 and 10 ppm:	97.3815% (municipality area: 95.6821%)
Area between -20 and 20 ppm:	100.0000% (municipality area: 100.0000%)

Map created by Christopher Poetschner based on maps created by Michael Dennis in the Kansas Regional Coordinate System Project Report. (Rendered: 4/22/2021)

ICS83: 33 Zone

ICS83-Decatur

Zone 19

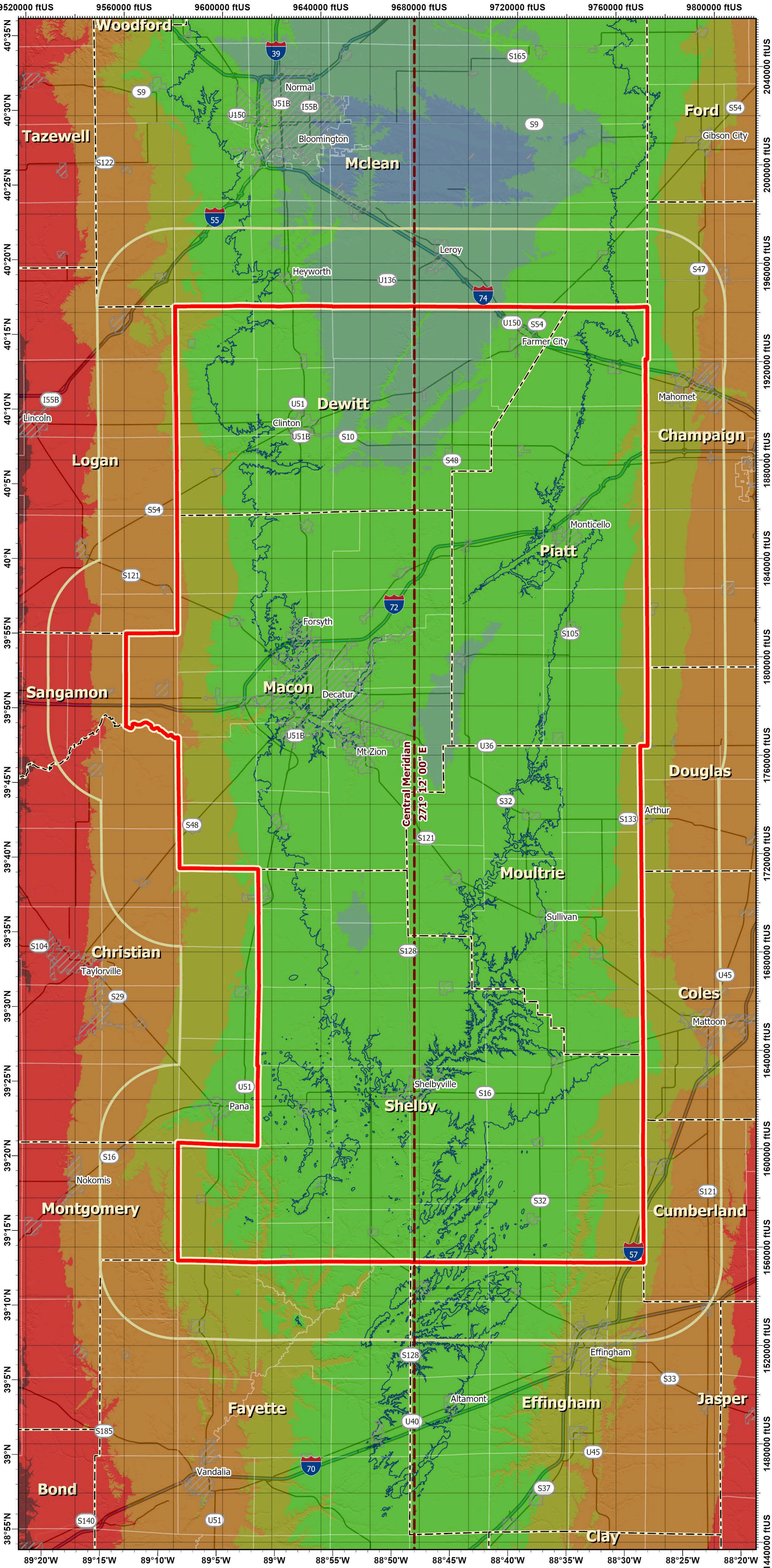
Scale: 1:450,000

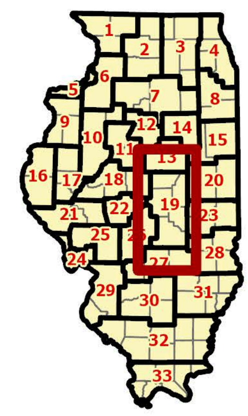
(When printed on 11" x 17" paper)

Faint white lines delineate townships

N

0 1.75 3.5 7 10.5 14 Miles





Legend

- Central Meridian or Parallel
- 6-Mile Zone Buffer
- Zone Boundary
- State Boundary
- County Boundary
- Municipality

Linear Distortion (parts per million)

- Zero distortion
- ≤ -30 ppm (0.16 ft / mile)
- -30 to -20 ppm
- -20 to -10 ppm
- -10 to -5 ppm
- -5 to 5 ppm (0.025 ft / mile)
- 5 to 10 ppm
- 10 to 20 ppm
- 20 to 30 ppm
- > 30 ppm (0.16 ft / mile)

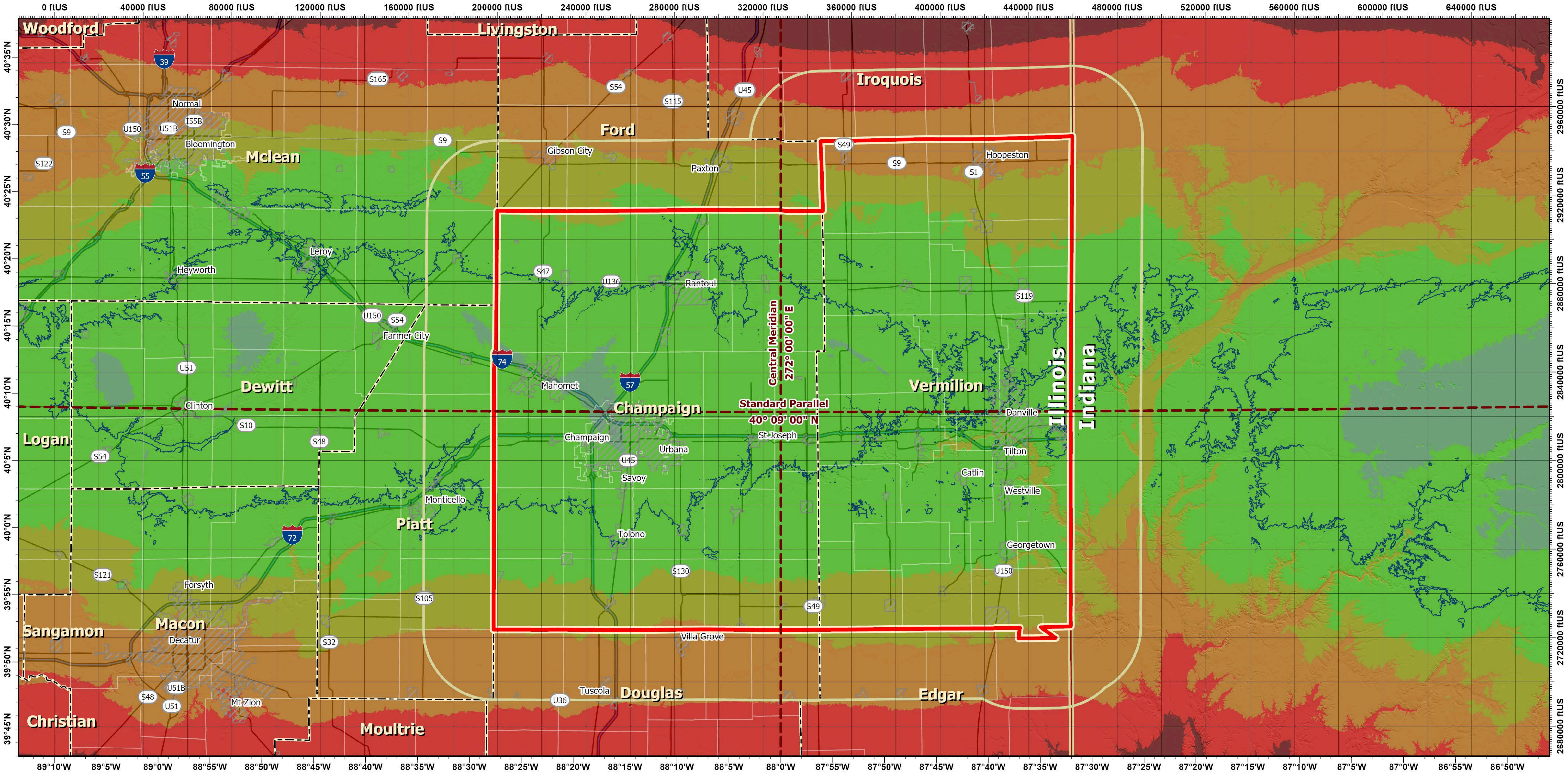
Projection Type: Transverse Mercator

Grid origin latitude:	36° 18' 00" N
Central meridian:	271° 12' 00" E
Central meridian scale factor:	1.000024 (exact)
False northing:	492000 USft
False easting:	9678000 USft
Maximum negative distortion:	-9.5039 ppm
Mean distortion:	0.2592 ppm
Maximum positive distortion:	18.1148 ppm
Variance of Distortion:	16.5818 ppm²
Area between -5 and 5 ppm:	80.2159%
Area between -10 and 10 ppm:	98.3102%
Area between -20 and 20 ppm:	100.0000%

Municipal Distortion Coverage

Area between -5 and 5 ppm (muni):	94.7857%
Area between -10 and 10 ppm (muni):	98.8186%
Area between -20 and 20 ppm (muni):	100.0000%

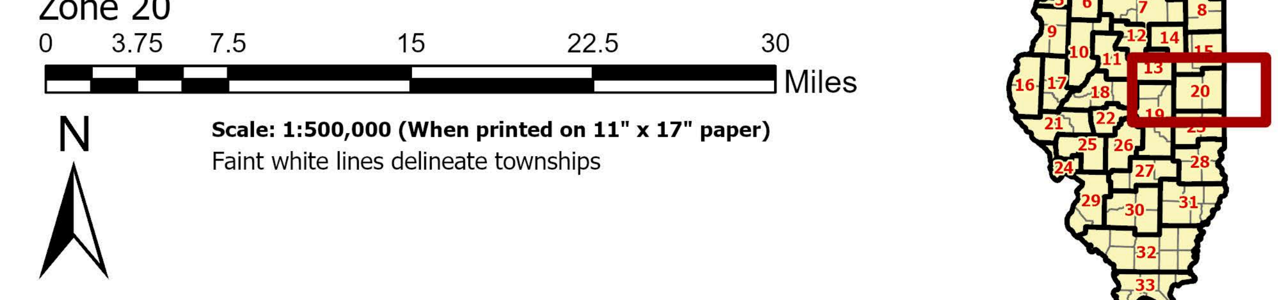
Map created by Christopher Poetschner based on maps created by Michael Dennis in the Kansas Regional Coordinate System Project Report.
(Rendered: 4/22/2021)



ICS83: 33 Zone

ICS83-Champaign

Zone 20



Scale: 1:500,000 (When printed on 11" x 17" paper)

Faint white lines delineate townships

Legend

- Central Meridian or Parallel
- 6-Mile Zone Buffer
- Zone Boundary
- State Boundary
- County Boundary
- Municipality

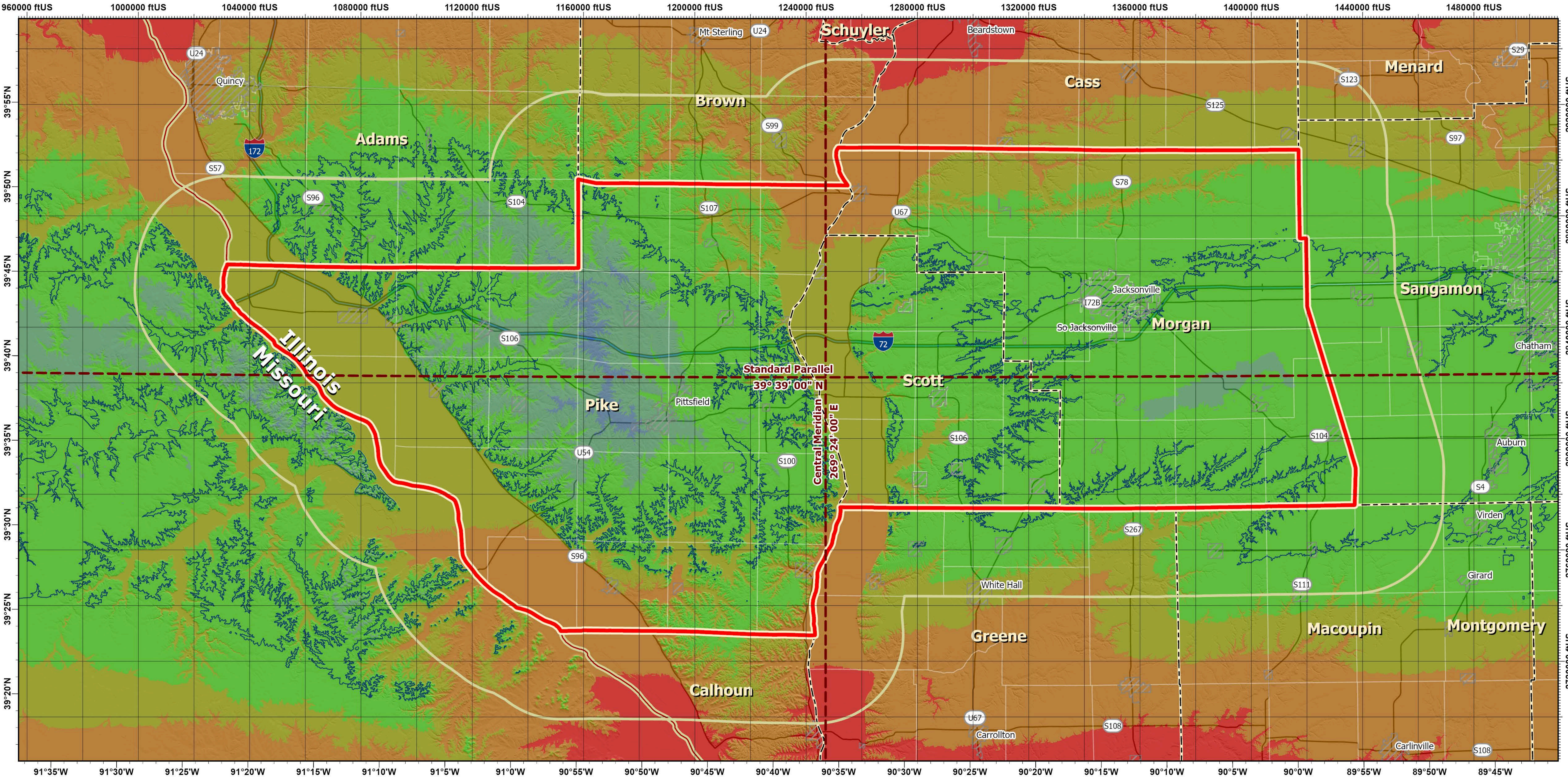
Linear Distortion (parts per million)

- Zero distortion
- ≤ -30 ppm (0.16 ft / mile)
- -30 to -20 ppm
- -20 to -10 ppm
- -10 to -5 ppm
- -5 to 5 ppm (0.025 ft / mile)
- 5 to 10 ppm
- 10 to 20 ppm
- 20 to 30 ppm
- > 30 ppm (0.16 ft / mile)

Projection Type: Lambert Conformal Conic (single parallel)

Standard parallel / grid origin:	40° 09' 00" N
Central meridian:	272° 00' 00" E
Standard parallel scale:	1.000026 (exact)
False northing:	2822000 USft
False easting:	328000 USft
Maximum negative distortion:	-9.7520 ppm
Mean distortion:	1.9024 ppm
Maximum positive distortion:	16.4010 ppm
Variance of Distortion:	16.1911 ppm²
Area between -5 and 5 ppm:	76.6266% (municipality area: 81.1993%)
Area between -10 and 10 ppm:	96.1452% (municipality area: 96.4773%)
Area between -20 and 20 ppm:	100.0000% (municipality area: 100.0000%)

Map created by Christopher Poetschner based on maps created by Michael Dennis in the Kansas Regional Coordinate System Project Report. (Rendered: 4/22/2021)



ICS83: 33 Zone

ICS83-Jacksonville

Zone 21

0 3 6 12 18 24 Miles

N

Scale: 1:400,000 (When printed on 11" x 17" paper)
Faint white lines delineate townships

Legend

- Central Meridian or Parallel
- 6-Mile Zone Buffer
- Zone Boundary
- State Boundary
- County Boundary
- Municipality

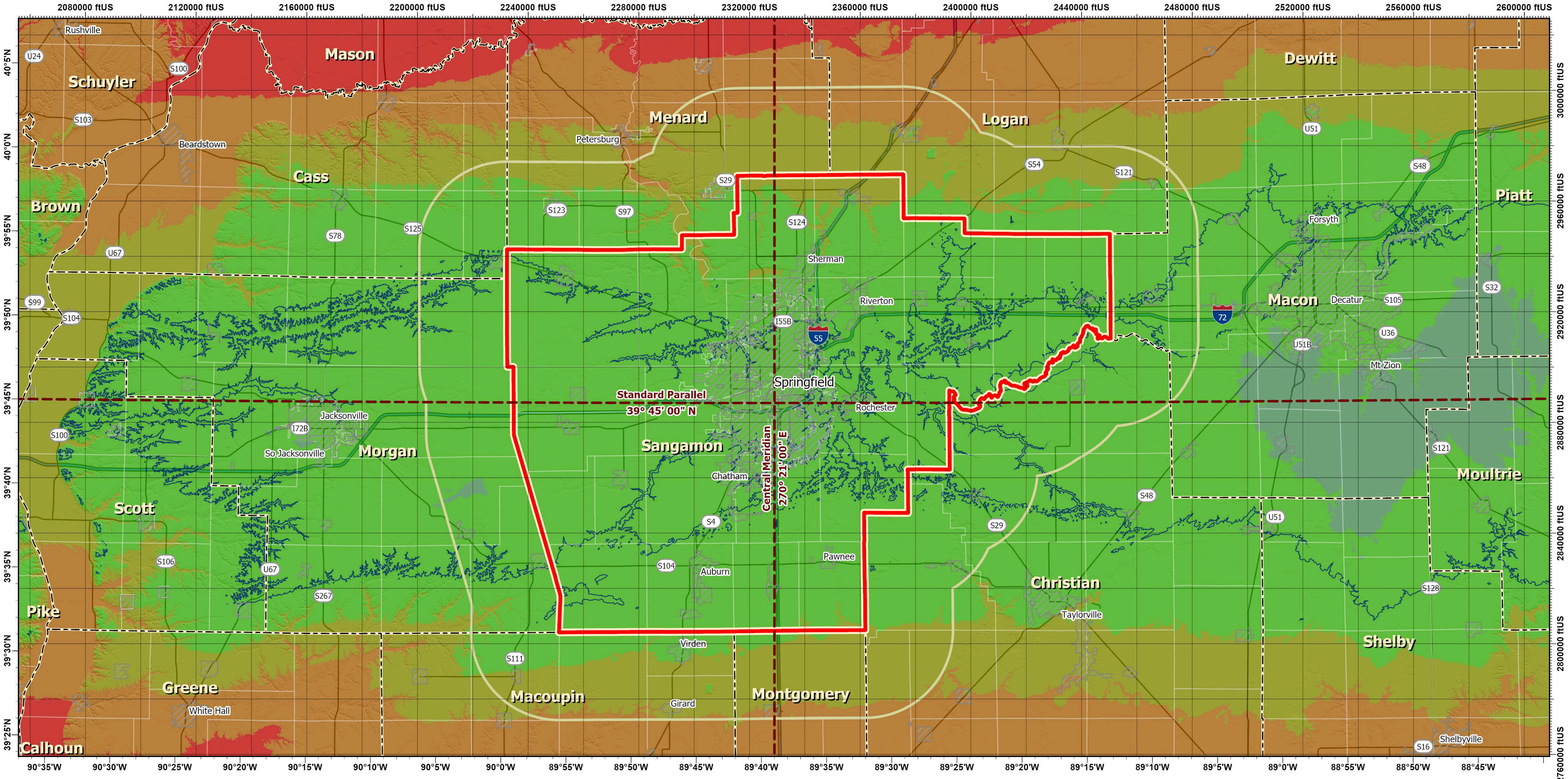
Linear Distortion (parts per million)

- Zero distortion
- ≤ -30 ppm (0.16 ft / mile)
- -30 to -20 ppm
- -20 to -10 ppm
- -10 to -5 ppm
- -5 to 5 ppm (0.025 ft / mile)
- 5 to 10 ppm
- 10 to 20 ppm
- 20 to 30 ppm
- > 30 ppm (0.16 ft / mile)

Projection Type: Lambert Conformal Conic (single parallel)

Standard parallel / grid origin:	39° 39' 00" N
Central meridian:	269° 24' 00" E
Standard parallel scale:	1.000023 (exact)
False northing:	2822000 USft
False easting:	1247000 USft
Maximum negative distortion:	-13.4166 ppm
Mean distortion:	1.5174 ppm
Maximum positive distortion:	18.7697 ppm
Variance of Distortion:	30.2028 ppm²
Area between -5 and 5 ppm:	61.9050% (municipality area: 64.6970%)
Area between -10 and 10 ppm:	91.9146% (municipality area: 91.2402%)
Area between -20 and 20 ppm:	100.0000% (municipality area: 100.0000%)

Map created by Christopher Poetschner based on maps created by Michael Dennis in the Kansas Regional Coordinate System Project Report. (Rendered: 4/21/2021)



ICS83: 33 Zone

ICS83-Springfield

Zone 22

0 3 6 12 18 24 Miles

N

Scale: 1:400,000 (When printed on 11" x 17" paper)

Faint white lines delineate townships

Legend

- Central Meridian or Parallel
- 6-Mile Zone Buffer
- Zone Boundary
- State Boundary
- County Boundary
- Municipality

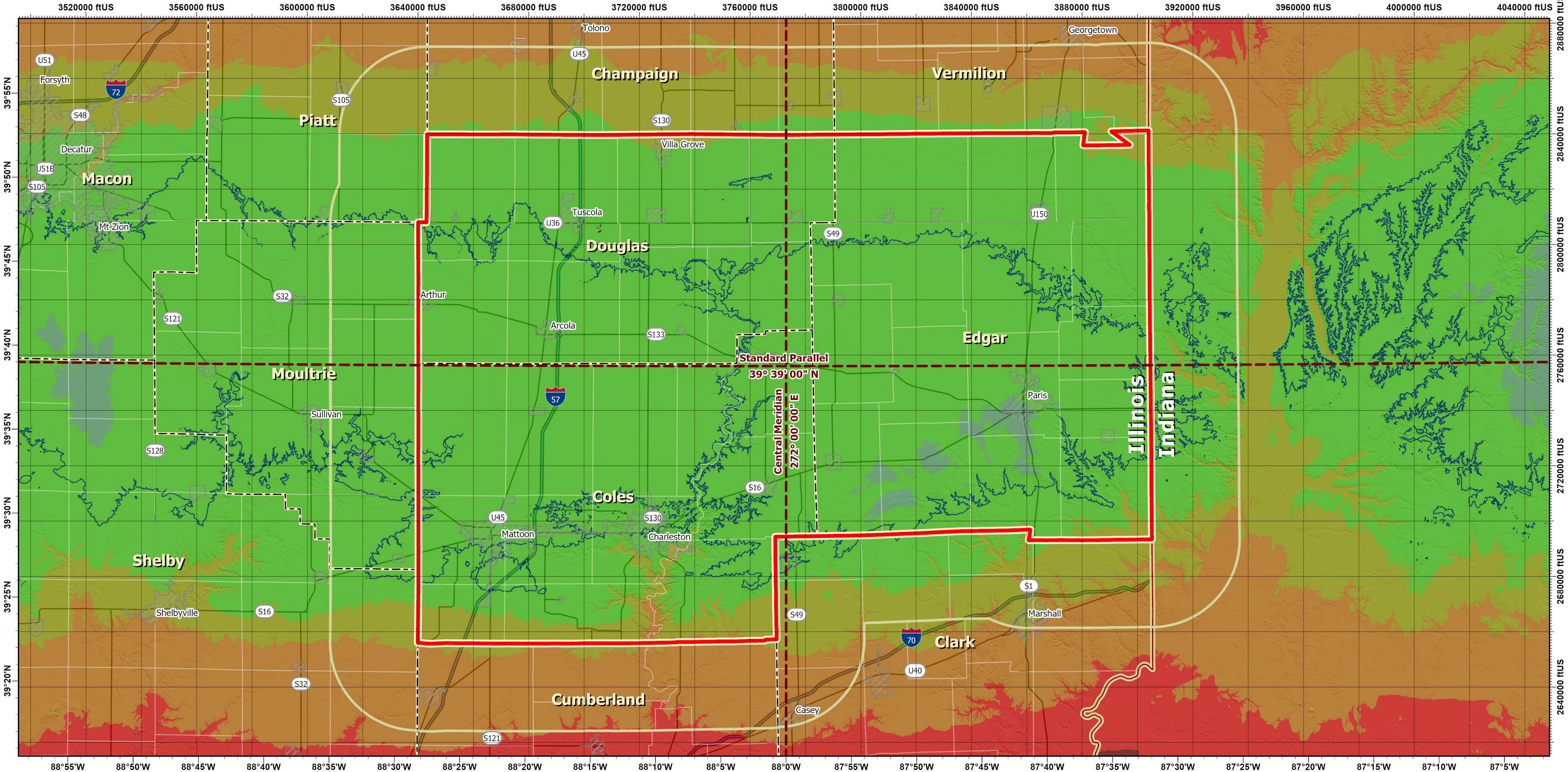
Linear Distortion (parts per million)

- Zero distortion
- ≤ -30 ppm (0.16 ft / mile)
- -30 to -20 ppm
- -20 to -10 ppm
- -10 to -5 ppm
- -5 to 5 ppm (0.025 ft / mile)
- 5 to 10 ppm
- 10 to 20 ppm
- 20 to 30 ppm
- > 30 ppm (0.16 ft / mile)

Projection Type: Lambert Conformal Conic (single parallel)

Standard parallel / grid origin:	39° 45' 00" N
Central meridian:	270° 21' 00" E
Standard parallel scale:	1.000022 (exact)
False northing:	2887000 USft
False easting:	2329000 USft
Maximum negative distortion:	-4.9312 ppm
Mean distortion:	0.4410 ppm
Maximum positive distortion:	7.9554 ppm
Variance of Distortion:	4.9185 ppm²
Area between -5 and 5 ppm:	96.7842% (municipality area: 99.1785%)
Area between -10 and 10 ppm:	100.0000% (municipality area: 100.0000%)
Area between -20 and 20 ppm:	100.0000% (municipality area: 100.0000%)

Map created by Christopher Poetschner based on maps created by Michael Dennis in the Kansas Regional Coordinate System Project Report. (Rendered: 4/21/2021)



ICS83: 33 Zone

ICS83-Charleston

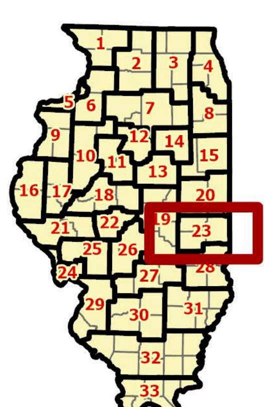
Zone 23

0 3 6 12 18 24 Miles

N

Scale: 1:400,000 (When printed on 11" x 17" paper)

Faint white lines delineate townships



Legend

- Central Meridian or Parallel
- 6-Mile Zone Buffer
- Zone Boundary
- State Boundary
- County Boundary
- Municipality

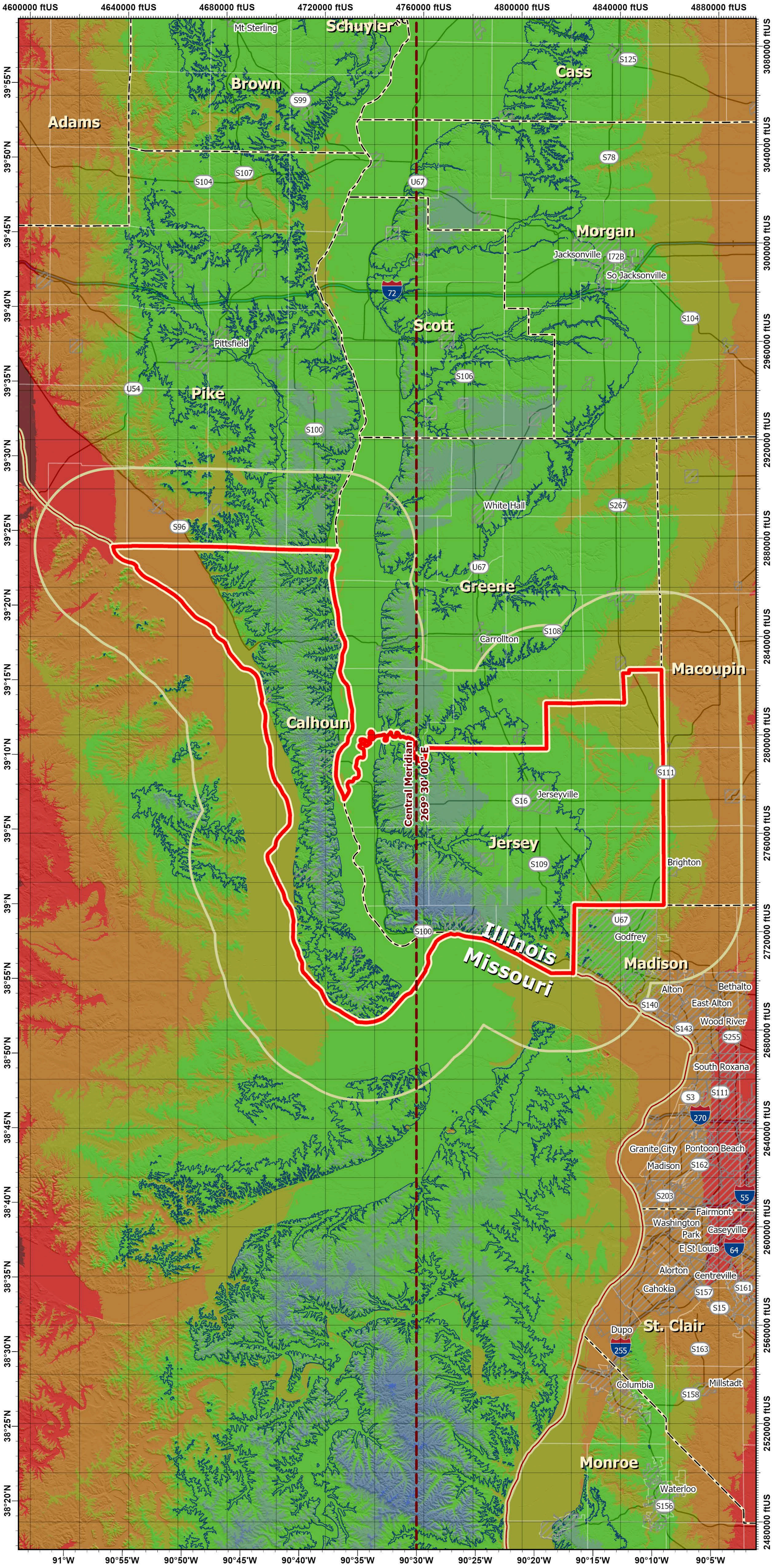
Linear Distortion (parts per million)

- Zero distortion
- ≤ -30 ppm (0.16 ft / mile)
- -30 to -20 ppm
- -20 to -10 ppm
- -10 to -5 ppm
- -5 to 5 ppm (0.025 ft / mile)
- 5 to 10 ppm
- 10 to 20 ppm
- 20 to 30 ppm
- > 30 ppm (0.16 ft / mile)

Projection Type: Lambert Conformal Conic (single parallel)

Standard parallel / grid origin:	39° 39' 00" N
Central meridian:	272° 00' 00" E
Standard parallel scale:	1.000024 (exact)
False northing:	2756000 USft
False easting:	3773000 USft
Maximum negative distortion:	-8.0675 ppm
Mean distortion:	-0.1539 ppm
Maximum positive distortion:	14.9554 ppm
Variance of Distortion:	8.2913 ppm²
Area between -5 and 5 ppm:	93.5841% (municipality area: 89.8590%)
Area between -10 and 10 ppm:	99.6674% (municipality area: 100.0000%)
Area between -20 and 20 ppm:	100.0000% (municipality area: 100.0000%)

Map created by Christopher Poetschner based on maps created by Michael Dennis in the Kansas Regional Coordinate System Project Report. (Rendered: 4/21/2021)



ICS83: 33 Zone

ICS83-Jerseyville

Zone 24

Scale: 1:450,000

(When printed on 11" x 17" paper)

Faint white lines delineate townships

0 1.75 3.5 7 10.5 14 Miles

Legend

- Central Meridian or Parallel
- 6-Mile Zone Buffer
- Zone Boundary
- State Boundary
- County Boundary
- Municipality

Linear Distortion (parts per million)

- Zero distortion
- ≤ -30 ppm (0.16 ft / mile)
- -30 to -20 ppm
- -20 to -10 ppm
- -10 to -5 ppm
- -5 to 5 ppm (0.025 ft / mile)
- 5 to 10 ppm
- 10 to 20 ppm
- 20 to 30 ppm
- > 30 ppm (0.16 ft / mile)

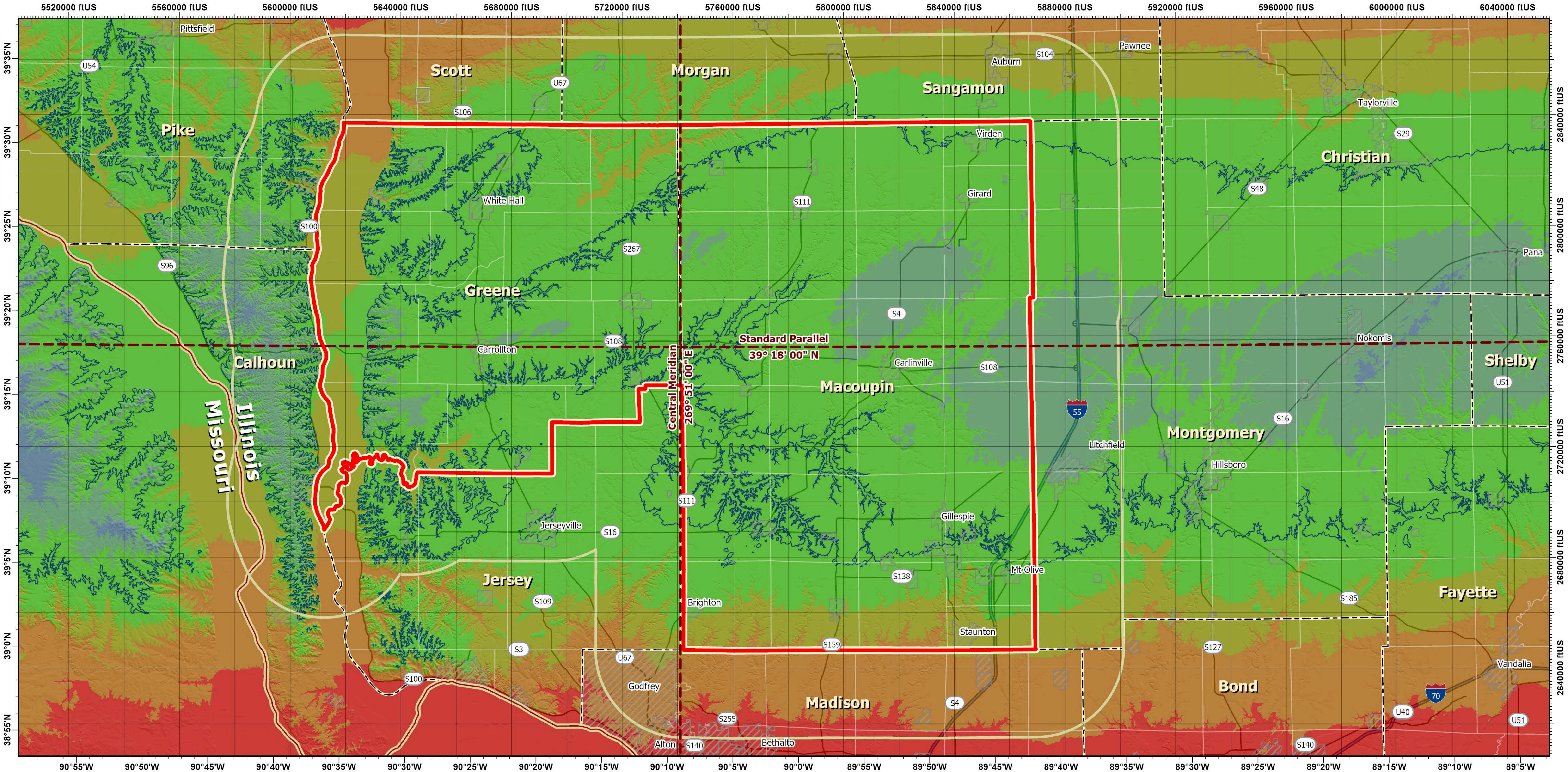
Projection Type: Transverse Mercator

Grid origin latitude:	32° 51' 00" N
Central meridian:	269° 30' 00" E
Central meridian scale factor:	1.000019 (exact)
False northing:	492000 USft
False easting:	4757000 USft
Maximum negative distortion:	-18.9287 ppm
Mean distortion:	0.1680 ppm
Maximum positive distortion:	20.0636 ppm
Variance of Distortion:	33.8453 ppm²
Area between -5 and 5 ppm:	63.0261%
Area between -10 and 10 ppm:	92.6282%
Area between -20 and 20 ppm:	99.9997%

Municipal Distortion Coverage

Area between -5 and 5 ppm (muni):	76.8410%
Area between -10 and 10 ppm (muni):	95.3171%
Area between -20 and 20 ppm (muni):	100.0000%

Map created by Christopher Poetschner based on maps created by Michael Dennis in the Kansas Regional Coordinate System Project Report.
(Rendered: 4/22/2021)



ICS83: 33 Zone

ICS83-Carlinville

Zone 25

0 3 6 12 18 24 Miles

N

Scale: 1:400,000 (When printed on 11" x 17" paper)
Faint white lines delineate townships

Legend

- Central Meridian or Parallel
- 6-Mile Zone Buffer
- Zone Boundary
- State Boundary
- County Boundary
- Municipality

Linear Distortion (parts per million)

- Zero distortion
- ≤ -30 ppm (0.16 ft / mile)
- -30 to -20 ppm
- -20 to -10 ppm
- -10 to -5 ppm
- -5 to 5 ppm (0.025 ft / mile)
- 5 to 10 ppm
- 10 to 20 ppm
- 20 to 30 ppm
- > 30 ppm (0.16 ft / mile)

Projection Type: Lambert Conformal Conic (single parallel)

Standard parallel / grid origin:	39° 18' 00" N
Central meridian:	269° 51' 00" E
Standard parallel scale:	1.00002 (exact)
False northing:	2756000 USft
False easting:	5741000 USft
Maximum negative distortion:	-9.4042 ppm
Mean distortion:	-0.4489 ppm
Maximum positive distortion:	14.5631 ppm
Variance of Distortion:	15.0868 ppm²
Area between -5 and 5 ppm:	81.0477% (municipality area: 89.5621%)
Area between -10 and 10 ppm:	98.6997% (municipality area: 99.9738%)
Area between -20 and 20 ppm:	100.0000% (municipality area: 100.0000%)

Map created by Christopher Poetschner based on maps created by Michael Dennis in the Kansas Regional Coordinate System Project Report. (Rendered: 4/21/2021)

ICS83: 33 Zone

ICS83-Taylorville

Zone 26

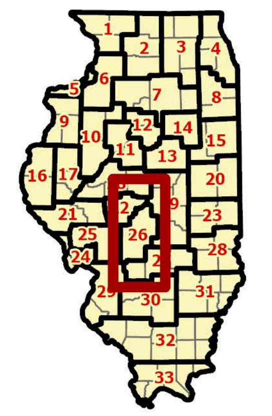
Scale: 1:400,000

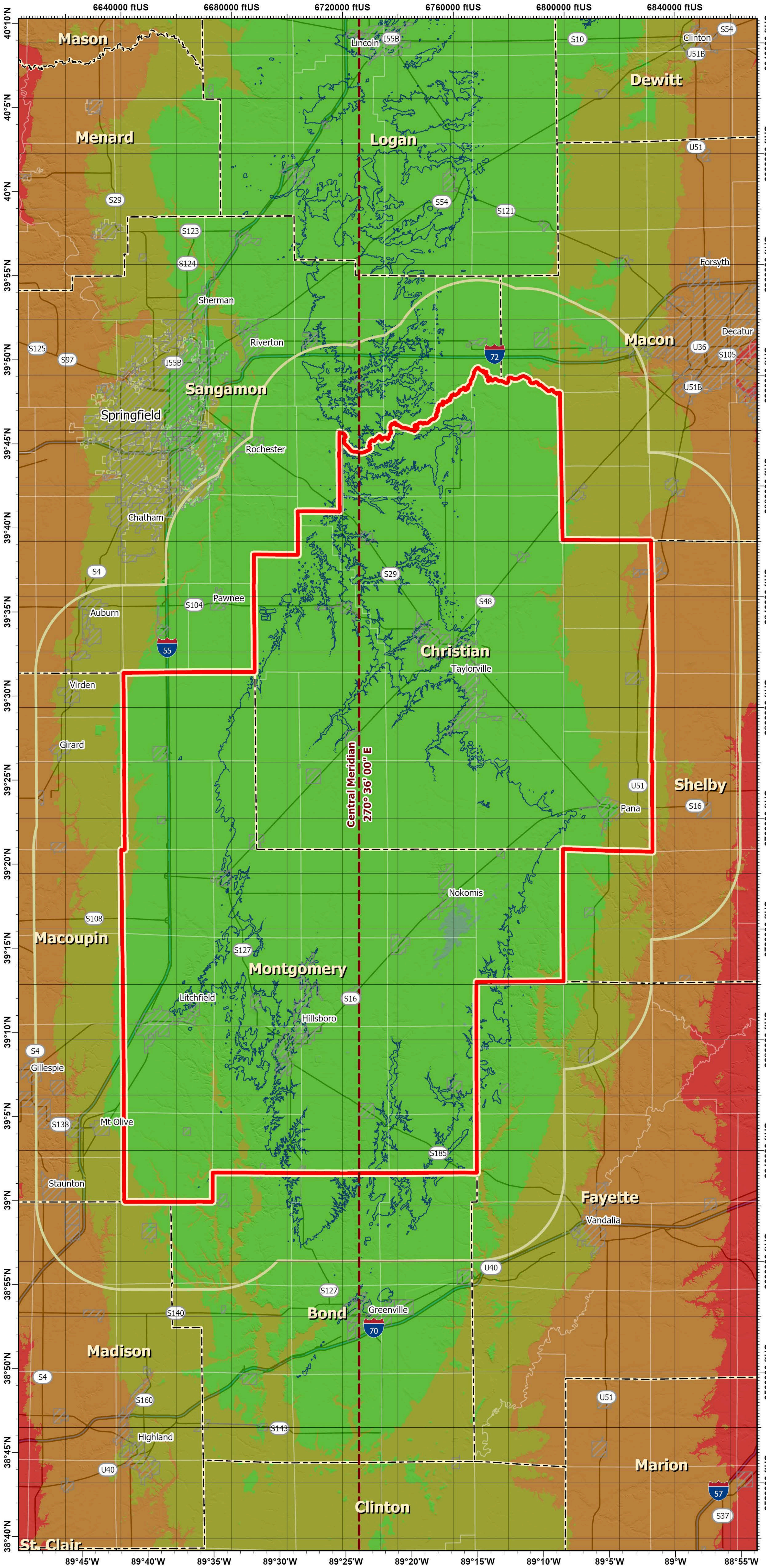
(When printed on 11" x 17" paper)

Faint white lines delineate townships

0 1.5 3 6 9 12 Miles

N





Legend

- Central Meridian or Parallel
- 6-Mile Zone Buffer
- Zone Boundary
- State Boundary
- County Boundary
- Municipality

Linear Distortion (parts per million)

- Zero distortion
- ≤ -30 ppm (0.16 ft / mile)
- -30 to -20 ppm
- -20 to -10 ppm
- -10 to -5 ppm
- -5 to 5 ppm (0.025 ft / mile)
- 5 to 10 ppm
- 10 to 20 ppm
- 20 to 30 ppm
- > 30 ppm (0.16 ft / mile)

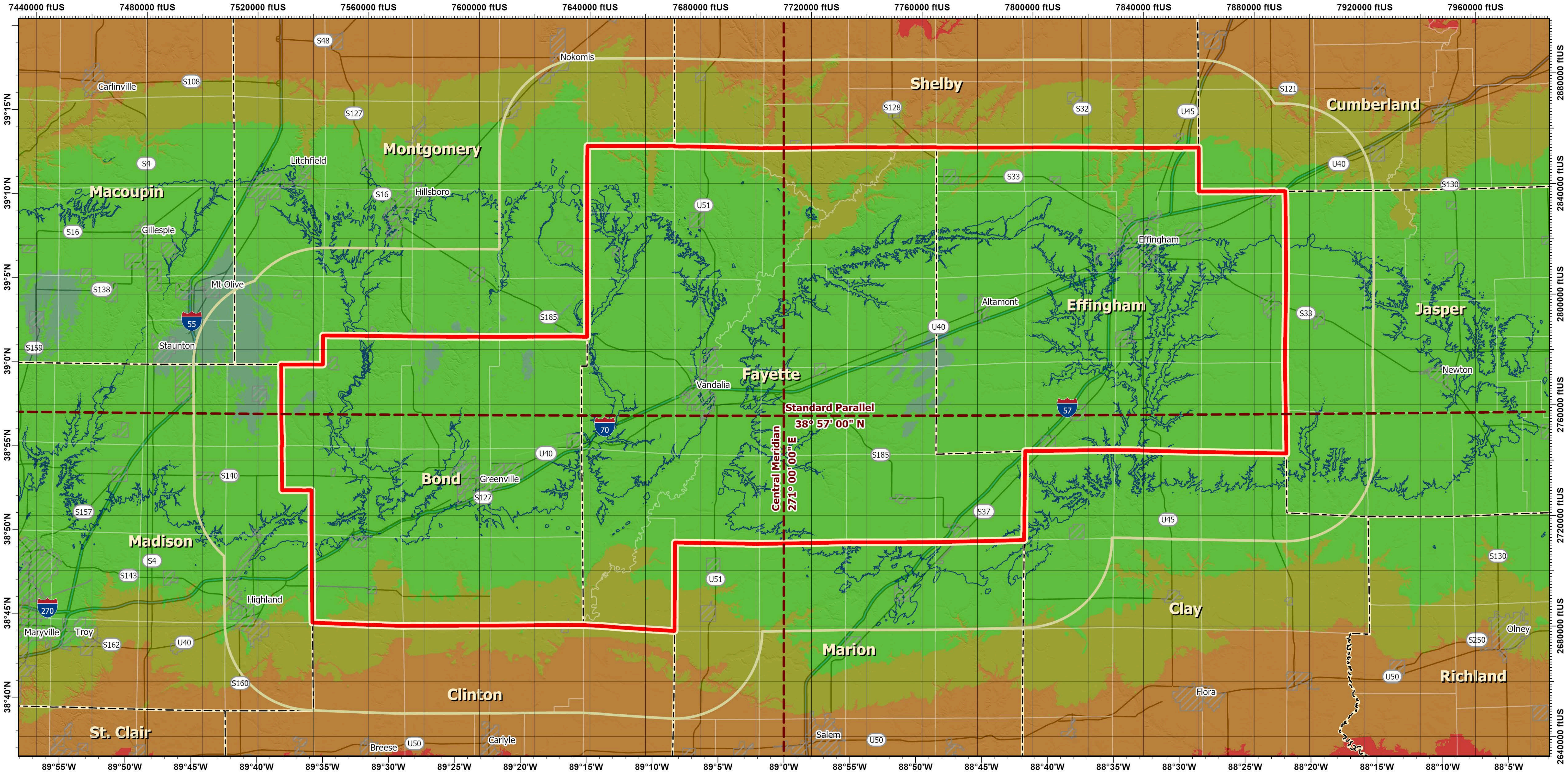
Projection Type: Transverse Mercator

Grid origin latitude:	33° 09' 00" N
Central meridian:	270° 36' 00" E
Central meridian scale factor:	1.000023 (exact)
False northing:	492000 USft
False easting:	6726000 USft
Maximum negative distortion:	-7.9100 ppm
Mean distortion:	0.7968 ppm
Maximum positive distortion:	12.4037 ppm
Variance of Distortion:	8.7662 ppm²
Area between -5 and 5 ppm:	91.1127%
Area between -10 and 10 ppm:	99.1793%
Area between -20 and 20 ppm:	100.0000%

Municipal Distortion Coverage

Area between -5 and 5 ppm (muni):	95.0787%
Area between -10 and 10 ppm (muni):	98.8664%
Area between -20 and 20 ppm (muni):	100.0000%

Map created by Christopher Poetschner based on maps created by Michael Dennis in the Kansas Regional Coordinate System Project Report.
(Rendered: 4/22/2021)



ICS83: 33 Zone

ICS83-Effingham

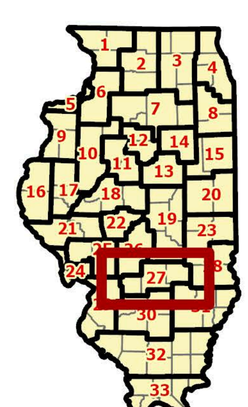
Zone 27

0 3 6 12 18 24 Miles

N

Scale: 1:400,000 (When printed on 11" x 17" paper)

Faint white lines delineate townships



Legend

- Central Meridian or Parallel
- 6-Mile Zone Buffer
- Zone Boundary
- State Boundary
- County Boundary
- Municipality

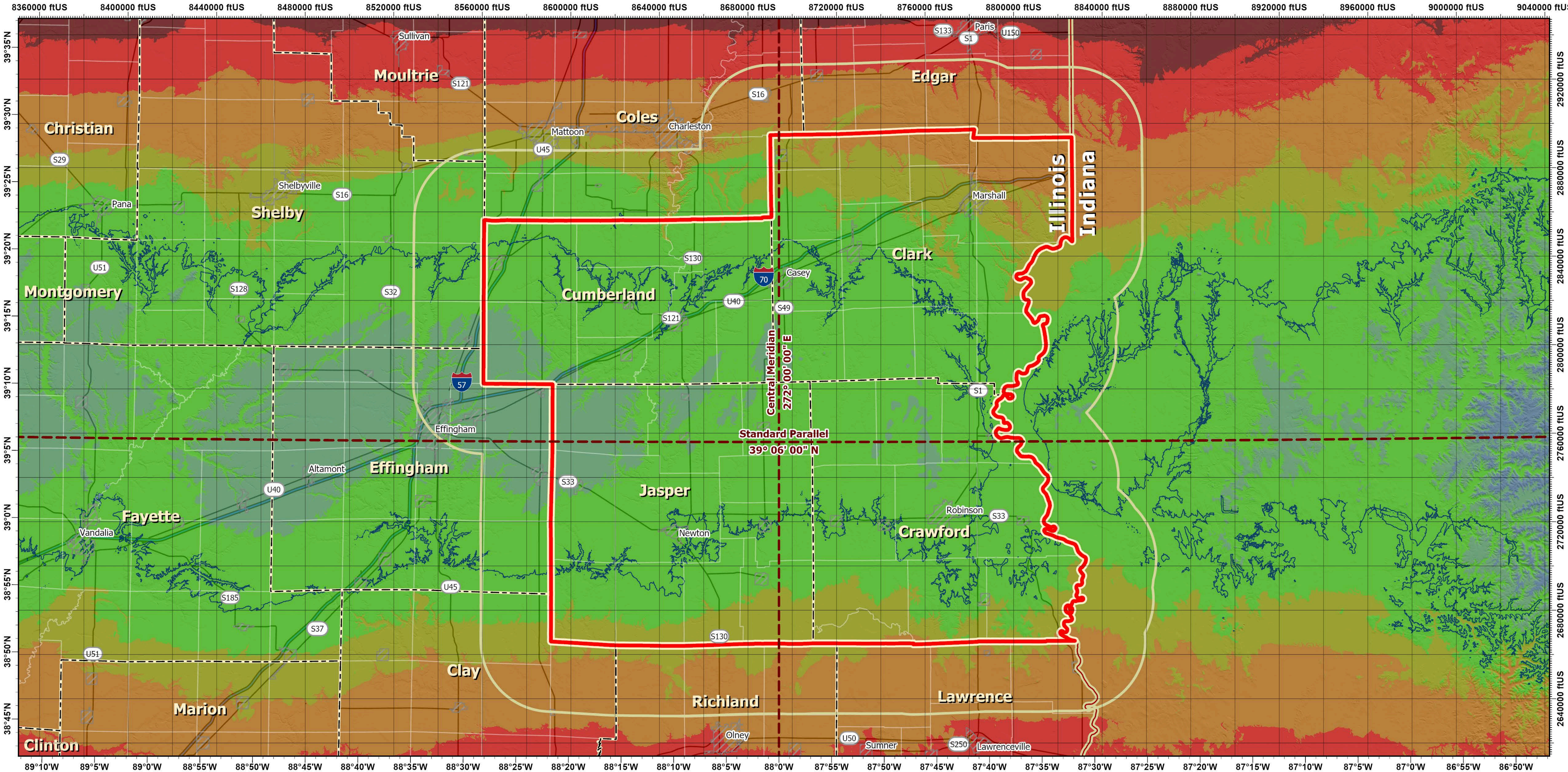
Linear Distortion (parts per million)

- Zero distortion
- ≤ -30 ppm (0.16 ft / mile)
- -30 to -20 ppm
- -20 to -10 ppm
- -10 to -5 ppm
- -5 to 5 ppm (0.025 ft / mile)
- 5 to 10 ppm
- 10 to 20 ppm
- 20 to 30 ppm
- > 30 ppm (0.16 ft / mile)

Projection Type: Lambert Conformal Conic (single parallel)

Standard parallel / grid origin:	38° 57' 00" N
Central meridian:	271° 00' 00" E
Standard parallel scale:	1.000019 (exact)
False northing:	2756000 USft
False easting:	7710000 USft
Maximum negative distortion:	-7.7568 ppm
Mean distortion:	-0.1683 ppm
Maximum positive distortion:	10.8140 ppm
Variance of Distortion:	9.6383 ppm²
Area between -5 and 5 ppm:	91.1963% (municipality area: 98.7401%)
Area between -10 and 10 ppm:	99.9830% (municipality area: 100.0000%)
Area between -20 and 20 ppm:	100.0000% (municipality area: 100.0000%)

Map created by Christopher Poetschner based on maps created by Michael Dennis in the Kansas Regional Coordinate System Project Report. (Rendered: 4/21/2021)



ICS83: 33 Zone

ICS83-Robinson

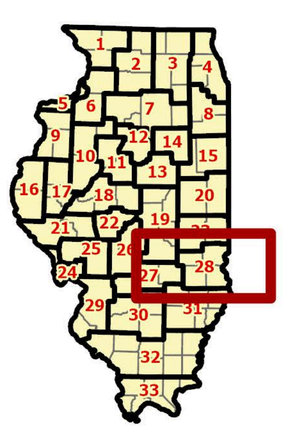
Zone 28

0 3.75 7.5 15 22.5 30 Miles

N

Scale: 1:500,000 (When printed on 11" x 17" paper)

Faint white lines delineate townships



Legend

- Central Meridian or Parallel
- 6-Mile Zone Buffer
- Zone Boundary
- State Boundary
- County Boundary
- Municipality

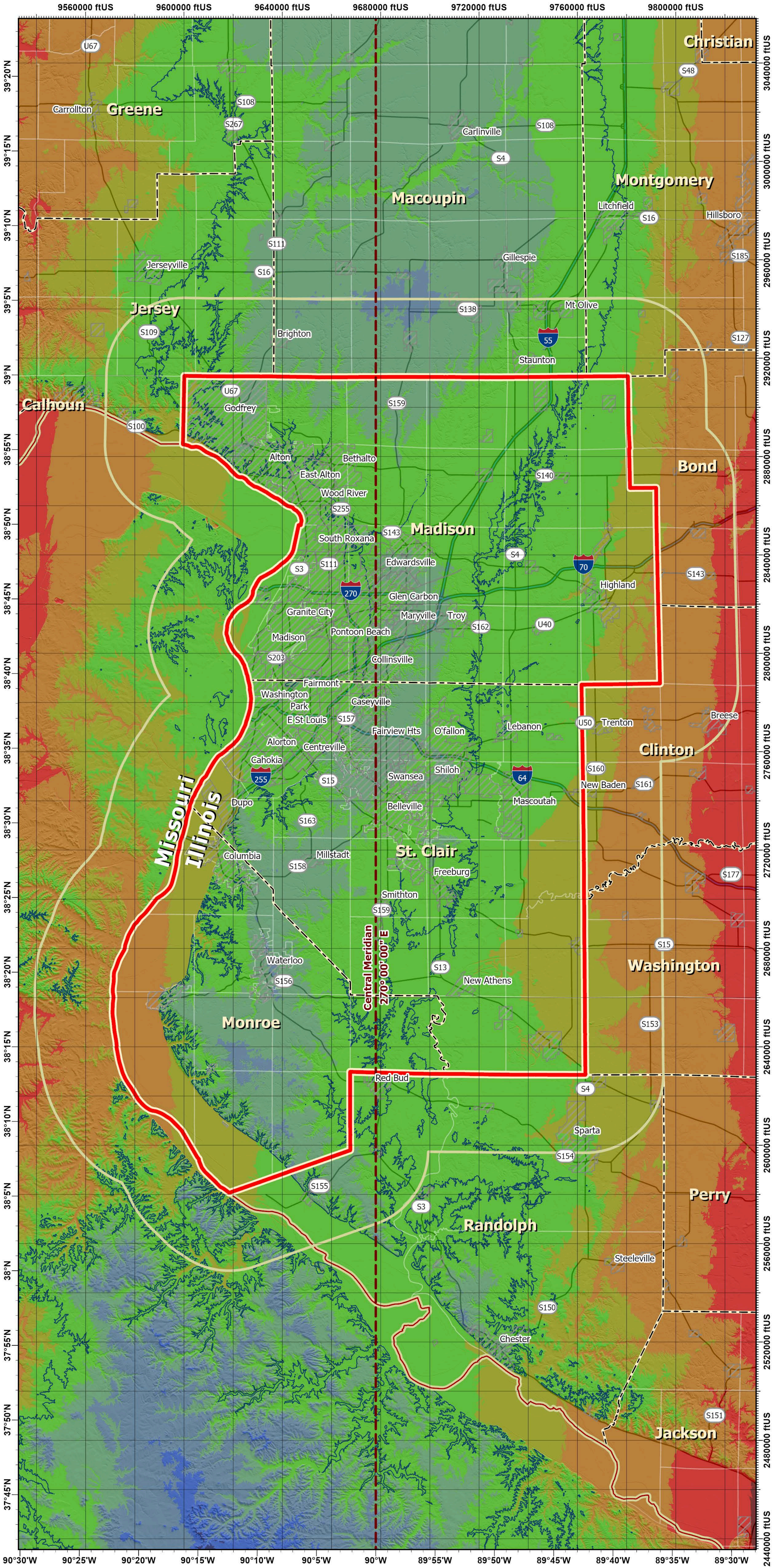
Linear Distortion (parts per million)

- Zero distortion
- ≤ -30 ppm (0.16 ft / mile)
- -30 to -20 ppm
- -20 to -10 ppm
- -10 to -5 ppm
- -5 to 5 ppm (0.025 ft / mile)
- 5 to 10 ppm
- 10 to 20 ppm
- 20 to 30 ppm
- > 30 ppm (0.16 ft / mile)

Projection Type: Lambert Conformal Conic (single parallel)

Standard parallel / grid origin:	39° 06' 00" N
Central meridian:	272° 00' 00" E
Standard parallel scale:	1.000017 (exact)
False northing:	2756000 USft
False easting:	8694000 USft
Maximum negative distortion:	-7.9623 ppm
Mean distortion:	0.6181 ppm
Maximum positive distortion:	18.2850 ppm
Variance of Distortion:	22.3341 ppm²
Area between -5 and 5 ppm:	74.3821% (municipality area: 84.9691%)
Area between -10 and 10 ppm:	95.5942% (municipality area: 99.6719%)
Area between -20 and 20 ppm:	100.0000% (municipality area: 100.0000%)

Map created by Christopher Poetschner based on maps created by Michael Dennis in the Kansas Regional Coordinate System Project Report. (Rendered: 4/21/2021)



ICS83: 33 Zone

ICS83-Belleville

Zone 29

Scale: 1:450,000

(When printed on 11" x 17" paper)

Faint white lines delineate townships

0 1.75 3.5 7 10.5 14 Miles

Legend

- Central Meridian or Parallel
- 6-Mile Zone Buffer
- Zone Boundary
- State Boundary
- County Boundary
- Municipality

Linear Distortion (parts per million)

- Zero distortion
- ≤ -30 ppm (0.16 ft / mile)
- -30 to -20 ppm
- -20 to -10 ppm
- -10 to -5 ppm
- -5 to 5 ppm (0.025 ft / mile)
- 5 to 10 ppm
- 10 to 20 ppm
- 20 to 30 ppm
- > 30 ppm (0.16 ft / mile)

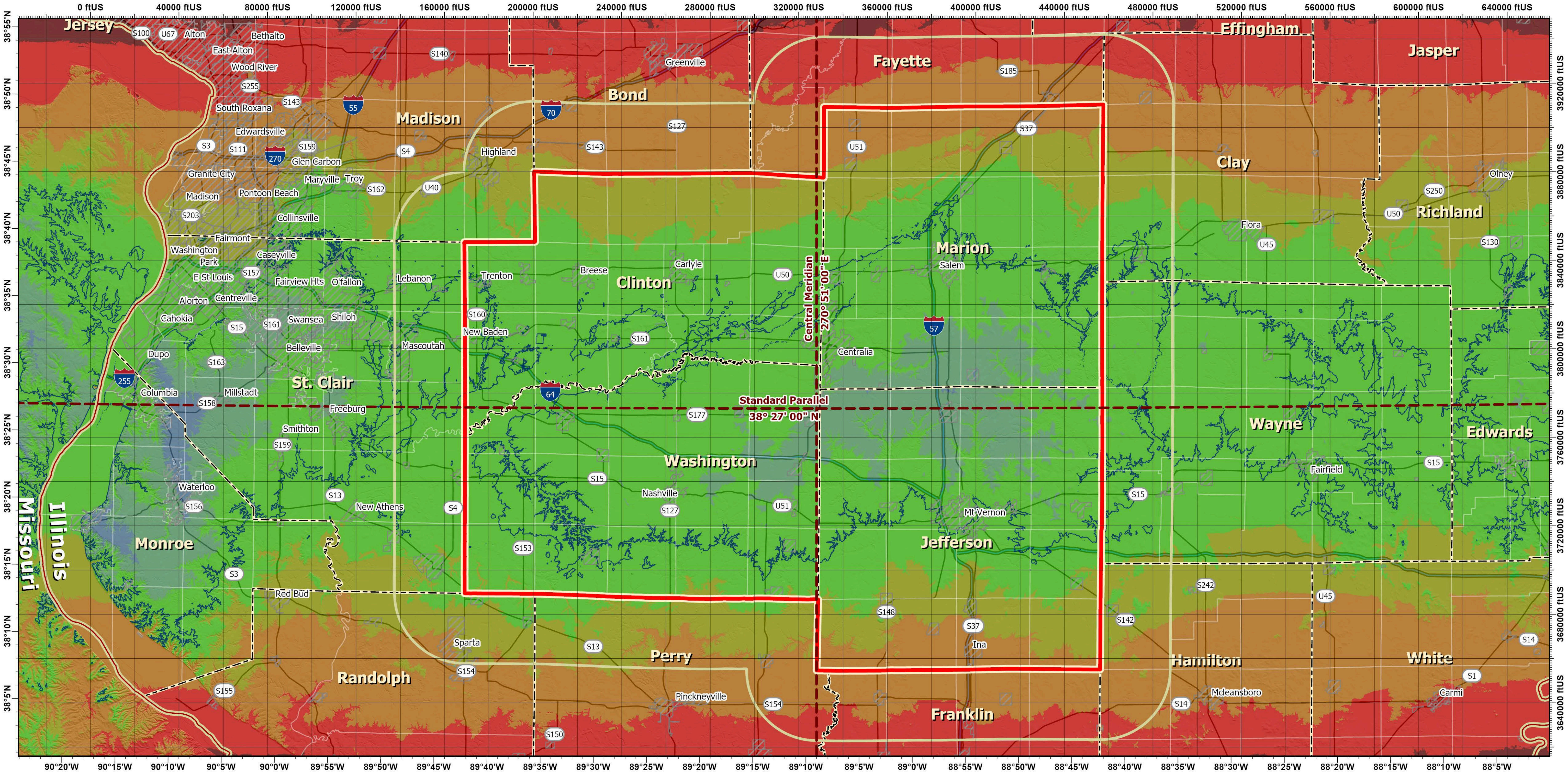
Projection Type: Transverse Mercator

Grid origin latitude:	32° 21' 00" N
Central meridian:	270° 00' 00" E
Central meridian scale factor:	1.000016 (exact)
False northing:	492000 USft
False easting:	9678000 USft
Maximum negative distortion:	-13.4188 ppm
Mean distortion:	0.1994 ppm
Maximum positive distortion:	16.1309 ppm
Variance of Distortion:	25.9698 ppm²
Area between -5 and 5 ppm:	66.2480%
Area between -10 and 10 ppm:	95.6167%
Area between -20 and 20 ppm:	100.0000%

Municipal Distortion Coverage

Area between -5 and 5 ppm (muni):	76.7328%
Area between -10 and 10 ppm (muni):	99.4877%
Area between -20 and 20 ppm (muni):	100.0000%

Map created by Christopher Poetschner based on maps created by Michael Dennis in the Kansas Regional Coordinate System Project Report.
(Rendered: 4/22/2021)



ICS83: 33 Zone

ICS83-Mount Vernon

Zone 30

0 3.75 7.5 15 22.5 30 Miles

N

Scale: 1:500,000 (When printed on 11" x 17" paper)

Faint white lines delineate townships

Legend

- Central Meridian or Parallel
- 6-Mile Zone Buffer
- Zone Boundary
- State Boundary
- County Boundary
- Municipality

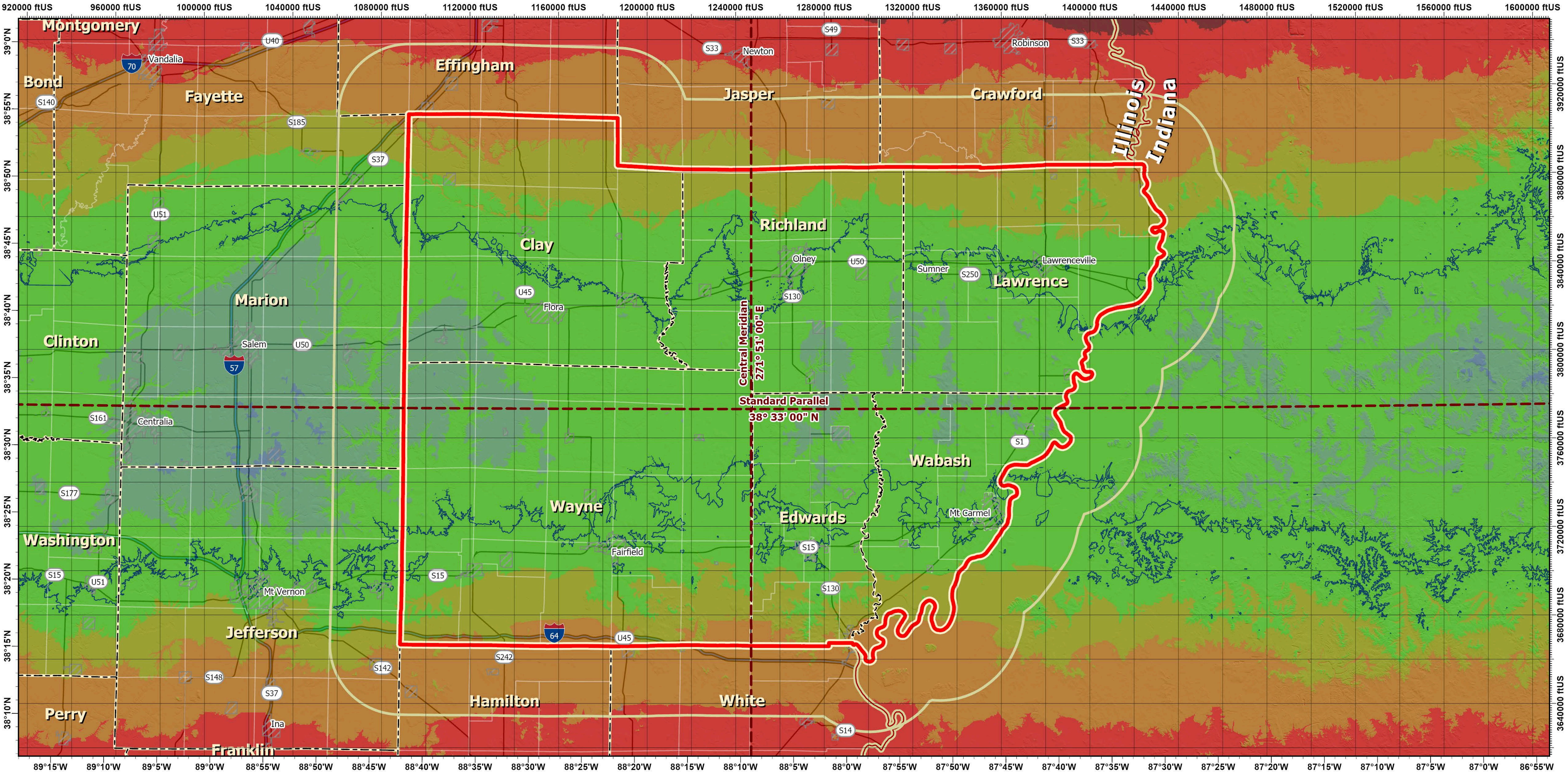
Linear Distortion (parts per million)

- Zero distortion
- ≤ -30 ppm (0.16 ft / mile)
- -30 to -20 ppm
- -20 to -10 ppm
- -10 to -5 ppm
- -5 to 5 ppm (0.025 ft / mile)
- 5 to 10 ppm
- 10 to 20 ppm
- 20 to 30 ppm
- > 30 ppm (0.16 ft / mile)

Projection Type: Lambert Conformal Conic (single parallel)

Standard parallel / grid origin:	38° 27' 00" N
Central meridian:	270° 51' 00" E
Standard parallel scale:	1.000015 (exact)
False northing:	3773000 USft
False easting:	328000 USft
Maximum negative distortion:	-10.8893 ppm
Mean distortion:	1.1534 ppm
Maximum positive distortion:	19.4405 ppm
Variance of Distortion:	25.4310 ppm²
Area between -5 and 5 ppm:	69.6493% (municipality area: 79.9023%)
Area between -10 and 10 ppm:	93.1517% (municipality area: 93.1559%)
Area between -20 and 20 ppm:	100.0000% (municipality area: 100.0000%)

Map created by Christopher Poetschner based on maps created by Michael Dennis in the Kansas Regional Coordinate System Project Report. (Rendered: 4/22/2021)



ICS83: 33 Zone

ICS83-Olney

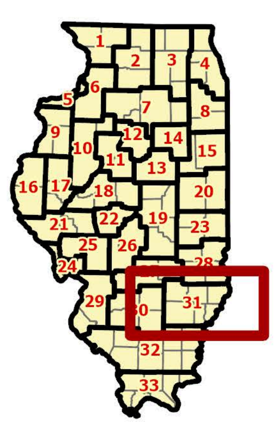
Zone 31

0 3.75 7.5 15 22.5 30 Miles

N

Scale: 1:500,000 (When printed on 11" x 17" paper)

Faint white lines delineate townships



Legend

- Central Meridian or Parallel
- 6-Mile Zone Buffer
- Zone Boundary
- State Boundary
- County Boundary
- Municipality

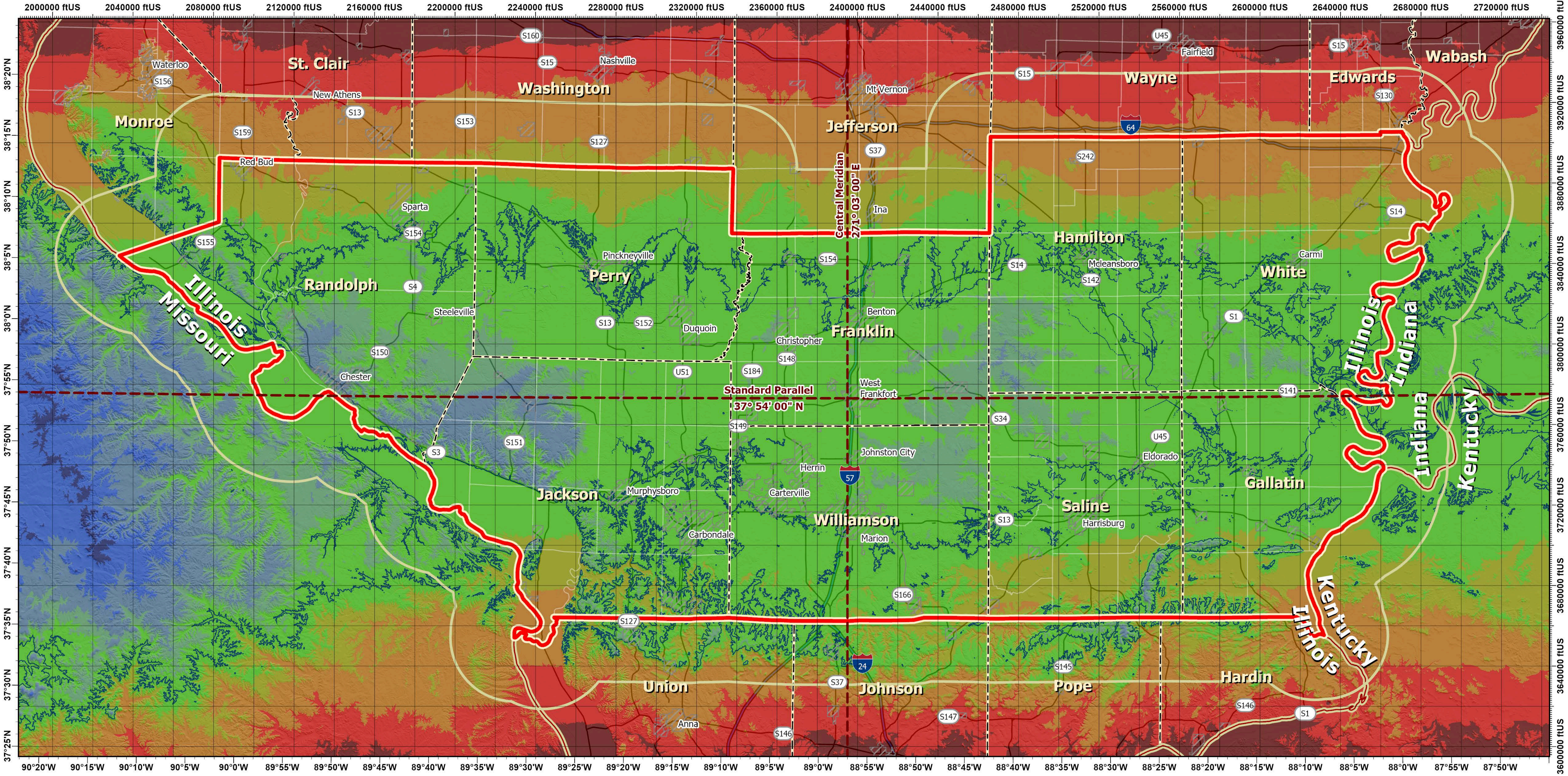
Linear Distortion (parts per million)

- Zero distortion
- ≤ -30 ppm (0.16 ft / mile)
- -30 to -20 ppm
- -20 to -10 ppm
- -10 to -5 ppm
- -5 to 5 ppm (0.025 ft / mile)
- 5 to 10 ppm
- 10 to 20 ppm
- 20 to 30 ppm
- > 30 ppm (0.16 ft / mile)

Projection Type: Lambert Conformal Conic (single parallel)

Standard parallel / grid origin:	38° 33' 00" N
Central meridian:	271° 51' 00" E
Standard parallel scale:	1.000013 (exact)
False northing:	3773000 USft
False easting:	1247000 USft
Maximum negative distortion:	-10.6943 ppm
Mean distortion:	0.9835 ppm
Maximum positive distortion:	16.0960 ppm
Variance of Distortion:	22.3807 ppm²
Area between -5 and 5 ppm:	69.6964% (municipality area: 87.8145%)
Area between -10 and 10 ppm:	95.8026% (municipality area: 99.0156%)
Area between -20 and 20 ppm:	100.0000% (municipality area: 100.0000%)

Map created by Christopher Poetschner based on maps created by Michael Dennis in the Kansas Regional Coordinate System Project Report. (Rendered: 4/22/2021)



ICS83: 33 Zone

ICS83-Carbondale

Zone 32

0 4 8 16 24 32 Miles

N

Scale: 1:550,000 (When printed on 11" x 17" paper)

Faint white lines delineate townships

Legend

- Central Meridian or Parallel
- 6-Mile Zone Buffer
- Zone Boundary
- State Boundary
- County Boundary
- Municipality

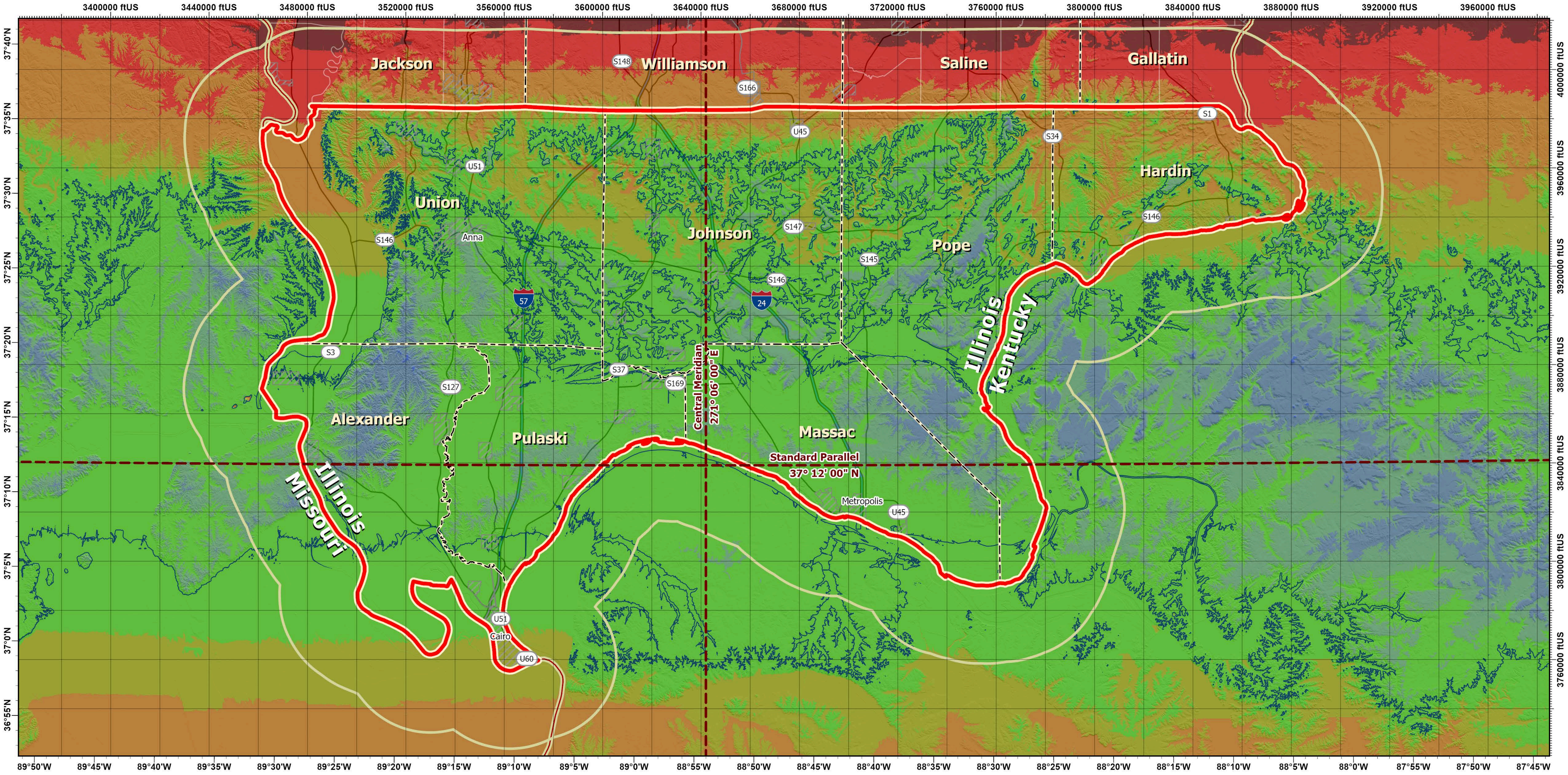
Linear Distortion (parts per million)

- Zero distortion
- ≤ -30 ppm (0.16 ft / mile)
- -30 to -20 ppm
- -20 to -10 ppm
- -10 to -5 ppm
- -5 to 5 ppm (0.025 ft / mile)
- 5 to 10 ppm
- 10 to 20 ppm
- 20 to 30 ppm
- > 30 ppm (0.16 ft / mile)

Projection Type: Lambert Conformal Conic (single parallel)

Standard parallel / grid origin:	37° 54' 00" N
Central meridian:	271° 03' 00" E
Standard parallel scale:	1.000012 (exact)
False northing:	3773000 USft
False easting:	2395000 USft
Maximum negative distortion:	-20.6390 ppm
Mean distortion:	0.5497 ppm
Maximum positive distortion:	19.3120 ppm
Variance of Distortion:	28.2138 ppm²
Area between -5 and 5 ppm:	71.1635% (municipality area: 83.2581%)
Area between -10 and 10 ppm:	92.0522% (municipality area: 95.1485%)
Area between -20 and 20 ppm:	99.9999% (municipality area: 100.0000%)

Map created by Christopher Poetschner based on maps created by Michael Dennis in the Kansas Regional Coordinate System Project Report. (Rendered: 4/22/2021)



ICS83: 33 Zone

ICS83-Metropolis

Zone 33

0 3.25 6.5 13 19.5 26 Miles

N

Scale: 1:450,000 (When printed on 11" x 17" paper)

Faint white lines delineate townships

Legend

- Central Meridian or Parallel
- 6-Mile Zone Buffer
- Zone Boundary
- State Boundary
- County Boundary
- Municipality

Linear Distortion (parts per million)

- Zero distortion
- ≤ -30 ppm (0.16 ft / mile)
- -30 to -20 ppm
- -20 to -10 ppm
- -10 to -5 ppm
- -5 to 5 ppm (0.025 ft / mile)
- 5 to 10 ppm
- 10 to 20 ppm
- 20 to 30 ppm
- > 30 ppm (0.16 ft / mile)

Projection Type: Lambert Conformal Conic (single parallel)

Standard parallel / grid origin:	37° 12' 00" N
Central meridian:	271° 06' 00" E
Standard parallel scale:	1.00001 (exact)
False northing:	3839000 USft
False easting:	3642000 USft
Maximum negative distortion:	-23.9833 ppm
Mean distortion:	0.5508 ppm
Maximum positive distortion:	23.0794 ppm
Variance of Distortion:	33.7575 ppm²
Area between -5 and 5 ppm:	64.2869% (municipality area: 76.3653%)
Area between -10 and 10 ppm:	90.3971% (municipality area: 99.6592%)
Area between -20 and 20 ppm:	99.8968% (municipality area: 100.0000%)

Map created by Christopher Poetschner based on maps created by Michael Dennis in the Kansas Regional Coordinate System Project Report. (Rendered: 4/22/2021)

Appendix H – Illinois Coordinate System of 2022: Single Zone

This space reserved for information on the statewide single-zone projection to be developed by NGS.

Appendix I – Illinois Coordinate System of 2022: 33 Zone

This space reserved for future information to be published concerning the ICS2022: 33 Zone to be released with SPCS2022.

Appendix J – Illinois Coordinate Transformation Tool (ILCAT)

The Illinois Coordinate Transformation Tool (ILCAT) will offer coordinate transformations between NAD 83 coordinates of various projections. This tool will NOT provide transformations between NAD 83 and NATRF2022 coordinates. It is anticipated that NGS will develop an official tool for transformations between datums.

ILCAT can be found on the Illinois Geospatial Data Clearinghouse. https://clearinghouse.isgs.illinois.edu/

NGS Coordinate Conversion and Transformation Tool (NCAT) will be updated to transform coordinates from historic datums (NAD 27, NAD 83, etc.) to coordinates in the modernized NSRS at the first reference epoch of the modernized NSRS (2020.00). Single-zone and multi-zone layers that are a part of the NSRS will be incorporated into this tool.

NOTE: Depending on your accuracy requirements, consider saving original observation files and/or plan for re-observations. Transformations can introduce distortions inherent in the transformation parameters that may be able to be reduced or eliminated by re-processing or re-observing positions directly in the new datum and resulting coordinate system.

Knowing the datums and epochs for your geospatial files will simplify your datum transformations, so require complete metadata statements to be recorded in all surveying and mapping contracts.

ICS GUIDE
Corrections

As of July 1, 2023

Item	Current Version	Page	Line	Current	Next Version	Notes	Corrected in Version
1	0.9	Where applicable	Where applicable	"subsystem(s)"	"coordinate reference system(s)"	This would align the Guide with ISO standards.	
2	0.9	Where applicable	Where applicable	Titles and Subtitles	The coordinate reference system Titles and Subtitle headings in the Table of Contents and throughout the Guide should match, and also match the list of coordinate reference systems on the naming convention poster contained in the document (page 35).	Example of correction; ICS27: 2 Zone, ICS27: ILLIMAP, ICS2022: 33 Zone, ICS2022: Single Zone.	
3	0.9	66		Average Elevation of Zone (sft)	Remove the "Average Elevation of Zone (sft)" column from the table.	This column was included in a previous table for calculating optimal zone designs statewide.	
4	0.9	Where applicable	Where applicable		The Guide is missing information concerning how to work with local coordinate reference systems.	How metadata is managed when working with a local coordinate reference system should be added to the Guide.	
5	0.9	Where applicable	Where applicable		Definition of North and East (West) along with Y and X is missing from the Guide.	North as Y and East (West) as X is defined in current legislation and needs to carry over to the Guide. (This can be added to the "unit of measurement" definition - see Item 8)	
6	0.9	67			Replace the table with the corrected table.	Update the table to correct the rounding error for the check points in the original submittal to NGS.	
7	0.9	Where applicable	Where applicable	Illinois State Plane Coordinate System Committee	Illinois Coordinate System Committee	Remove "State Plane" from the committee name to align with proposed legislation and align with the separation of SPCS and non-SPCS recognized coordinate reference systems in the Guide.	
8	0.9	Where applicable	Where applicable		Define units of measurement in the Guide.	Add the definition for US Survey Foot, International Foot and Meters to the Guide. (This can be added to the "North and East" definition - see Item 5)	