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Flood-Inundation Maps for a Nine-Mile Reach of the Des Plaines River from Riverwoods to Mettawa, Illinois

Scientific Investigations Report 2012–5227

U.S. Department of the Interior
U.S. Geological Survey

Cover photo. View of houses surrounded by flood waters along Rivershire Lane in Lincolnshire, Illinois, taken from a helicopter on May 25, 2004. Photograph provided by Lake County Stormwater Management Commission.

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KEN SALAZAR, Secretary

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Map Sheets

(Map sheets are also available for downloading separately at *http://pubs.usgs.gov/sir/2012/5227/*.)

Conversion Factors

Multiply	By	To obtain
	Length	
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
square mile (mi^2)	2.590	square kilometer (km^2)
	Flow rate	
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
	Hydraulic gradient	
foot per mile (ft/mi)	0.1894	meter per kilometer (m/km)

Vertical coordinate information is referenced to the North American Vertical Datum of 1988 (NAVD 88).

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

Elevation, as used in this report, refers to distance above the vertical datum.

Flood-Inundation Maps for a Nine-Mile Reach of the Des Plaines River from Riverwoods to Mettawa, Illinois

By Elizabeth A. Murphy, David T. Soong, and Jennifer B. Sharpe

Abstract

Digital flood-inundation maps for a 9-mile reach of the Des Plaines River from Riverwoods to Mettawa, Illinois, were created by the U.S. Geological Survey (USGS) in cooperation with the Lake County Stormwater Management Commission and the Villages of Lincolnshire and Riverwoods. The inundation maps, which can be accessed through the USGS Flood Inundation Mapping Science Web site at *http://water.usgs.gov/osw/flood_inundation/,* depict estimates of the areal extent of flooding corresponding to selected water levels (gage heights) at the USGS streamgage at Des Plaines River at Lincolnshire, Illinois (station no. 05528100). Current conditions at the USGS streamgage may be obtained on the Internet at *http://waterdata.usgs.gov/usa/nwis/uv?05528100*. In addition, this streamgage is incorporated into the Advanced Hydrologic Prediction Service (AHPS) flood warning system (*http://water.weather.gov/ahps/*) by the National Weather Service (NWS). The NWS forecasts flood hydrographs at many places that are often co-located at USGS streamgages. The NWS forecasted peak-stage information, also shown on the Des Plaines River at Lincolnshire inundation Web site, may be used in conjunction with the maps developed in this study to show predicted areas of flood inundation.

In this study, flood profiles were computed for the stream reach by means of a one-dimensional step-backwater model. The hydraulic model was then used to determine seven water-surface profiles for flood stages at roughly 1-ft intervals referenced to the streamgage datum and ranging from the 50- to 0.2-percent annual exceedance probability flows. The simulated water-surface profiles were then combined with a Geographic Information System (GIS) Digital Elevation Model (DEM) (derived from Light Detection And Ranging (LiDAR) data) in order to delineate the area flooded at each water level.

These maps, along with information on the Internet regarding current gage height from USGS streamgages and forecasted stream stages from the NWS, provide emergency management personnel and residents with information that is critical for flood response activities such as evacuations and road closures, as well as for post-flood recovery efforts.

Introduction

Lake County is part of the Chicago, Illinois (Ill.), metropolitan area, with a population of 703,462 in 2010 (U.S. Census Bureau, 2012). Parts of Lake County have experienced severe flooding numerous times, most notably in September 1986, August 2007, and September 2008. Damage costs along the Des Plaines River for the 1986 flood were reported to be $35 million (Northwest Municipal Conference, 2012). Flood plains within Lake County are highly urbanized and contain a mix of residential and commercial structures.

Prior to this study, Lake County and municipal officials relied on several information sources to make decisions on how to best alert the public about impending flooding and to mitigate flood damages. One source is the Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS) for Lake County, Illinois, and Incorporated Areas, dated November 16, 2006 (Federal Emergency Management Agency, 2006). A second source of information has been the U.S. Geological Survey (USGS) streamgage Des Plaines River at Lincolnshire, Ill. (station no. 05528100), from which current or historical water levels (gage heights) can be obtained. A third source has been the National Weather Service (NWS) forecast of peak stage (gage height) at the USGS Lincolnshire streamgage through the Advanced Hydrologic Prediction Service (AHPS) site. The Illinois Department of Natural Resources-Office of Water Resources (IDNR-OWR) provides inundation and depth information in near real time for some flood forecasts issued by the NWS. Although USGS current gage height and NWS forecast stage information is particularly useful for residents in the immediate vicinity of a streamgage, it is of limited use to residents farther upstream or downstream because the water-surface elevation is not constant along the entire stream channel. Also, FEMA and State emergency management mitigation teams or property owners typically lack information related to how deep the water is at locations other than near USGS streamgage or NWS flood-forecast points.

Purpose and Scope

The purpose of this report is to (1) describe the development of a series of estimated flood-inundation maps for a 9-mile reach of the Des Plaines River between Mettawa and Riverwoods, Ill., and (2) provide users with a library of flood-inundation maps that correspond to water levels referenced to the water-surface elevation and gage heights at the USGS streamgage on the Des Plaines River at Lincolnshire, Ill. The reference gage heights range from 13.2 ft to 19.1 ft, corresponding to floods at the streamgage with annual exceedance probability ranging from 50 to 0.2 percent, respectively. This report is a description of the Des Plaines River inundation maps and other flood information available on the USGS Flood Inundation Mapping Science Web site at *http://water.usgs.gov/osw/flood_inundation/*.

Study Area Description

The Des Plaines River is in northeast Illinois in the Central Lowland physiographic province (Illinois State Geological Survey, 2012). The drainage area is 273 mi^2 at the Lincolnshire streamgage (table 1; U.S. Geological Survey, 2011).

The headwaters of the Des Plaines River are in southeast Wisconsin, and the stream flows generally southward before entering the study area (fig. 1). The basin terrain is generally flat. The study reach is approximately 9 mi long, has an average top-of-bank channel width of about 165 ft, and an average channel slope of 1.1 ft/mi. Lake County is still under development, as evidenced by a population increase of 9.2 percent (from 644,356 to 703,462) between 2000 and 2010 (U.S. Census Bureau, 2012). The land use along the study reach is a mix of commercial, residential, and forest preserve land. The main channel within the study reach has three major road crossings.

Previous Studies

The current FIS for Lake County, Illinois, and Incorporated Areas, dated November 16, 2006 (Federal Emergency Management Agency, 2006), includes the hydrologic and hydraulic analysis of the Des Plaines River completed by the U.S. Army Corps of Engineers (USACE) for the September 7, 2000, revision of the FIS. The USACE analysis of the Des Plaines River included calibrating the HEC-1 hydrologic model and HEC-2 hydraulic model to statistical analyses of four long-term USGS streamgages on the Des Plaines River where discharge is computed (at Russell, Ill. (05527800), near Gurnee, Ill. (05528000), near Des Plaines, Ill. (05529000), and at Riverside, Ill. (05532500); locations shown in fig. 1). The HEC-2 model was also validated with high-water marks from a flood in 1986 (Federal Emergency Management Agency, 2006). Estimates of the peak discharges for the 10-, 2-, 1-, and 0.2-percent annual exceedance probability flood along the Des Plaines River, as listed in table 2 for the study reach, are described by FEMA (2006).

Table 1. U.S. Geological Survey streamgage information for study area, Des Plaines River, Illinois.

[mi^2, square miles; ft, feet; NAVD 88, North American Vertical Datum of 1988]

Station name	Station number	Drainage area (mi^2)	Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Period of record	Maximum recorded elevation at gage (ft above NAVD 88) and date
Des Plaines River at Lincolnshire, Ill.	05528100	273	42°12′02″ N.	87°55′07″ W.	June 10, 2009, to current year (2012)	644.03 ft May 14, 2010

Table 2. Estimates of the 10-, 2-, 1-, and 0.2-percent annual exceedance probability peak discharge for a selected location on the Des Plaines River, Illinois (from Federal Emergency Management Agency, 2006).

[mi^2, square miles; ft^3/s, cubic feet per second]

Location on Des Plaines River	Drainage area (mi^2)	Annual exceedance probability peak-discharge estimate			
		10-percent discharge estimate (ft^3/s)	2-percent discharge estimate (ft^3/s)	1-percent discharge estimate (ft^3/s)	0.2-percent discharge estimate (ft^3/s)
Approximately 0.98 mile downstream of Half Day Road	326.53	3,727	5,367	6,018	7,511

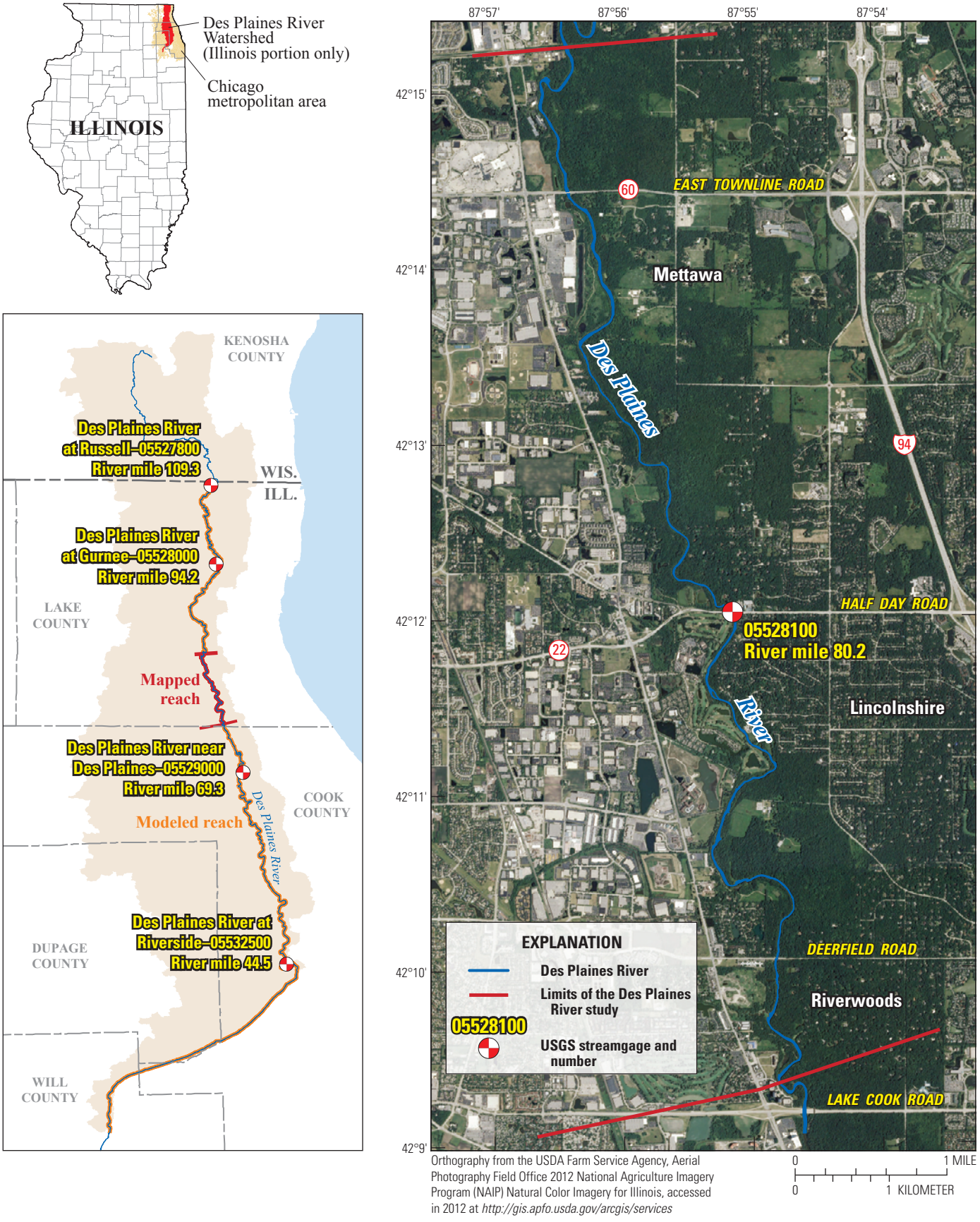


Figure 1. Map showing location of mapped reach for the Des Plaines River, Illinois, and location of U.S. Geological Survey streamgage and National Weather Service forecast point at Lincolnshire.

Constructing Water-Surface Profiles

The water-surface profiles used to produce the seven flood-inundation maps for this study were computed by using HEC-2, version 4.6 (U.S. Army Corps of Engineers, Hydrologic Engineering Center, 1991). HEC-2 is a one-dimensional step-backwater model for simulation of water-surface profiles with steady-state computation. The HEC-2 hydraulic model used in this study was provided by IDNR-OWR (David Mick, Illinois Department of Natural Resources-Office of Water Resources, written commun., 2009). It is an updated version of the effective FIS model developed by the USACE described above (Federal Emergency Management Agency, 2006) and is used by IDNR-OWR in a river inundation project based on NWS forecasts for the Des Plaines River. The HEC-2 model simulated reach covers approximately 90 mi of the Des Plaines River, of which a 9-mi reach was mapped in this study (fig. 1). Mapping a short part of the modeled reach allowed the model boundary conditions to be sufficiently far away from the mapped reach as to have no appreciable effect on the water-surface profile.

Hydrologic and Steady-Flow Data

Hydrologic data in the study area were from one streamgage (fig. 1; table 1), Des Plaines River at Lincolnshire, Ill. (05528100). This gage was installed in June 2009 and has been used to measure gage heights continuously since installation. All water-surface elevations are referenced to North American Vertical Datum of 1988 (NAVD 88). This location was operated as a crest-stage gage from 1962 to 1976 in cooperation with the Northeastern Illinois Metropolitan Area Planning Commission as part of flood-inundation studies. In addition, discrete discharge measurements have been made at this site since installation. These discharge measurements were the basis for a rating curve for this gaging station developed in 2011. The maximum gage height at the streamgage since installation has been 14.05 ft, so there have not been sufficiently high flows to collect discharge measurements corresponding to the range of gage heights in this inundation mapping study (13.2 ft to 19.1 ft).

The steady-flow data for the study reach were interpolated from the flows in the HEC-2 model from IDNR-OWR (David Mick, Illinois Department of Natural Resources-Office of Water Resources, written commun., 2009). These steady-state flows correspond to annual exceedance probabilities of 50-, 20-, 10-, 4-, 2-, 1-, and 0.2-percent. These existing flow data were used to construct curves of the range of annual exceedances (50- to 0.2-percent) for all flow-change locations in the HEC-2 model to estimate the flows needed for generating water-surface profiles at 1-ft intervals for gage heights between 13.2 and 19.1 ft.

Topographic/Bathymetric Data

The study model was a version of the effective FIS HEC-2 hydraulic model (Federal Emergency Management Agency, 2006) with some updates by IDNR (David Mick, Illinois Department of Natural Resources-Office of Water Resources, written commun., 2009). The USGS did not do any surveying in the field to change any channel cross sections in the model. Digital Elevation Model (DEM) data were derived from a 1-ft horizontal resolution Light Detection And Ranging (LiDAR) dataset with a vertical accuracy sufficient to produce 2-ft contours. The DEM data, created in 2005, were obtained from the Illinois Department of Natural Resources-Office of Water Resources (David Mick, Illinois Department of Natural Resources-Office of Water Resources, written commun., 2009).

Various structures (bridges, culverts, roadway embankments, levees, and dams) in and along the stream affect or have the potential to affect water-surface elevations during floods. To properly account for these features in the model, the structures in the study reach were checked for needed updates. It was found that changes had been made to structures since the model had last been updated by IDNR. As part of this study, USGS made updates to the HEC-2 model based on as-built drawings of Deerfield Road bridge and bike path (Mike Zemaitis, Lake County Division of Transportation, written commun., 2011) and Half Day Road (Route 22) bridge (E. Perry Masouridis, Illinois Department of Transportation, written commun., 2009).

Energy Loss Factors

Manning's roughness coefficients ("n" values) are used in hydraulic modeling for energy (friction) loss calculations. The Manning's n values used were 0.045 for the main channel and a range from 0.07 to 0.19 for the overbank areas modeled in this analysis. Ineffective flow areas were represented in the model with an n value of 100. The main channel bed is mostly gravel near the streamgage; the overbank areas are vegetated, with some areas having shrub and tree cover.

Model Verification

High-water marks were collected in the study area after a July 2010 flood; however, the peak gage height at the Des Plaines River at Lincolnshire streamgage (05528100) was below the lowest gage height modeled in this study. Because of the relatively short record (3 years) at the Lincolnshire streamgage, the established stage-discharge relation was developed with measured flows corresponding to gage heights at the low end of the range of gage heights mapped in this study. The limited stage-discharge relation at the gage, therefore, cannot be compared to the full range of stage-discharge data from the hydraulic model.

Although there is no additional verification of the USACE model by USGS for this study, the FIS report describes the calibration of the HEC-2 hydraulic model to statistical analyses of four long-term USGS streamgages on the Des Plaines River (at Russell, Ill. (05527800), near Gurnee, Ill. (05528000), near Des Plaines, Ill. (05529000), and at Riverside, Ill. (05532500); locations shown in fig. 1). The HEC-2 model was also validated with high-water marks from a flood in 1986 (Federal Emergency Management Agency, 2006).

Development of Water-Surface Profiles

Water-surface profiles were developed for a total of seven gage heights at an approximately 1-ft interval. The gage heights ranged between 13.2 ft and 19.1 ft as referenced to the Des Plaines River at Lincolnshire streamgage (05528100). This range of gage heights includes the 50-percent to the 0.2-percent annual exceedance probability floods.

Discharges corresponding to the various gage heights were obtained from the stage-discharge relation interpolated for the Lincolnshire streamgage by the IDNR (Rick Gosch, Illinois Department of Natural Resources-Office of Water Resources, written commun., 2009). The IDNR has developed a system to assign an interpolated annual exceedance probability to each cross section in the HEC-2 model on the basis of annual exceedance probability determined at the four long-term USGS streamgages on the Des Plaines River (at Russell, Ill. (05527800), near Gurnee, Ill. (05528000), near Des Plaines, Ill. (05529000), and at Riverside, Ill. (05532500)). The annual exceedance probabilities for each modeled cross section have associated gage heights. These gage heights were then used to create the water-surface profiles for each gage height from 13.2 to 19.1 ft.

Discharges for all profiles mapped in this study reach on the Des Plaines River are listed in table 3.

Inundation Mapping

Flood-inundation maps were developed for the seven water-surface profiles generated for the gage heights observed at the Des Plaines River at Lincolnshire gage. The maps were created in ArcMap (Ormsby and others, 2010) by combining the water-surface profiles and DEM data. Estimated flood-inundation boundaries for each simulated profile were created by using a DEM with a 10-ft cell size, modeled cross sections, and water-surface elevations for specific predefined stages for the cross sections derived from the HEC-2 hydraulic model. Water-surface elevation values were joined to the corresponding cross section, and a water-level surface for each predefined gage height was generated by using an Arc Macro Language (AML) (ESRI, 1999) script modified from an AML provided by the Illinois Department of Natural Resources (IDNR) (David Mick, Illinois Department of Natural Resources-Office of Water Resources, written commun., 2009). The inundation surface and the depth grids were then created by subtracting the ground-surface DEM elevations from the water-level-surface elevations. Cells with a value greater than 0.1 were retained, and the result was two grids—a flat-surface grid representing the extent of inundation and a depth grid retaining the differences between the ground-surface and water-surface elevations. The inundation maps show depth shading for estimated flooded areas overlaid on high-resolution, georeferenced aerial photographs of the study area for each of the water-surface profiles that were generated by the hydraulic model for approximately every foot change in gage height ranging from 13.2 to 19.1 ft. For mapping purposes, the depth grids were displayed by using a 1-ft interval up to 2 ft, grouping depths from 2.1 ft to 5 ft and then one shade of color for values greater than 5 ft.

Table 3. Discharge estimates corresponding to gage heights (elevations) at selected locations on the Des Plaines River, Illinois, for selected simulated water-surface profiles (interpolated from Illinois Department of Natural Resources data).

[RM, River mile (see fig. 1 for river miles at streamgages in the modeled reach); Ds, downstream]

Location	Discharge, in cubic feet per second, corresponding to gage height, in feet above gage datum (elevation, in feet above NAVD 88)						
	13.2 (643.2)	14.0 (644.0)	14.9 (644.9)	16.0 (646.0)	17.0 (647.0)	18.0 (648.0)	19.1 (649.1)
RM 72.48	2,630	3,668	4,397	5,232	5,849	6,384	7,411
RM 75.04 Ds of Lake Cook Rd	2,136	2,966	3,522	4,421	5,211	5,858	7,452
RM 79.98	1,540	2,508	3,185	4,139	4,952	5,693	7,649
RM 92.53	1,368	2,264	2,965	3,996	4,783	5,584	7,750

Three bridges span the Des Plaines River in the study reach: East Townline Road (Illinois State Highway 60), Half Day Road (Illinois State Highway 22), and Deerfield Road. The bridge decks of all three bridges are higher than the range of inundation surfaces mapped; however, the LiDAR data used cuts the bridge decks out, and the cut-out area is given the elevation of the stream instead of the bridge crossing the stream. Because of this feature of the LiDAR data, it was necessary to manually process the bridge deck elevations. A rectangular area representing each bridge deck was digitized and assigned the minimum elevation of the bridge deck from bridge data in the HEC-2 hydraulic model. These rectangular areas were then merged into the land-elevation DEM so when the inundated area was subtracted from the land-surface elevation, the bridge decks remained above the inundated surface when the road was not inundated. In the published maps, however, the bridge decks are shown as inundated when the roads approaching the bridge decks are inundated in order to discourage people from crossing the bridge.

Inundation Verification

As mentioned previously, high-water marks were collected in the study area during a July 2010 flood; however, the peak gage height (11.1 ft) was below the lowest gage height modeled in this study (13.2 ft). Nevertheless, estimated inundation for the peak gage height is consistent with reports from a March 2010 flood (Filas, 2010), when Londonderry Lane within the study area was closed by flooding at an observed gage height only 0.1 ft lower than the lowest gage height mapped in the study. The mapped inundation surface for 13.2 ft gage height accurately predicts that Londonderry Lane will be inundated (fig. 2).

Des Plaines River, Illinois, Flood-Inundation Maps on the Internet

A USGS Flood Inundation Mapping Science World Wide Web portal has been established at URL *http://water.usgs.gov/osw/flood_inundation/* to provide estimated flood-inundation information to the public. The maps from this study showing the extent of inundated areas can be downloaded in three electronic file formats from that portal; (1) GIS shapefile format, (2) KMZ file format, and (3) Portable Document Format (PDF). Users can print out formatted maps or create customized maps using available GIS data layers. Each stream reach displayed on the Web site contains links to NWISWeb graphs of the current gage height at USGS streamgage Des Plaines River at Lincolnshire, to which the inundation maps are referenced. A link also is provided to the NWS AHPS site (*http://water.weather.gov/ahps/*) so that the user can obtain applicable information on forecasted peak stage. The estimated flood-inundation maps are displayed in sufficient detail to note the extent of flooding with respect to individual structures so that preparations for flooding and decisions for emergency response can be performed efficiently. Roadways and bridges were closely reviewed and are shown as shaded (inundated and likely impassable) or not shaded (dry and passable) to facilitate emergency planning and use. However, buildings which are shaded do not reflect inundation but denote that bare earth surfaces in the vicinity of the buildings are inundated. When the water depth in the vicinity of the building of interest exceeds that building's height, the structure can be considered fully submerged.

Disclaimer for Flood-Inundation Maps

Inundated areas shown should not be used for navigation, regulatory, permitting, or other legal purposes. The USGS provides these maps "as-is" for a quick reference, emergency planning tool but assumes no legal liability or responsibility resulting from the use of this information.

Uncertainties and Limitations Associated With Inundation Maps

Although the flood-inundation maps represent the boundaries of inundated areas with a distinct line, some uncertainty is associated with these maps. The flood boundaries shown were estimated on the basis of gage heights (water-surface elevations) and streamflows (discharges) at a selected USGS streamgage. Water-surface elevations along the stream reaches were estimated by steady-state hydraulic modeling, assuming unobstructed flow, and using streamflows and hydrologic conditions anticipated at the USGS streamgage. The hydraulic model reflects the land-cover characteristics and any bridge, dam, levee, or other hydraulic structures existing in 2010. Unique meteorological factors (timing and distribution of precipitation) may cause actual streamflows along the modeled reach to vary from those assumed during a flood, which may lead to deviations in the water-surface elevations and inundation boundaries shown. Additional areas may be flooded due to unanticipated conditions such as changes in the streambed elevation or roughness, backwater into major tributaries along a main stem river, or backwater from localized debris or ice jams. The accuracy of the floodwater extent portrayed on these maps will vary with the accuracy of the Digital Elevation Model used to simulate the land surface. Additional uncertainties and limitations pertinent to this study may be described elsewhere in this report.

If this series of flood-inundation maps will be used in conjunction with National Weather Service (NWS) river forecasts, the user should be aware of additional uncertainties that may be inherent or factored into NWS forecast procedures. The NWS uses forecast models to estimate the quantity and timing of water flowing through selected stream reaches in the United States. These forecast models (1) estimate the amount of runoff generated by precipitation and snowmelt, (2) simulate the movement of floodwater as it proceeds downstream, and (3) predict the flow and stage (water-surface elevation) for

Figure 2. Estimated inundation of part of the mapped area for a gage height of 13.2 feet at the USGS streamgage on the Des Plaines River at Lincolnshire (05528100). The observed gage height for the March 2010 event during which Londonderry Lane was closed in response to flooding was 13.1 feet.

the stream at a given location (AHPS forecast point) throughout the forecast period (every 6 hours and 3 to 5 days out in many locations). For more information on AHPS forecasts, please see *http://water.weather.gov/ahps/pcpn_and_river_forecasting.pdf*.

Acknowledgments

The authors wish to thank the many local, State, and Federal agencies that provided funding and cooperated in the operation and maintenance of the gages used for this study. Special thanks go to Rick Gosch and David Mick at Illinois Department of Natural Resources-Office of Water Resources; Brian Cook and other staff at the Lake County Stormwater Management Commission; and Jennifer Hughes, Village Engineer at Village of Lincolnshire. Perry Masouridis at the Illinois Department of Transportation and Michael Zemaitis at the Lake County Division of Transportation provided information on changes to structures in the study reach. Additional thanks go to Benjamin Roby, USGS intern, for his work updating the HEC-2 model with new structure information and to Joe Gonzalez and Terry Ortel for their work on the design of the inundation mapping Web site.

Summary

A series of estimated flood-inundation maps for the Des Plaines River between Mettawa and Riverwoods, Illinois, were developed in cooperation with the Lake County Stormwater Management Commission and the Villages of Lincolnshire and Riverwoods. These maps (available at *http://water.usgs.gov/osw/flood_inundation/*), in conjunction with the real-time gage-height data from the USGS streamgage at the Des Plaines River at Lincolnshire, Ill. (station no. 05528100), and National Weather Service flood-stage forecasts, can help to guide the general public in taking individual safety precautions and can provide city officials with a tool to efficiently manage emergency flood operations and flood mitigation efforts.

The maps were developed by using the HEC-2 and ArcMap programs to compute water-surface profiles and to delineate estimated flood-inundation areas for selected gage heights. The maps show depth shading for estimated flood-inundation areas overlaid on high-resolution, georeferenced aerial photographs of the study area for gage heights between 13.2 ft and 19.1 ft at the Des Plaines River at Lincolnshire streamgage.

References Cited

ESRI, 1999, ARC Macro Language, self-study workbook—Developing ARC/INFO menus and macros with AML: Redlands, Calif., ESRI Press, 828 p., ISBN 978–1879102187.

Federal Emergency Management Agency, 2006, Flood insurance study, a report of flood hazards in Lake County, Illinois, and incorporated areas: Flood Insurance Study Number 17097CV002A [variously paginated].

Filas, L., 2010, Suburbs under flood watch as Fox, Des Plaines Rivers rise: The Daily Herald, March 15, 2010, accessed April 9, 2012, at *http://www.dailyherald.com/article/20100315/news/303159849/*.

Illinois State Geological Survey, 2012, Physiographic divisions of Illinois: Accessed July 20, 2012, at *http://www.isgs.illinois.edu/maps-data-pub/publications/physio.shtml*.

Northwest Municipal Conference, 2012, Des Plaines River Phase I Project: Accessed on April 12, 2012, at *http://www.nwmc-cog.org/Products-and-Services/Stormwater-Management/Upper-Des-Plaines-River-Study.aspx*.

Ormsby, Tim; Napoleon, E.J.; Burke, Robert; Groessl, Carolyn; and Bowden, Laura, 2010, Getting to know ArcGIS Desktop: Redlands, Calif., ESRI Press, 604 p., ISBN 978–1589482609.

U.S. Census Bureau, 2012, Lake County QuickFacts: Accessed April 5, 2012, at *http://quickfacts.census.gov/qfd/states/17/17097.html*.

U.S. Army Corps of Engineers, Hydrologic Engineering Center, 1991, HEC-2 Water surface profiles—User's manual: 334 p.

U.S. Geological Survey, 2011, National Water Information System—Web Interface, USGS 05528100 Des Plaines River at Lincolnshire, IL: Accessed November 15, 2011, at *http://waterdata.usgs.gov/il/nwis/inventory/?site_no=05528100&agency_cd=USGS&amp*.

Glossary

Annual exceedance probability The annual exceedance probability is the probability that a particular flood size will occur in any given year. As an example, a 1-percent annual exceedance probability flood has a 1-percent chance of being equaled or exceeded in any single year. A 1-percent annual exceedance probability flood is also referred to as a 100-year flood.

DEM A Digital Elevation Model (DEM) is a digital file consisting of terrain elevations for ground positions at regularly spaced horizontal intervals.

Depth grid A digital file consisting of the mathematical difference between the water-elevation surface and ground-elevation surface for ground positions at regularly spaced horizontal intervals.

Gage height Gage height is the term used by the USGS National Water Information System display to describe the height of water above the datum at a streamgage. It is synonymous with stage.

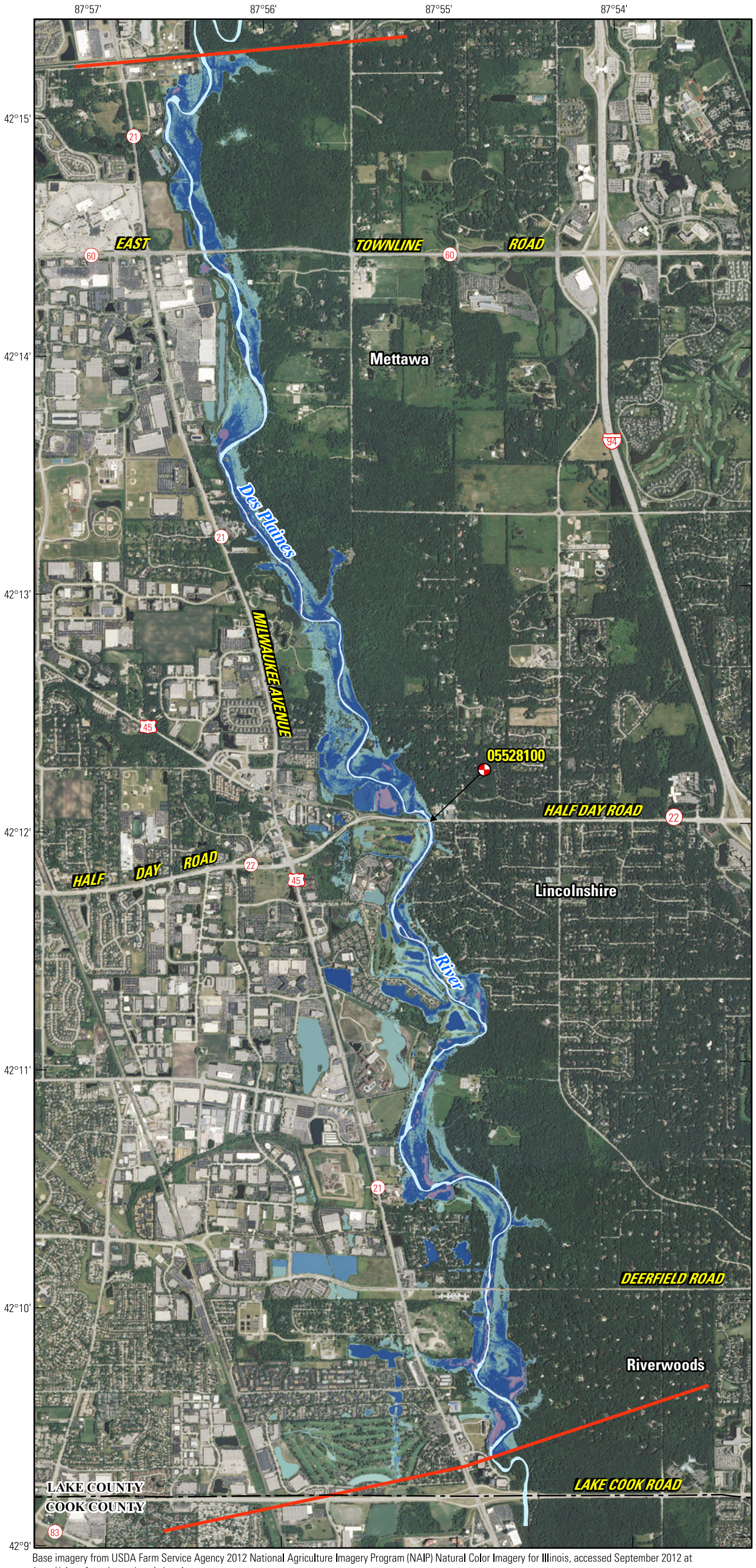
Inundation surface The mathematical difference between the water-elevation surface and ground-elevation surface results in the inundation surface representing the area covered by water.

Rating curve A rating curve is the relation between stage and discharge at a cross section in a river.

Stage Stage is the term used by the National Weather Service to describe the height of water above the datum at a streamgage. It is synonymous with gage height.

Water-surface elevation Water-surface elevation at a streamgage is determined by adding the gage height of the water to the datum for the streamgage.

Water-surface profile A water-surface profile shows how the elevation of a river changes along its centerline.



Base imagery from USDA Farm Service Agency 2012 National Agriculture Imagery Program (NAIP) Natural Color Imagery for Illinois, accessed September 2012 at *http://gis.apfo.usda.gov/arcgis/services*

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Scientific Investigations Report 2012–5227

Murphy, E.A., Soong, D.T., Sharpe, J.B., 2012

EXPLANATION

Flood-inundation depth, in feet

- 0.1 to 1.0
- 1.1 to 2.0
- 2.1 to 5.0
- Greater than 5.0

Limits of the study area

05528100 **USGS streamgage and number**

Illinois State route marker

U.S. route marker

Interstate marker

0 0.2 0.4 0.6 0.8 1 MILE

0 0.2 0.4 0.6 0.8 1 KILOMETER

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UNCERTAINTIES AND LIMITATIONS FOR USE OF FLOOD-INUNDATION MAPS

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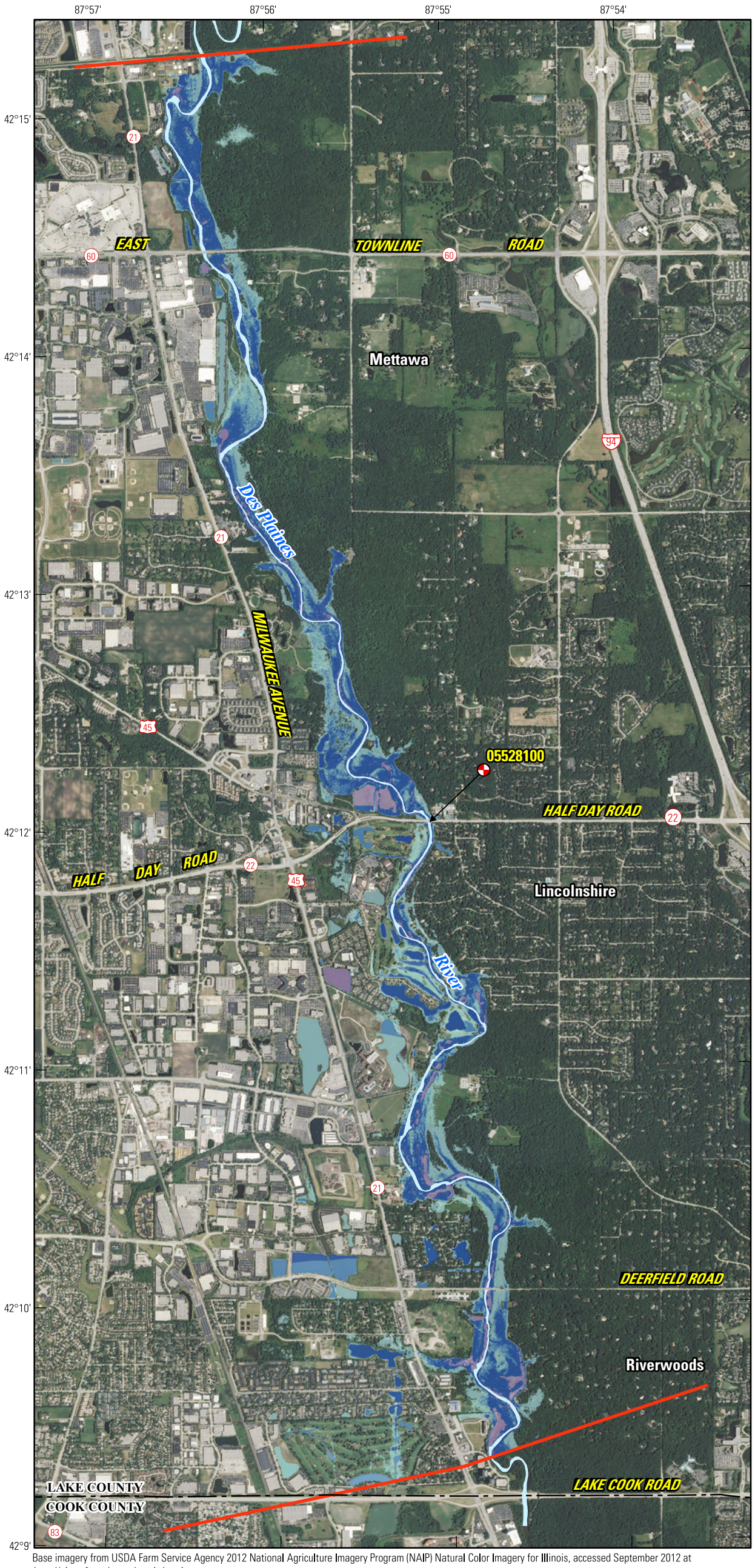
Sheet 1. Flood-inundation map for a 9-mile reach of the Des Plaines River, Illinois, corresponding to a gage height (elevation) of 13.2 feet (643.2 feet) at USGS streamgage number 05528100, Des Plaines River at Lincolnshire, Illinois.



Base imagery from USDA Farm Service Agency 2012 National Agriculture Imagery Program (NAIP) Natural Color Imagery for Illinois, accessed September 2012 at *http://gis.apfo.usda.gov/arcgis/services*

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Scientific Investigations Report 2012–5227
Murphy, E.A., Soong, D.T., Sharpe, J.B., 2012

EXPLANATION

Flood-inundation depth, in feet

- 0.1 to 1.0
- 1.1 to 2.0
- 2.1 to 5.0
- Greater than 5.0

Limits of the study area

05528100 **USGS streamgage and number**

13 **Illinois State route marker**

45 **U.S. route marker**

94 **Interstate marker**

0 0.2 0.4 0.6 0.8 1 MILE
0 0.2 0.4 0.6 0.8 1 KILOMETER

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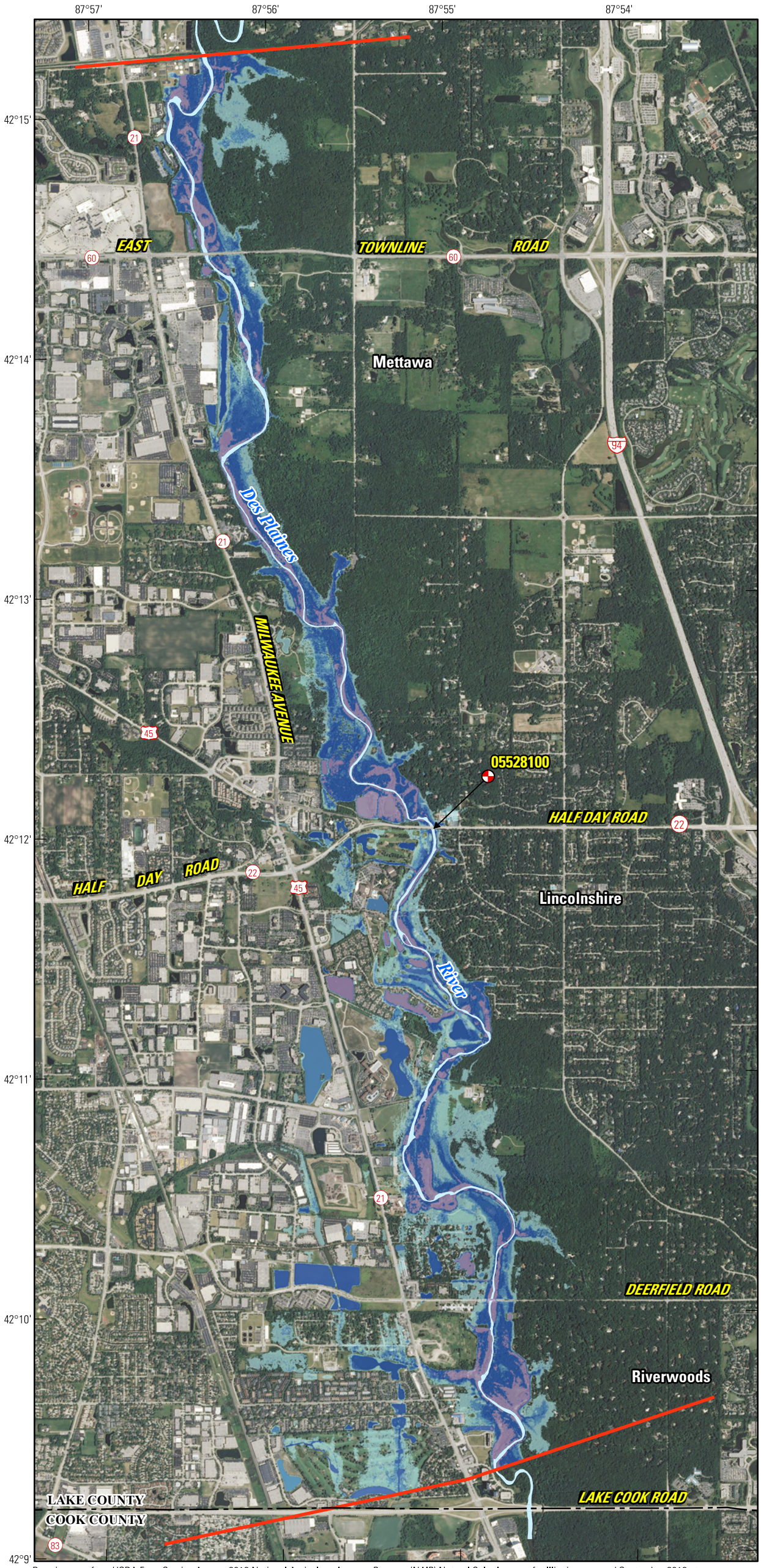
Sheet 2. Flood-inundation map for a 9-mile reach of the Des Plaines River, Illinois, corresponding to a gage height (elevation) of 14.0 feet (644.0 feet) at USGS streamgage number 05528100, Des Plaines River at Lincolnshire, Illinois.



Base imagery from USDA Farm Service Agency 2012 National Agriculture Imagery Program (NAIP) Natural Color Imagery for Illinois, accessed September 2012 at *http://gis.apfo.usda.gov/arcgis/services*

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Scientific Investigations Report 2012–5227
Murphy, E.A., Soong, D.T., Sharpe, J.B., 2012

EXPLANATION

Flood-inundation depth, in feet

- 0.1 to 1.0
- 1.1 to 2.0
- 2.1 to 5.0
- Greater than 5.0

Limits of the study area

05528100 **USGS streamgage and number**

13 **Illinois State route marker**

45 **U.S. route marker**

94 **Interstate marker**

0 0.2 0.4 0.6 0.8 1 MILE
0 0.2 0.4 0.6 0.8 1 KILOMETER

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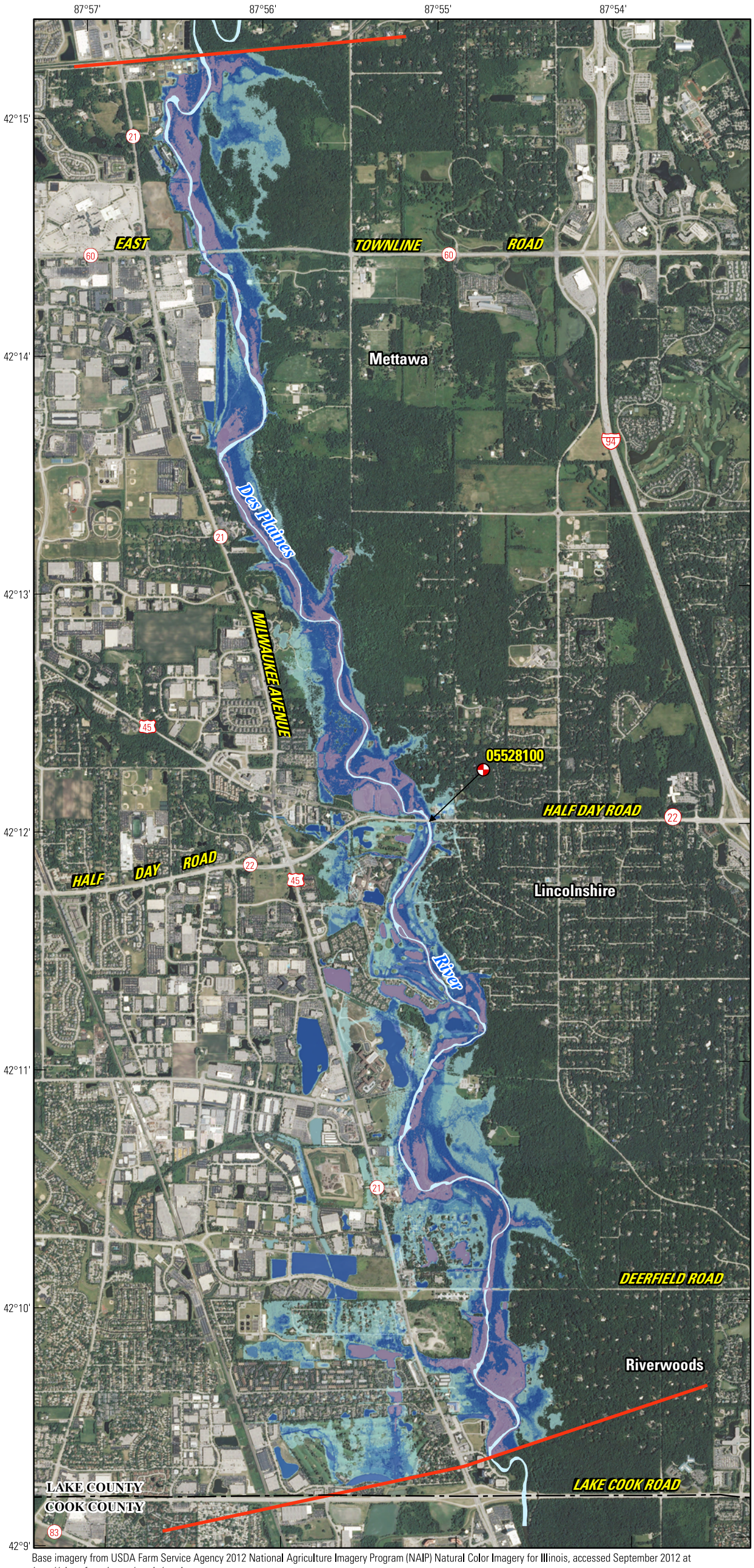
Sheet 3. Flood-inundation map for a 9-mile reach of the Des Plaines River, Illinois, corresponding to a gage height (elevation) of 14.9 feet (644.9 feet) at USGS streamgage number 05528100, Des Plaines River at Lincolnshire, Illinois.



Base imagery from USDA Farm Service Agency 2012 National Agriculture Imagery Program (NAIP) Natural Color Imagery for Illinois, accessed September 2012 at *http://gis.apfo.usda.gov/arcgis/services*

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Scientific Investigations Report 2012–5227

Murphy, E.A., Soong, D.T., Sharpe, J.B., 2012

EXPLANATION

- Flood-inundation depth, in feet
  - 0.1 to 1.0
  - 1.1 to 2.0
  - 2.1 to 5.0
  - Greater than 5.0
- Limits of the study area
- 05528100 USGS streamgage and number
- 13 Illinois State route marker
- 45 U.S. route marker
- 94 Interstate marker

0 0.2 0.4 0.6 0.8 1 MILE
0 0.2 0.4 0.6 0.8 1 KILOMETER

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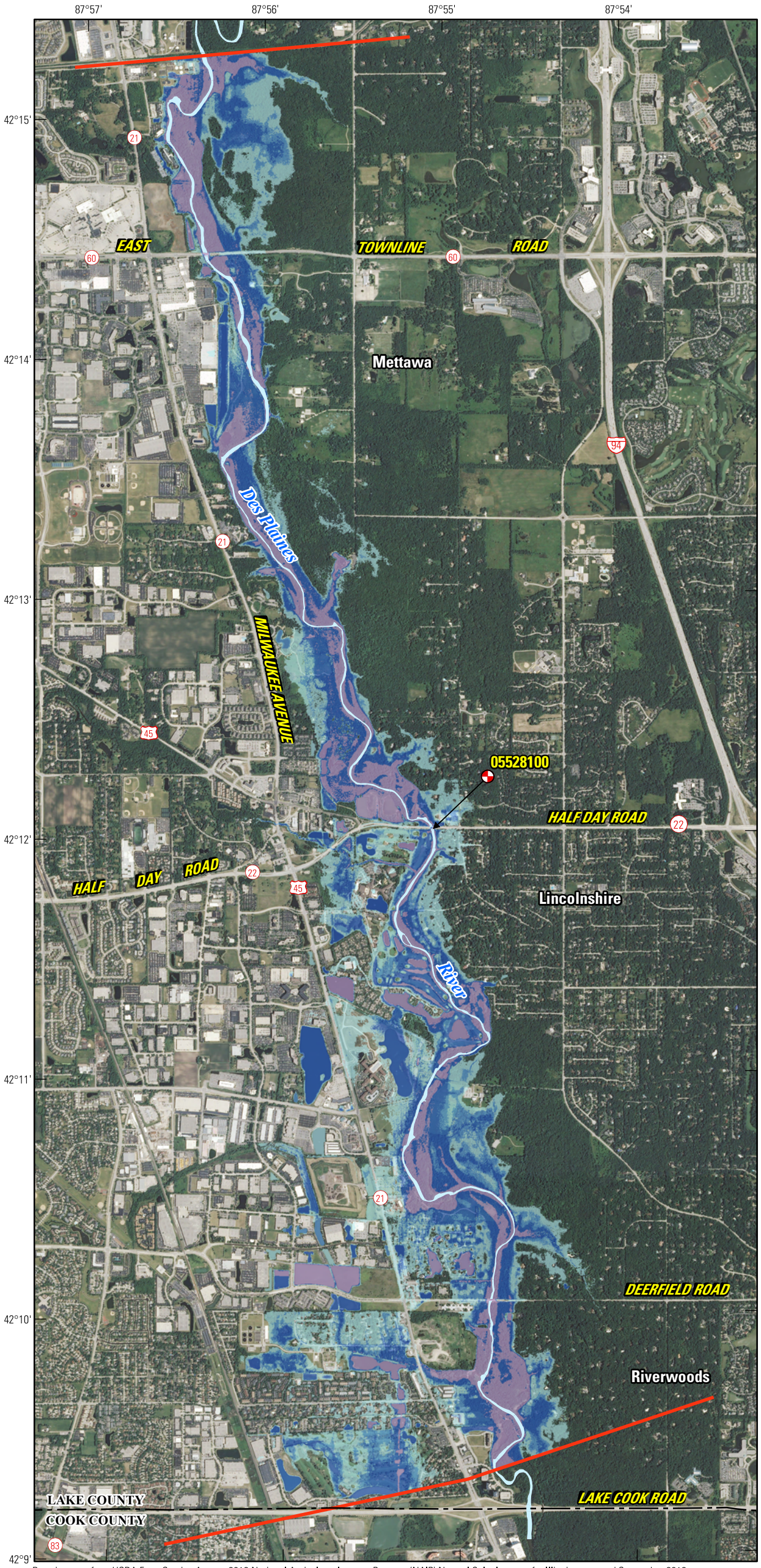
Sheet 4. Flood-inundation map for a 9-mile reach of the Des Plaines River, Illinois, corresponding to a gage height (elevation) of 16.0 feet (646.0 feet) at USGS streamgage number 05528100, Des Plaines River at Lincolnshire, Illinois.



Base imagery from USDA Farm Service Agency 2012 National Agriculture Imagery Program (NAIP) Natural Color Imagery for Illinois, accessed September 2012 at *http://gis.apfo.usda.gov/arcgis/services*

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Scientific Investigations Report 2012–5227
Murphy, E.A., Soong, D.T., Sharpe, J.B., 2012

EXPLANATION

Flood-inundation depth, in feet
- 0.1 to 1.0
- 1.1 to 2.0
- 2.1 to 5.0
- Greater than 5.0

Limits of the study area

05528100 **USGS streamgage and number**

Illinois State route marker

U.S. route marker

Interstate marker

0 0.2 0.4 0.6 0.8 1 MILE
0 0.2 0.4 0.6 0.8 1 KILOMETER

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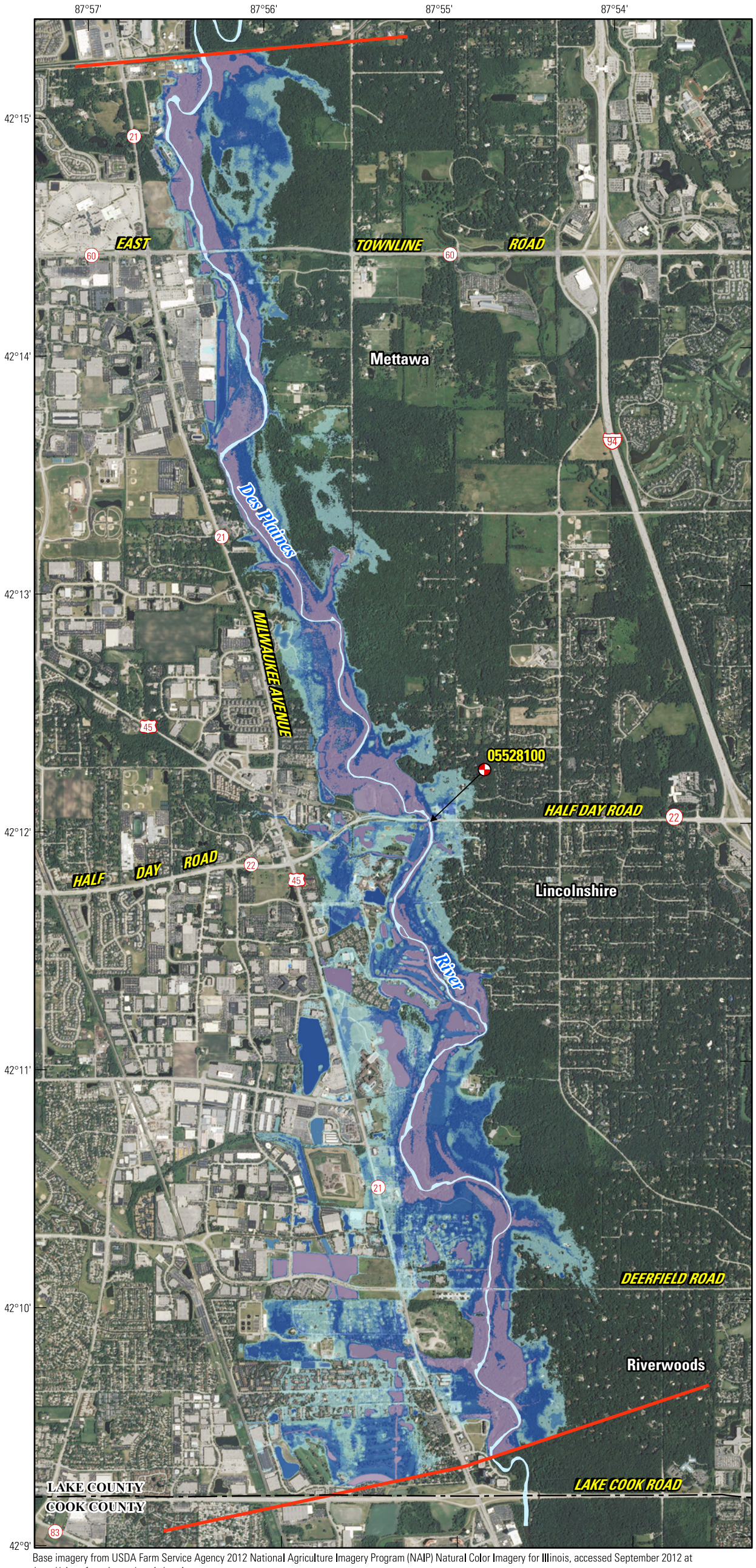
Sheet 5. Flood-inundation map for a 9-mile reach of the Des Plaines River, Illinois, corresponding to a gage height (elevation) of 17.0 feet (647.0 feet) at USGS streamgage number 05528100, Des Plaines River at Lincolnshire, Illinois.



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Scientific Investigations Report 2012–5227

Murphy, E.A., Soong, D.T., Sharpe, J.B., 2012

EXPLANATION

- Flood-inundation depth, in feet
  - 0.1 to 1.0
  - 1.1 to 2.0
  - 2.1 to 5.0
  - Greater than 5.0
- Limits of the study area
- 05528100 USGS streamgage and number
- 13 Illinois State route marker
- 45 U.S. route marker
- 94 Interstate marker

0 0.2 0.4 0.6 0.8 1 MILE
0 0.2 0.4 0.6 0.8 1 KILOMETER

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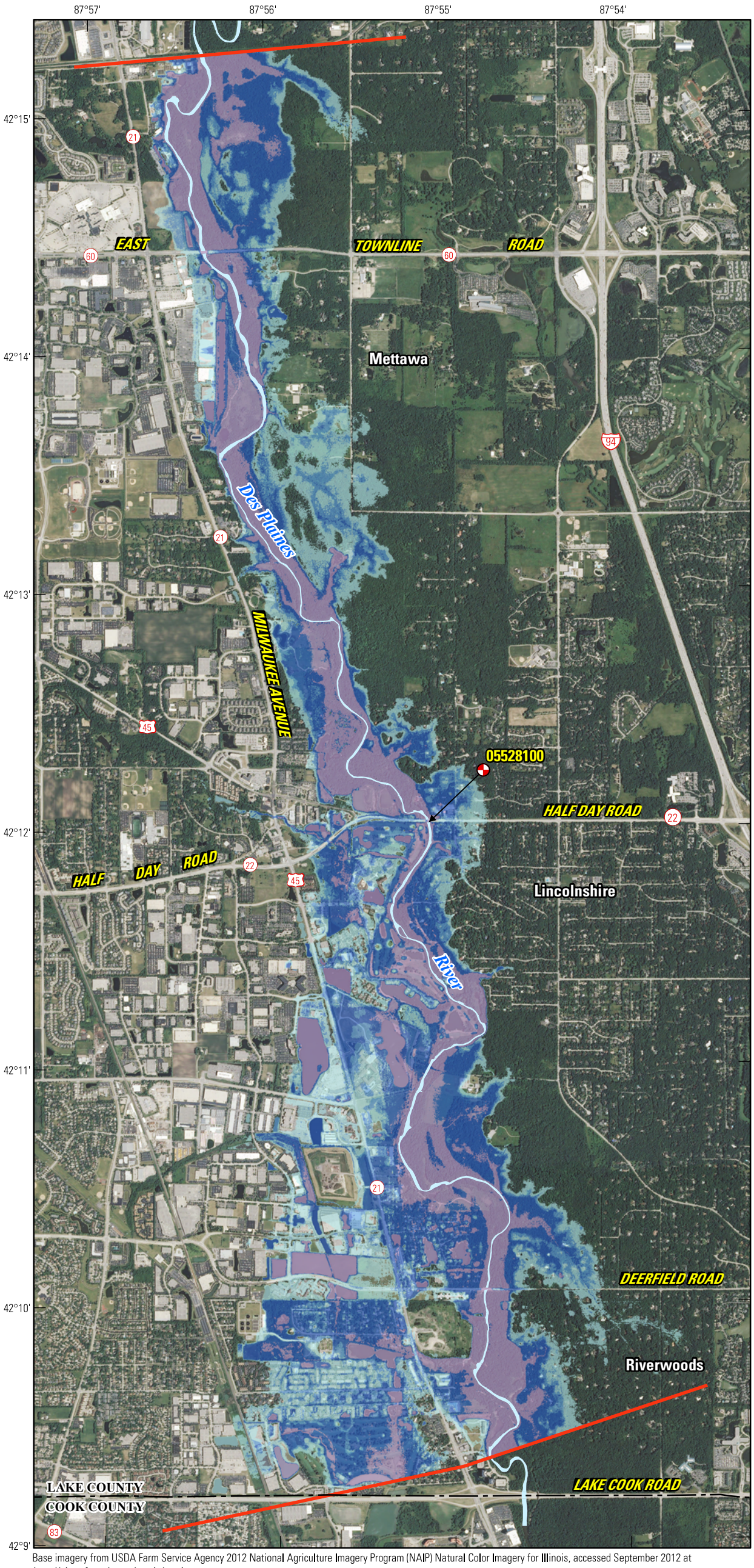
Sheet 6. Flood-inundation map for a 9-mile reach of the Des Plaines River, Illinois, corresponding to a gage height (elevation) of 18.0 feet (648.0 feet) at USGS streamgage number 05528100, Des Plaines River at Lincolnshire, Illinois.



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Scientific Investigations Report 2012–5227

Murphy, E.A., Soong, D.T., Sharpe, J.B., 2012

EXPLANATION

Flood-inundation depth, in feet

- 0.1 to 1.0
- 1.1 to 2.0
- 2.1 to 5.0
- Greater than 5.0

Limits of the study area

05528100 **USGS streamgage and number**

13 **Illinois State route marker**

45 **U.S. route marker**

94 **Interstate marker**

0 0.2 0.4 0.6 0.8 1 MILE

0 0.2 0.4 0.6 0.8 1 KILOMETER

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Sheet 7. Flood- inundation map for a 9-mile reach of the Des Plaines River, Illinois, corresponding to a gage height (elevation) of 19.1 feet (649.1 feet) at USGS streamgage number 05528100, Des Plaines River at Lincolnshire, Illinois.