

# Plum Creek / Hart Ditch Flooding Watershed Study

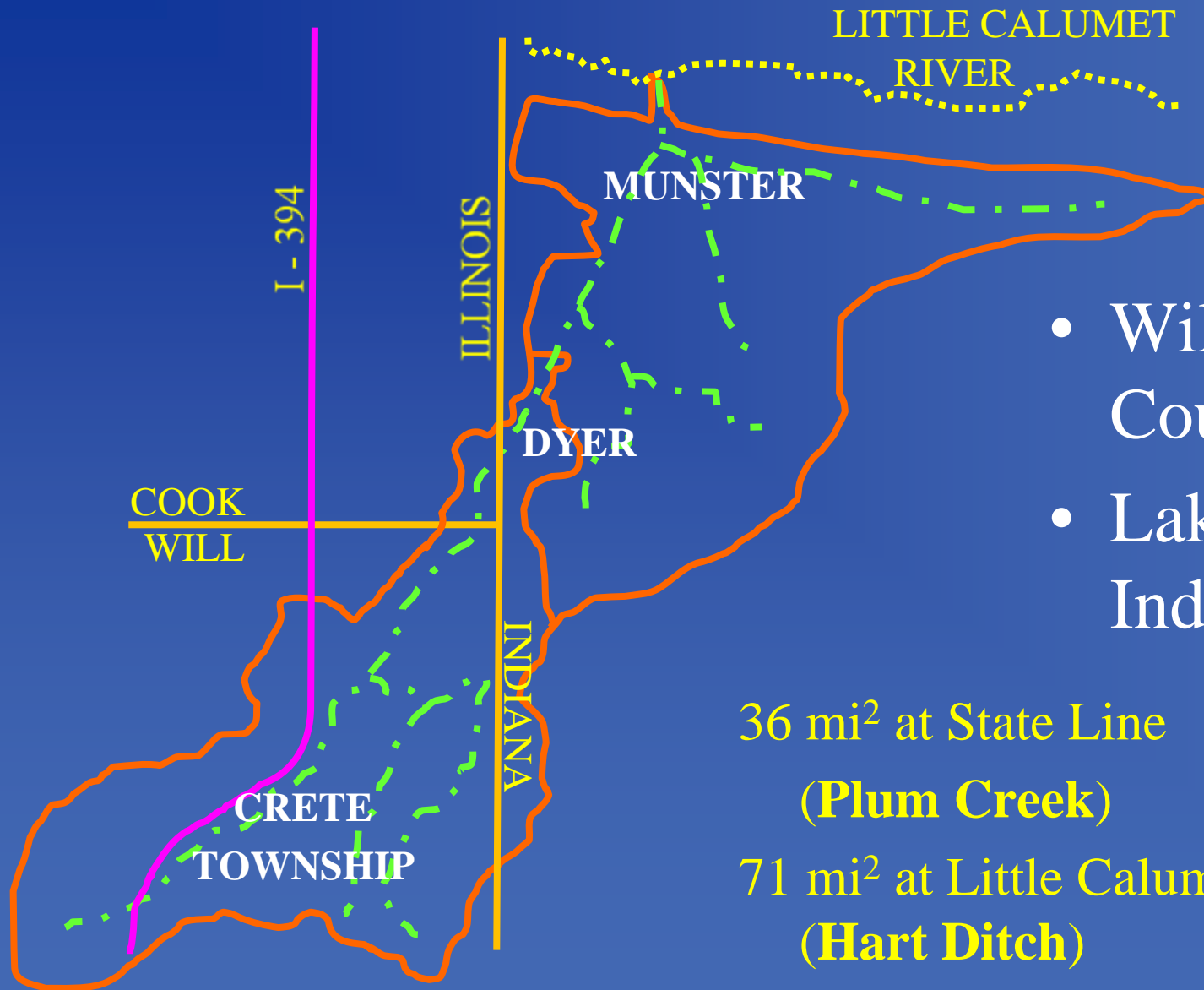
March 11, 2009

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# Plum Creek / Hart Ditch Watershed



- Will and Cook County Illinois
- Lake County Indiana

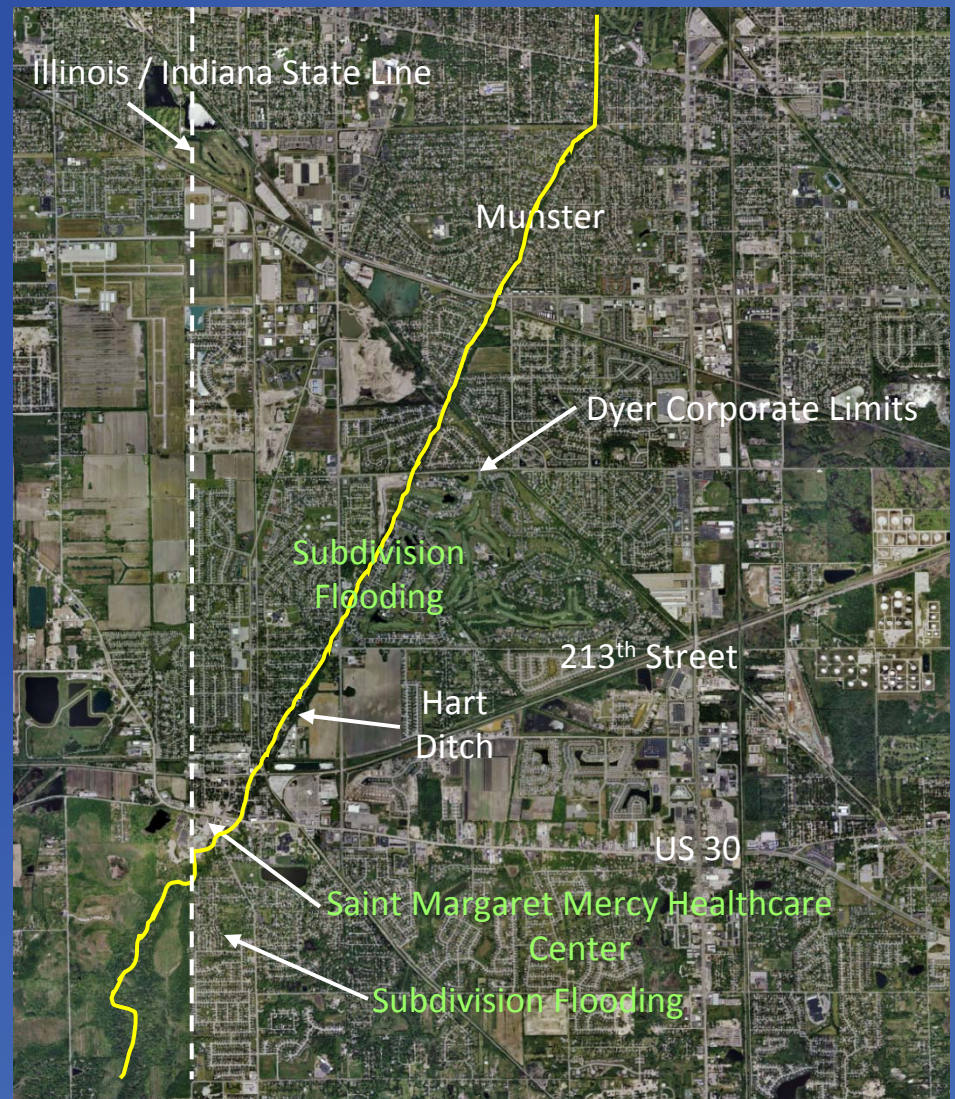
36 mi<sup>2</sup> at State Line  
(**Plum Creek**)

71 mi<sup>2</sup> at Little Calumet River  
(**Hart Ditch**)



# Study Purpose

- Plum Creek / Hart Ditch Overtopped Banks (August 2007)
- Significant Damages
  - Crete Township
  - Dyer, Indiana
    - Saint Margaret Mercy Healthcare Center
    - Several Subdivisions



## Photos of the Year 2007



JESSICA KOSCIELNIAK/ THE TIMES  
Flood waters at St. Margeret Mercy in Dyer , Indiana.

14 / 47

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# Dyer Flooding

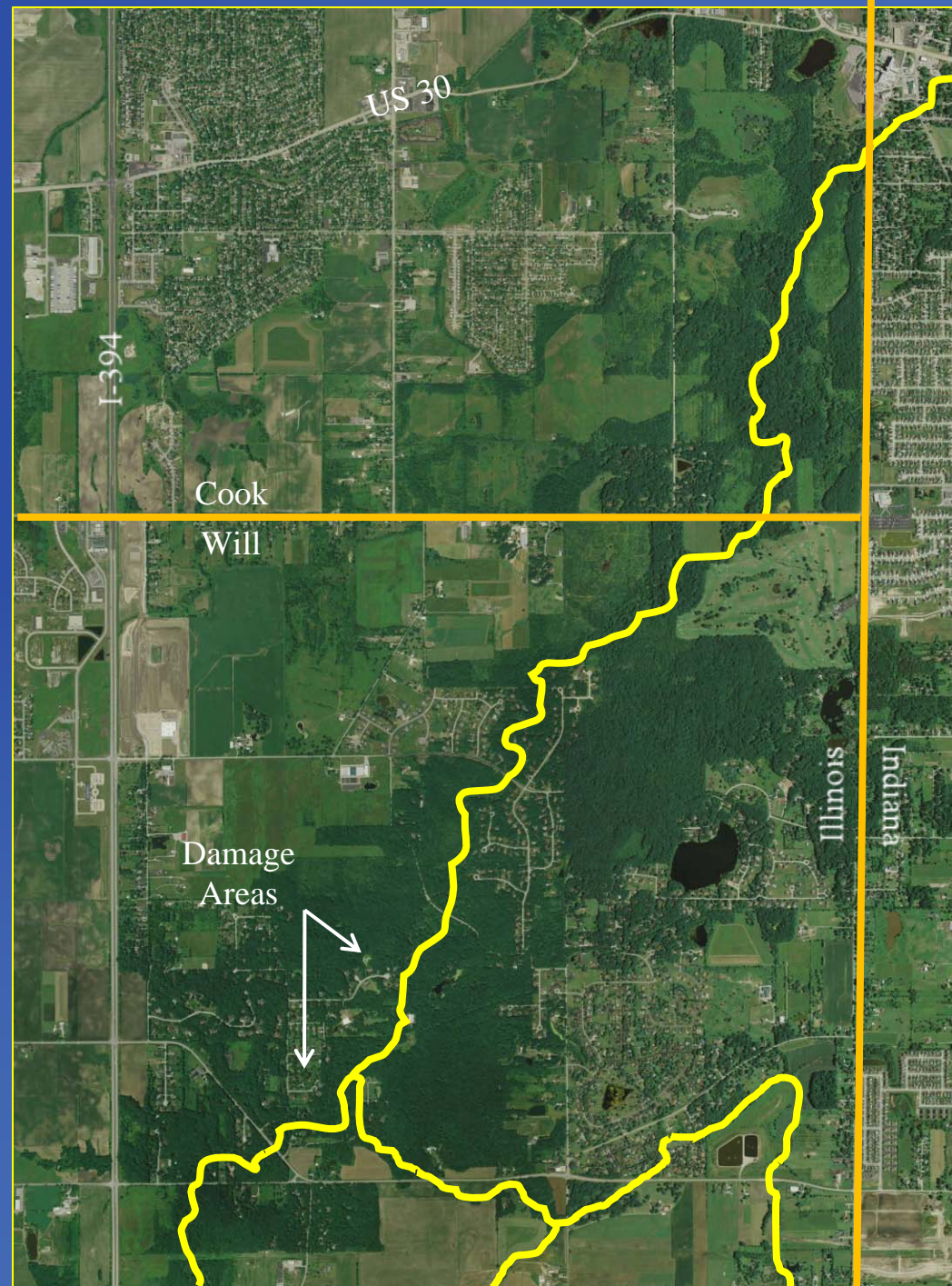
August 24<sup>th</sup>  
2007

\$33 Million in  
Damages



# Study Purpose

- Plum Creek / Hart Ditch overtopped its banks (August 2007)
  - Property damage (12"-18" in 1<sup>st</sup> Floor)
  - Roadway closures (confluence area)
  - Isolated from emergency services 30+hrs



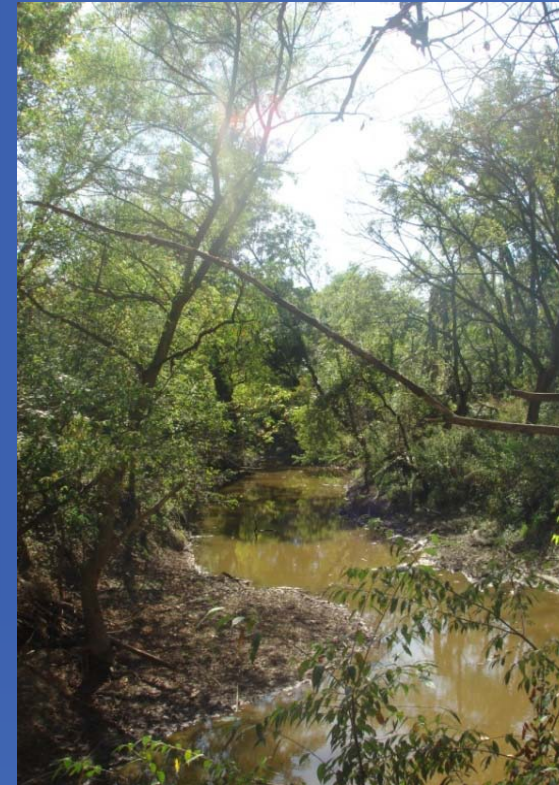
# Study Objective

- Determine the cause of the August 23<sup>rd</sup> and 24<sup>th</sup> , 2007 Flooding
- Identify damage areas and structures in the Plum Creek / Hart Ditch Watershed
- Develop Hydrologic and Hydraulic Models
  - Calibrate August 2007 storm event
  - FIS Flow rates compared to calibrated model



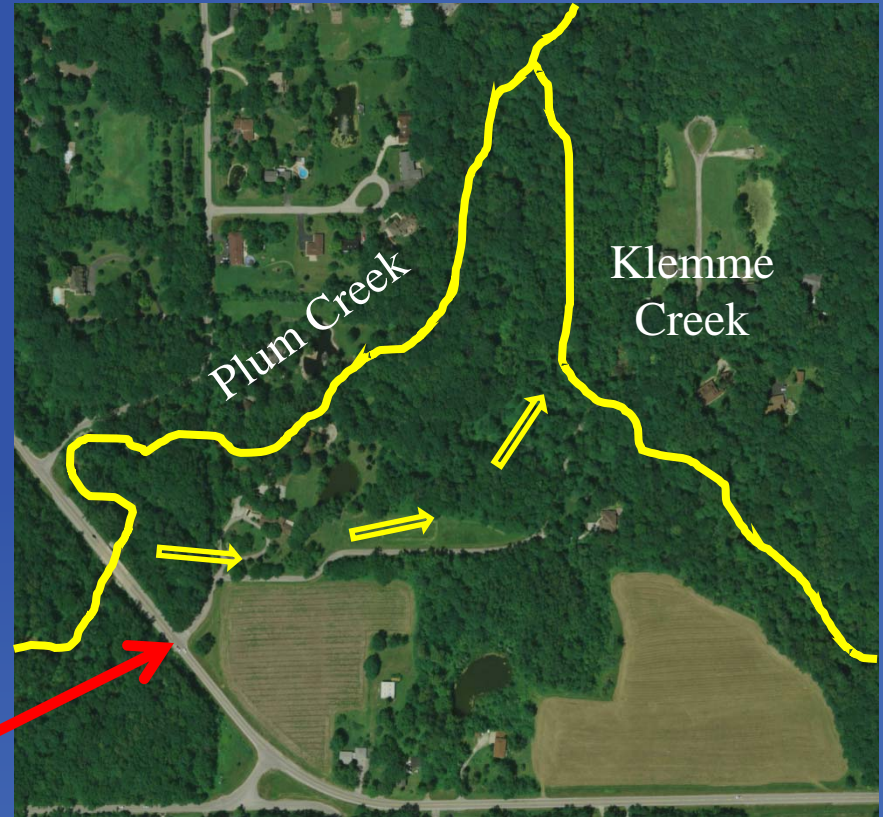
# Study Partners

- Crete Township
- Lake County Surveyors Office,  
Lake County Indiana
- Saint Margaret Mercy Healthcare  
Centers, Dyer Campus
- Town of Dyer, Indiana



# Crete Township Flooding

- Confluence Area
  - 30 mi<sup>2</sup> at confluence of Klemme and Plum Creek



# FIS Differences IL to IN

- Regulatory Models
  - Illinois and Indiana discrepancies
    - Illinois - HEC 1
      - Three subbasin model
      - FIS flowrate at state line = 2,689 cfs
    - Indiana - Coordinated Discharge Curve
      - FIS flowrate at state line = 1,860 cfs
  - 0.5 foot difference in 100-year elevations at State Line

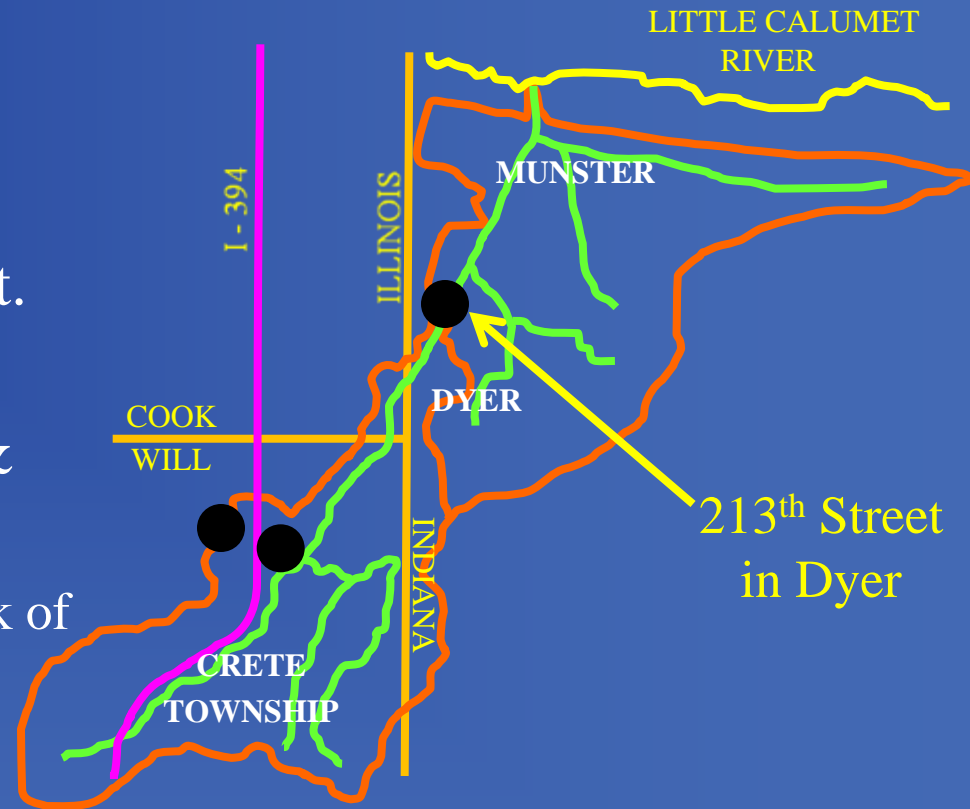


# Study Approach (Hydrologic Gage Data)

## Hydrologic Modeling

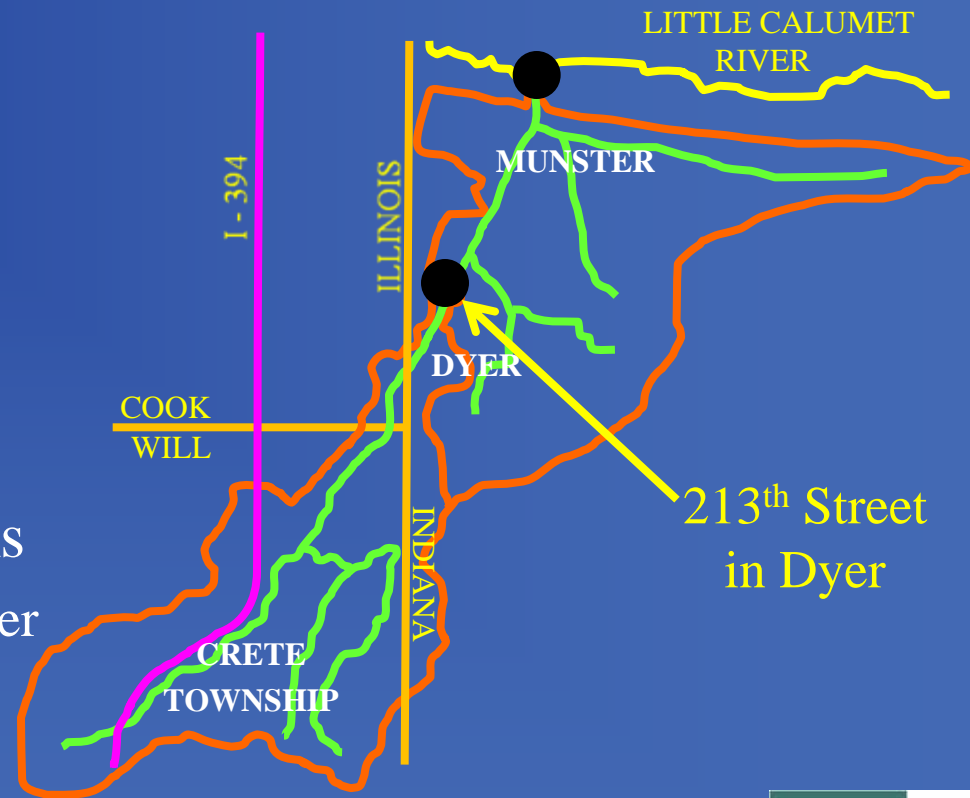
### – Precipitation Gages

- USGS – Crete and 213<sup>th</sup> St.
- CoCoRaHS (Community Collaborative Rain, Hail & Snow Network)
  - Community-based network of volunteers
  - Located in Will County

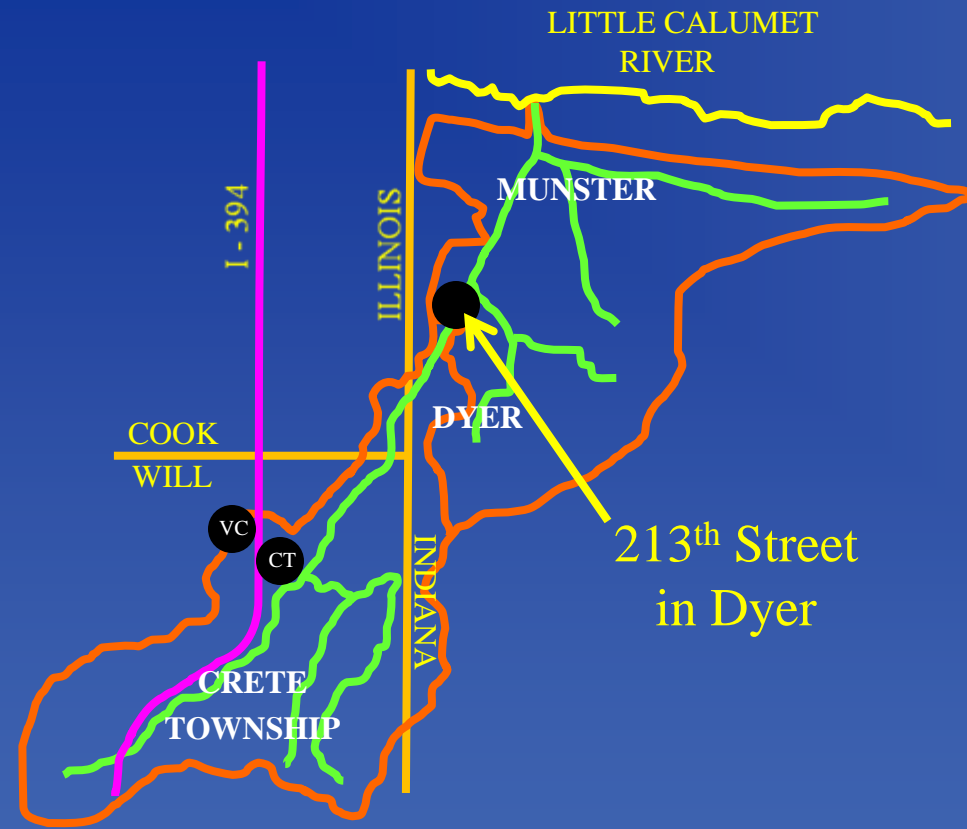


# Study Approach (Hydraulic Gage Data)

- Hydraulic Modeling
  - Stage Gages
    - USGS – Hart Ditch at 213<sup>th</sup> Street
    - USGS – Hart Ditch at Munster
    - Local High Water Marks
      - Observed; Crete and Dyer



# August 2007 Storm Event



- Bulletin 70
  - 100-year, 5-day = 10.9 inches
- Measured
  - 10.2 inches in 5-days

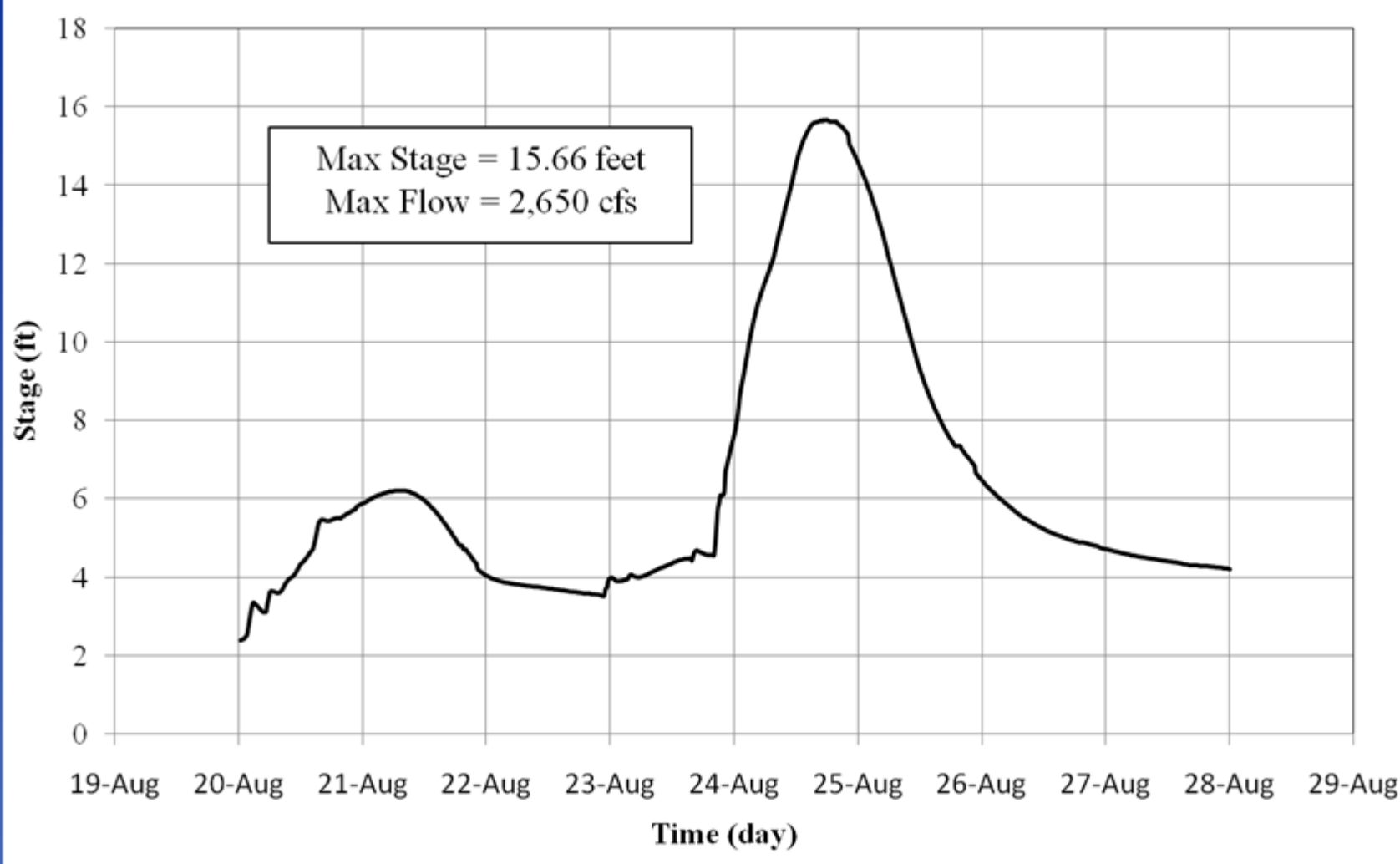
Date	USGS	CoCoRaHS	
	213 <sup>th</sup> Street Dyer (IN)	Village of Crete VC(IL)	Crete Township CT(IL)
	NA	IL-WL-18	IL-WL-25
	(inches)	(inches)	(inches)
08/14/2007	0.37	0.32	0.21
08/15/2007	0.24	0.09	0.19
08/16/2007	0.01	0.01	0.00
08/17/2007	0.00	0.00	0.00
08/18/2007	0.30	0.00	0.00
08/19/2007	0.92	0.06	0.06
08/20/2007	2.51	2.94	2.97
08/21/2007	0.01	1.03	1.14
08/22/2007	1.09	0.20	0.13
08/23/2007	2.31	1.50	1.05
08/24/2007	0.97	3.95	4.94
<b>Total</b>	<b>8.73</b>	<b>10.10</b>	<b>10.69</b>

# Sunny in Dyer

- August 24, 2007
  - 0.97 inches in Dyer (downstream)
    - Storms moved through area and giving way to sunshine in Dyer
  - 4.94 inches in Crete Township (upstream)
- Flooding came by surprise



# August 2007 Storm Event



USGS Gage – 213<sup>th</sup> Street in Dyer

Regulatory 100-year flow rate, 1910 cfs at 213<sup>th</sup> St.



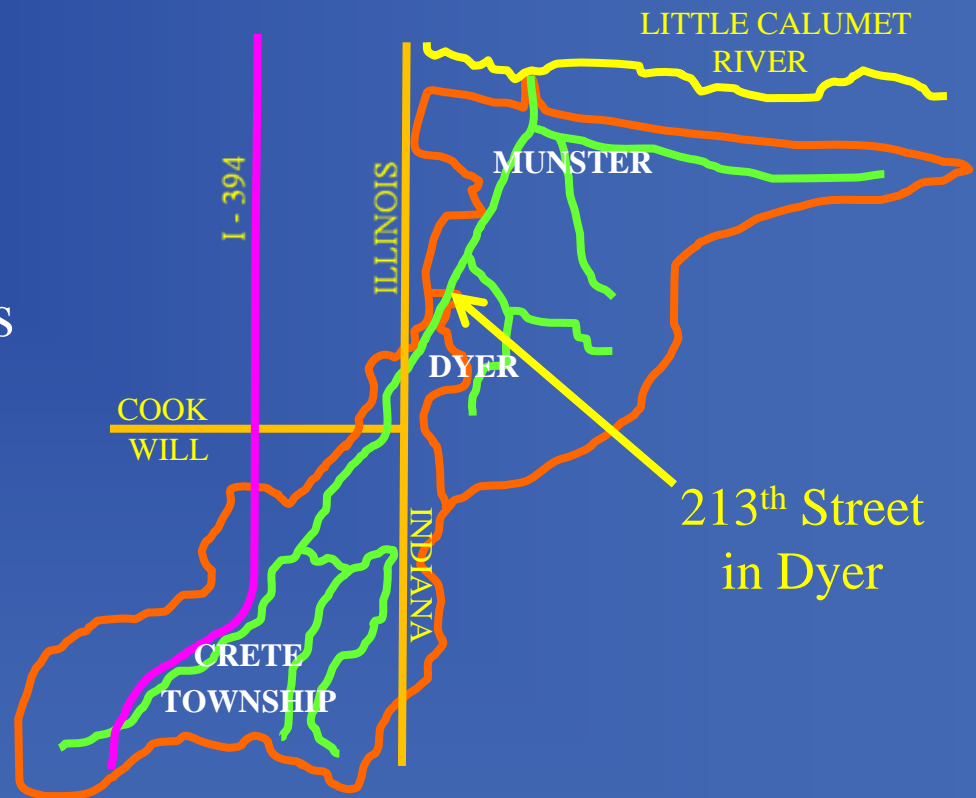
# Calibrated Hydrologic Study

- A detailed hydrologic model was developed using the precipitation and other gage data in the watershed
  - HEC-HMS with 15 subbasins
  - Calibrated to August 2007 storm
  - Gage data from USGS precipitation gages
  - Match flow rate at 213<sup>th</sup> Street in Dyer



# Hydrologic Results at 213<sup>th</sup> Street

- Measured data
  - Measured vs. Simulated
    - 2,649 cfs vs. 2,645 cfs
- Design data
  - Bulletin 70
  - 100-year critical duration flow rate is more than double the measured flowrate



# Hydrologic Calibration

- Determine the 100-year design flowrate at 213<sup>th</sup> St.
  - Continuous rainfall over a 6-day period
    - Saturated watershed condition
  - 4.94 inches in Crete Township on August 24, 2007
    - No infiltration, large runoff volume
- Initial CNs are assumed to be AMC III
  - Convert AMC values for III condition to II
  - Execute HMS for August 2007 storm event
  - Compare hydrographs at 213<sup>th</sup> Street
  - 100-year design flowrate = 3,282 cfs



# Hydraulic Calibration

- Known water surface elevations
  - Observed during August 2007 event
    - SMMHC
    - Hart Street
    - Subdivisions throughout Dyer
- Calibrate HEC-RAS to match elevations observed and measured
  - Manning's N values



# Expanded Study Purpose

- September 14<sup>th</sup> 2008
  - Flooding Occurred again in the region
- Expand study to identify possible locations for floodwater storage facilities
- Determine flood reduction benefits throughout the watershed



# September 13<sup>th</sup> and 14<sup>th</sup> 2008



Source: The Times, Munster IN



# September 13<sup>th</sup> and 14<sup>th</sup> 2008



Source: Lake County Surveyors Office

# September 13<sup>th</sup> and 14<sup>th</sup> 2008



Source: The Times, Munster IN

# September 13<sup>th</sup> and 14<sup>th</sup> 2008



Source: Lake County Surveyors Office



# September 2008 Storm Event

## Precipitation Gages

- USGS
- CoCoRaHS (Community Collaborative Rain, Hail & Snow Network)

## Bulletin 70

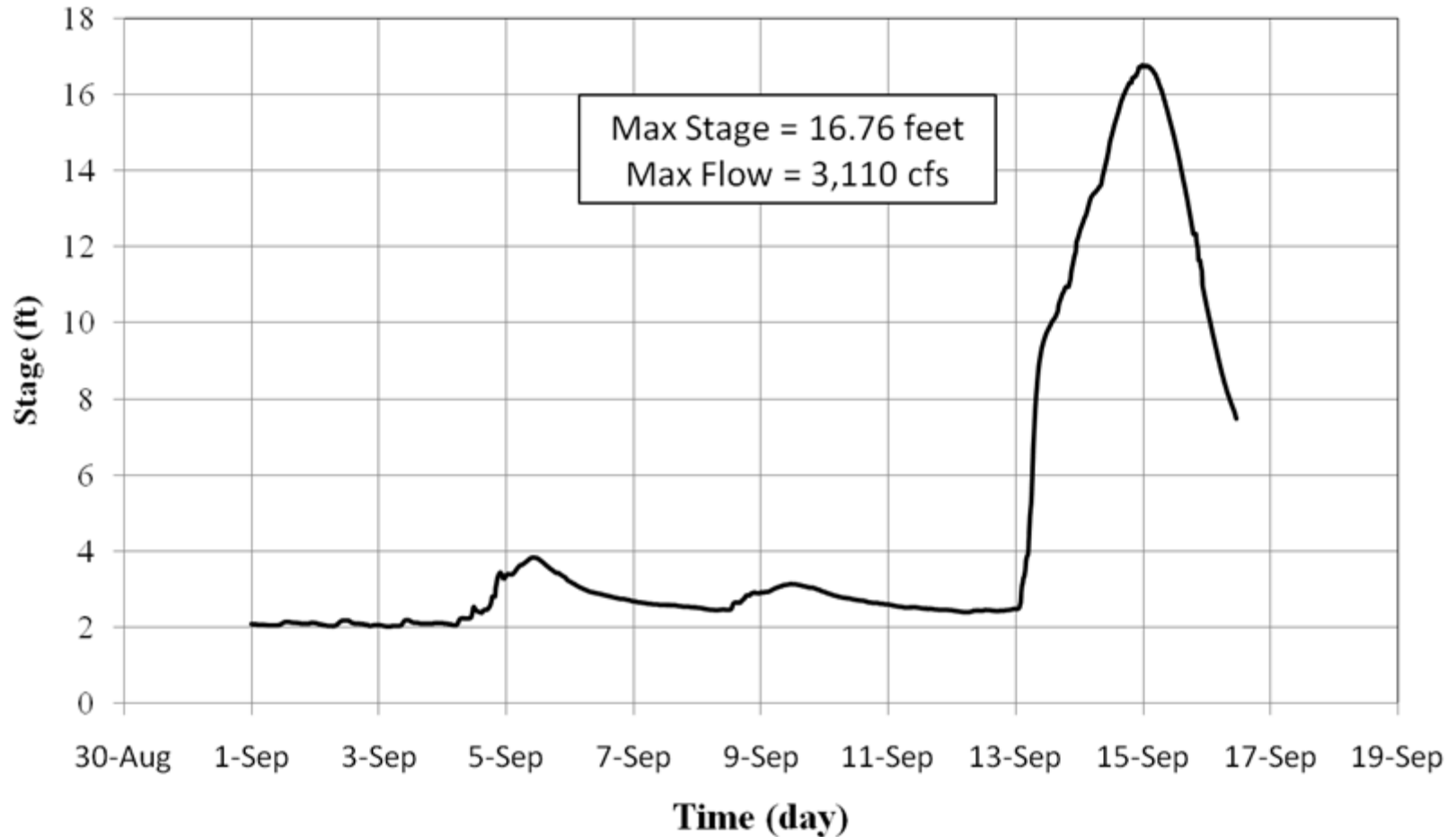
- 100-year, 10-day = 12.26”

Nearly 8 inches in 2-days

Date	USGS		CoCoRaHS	
	213 <sup>th</sup> Street Dyer (IN)	Village of Crete (IL)	Village of Crete (IL)	Crete Township (IL)
	NA	NA	IL-WL-18	IL-WL-25
	(inches)	(inches)	(inches)	(inches)
09/04/2008	3.71	3.16	0.30	0.34
09/05/2008	0.05	0.04	3.08	3.48
09/06/2008	0.00	0.00	0.01	0.00
09/07/2008	0.09	0.08	0.09	0.11
09/08/2008	1.31	1.16	0.00	0.00
09/09/2008	0.01	0.04	1.15	1.05
09/10/2008	0.00	0.00	0.02	0.00
09/11/2008	0.01	0.00	0.00	0.00
09/12/2008	0.46	0.40	0.13	0.17
09/13/2008	4.52	4.08	3.20	3.46
09/14/2008	3.35	2.96	2.53	2.78
<b>Total</b>	<b>13.51</b>	<b>11.92</b>	<b>10.51</b>	<b>11.34</b>



# September 2008 Storm Event



USGS Gage – 213<sup>th</sup> Street in Dyer

Regulatory 100-year flow rate, 1910 cfs at 213<sup>th</sup> St.



# Modeling Verification

- Execute hydrologic model using the September 2008 precipitation data
  - Match flowrate measured at 213<sup>th</sup> Street
    - Measured flow = 3,110 cfs
    - Simulated flow = 3,151 cfs
- Enter flowrates into HEC-RAS hydraulic model to verify measured stage at 213<sup>th</sup> St. gage



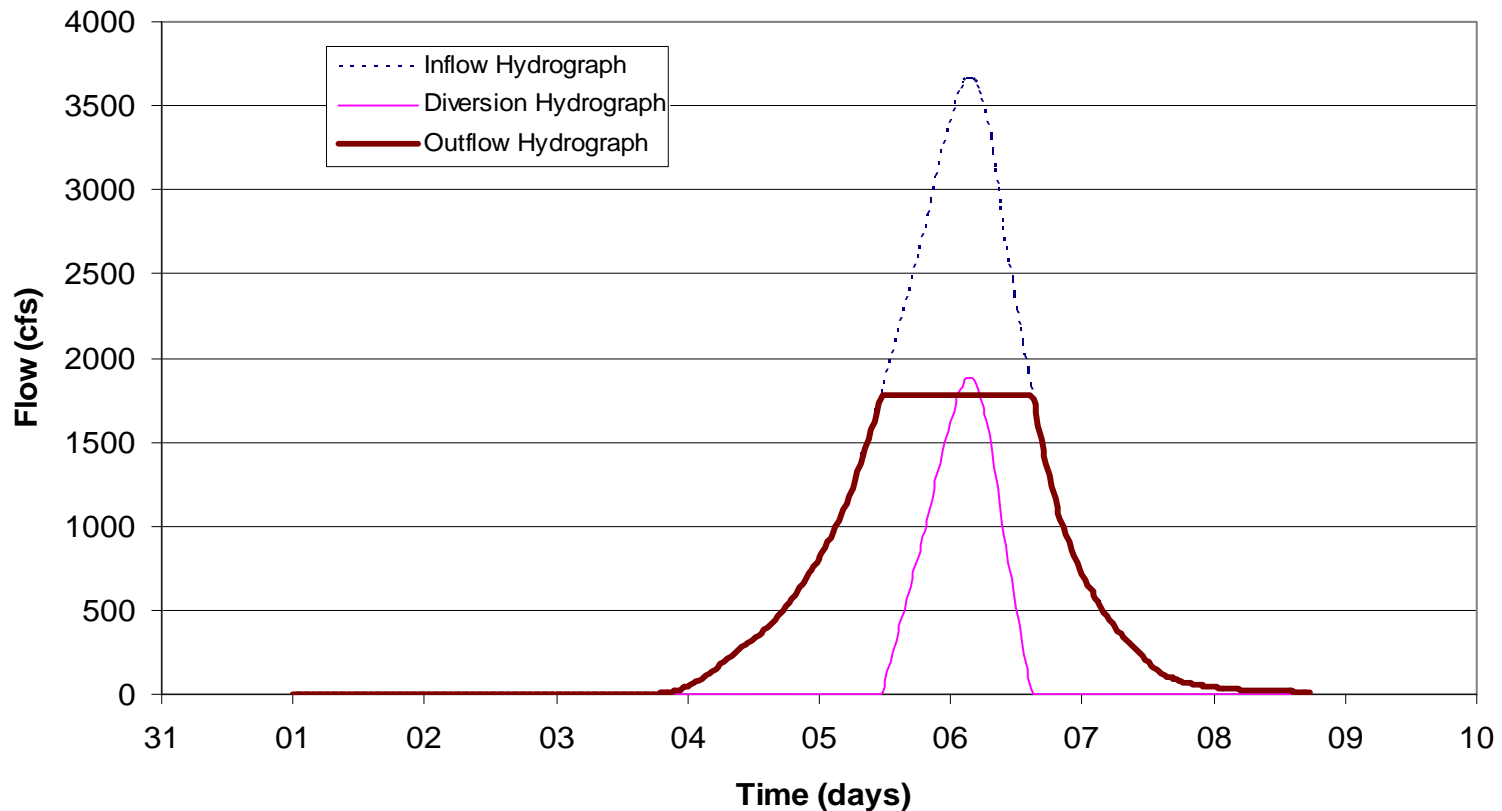
# Potential Flood Control Reservoir

- Flood storage upstream of flooding areas
  - Identified two locations in Illinois
    - One for the benefit of Crete Township
    - One for the benefit of Indiana
- Utilize flood storage by “cutting off” the peak of the hydrograph



# Regional Flood Control Reservoir

**Inflow - Outflow Hydrograph at  
Potetial Flood Control Reservoir**



Determine reservoir size by diverting volume off the peak

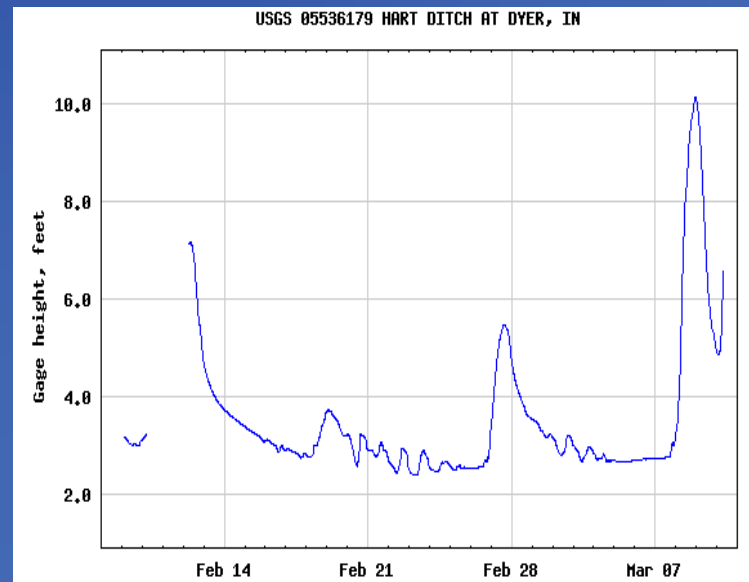
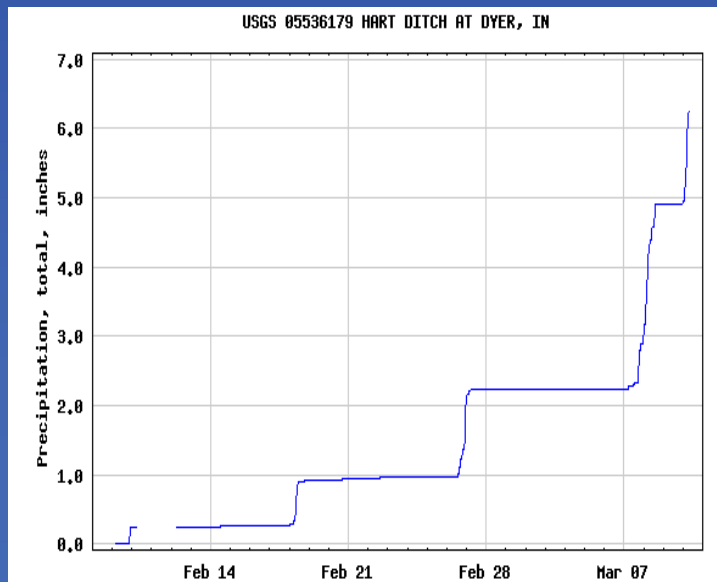
# Flood Reduction Benefits

- Determine flowrate reduction utilizing flood storage
- Determine decrease in water surface elevations through damage areas
- Benefits with flood reservoirs
  - Reduction of 1.5 feet in Crete Township
  - Reduction from 2 feet to 0.5 feet in Indiana all the way to the Little Calumet River



# Conclusions

- Early Warning system in Crete Township through cooperation with USGS
  - Currently working on forecast of downstream gage heights
  - Time to prepare, utilize an emergency action plan



# Challenges

- Regional Flood Control Reservoir
  - Multiple Location (s)
    - Crete Township and Lake Co, IN
    - Upstream of flooding
    - Provide storage in Illinois for Indiana
    - Land Acquisition, public or private
  - Funding
  - Permitting
  - Mapping



# Questions

