Plum Creek / Hart Ditch Flood Forecasting

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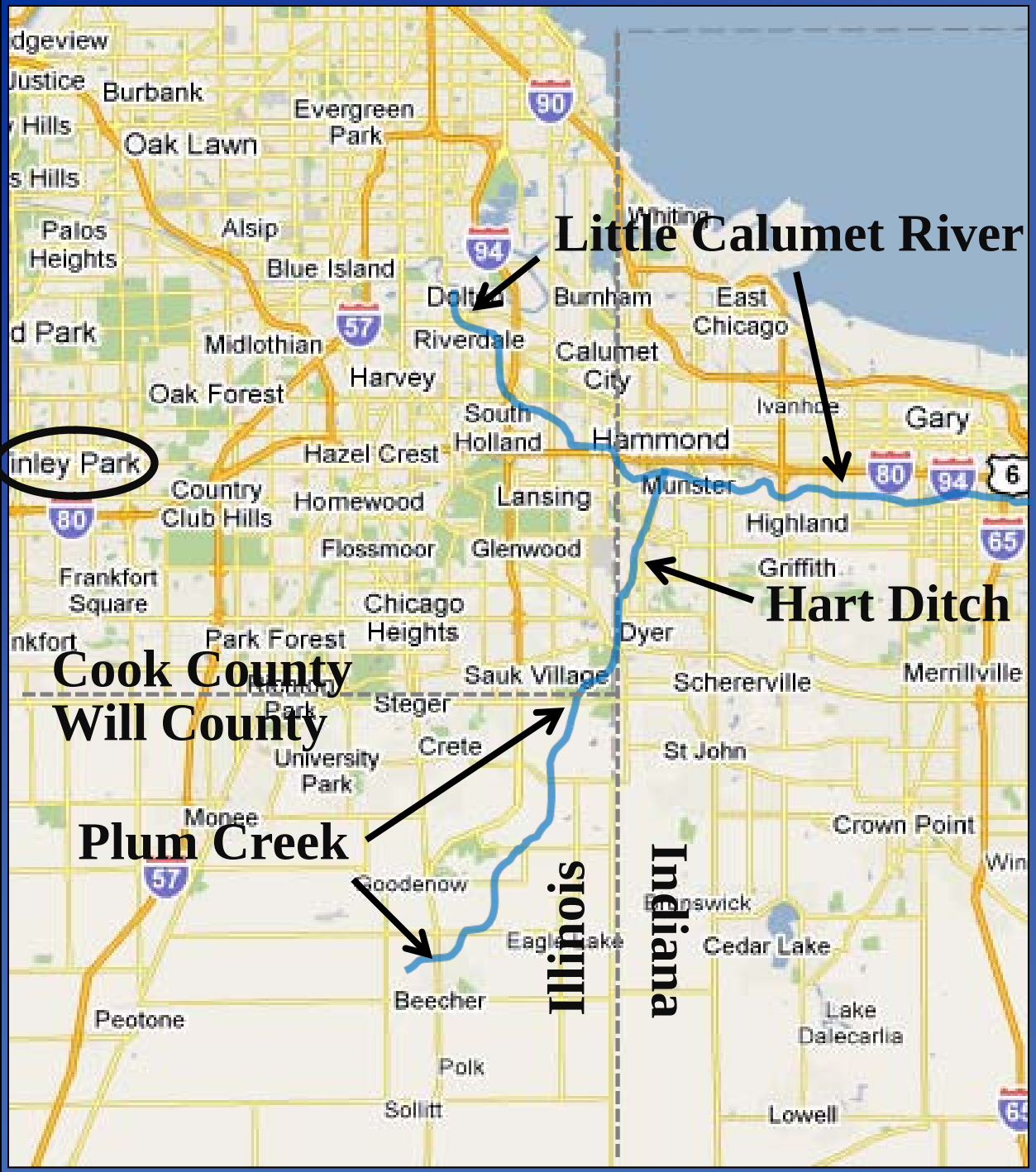
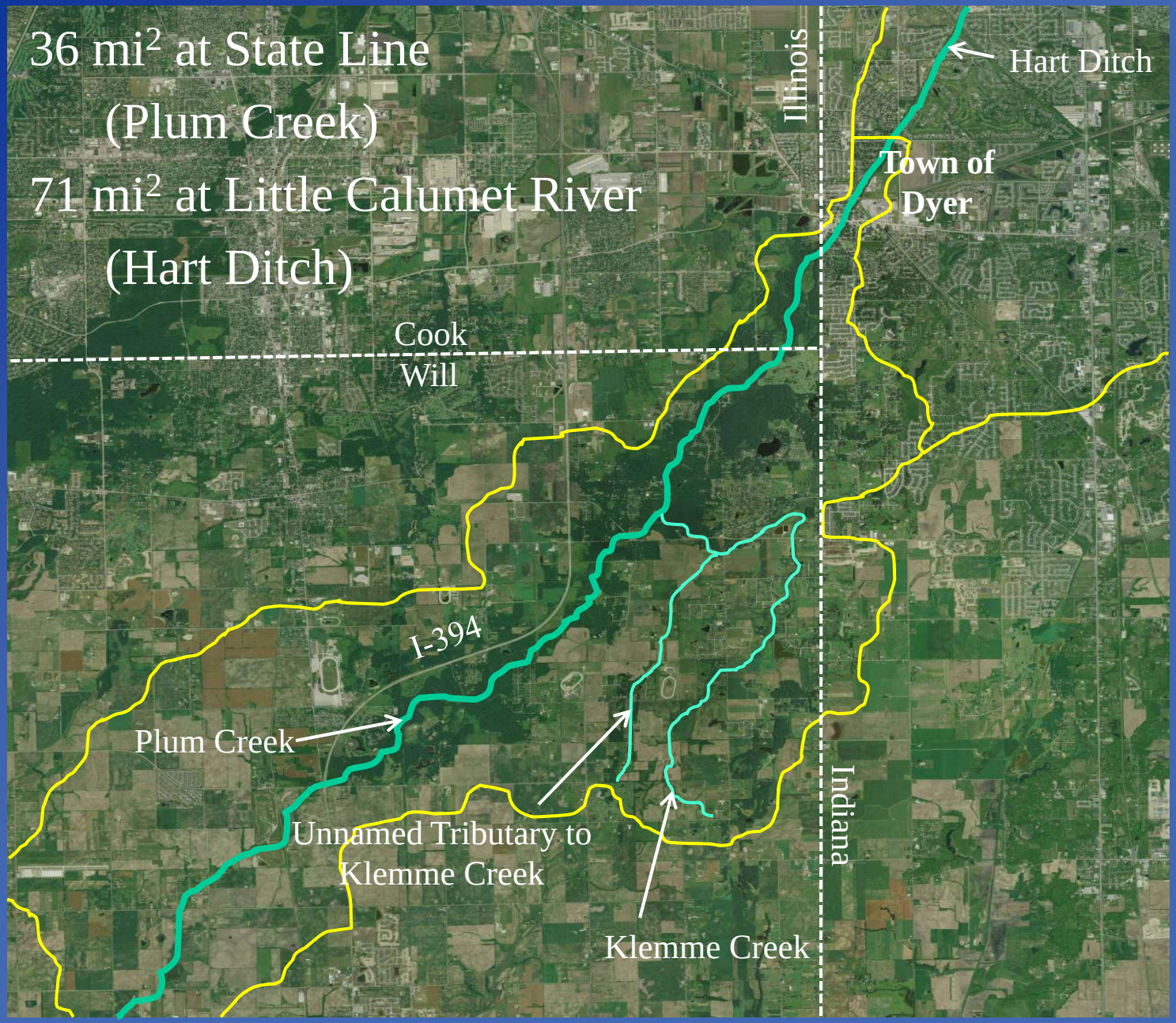
Plum Creek / Hart Ditch Watershed

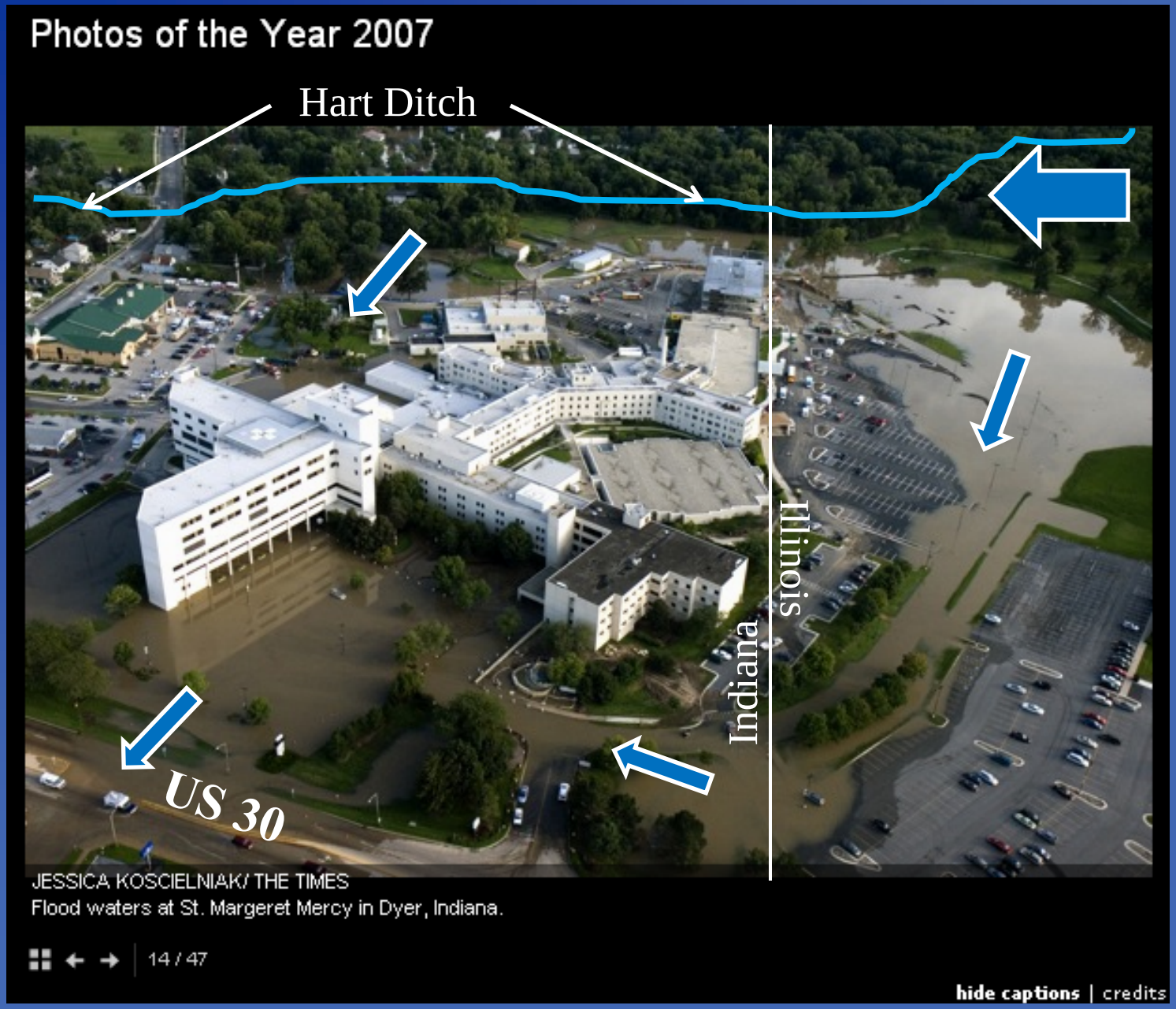


- Confluence with Little Calumet River in Munster, Indiana
  - 71 mi^2 at Little Calumet River

Plum Creek / Hart Ditch Watershed



Dyer Flooding



August 24th 2007

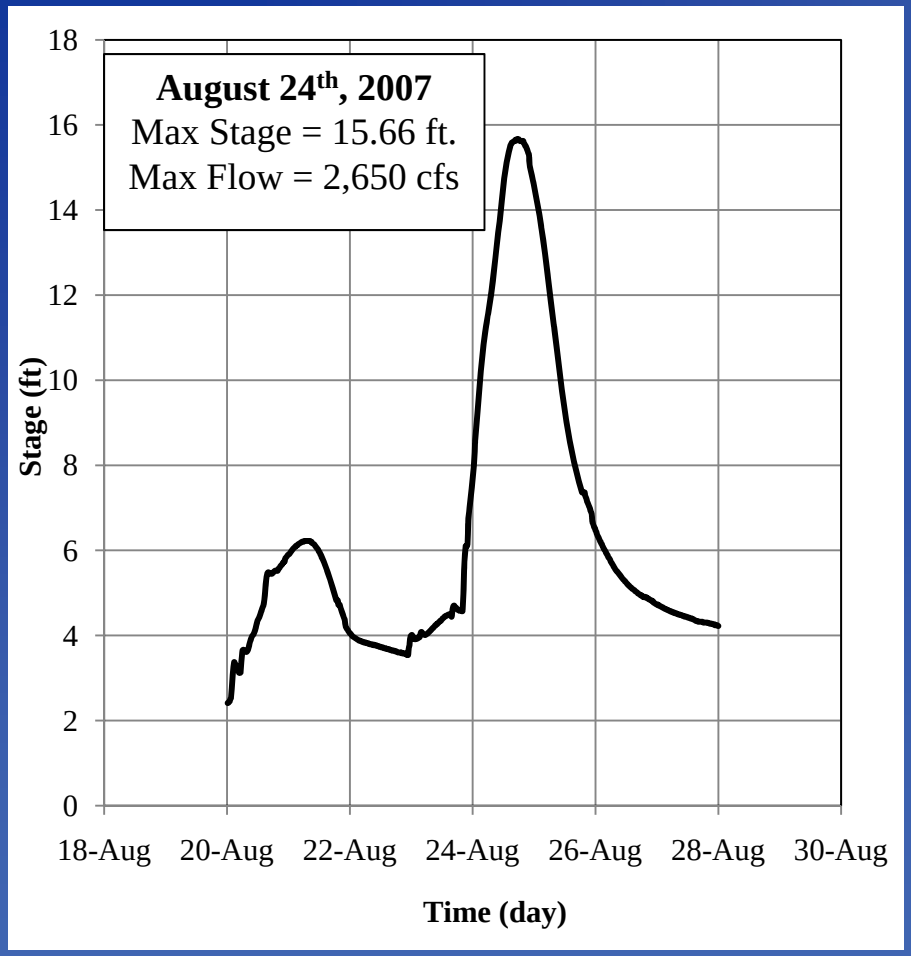
$33 Million in Damages

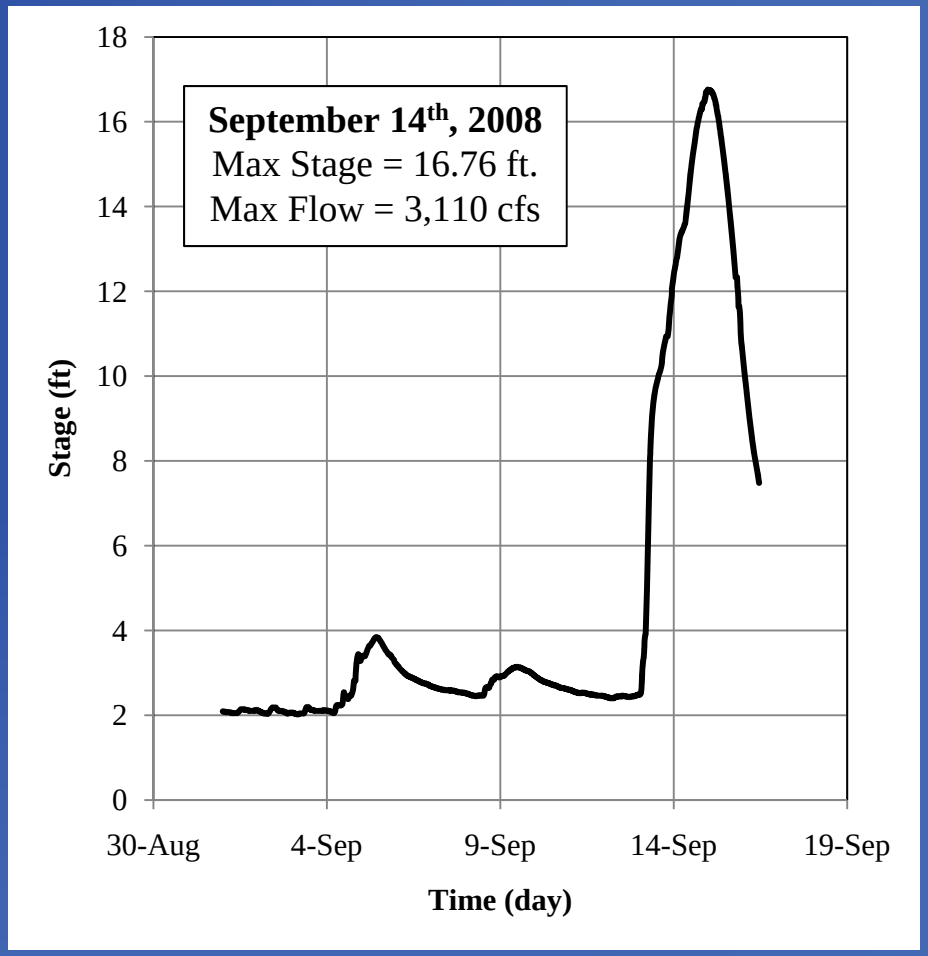
September 13th and 14th 2008

Source: Lake County Surveyors Office

USGS Gage at 213th Street in Dyer

USGS Gage at 213th Street in Dyer





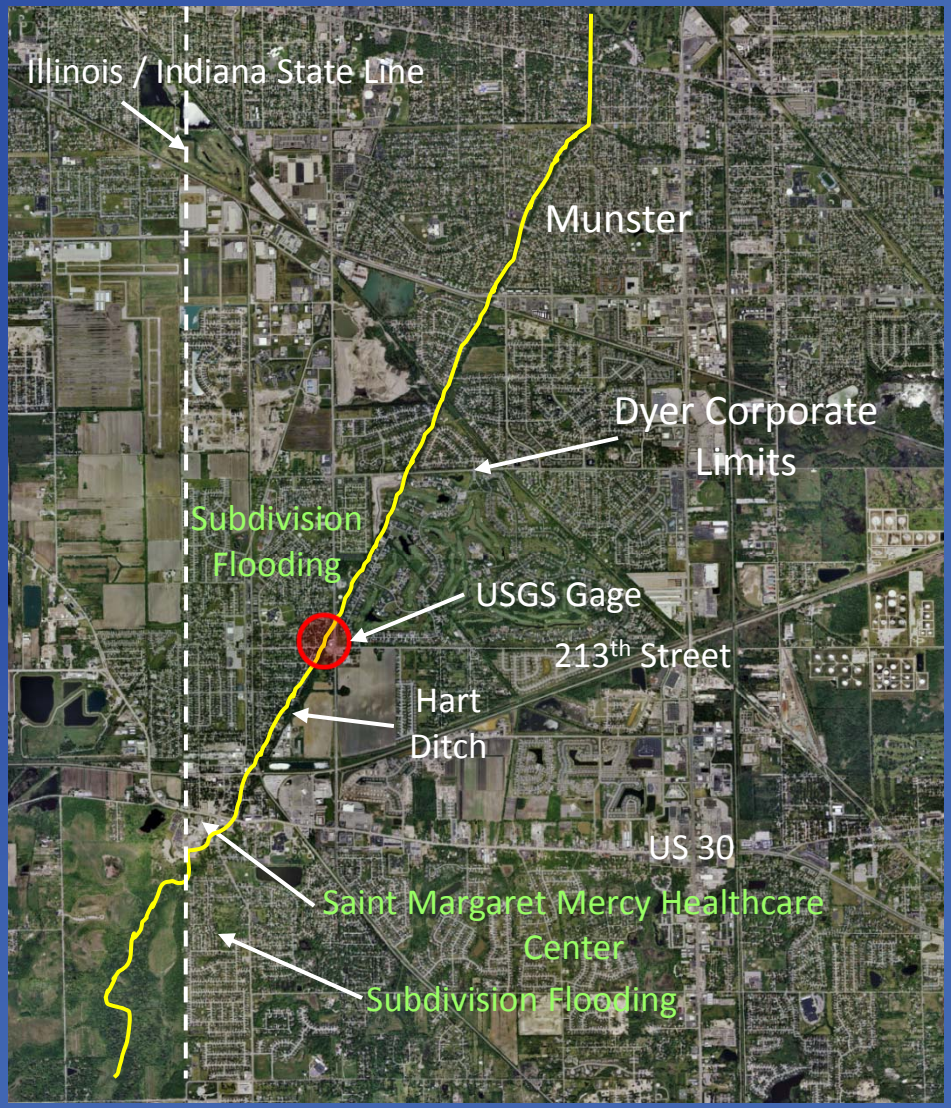
- Gage data available since Sep 1989
- Previous storm of record prior to Sep 2008 event was Nov 1990 storm event (1.4 feet)

28 - Nov - 90 → (15.40 ft.)
24 - Aug - 07 →(15.66 ft.)
08 - Jan - 08 → (12.31 ft.)
14 - Sep - 08 → (16.76 ft.)
23 - Dec - 08 → (11.32 ft.)

Flooding Areas

- Plum Creek / Hart Ditch Overtopped Banks
  - August 2007
  - September 2008

- Significant Damages
  - Dyer, Indiana
  - Munster, Indiana
  - Crete TWP, IL



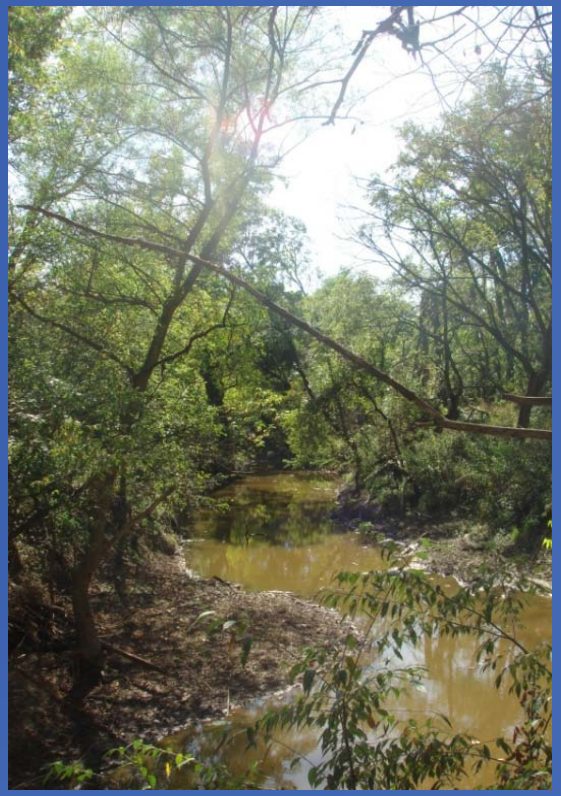
The Need for Early Warning

- 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

Study Partners

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



What Happens in Dyer During Storm Events?

- Will Hart Ditch overtop its banks?
- If flooding is imminent, when will flooding occur?
  - How much time for emergency response
- What is the magnitude of flooding or maximum water surface elevation?
  - Level of emergency response
- How high will the water surface elevation rise after the storm has passed?

Available Gage Data

- USGS Gage data
  - Existing gages
    - Rain gage – Crete, IL
    - Stage and rain gage – Hart Ditch at Dyer, IN
  - New gages (Cooperation with Dyer and LCSO)
    - Rain gage – Near Goodenow, IL (2009)
    - Stage gage – Plum Creek near Crete, IL (2009)

Available Hydrologic Gage Data

Available Hydraulic Gage Data

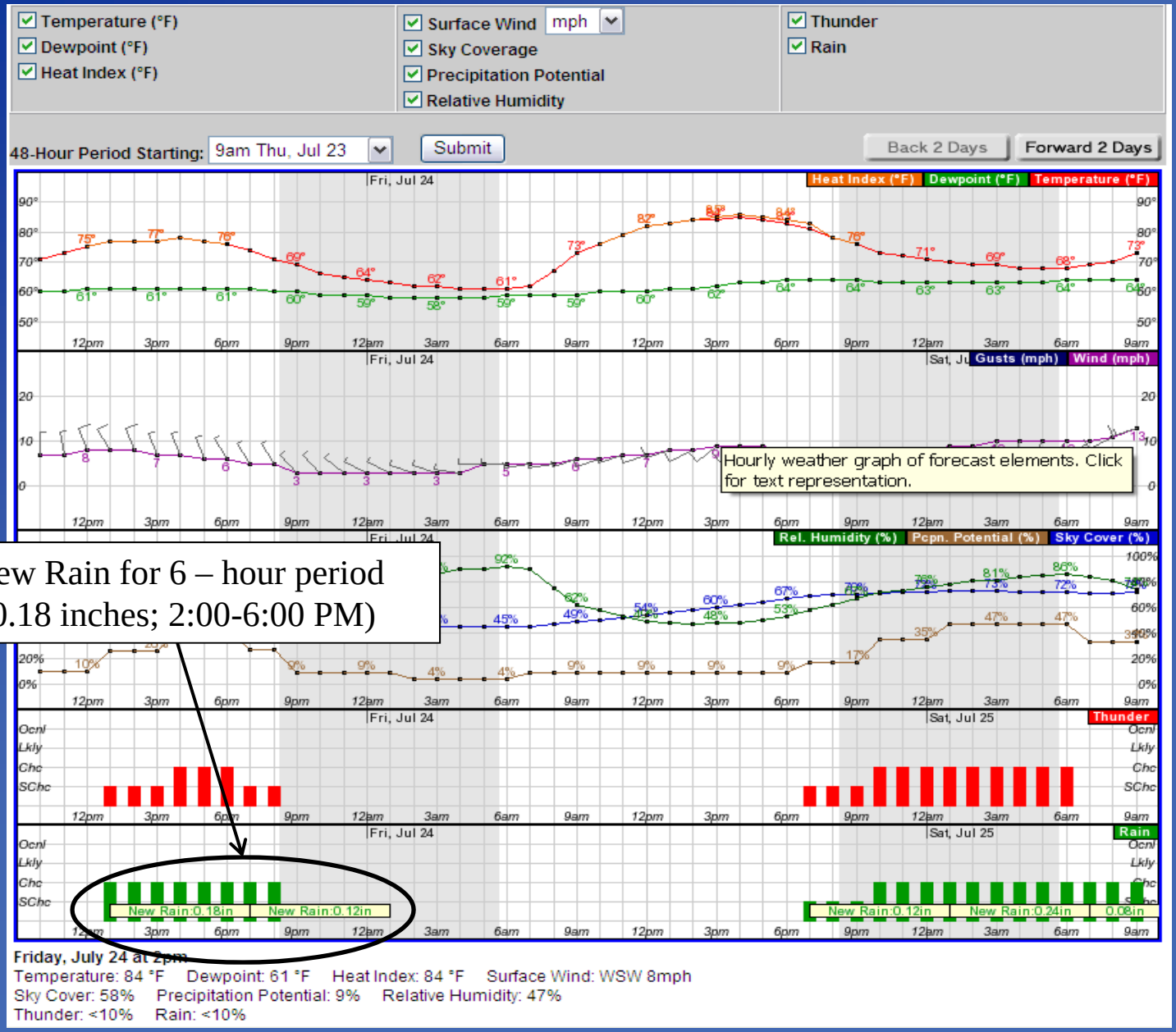
Its Raining - Will Flooding Occur?

- Make a prediction
- Hydrologic and Hydraulic models
  - HEC-HMS and HEC-RAS
    - Best available data
- Calibrated using August 2007 measurements
- Verified using September and January 2008 storm events
  - Observed high water marks
  - USGS gage data

During a Storm Event

- USGS gage monitoring via internet
  - How much precipitation has fallen
  - What is the water surface elevation in Will County and Dyer
- What is the precipitation forecast for the watershed (National Weather Service)
  - Six hour forecast

National Weather Service Forecast



New Rain for 6 – hour period
(0.18 inches; 2:00-6:00 PM)

Making a Prediction

- Pull data from Crete and Goodenow precipitation gages
- Add precipitation forecast from NWS
- Enter storm event into HEC-HMS
- Execute HMS and extract flow rates
  - Determine time of peak at 213th Street in Dyer
- Enter flow rate into RAS
- Determine maximum flood elevation throughout Dyer

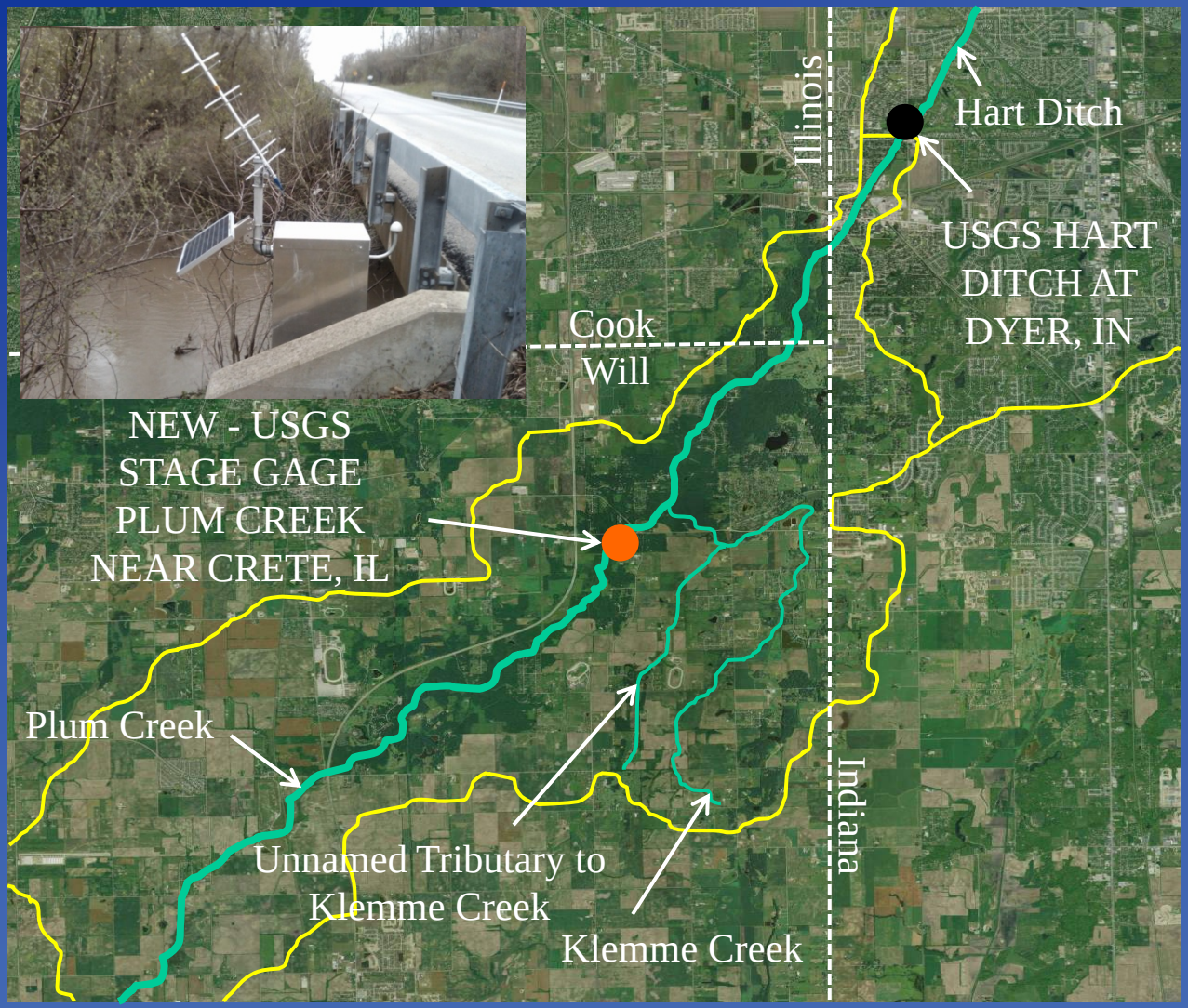
Predictions

- At 213th Street in Dyer
  - May 12th – May 15th 2009
    - Predicted = 7.2 feet on May 16th at 7:00 AM
    - Measured = 6.7 feet on May 16th at 8:15 AM
  - October 23rd – October 31st 2009
    - Predicted = 9.6 feet on October 31st at 12:00 AM
    - Measured = 9.2 feet on October 31st at 3:30 AM
  - Watershed sensitivity
    - December 28th 2008, → 1.5” → 11.3 feet
    - December 26th 2009, → 0.9” → 6.12 feet
      - NWS predicted 1.5” over the watershed however only 0.9” was measured

Additional Tools

- Correlation between stage gages
  - Plum Creek near Crete vs. Hart Ditch at Dyer
  - If gage reading is at 15 feet near Crete what can be expected in Dyer
  - How much time is available to prepare if flooding is eminent
- What rainfall rate will produce a flood threat (i.e. 3 inches in 12 hours)

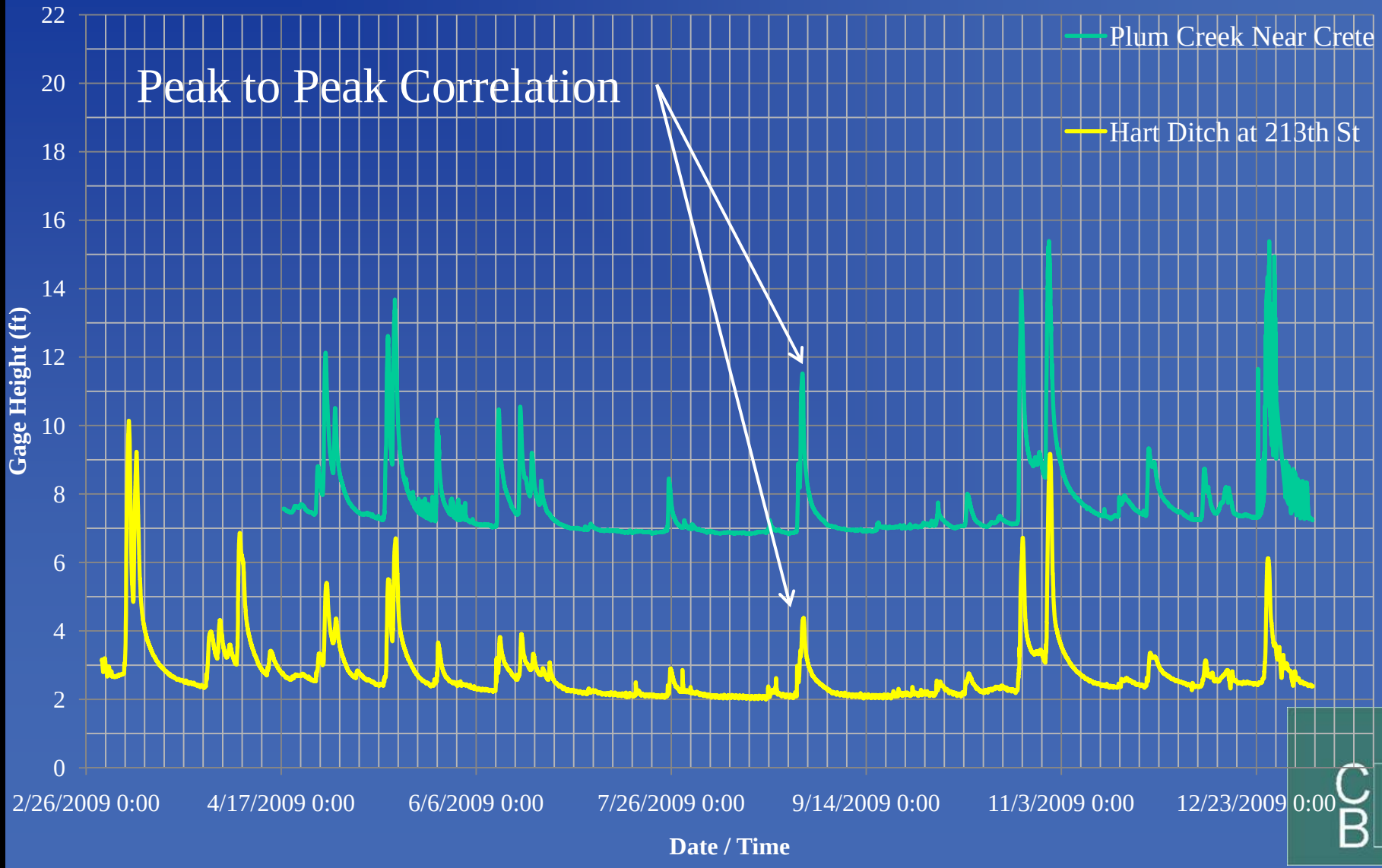
Correlation Between Stage Gages



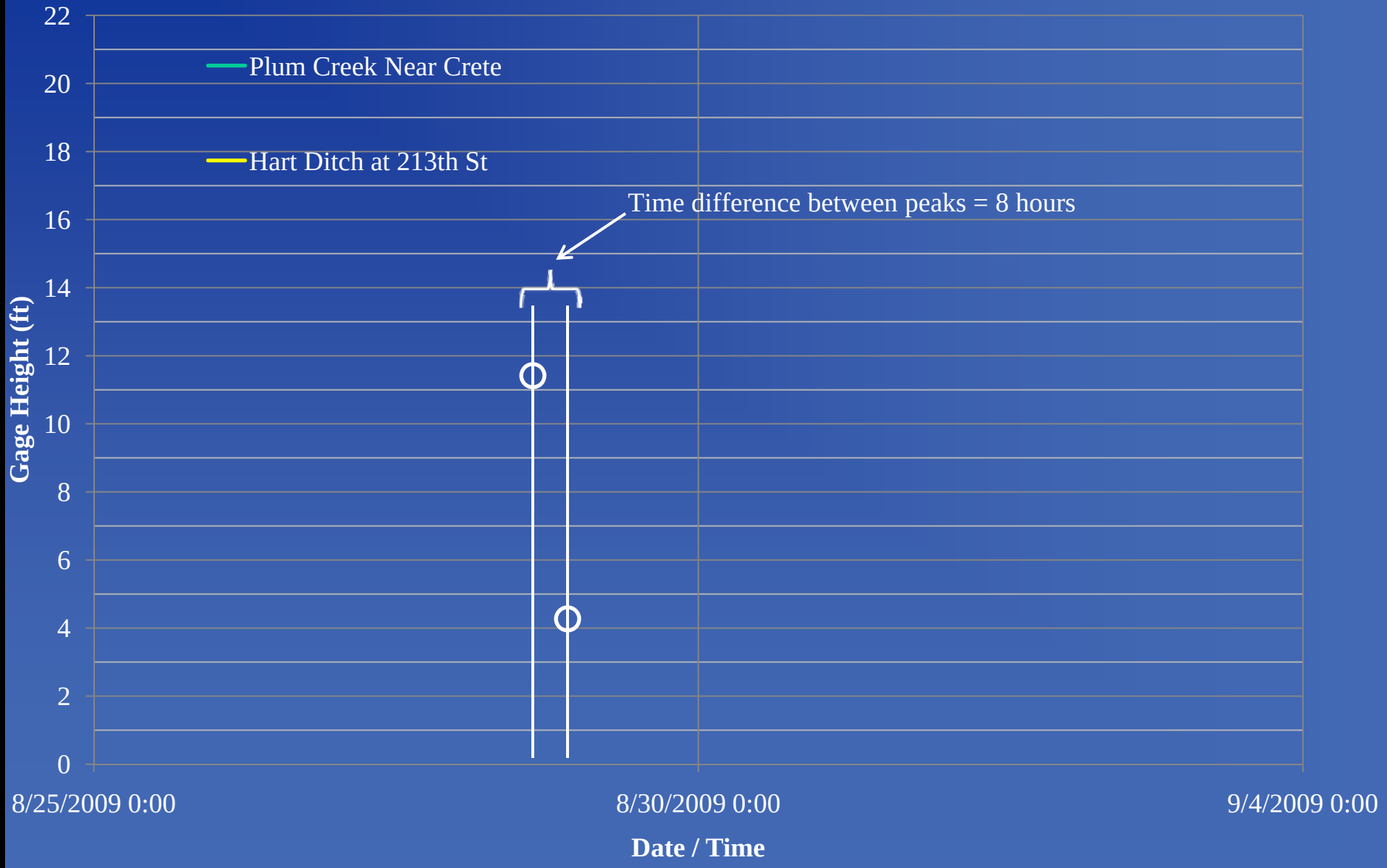
- 15 miles between two stage gages
- How much time between peaks

Data Collection

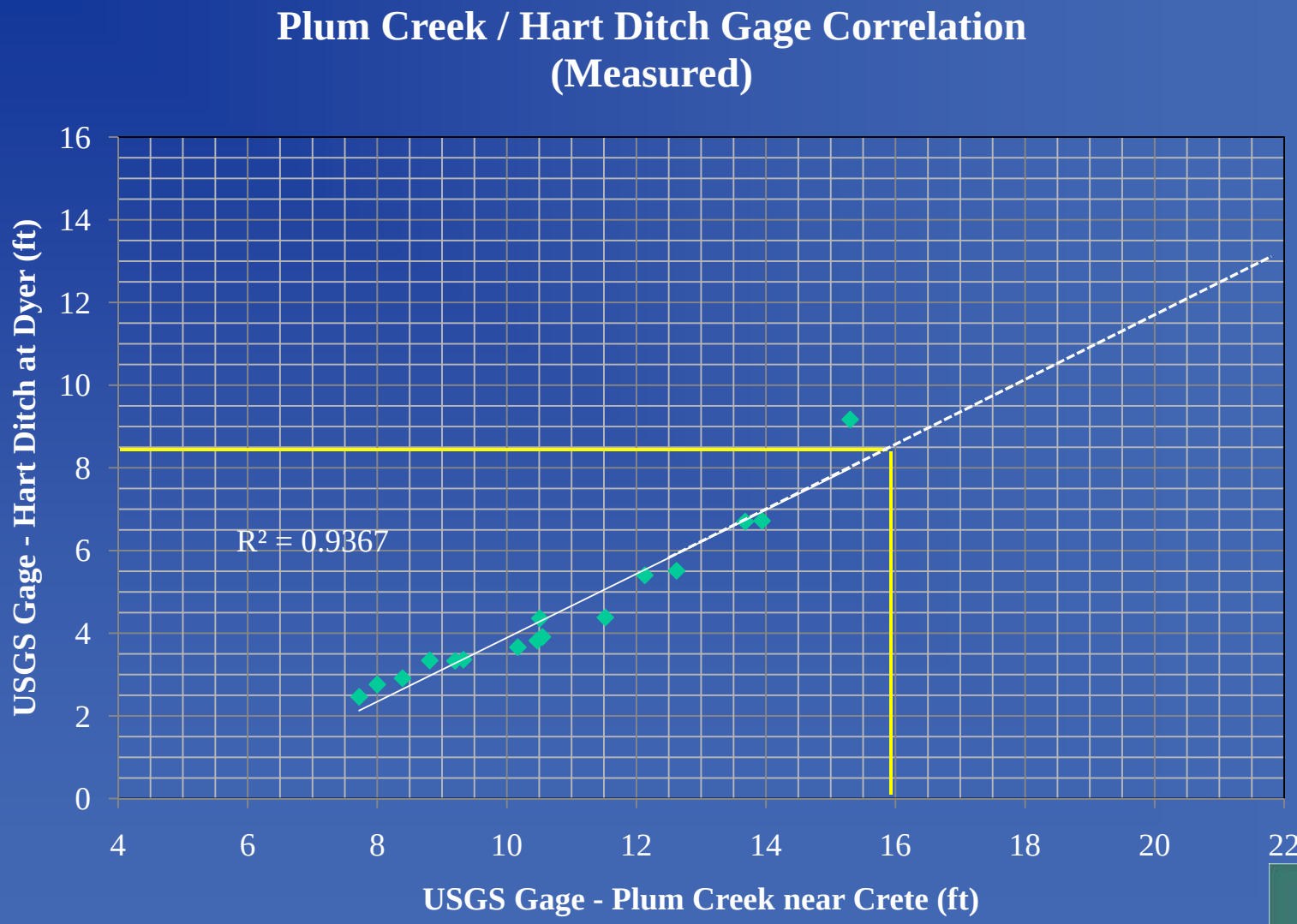
Plum Creek / Hart Ditch Gage Correlation



Peak to Peak Correlation



Correlation Between Stage Gages



USGS Automated Call-Out

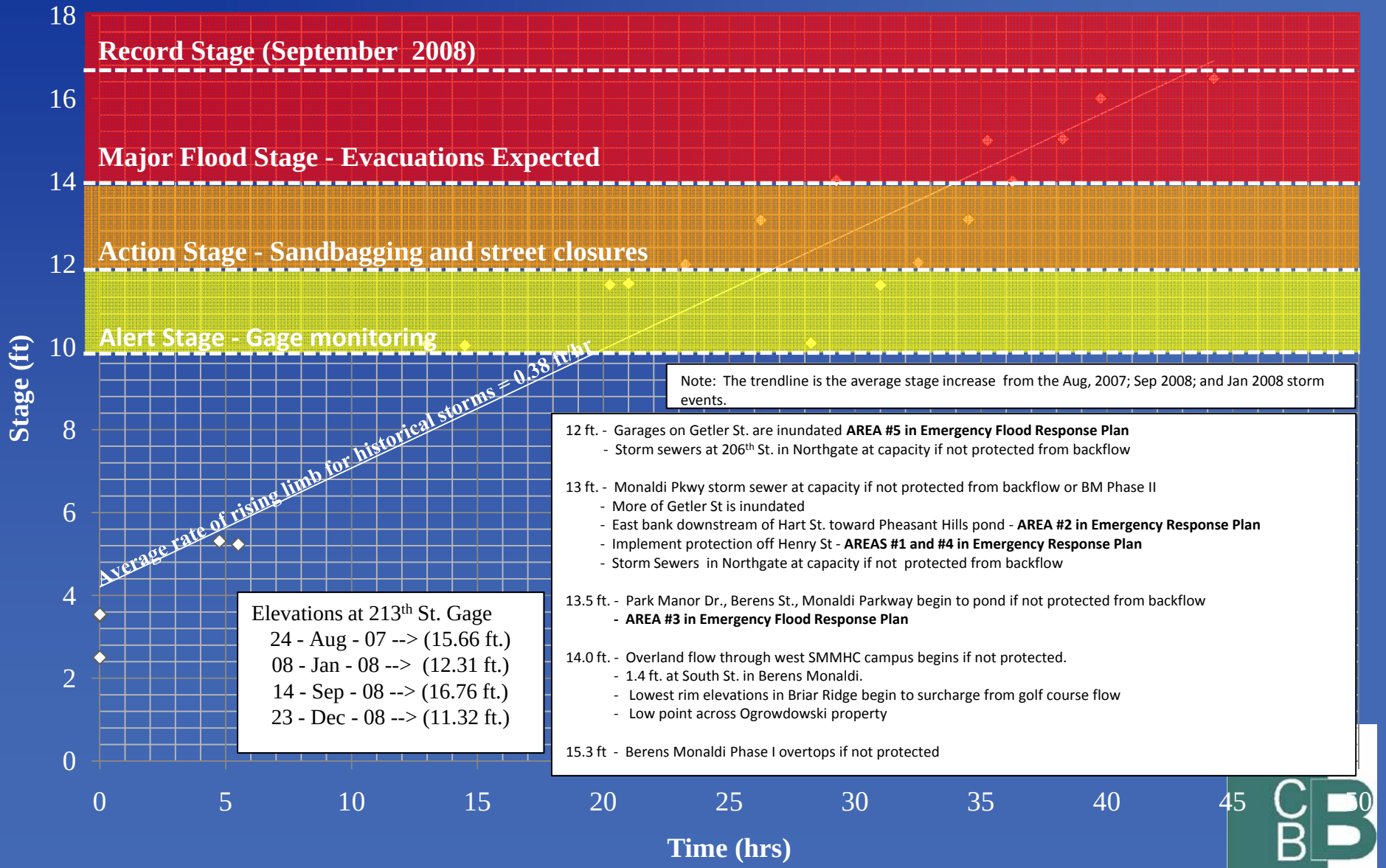
- The gages will send an automated message to a pre-determined list of emergency response personnel
  - Precipitation gages
    - 2 inches / 12 hours (voice message)
    - 4 inches / 24 hours (voice message)
  - Stage for Plum Creek near Crete
    - Gage sends a warning when water surface elevation reaches 16 feet (text and email)

Emergency Response Plan

- Gage notifies CBBEL and Dyer staff when warning height is reached
- CBBEL will make a hydrograph prediction
  - Timing and peak will be determined
- Magnitude of potential threat will be assessed
- Mobilize emergency response
  - Sand bag teams in flood prone areas
  - Reverse 911
  - Evacuation

Emergency Response

Warning Stage - 213th Street Gage, Dyer



Note: The trendline is the average stage increase from the Aug, 2007; Sep 2008; and Jan 2008 storm events.

12 ft. - Garages on Getler St. are inundated **AREA #5 in Emergency Flood Response Plan**
- Storm sewers at 206th St. in Northgate at capacity if not protected from backflow

13 ft. - Monaldi Pkwy storm sewer at capacity if not protected from backflow or BM Phase II
- More of Getler St is inundated
- East bank downstream of Hart St. toward Pheasant Hills pond - **AREA #2 in Emergency Response Plan**
- Implement protection off Henry St - **AREAS #1 and #4 in Emergency Response Plan**
- Storm Sewers in Northgate at capacity if not protected from backflow

13.5 ft. - Park Manor Dr., Berens St., Monaldi Parkway begin to pond if not protected from backflow
- **AREA #3 in Emergency Flood Response Plan**

14.0 ft. - Overland flow through west SMMHC campus begins if not protected.
- 1.4 ft. at South St. in Berens Monaldi.
- Lowest rim elevations in Briar Ridge begin to surcharge from golf course flow
- Low point across Ogrowdowski property

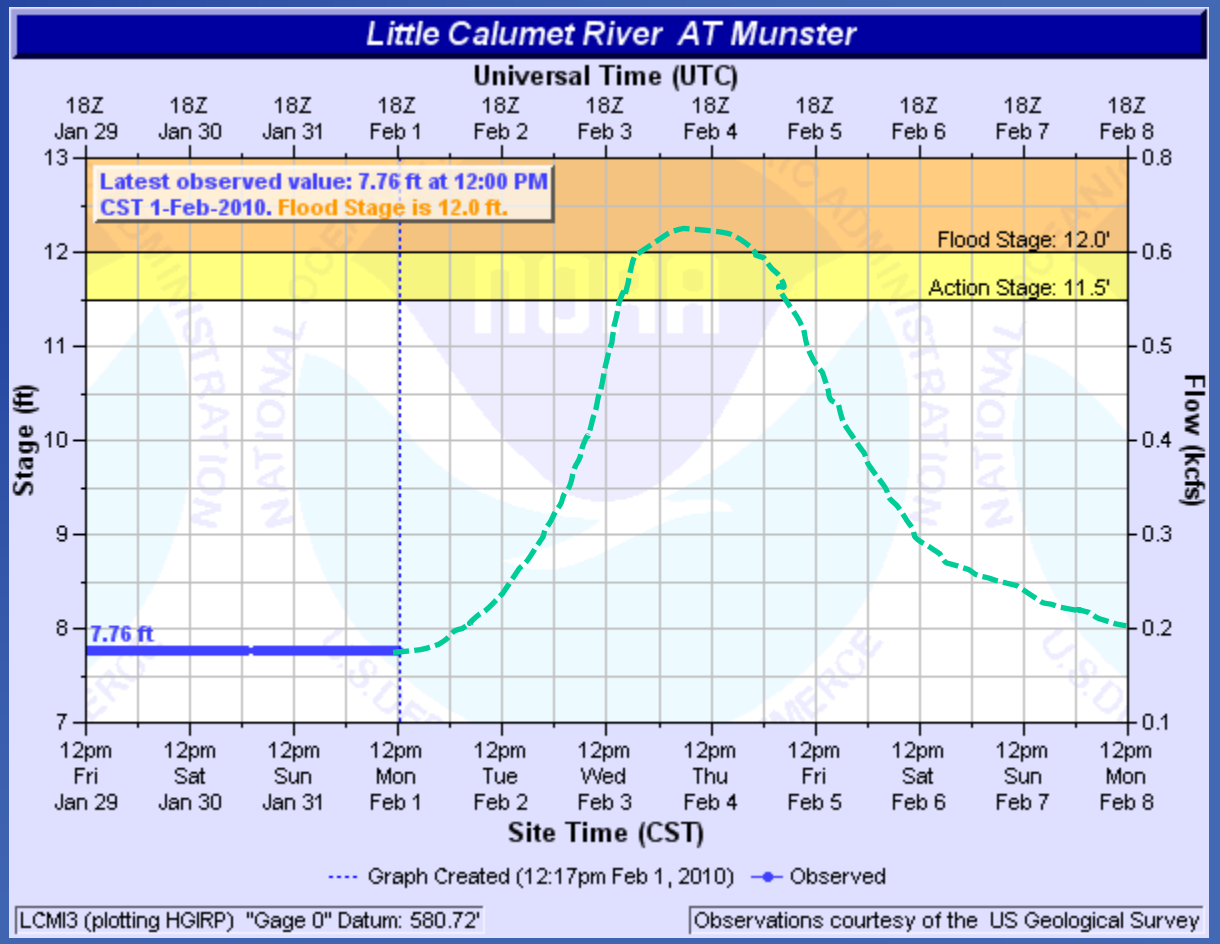
15.3 ft - Berens Monaldi Phase I overtops if not protected

Elevations at 213th St. Gage
24 - Aug - 07 --> (15.66 ft.)
08 - Jan - 08 --> (12.31 ft.)
14 - Sep - 08 --> (16.76 ft.)
23 - Dec - 08 --> (11.32 ft.)

National Weather Service

- NWS has an Advanced Hydrologic Prediction Service (AHPS)

- CBBEL is working with NWS to make Hart Ditch at Dyer a forecasting point
  - Scheduled to be on-line April 1, 2010



Emergency Response Plan and Town of Dyer

- Town is currently working on a website(s) that contains all gage, weather, and emergency response information
  - Two websites
    - Public access and separate Town access
  - Threat level
- USGS gages are monitored by website
- Predictions will be reported

Conclusions

- Early warning system using USGS gages
  - Developed a correlation between gages
    - 16 feet at Plum Creek gage = 8.5 feet at Hart Ditch gage
  - 8 hours lead time “peak to peak”
    - prepare and utilize an emergency action plan
- USGS gages will notify emergency personnel
  - 2 inches / 12 hours or 4 inches / 24 hours
  - 16 feet at Plum Creek near Crete
- NWS currently working on Hart Ditch at Dyer becoming an AHPS point


Comments