CE 3354 ENGINEERING HYDROLOGY

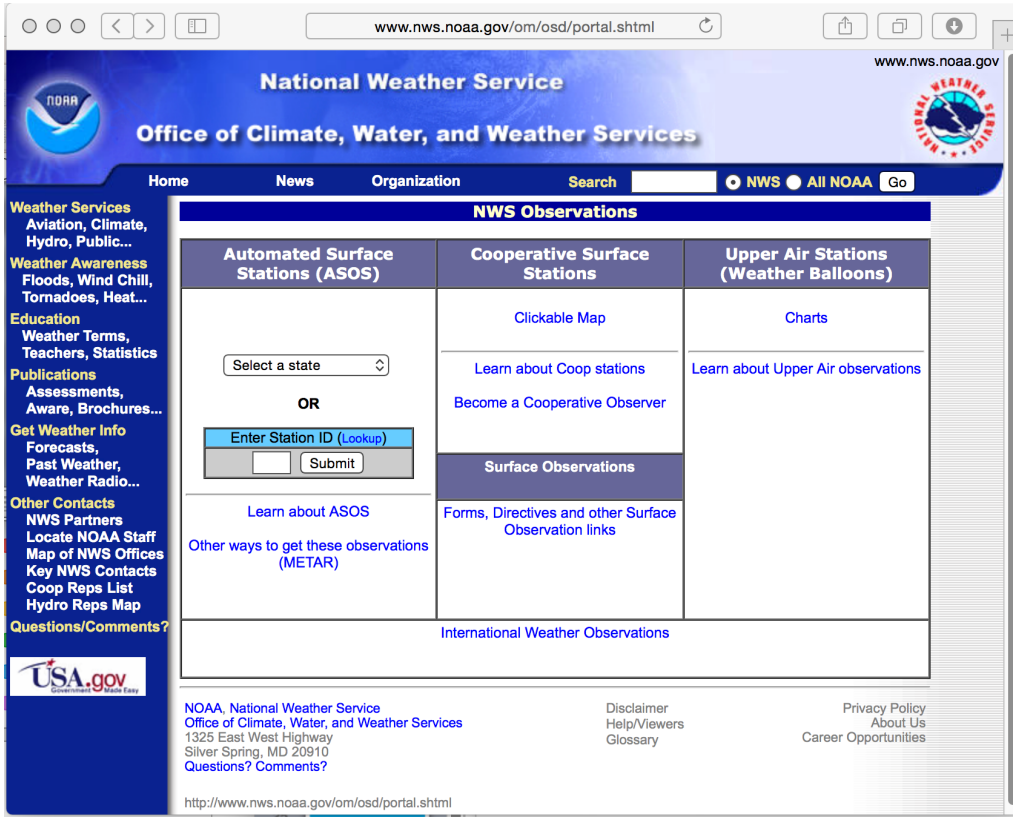
LECTURE 3: HYDROLOGIC DATA, WATERSHED DELINEATION

OUTLINE

- Hydrologic Data
- Watershed Delineation

HYDROLOGIC DATA

- Data sources for rainfall:
  - National Weather Service
  - Surface Weather Observation Stations

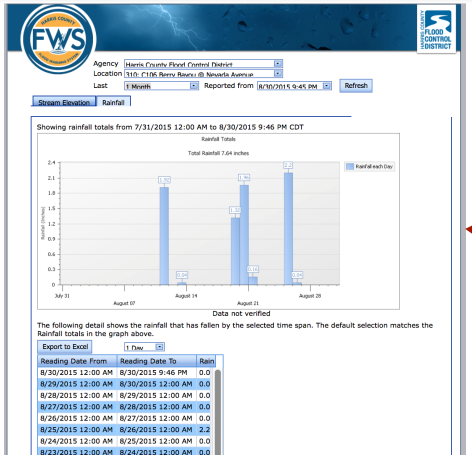


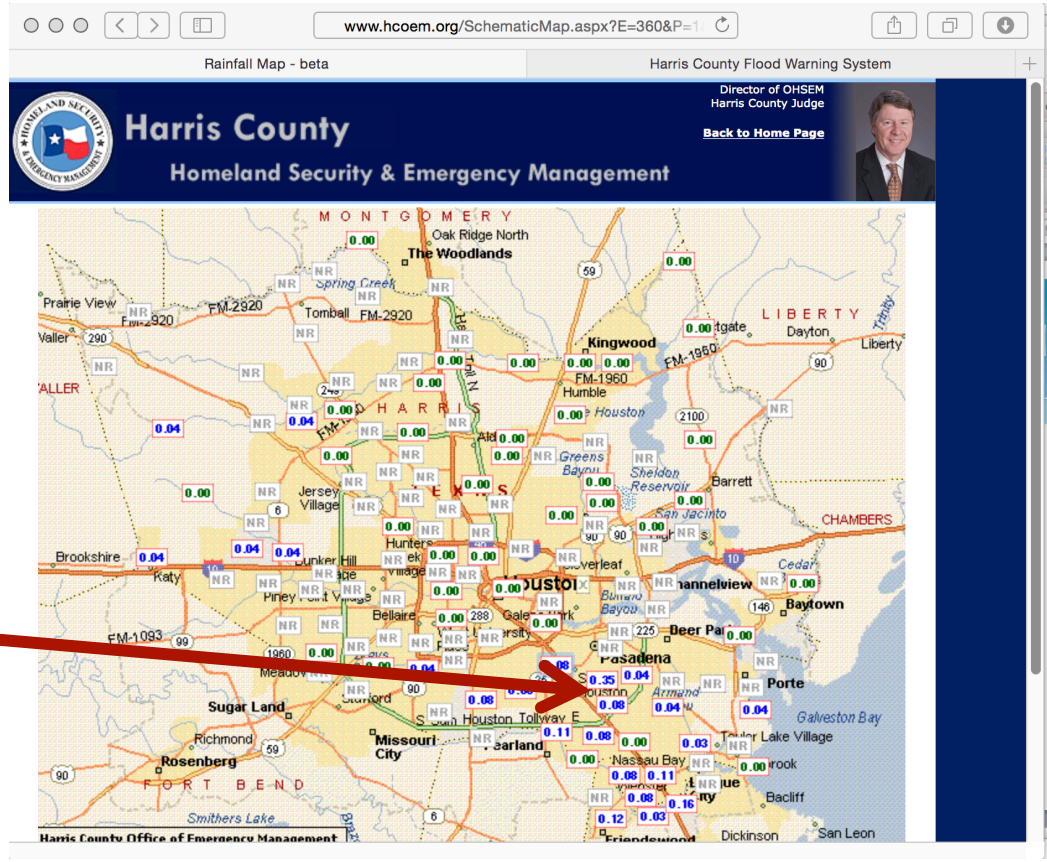
HYDROLOGIC DATA

- Data sources for rainfall:
  - National Weathe Service
  - Surface Weathe Observation Stations

HYDROLOGIC DATA

- Data sources for rainfall:
  - Local Gage Networks





HYDROLOGIC DATA

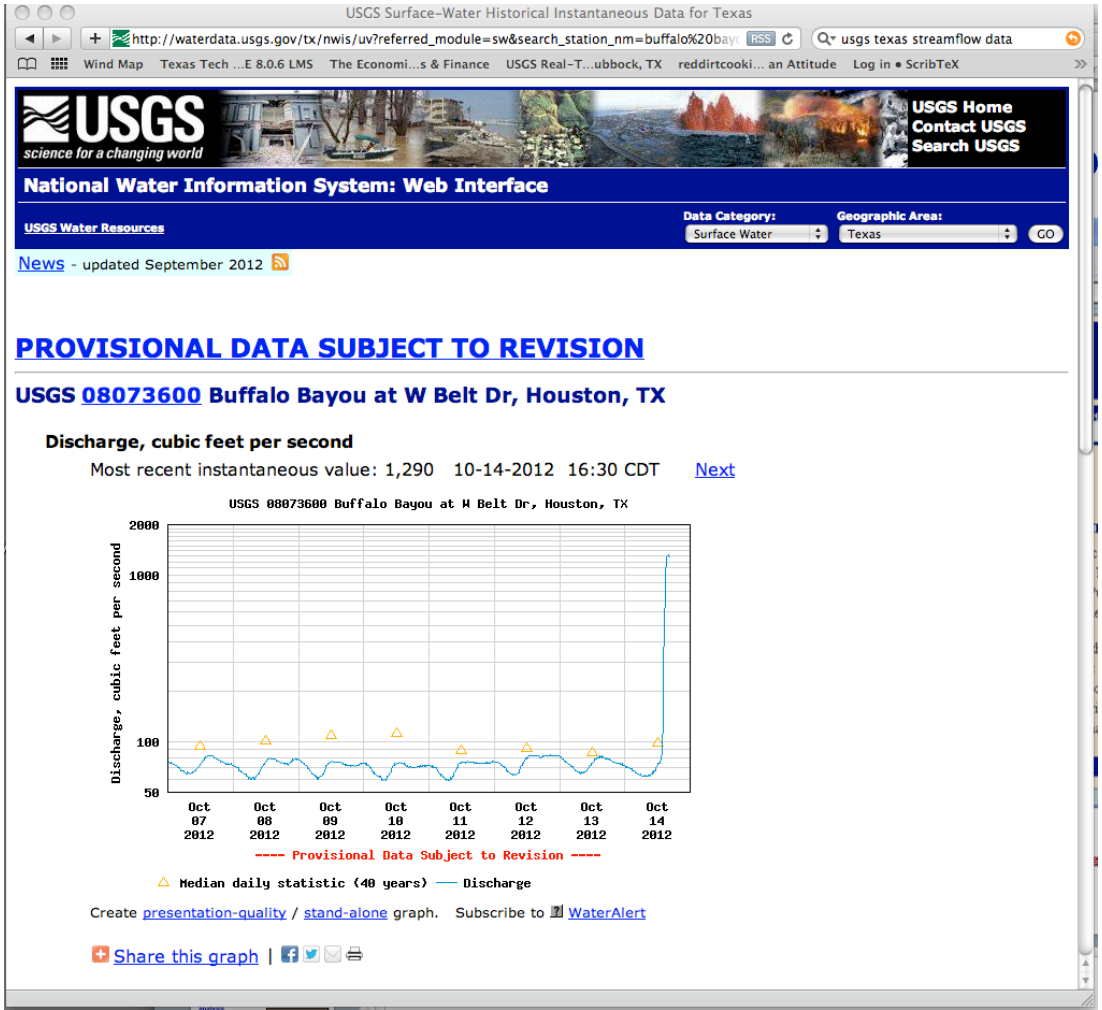
- Data sources for streamflow include:
  - USGS NWIS (Website)
  - IBWC
  - Older “paper-based” records
  - Local gage networks

USGS WEBSITE

Start here and build a QUERY →

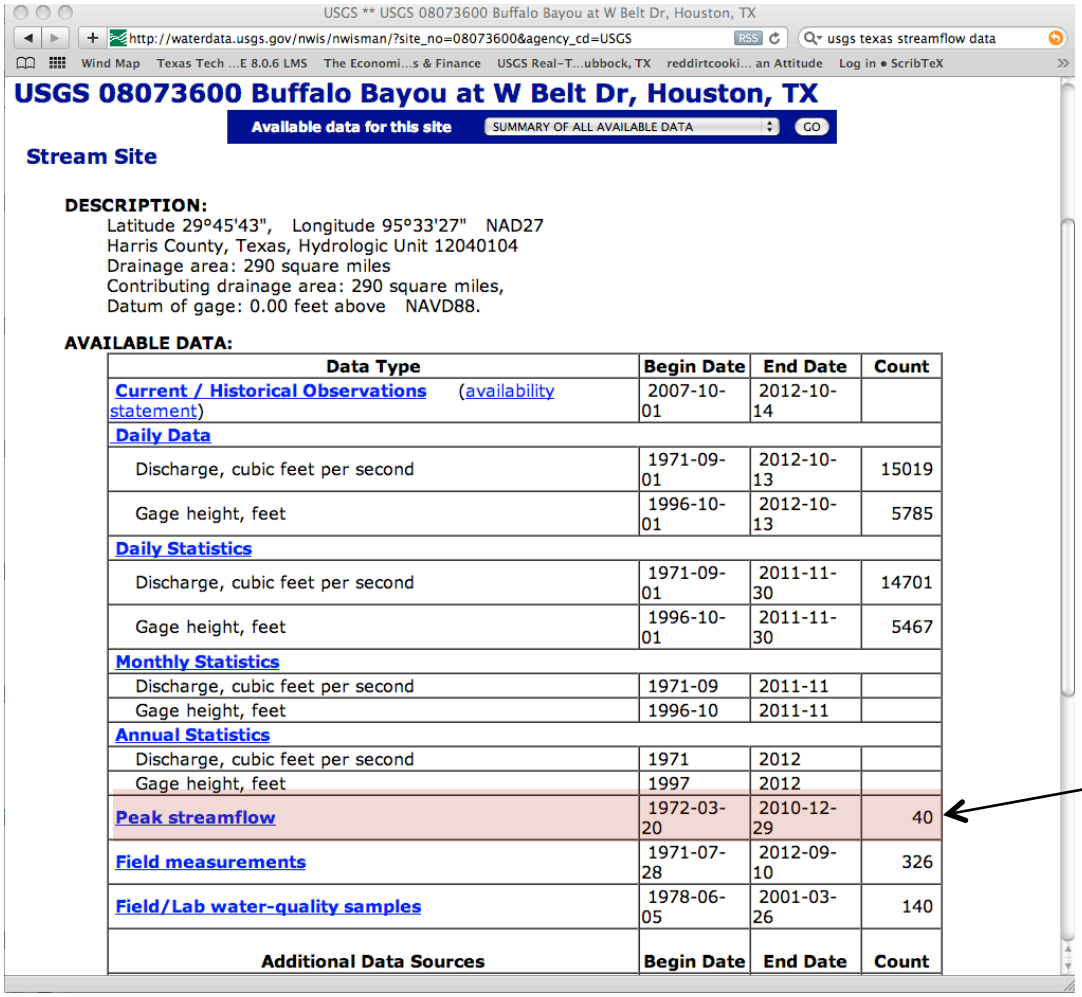
USGS WEBSITE

- Search Result for "Harris County + Buffalo Bayou"



USGS WEBSITE

- Select the Station ID can find Peak Discharges



USGS ** USGS 08073600 Buffalo Bayou at W Belt Dr, Houston, TX

http://waterdata.usgs.gov/nwis/nwisman/?site_no=08073600&agency_cd=USGS

usgs texas streamflow data

Wind Map | Texas Tech ...E 8.0.6 LMS | The Economi...s & Finance | USGS Real-T...ubbock, TX | reddirtcooki... an Attitude | Log in • ScribTeX

USGS 08073600 Buffalo Bayou at W Belt Dr, Houston, TX

Available data for this site | SUMMARY OF ALL AVAILABLE DATA | GO

Stream Site

DESCRIPTION:

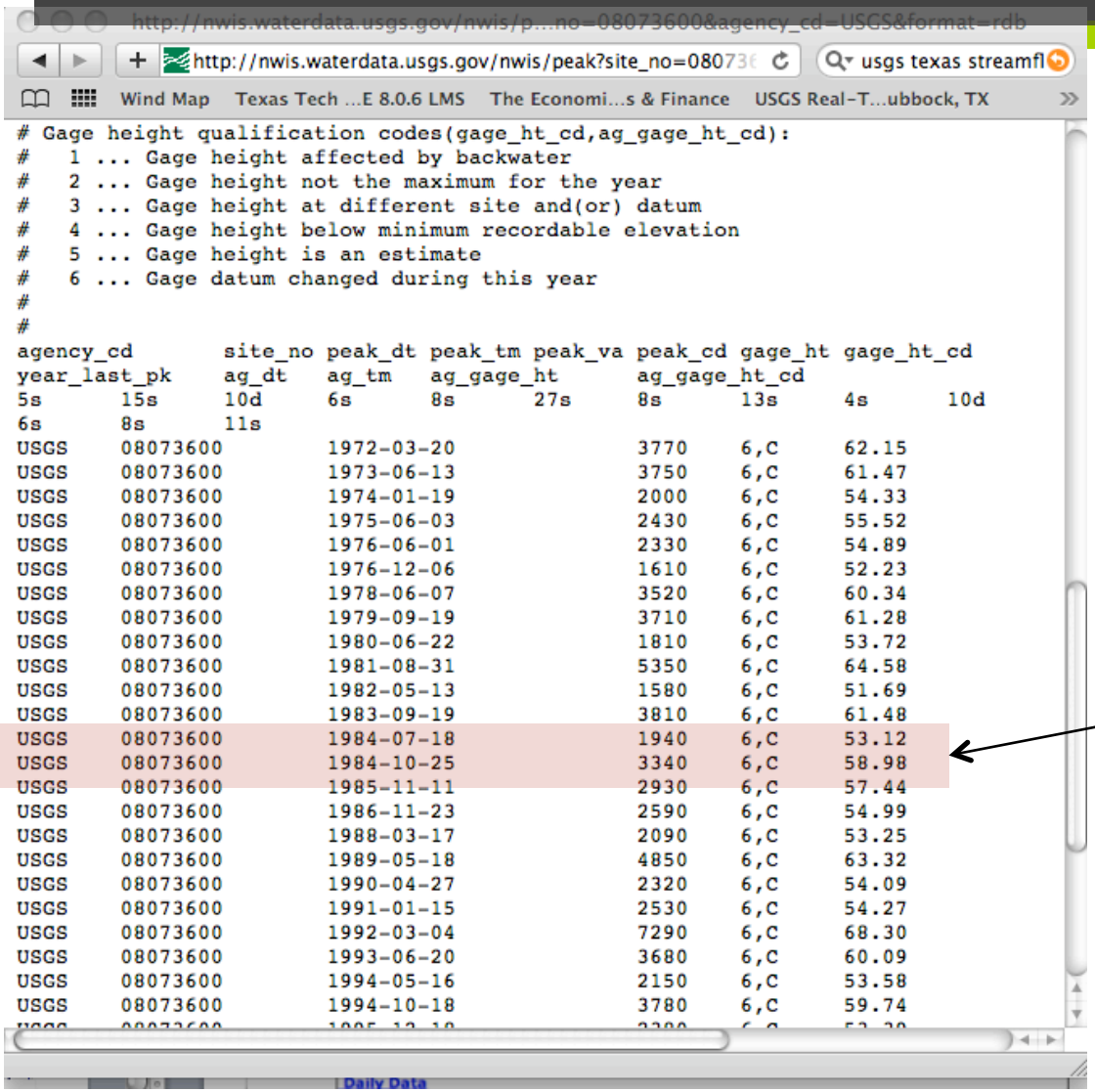
Latitude 29°45'43", Longitude 95°33'27" NAD27
Harris County, Texas, Hydrologic Unit 12040104
Drainage area: 290 square miles
Contributing drainage area: 290 square miles,
Datum of gage: 0.00 feet above NAVD88.

AVAILABLE DATA:

Data Type	Begin Date	End Date	Count
Current / Historical Observations (availability statement)	2007-10-01	2012-10-14	
Daily Data			
Discharge, cubic feet per second	1971-09-01	2012-10-13	15019
Gage height, feet	1996-10-01	2012-10-13	5785
Daily Statistics			
Discharge, cubic feet per second	1971-09-01	2011-11-30	14701
Gage height, feet	1996-10-01	2011-11-30	5467
Monthly Statistics			
Discharge, cubic feet per second	1971-09	2011-11	
Gage height, feet	1996-10	2011-11	
Annual Statistics			
Discharge, cubic feet per second	1971	2012	
Gage height, feet	1997	2012	
Peak streamflow	1972-03-20	2010-12-29	40
Field measurements	1971-07-28	2012-09-10	326
Field/Lab water-quality samples	1978-06-05	2001-03-26	140
Additional Data Sources	**Begin Date**	**End Date**	**Count**

40-yr. record, adequate for
1% AEP analysis as per Bulletin 17B

USGS WEBSITE



- Typical annual peak file from USGS

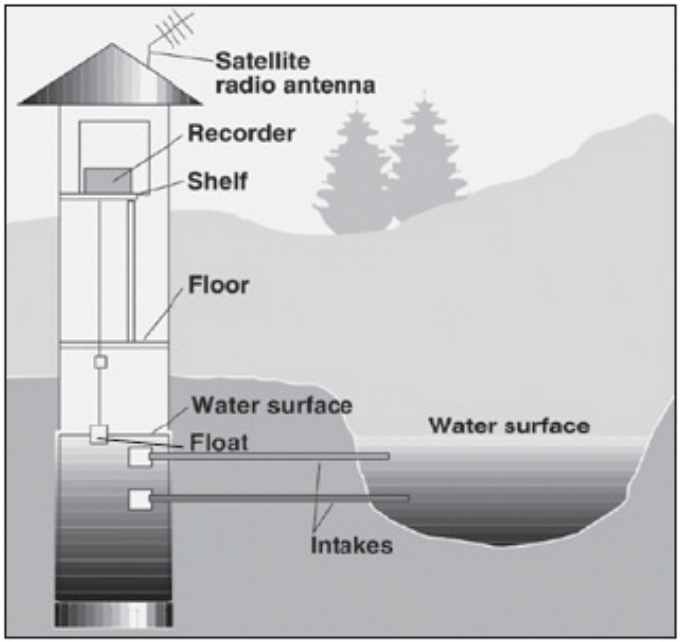
Annual peaks are by "water year"
Like a fiscal year, multiple water years span calendar years

STREAMFLOW GAUGES

- Different kinds of gages
  - Continuous record (usually stage, then rated to produce discharge)
    - Located at control section if possible
  - Crest-Stage (captures peak stage)
    - Uses slope-area to estimate discharge
    - Post-event site visit recommended to survey debris-line as independent check of estimate

CONTINUOUS GAGE (DCP)

- Continuous gage use some kind of stilling well, and transducers to measure stage and send to satellite. During visits, a nearby staff gage is read to independently validate the transducer readings



http://ga.water.usgs.gov/edu/streamflow1.html

CREST-STAGE GAGE

- Vertical pipe has holes in bottom – becomes a stilling well.
- Inside a staff gage and small amount of cork “flour” records water surface elevation.
- Analyst visits site routinely (or after event) and records cork elevation and re-sets gage.
- The elevations are marked on a staff inside the pipe with pencil (and dated)
- Slope area between several nearby pipes is used to estimate discharge

SLOPE-AREA

- Application of Manning's equation, using the slope of the water surface as the friction slope, and the stage-geometry at measured cross sections.

$$Q = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

* See pp 33-39 CMM for a derivation of Manning's equation
* See 7-31 TxDOT HDM for a description of slope-area (slope-conveyance) method

WHAT IS A WATERSHED?

- Topographic area that collects and discharges surface streamflow through one outlet or mouth (pour point)
- The area on the surface of the Earth that drains to a specific location
- In groundwater a similar concept is called a groundwater basin – only the boundaries can move depending on relative rates of recharge and discharge

WATERSHED DELINEATION

- Identifies the boundaries of our hydrologic unit / area of study.
  - Need to interpret topographic maps (or DEM/DTM) to construct the boundary
  - Read “How to …” on server (check the reading list!)

IDENTIFYING WATERSHED BOUNDARIES

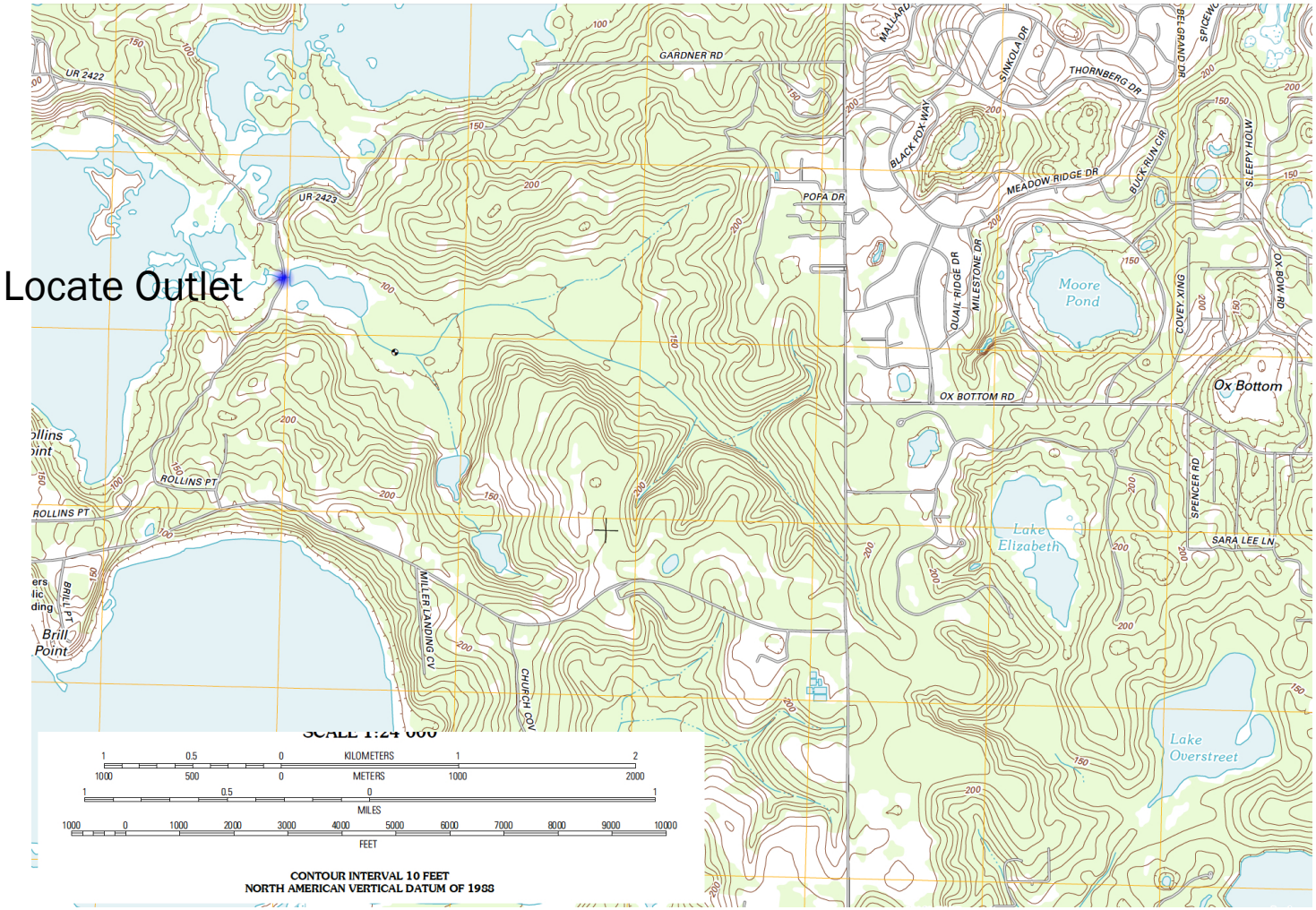
- Steps to delineation
  - Superimpose a grid
    – used to assign average elevations for demarking the boundary
  - Trace/outline the main stem of the stream that you want to examine
  - Trace all perennial or influential tributaries
  - Locate the lowest point/outlet of the main stem and work uphill

IDENTIFYING BOUNDARIES

- Working uphill, Identify the ridges and hill tops that divide the water from flowing into separate watersheds

- When in doubt, consider,
  - Where will the rain drops go

WATERSHED DELINEATION



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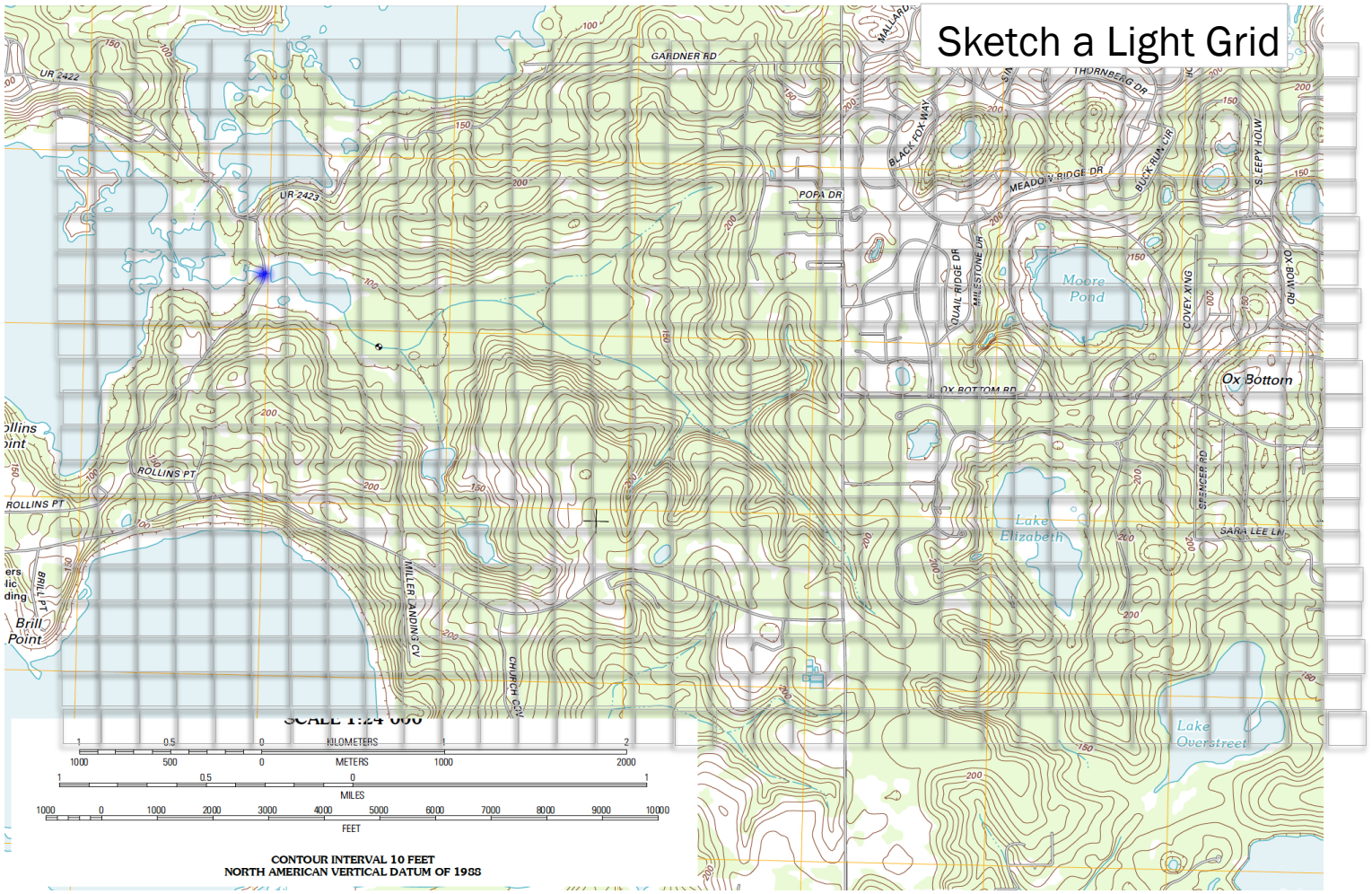

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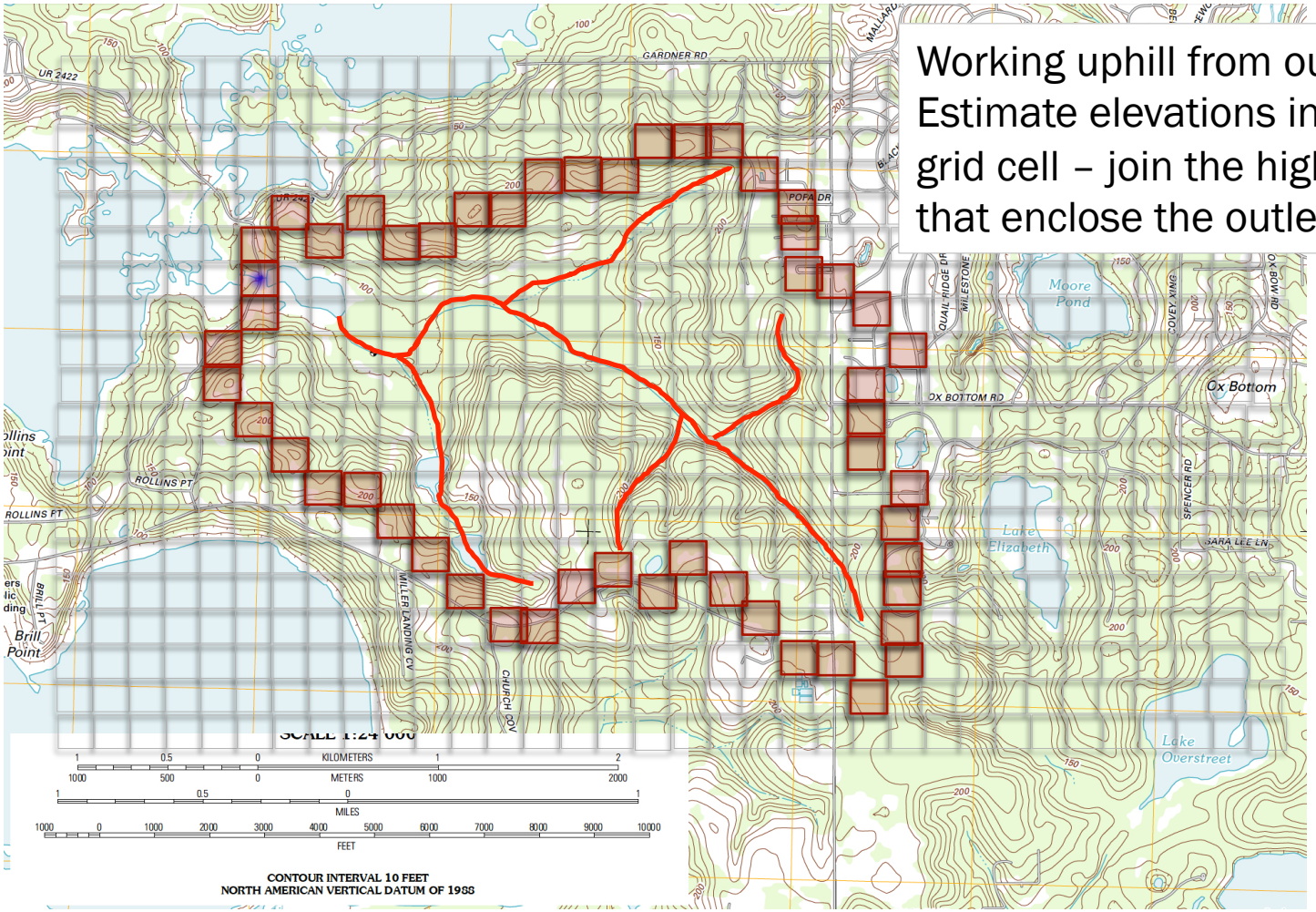

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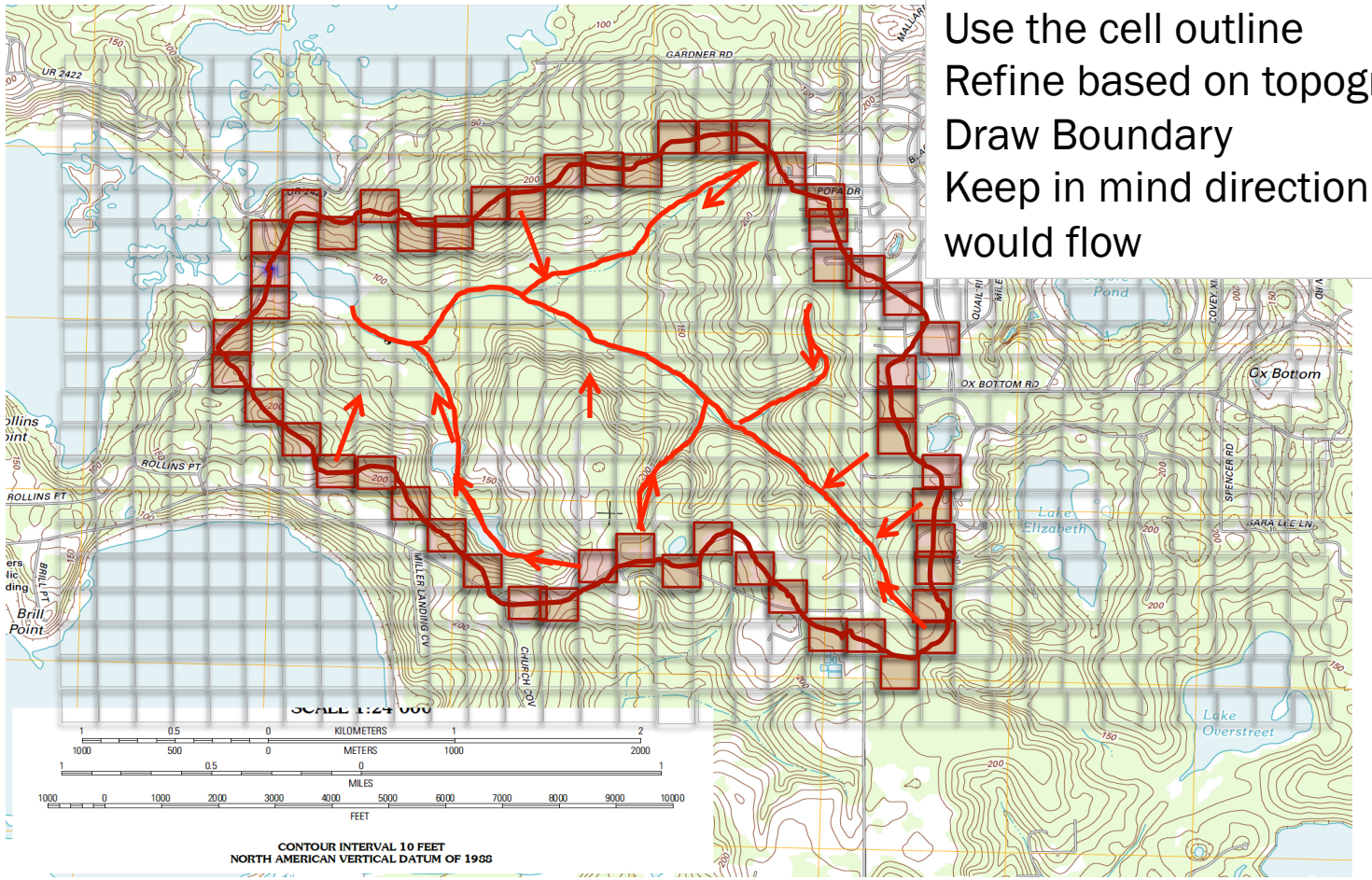

Use the cell outline
Refine based on topography
Draw Boundary
Keep in mind direction water would flow

WATERSHED DELINEATION

- Repeat the example in-class as team exercise
  - Work on 11X17 supplied maps
- Hardin Branch watershed as team exercise
  - Hardin Branch is part of the semester project, so be sure you delineate the watershed with some commitment to accuracy
  - Work on 11x17 supplied maps

Next Time

- Watershed Delineation (continued)
- Watershed Metrics