



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

The screenshot shows a web browser displaying the National Weather Service's Hydrologic Data portal. The URL in the address bar is www.nws.noaa.gov/om/osd/portal.shtml. The page title is "National Weather Service" and "Office of Climate, Water, and Weather Services". The main content area is titled "NWS Observations" and contains three columns: "Automated Surface Stations (ASOS)", "Cooperative Surface Stations", and "Upper Air Stations (Weather Balloons)". The ASOS column includes a dropdown menu for selecting a state, a search bar for entering a station ID, and links to learn about ASOS and METAR observations. The Cooperative Surface Stations column includes a "Clickable Map" and links to learn about Coop stations and become a cooperative observer. The Upper Air Stations column includes a "Charts" link and a link to learn about upper air observations. At the bottom of the page, there is footer information about NOAA, National Weather Service, and various contact links, along with links to Privacy Policy, About Us, and Career Opportunities.

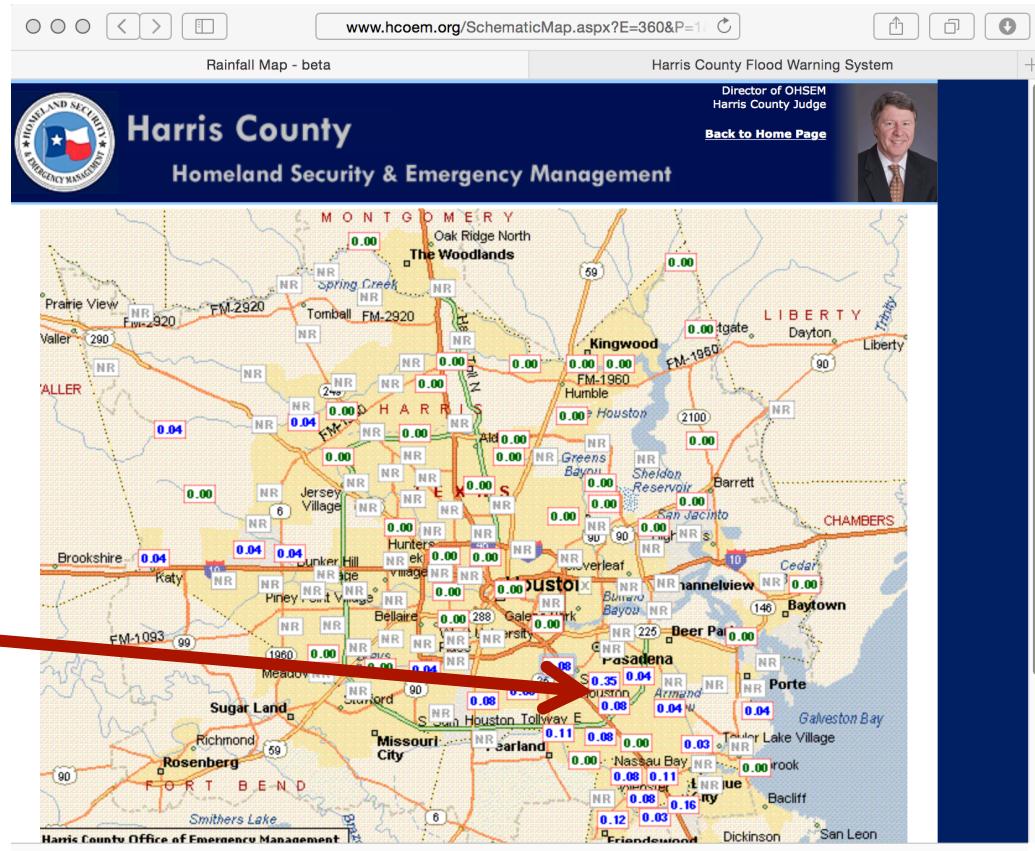
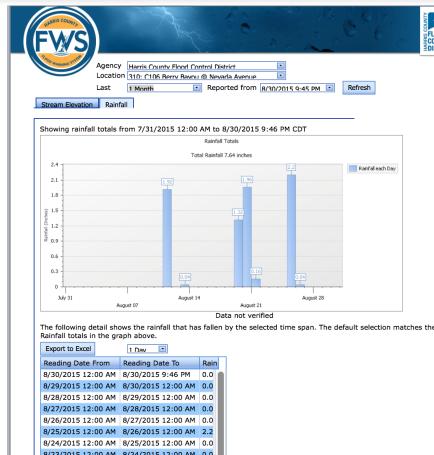
HYDROLOGIC DATA

- Data sources for rainfall:
 - National Weather Service
 - Surface Weather 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 Surface-Water Data for Texas

http://waterdata.usgs.gov/tx/nwis/sw

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

Reader Q usgs texas streamflow data

USGS Home Contact USGS Search USGS

National Water Information System: Web Interface

USGS Water Resources Data Category: Geographic Area:
Surface Water Texas GO

News - updated September 2012

USGS Surface-Water Data for Texas

Current Conditions (503 sites)
Current conditions at selected sites based on the most recent data from on-site automated recording equipment. Measurements are commonly recorded at a fixed interval of 15- to 60-minutes and transmitted to the USGS every hour. Values may include "Approved" (quality-assured data that may be published) and/or more recent "Provisional" data (of unverified accuracy and subject to revision). Most current data are provisional.

Historical Observations (647 sites)
The same data accessed by the Current Conditions link above but including both active and discontinued sites with data for any part of the period October 1, 2007, through the present. Values may include "Approved" (quality-assured data that may be published) and/or more recent "Provisional" data (of unverified accuracy and subject to revision).

Daily Data (926 sites)
Summary of all data for each day for the period of

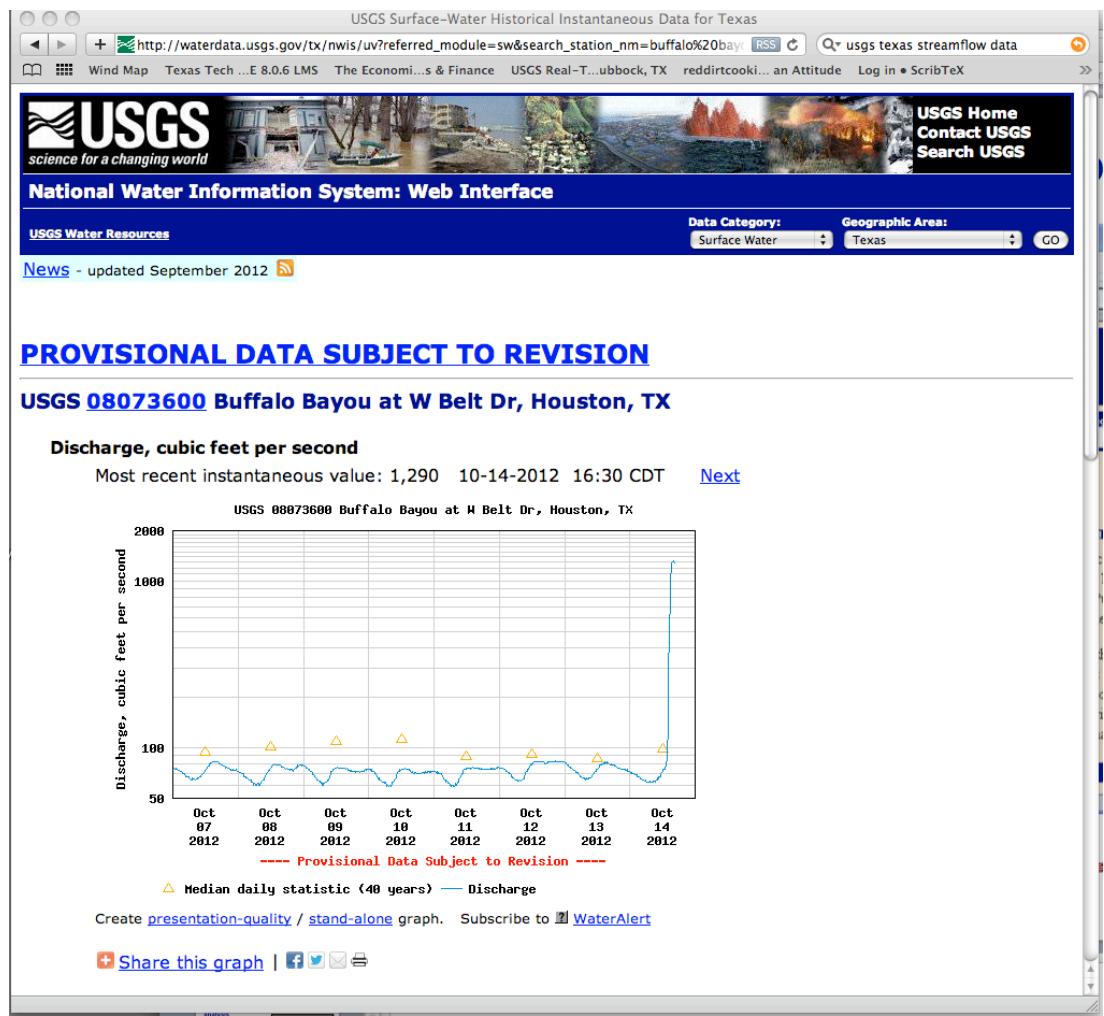
Introduction
The U.S. Geological Survey's (USGS) National Water Information System (NWIS) is a comprehensive and distributed application that supports the acquisition, processing, and long-term storage of water data. Water Data for the Nation serves as the publicly available portal to a geographically seamless set of much of the water data maintained within NWIS ([additional background](#)).

Nationally, USGS surface-water data includes more than 850,000 station years of time-series data that describe stream levels, streamflow (discharge), reservoir and lake levels, surface-water quality, and rainfall. The data are collected by automatic recorders and manual [field measurements](#) at installations across the Nation.

Data are collected by field personnel or relayed through telephones or satellites to offices where it is stored and processed. The data relayed through the Geostationary Operational Environmental Satellite (GOES) system are processed automatically in near real time, and in many cases, [current data](#) are

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

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

http://nwis.waterdata.usgs.gov/nwis/p...no=08073600&agency_cd=USGS&format=rdb

http://nwis.waterdata.usgs.gov/nwis/peak?site_no=08073600

usgs texas streamflow

Wind Map Texas Tech ...E 8.0.6 LMS The Economic & Finance USGS Real-Time Dubbo, TX

```
# Gage height qualification codes(gage_ht_cd,ag_gage_ht_cd):
# 1 ... Gage height affected by backwater
# 2 ... Gage height not the maximum for the year
# 3 ... Gage height at different site and(or) datum
# 4 ... Gage height below minimum recordable elevation
# 5 ... Gage height is an estimate
# 6 ... Gage datum changed during this year
#
# agency_cd      site_no peak_dt peak_tm peak_va peak_cd gage_ht gage_ht_cd
year_last_pk    ag_dt    ag_tm    ag_gage_ht      ag_gage_ht_cd
5s      15s    10d      6s      8s     27s      8s     13s      4s     10d
6s      8s      11s
```

agency_cd	site_no	peak_dt	peak_tm	peak_va	peak_cd	gage_ht	gage_ht_cd		
year_last_pk	ag_dt	ag_tm	ag_gage_ht		ag_gage_ht_cd				
5s	15s	10d	6s	8s	27s	8s	13s	4s	10d
USGS	08073600		1972-03-20			3770	6,C	62.15	
USGS	08073600		1973-06-13			3750	6,C	61.47	
USGS	08073600		1974-01-19			2000	6,C	54.33	
USGS	08073600		1975-06-03			2430	6,C	55.52	
USGS	08073600		1976-06-01			2330	6,C	54.89	
USGS	08073600		1976-12-06			1610	6,C	52.23	
USGS	08073600		1978-06-07			3520	6,C	60.34	
USGS	08073600		1979-09-19			3710	6,C	61.28	
USGS	08073600		1980-06-22			1810	6,C	53.72	
USGS	08073600		1981-08-31			5350	6,C	64.58	
USGS	08073600		1982-05-13			1580	6,C	51.69	
USGS	08073600		1983-09-19			3810	6,C	61.48	
USGS	08073600		1984-07-18			1940	6,C	53.12	
USGS	08073600		1984-10-25			3340	6,C	58.98	
USGS	08073600		1985-11-11			2930	6,C	57.44	
USGS	08073600		1986-11-23			2590	6,C	54.99	
USGS	08073600		1988-03-17			2090	6,C	53.25	
USGS	08073600		1989-05-18			4850	6,C	63.32	
USGS	08073600		1990-04-27			2320	6,C	54.09	
USGS	08073600		1991-01-15			2530	6,C	54.27	
USGS	08073600		1992-03-04			7290	6,C	68.30	
USGS	08073600		1993-06-20			3680	6,C	60.09	
USGS	08073600		1994-05-16			2150	6,C	53.58	
USGS	08073600		1994-10-18			3780	6,C	59.74	
USGS	08073600		1995-12-10			2260	6,C	52.20	

↗ Typical annual peak file from USGS

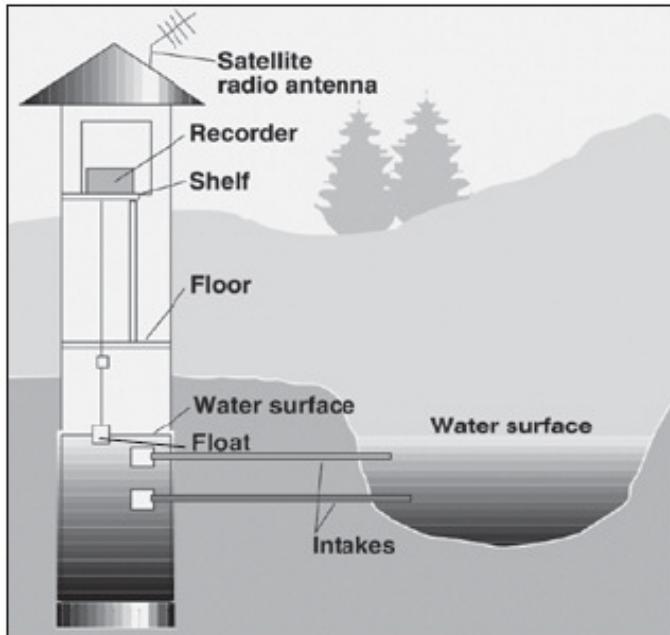
Annual peaks are by “water year”
Like a fiscal year, multiple water years span calendar years

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



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.

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

- * 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

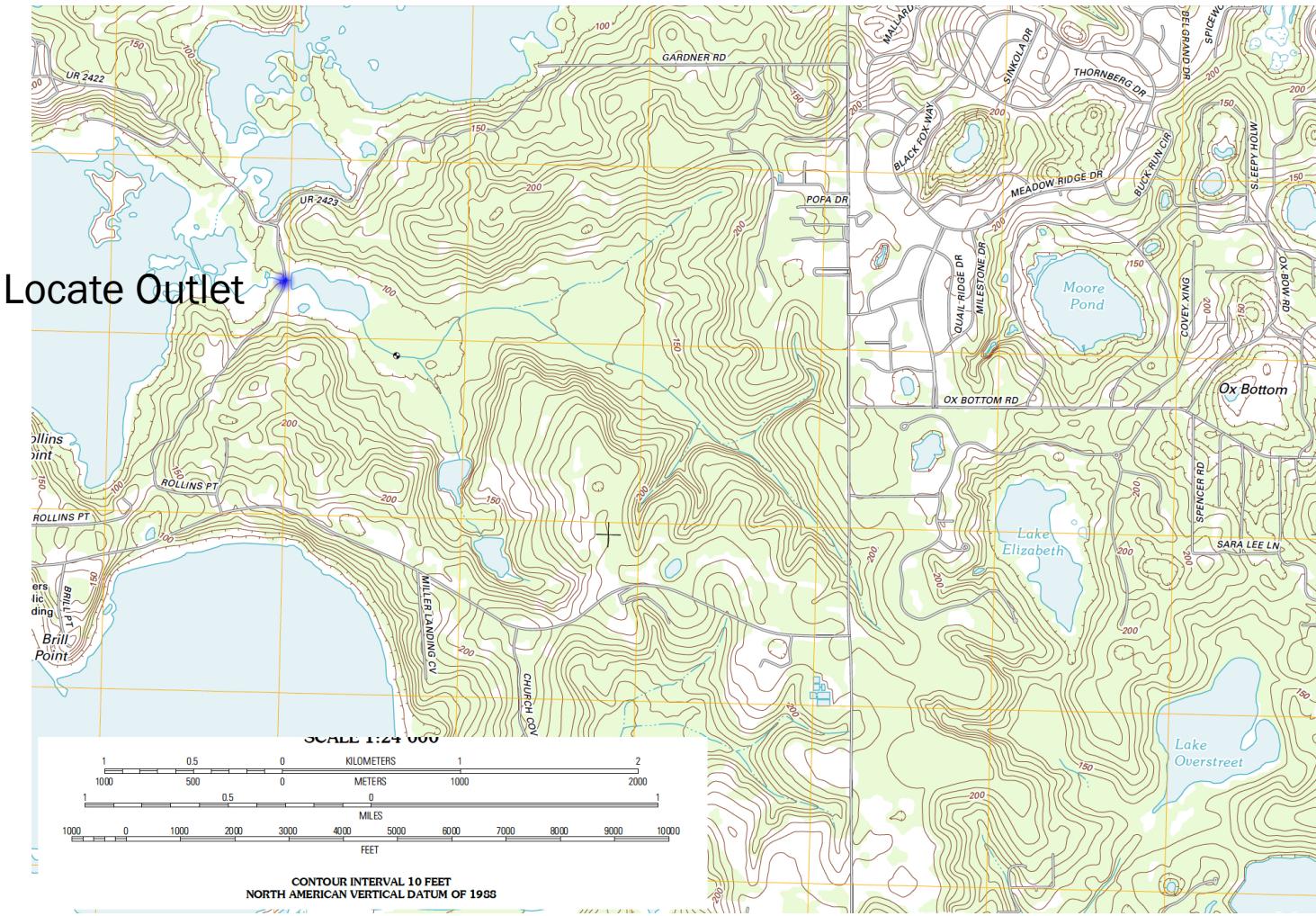
↗ Steps to delineation

- ↗ 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

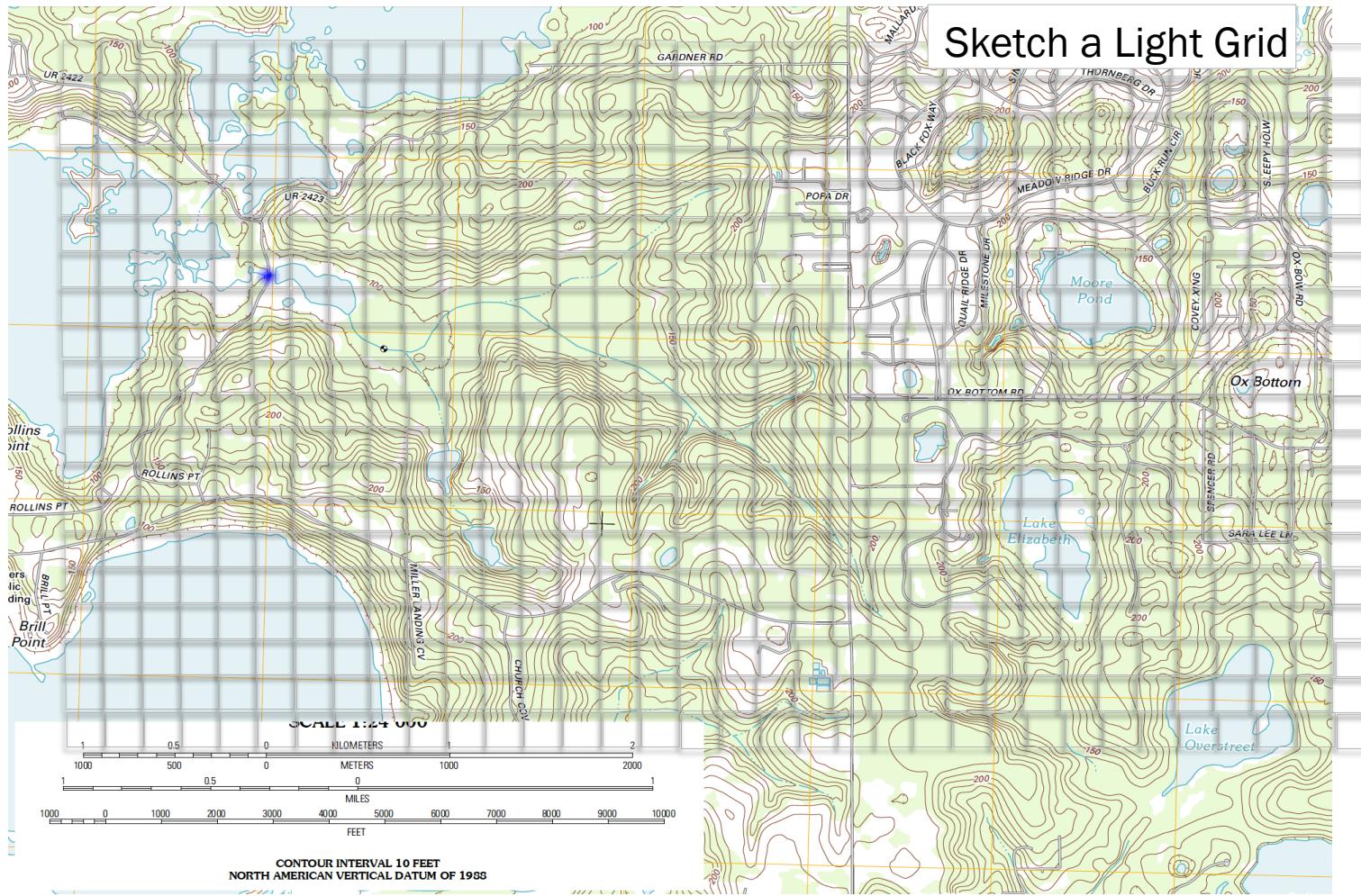
IDENTIFYING BOUNDARIES

- ↗ 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

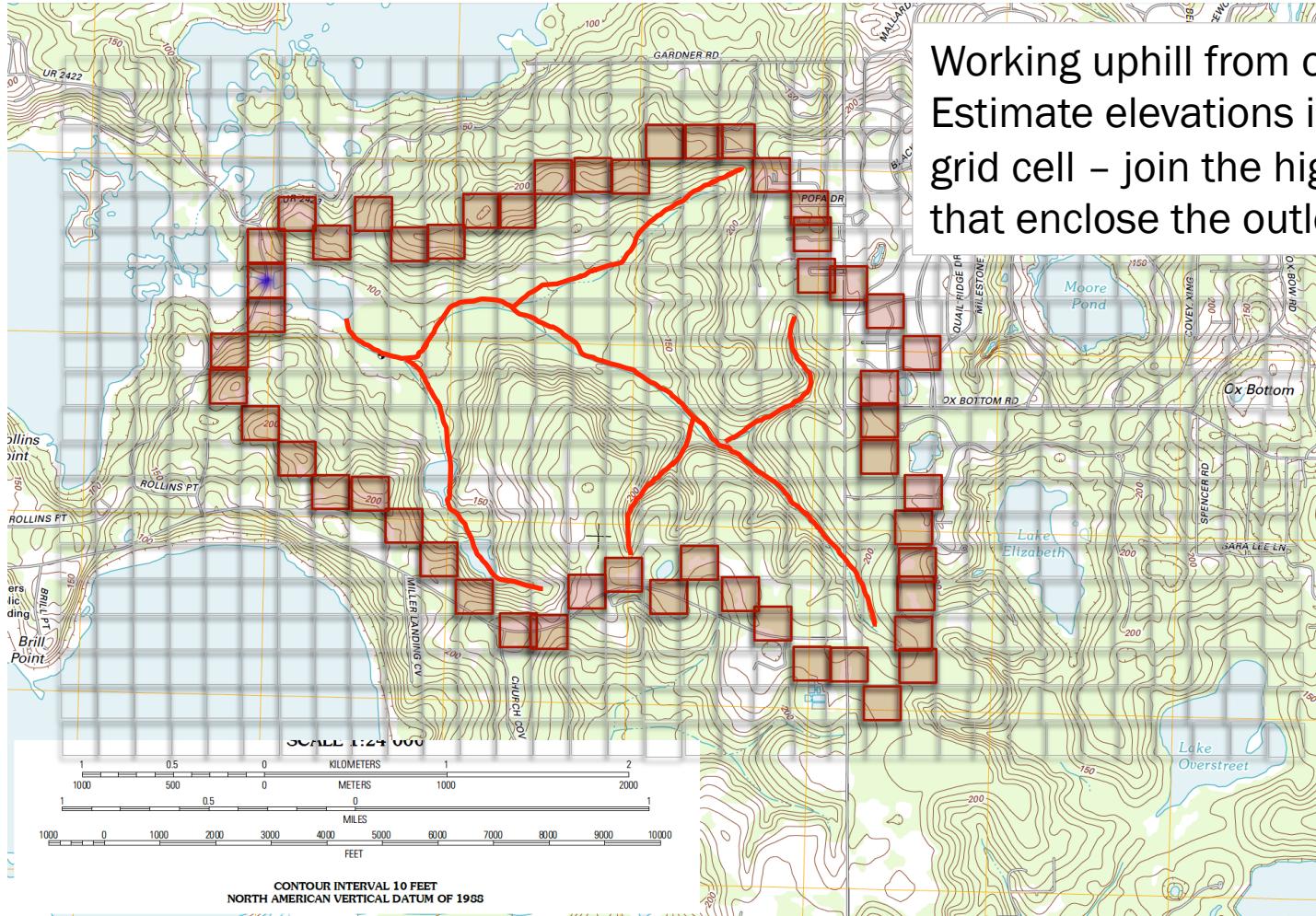
WATERSHED DELINEATION



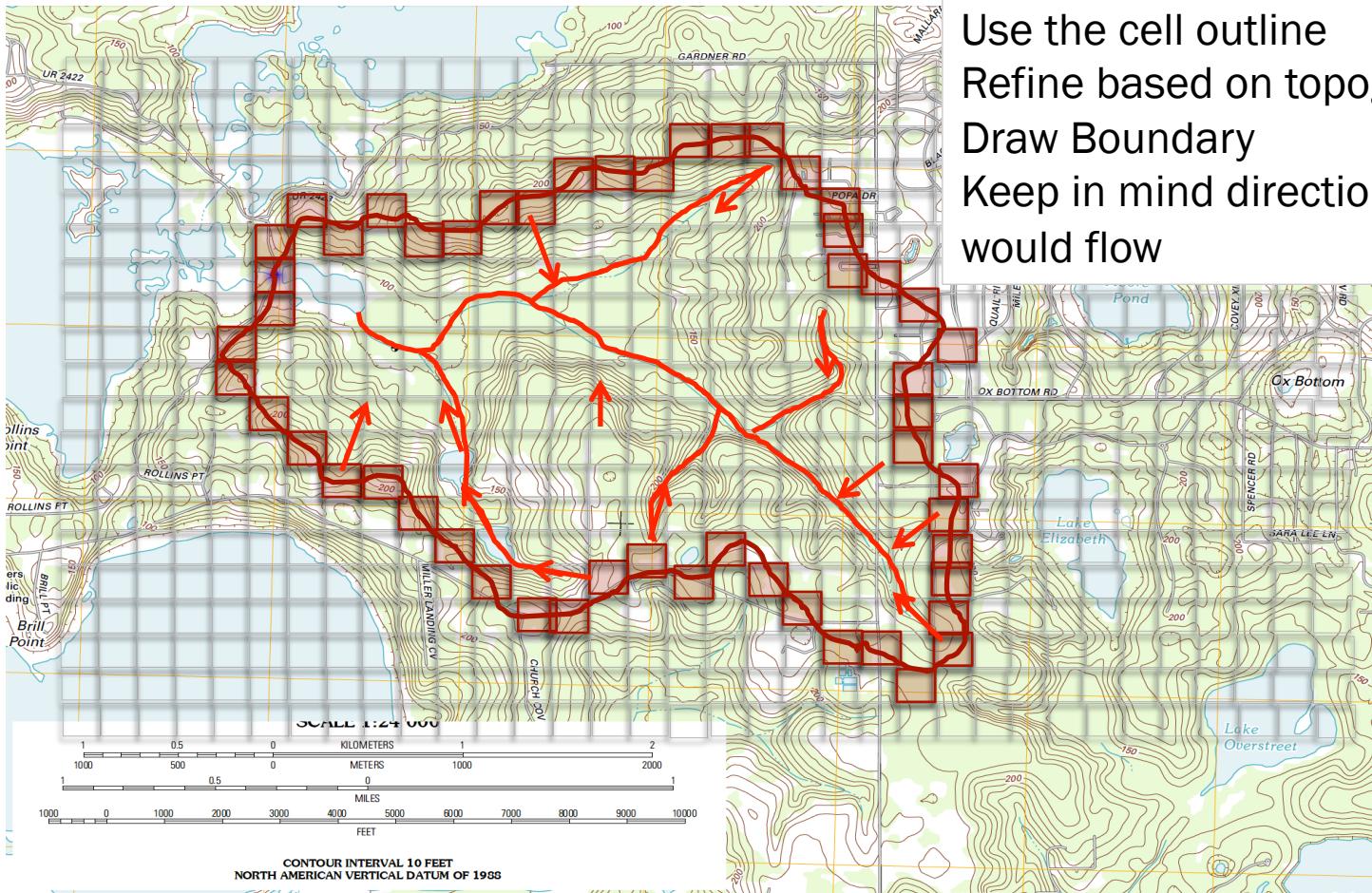
WATERSHED DELINEATION



WATERSHED DELINEATION



WATERSHED DELINEATION



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