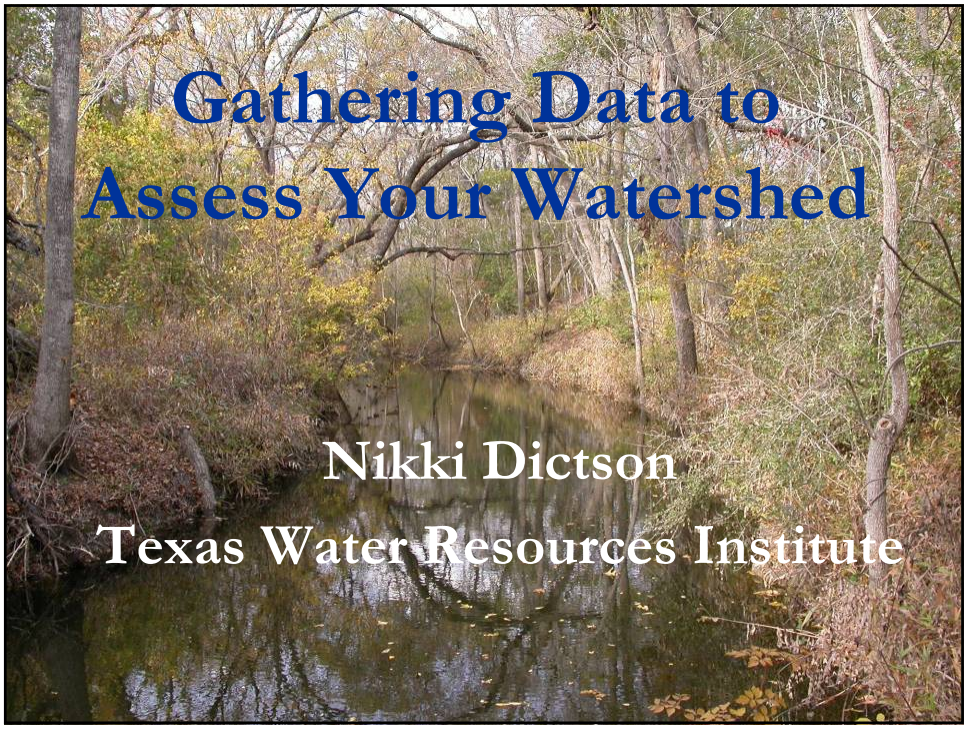


Gathering Data to Assess Your Watershed

Nikki Dictson
Texas Water Resources Institute

Presentation Goals:

- What data do you need?
- Where do you find the data?
- How do you get info from TCEQ and other agencies?
- This session will examine
  1) materials from Chapters 5-6 of the *Handbook*;
  2) how GIS may be used for watershed analysis, source identification and watershed characterization;
  3) sources of data in Texas and how best to obtain it.

Useful Types of Data

- Physical and Natural Features
  - Watershed Boundaries
  - Hydrology
  - Topography
  - Soils
  - Climate
  - Habitat
  - Wildlife

Useful Types of Data

- Land Use and Population Characteristics
  - Land use and Land Cover
  - Existing Management Practices
  - Demographics
- Waterbody Conditions
  - Water Quality Standards
  - 305(b) report & 303(d) list
  - TMDL reports
  - Source Water Assessments

Useful Types of Data

- Pollutant Sources
  - Point Sources (PS)
  - Nonpoint Sources (NPS)

Information from Local Governments

- County and City Planning Offices
  - Master Plans
  - Local Ordinances and
  - Stormwater Pollution Prevention Plans
- Environmental Depts.
  - Water Quality Data
  - Recycling Programs
- Economic Development
  - Census Data & Demographics
  - Tax Records

Information from Local Governments

- Water and Sanitation Dept.
  - Stormwater plans
  - Maps of water and sewer
- Public Health Department
  - OSSF permits and violations
  - Records of outbreaks
- Transportation Dept.
  - Transportation master plan
  - Permits
  - Road & bridge construction

Information from Local Governments

- Soil & Water Conservation Districts and USDA NRCS
  - Agricultural Land Use Information
  - Soil Surveys
  - Erosion Control Information
  - Flood Control Structures
- Council of Governments
  - Data & Information Including GIS Layers
  - Grant Funding Programs

Data from State Agencies

- Texas State Soil & Water Conservation Board (TSSWCB)
  - Water Quality Management Plans
  - Poultry CAFOs
  - Brush Control Program
  - Silviculture (Forestry)
- Texas A&M Forest Service (TFS)
  - Forest Management and Sustainable Forestry
  - Urban Forestry and Pest Management
  - Fire and Emergency Response

Data from State Agencies

- Texas Commission on Environmental Quality (TCEQ)
  - Water Main Page: http://www.tceq.texas.gov/agency/water_main.html
  - Water Quality Data: http://www.tceq.texas.gov/waterquality/clean-rivers/data/samplequery.html and http://www80.tceq.state.tx.us/SwqmisWeb/public/index.faces (currently down)
  - 305b reports and 303d Lists
  - Previous reports such as TMDLs, waste load reports, source water protection and any other studies

Data from State Agencies

- Texas Parks and Wildlife Data (TPWD)
  - Wildlife Data, Deer Counts and Endangered Species
  - Ecoregions and Habitat Data
  - Kills and Spills Data
- Texas Water Development Board (TWDB)
  - Ground Water/Well Data
  - Water and Wastewater Planning and Assessments
  - Population Projections
  - TNRIS

Data from State Agencies

- Railroad Commission (RRC)
  - Oil and Gas Well Data, Orphaned/Abandoned Wells
- Texas Natural Resources Information System (TNRIS)
  - Source of Geographic Information of Texas
  - Website: http://www.tnris.org/
  - Aerial Photos
  - Satellite Imagery
  - Electronic or Paper Maps

Data from Federal Agencies

- Environmental Protection Agency (EPA)
  - Enforcement and Compliance History Online
  - Permit Compliance System
- US Fish and Wildlife Service (USFWS)
  - Wildlife and Endangered/Threatened Species
  - Wetlands and Habitat

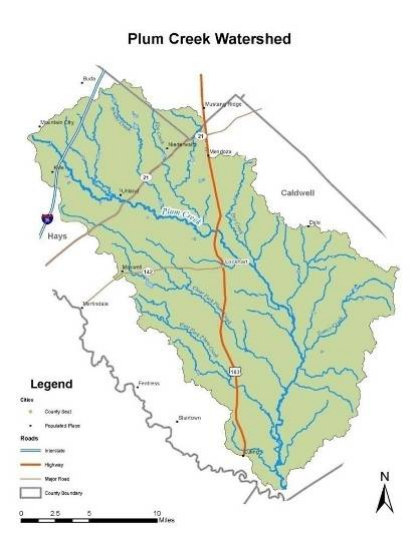
Data from Federal Agencies

- US Department of Agriculture (USDA)
  - Agricultural Census Data
- USDA Natural Resources Conservation Service (NRCS)
  - Soils Data
  - Agricultural Management and Plans
- USDA Farm Service Agency (FSA)
  - Farm and Crop Information

Data from Federal Agencies

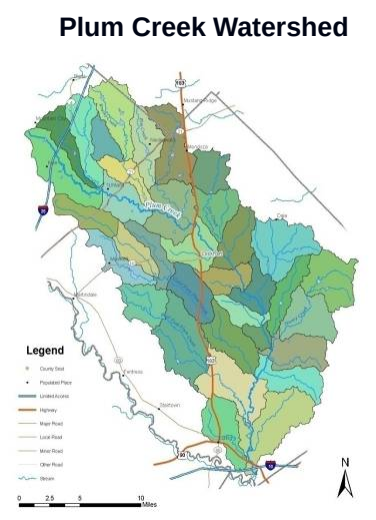
- US Geological Survey
  - Real time and historical water data
    - Stream Flow Data
    - Groundwater Data
    - Water Quality
    - Precipitation
    - Lake/Reservoir
    - Geology and Topography
    - Water Website - http://water.usgs.gov/
    - Texas Website - http://tx.usgs.gov/

Maps of the Watershed



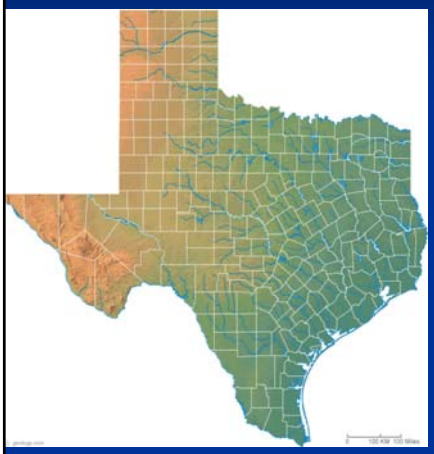
- Determine the boundaries of the watershed
- Determine counties and municipalities
- Partner with someone with GIS if you do not have the capability yourself

HUCs and Subwatersheds



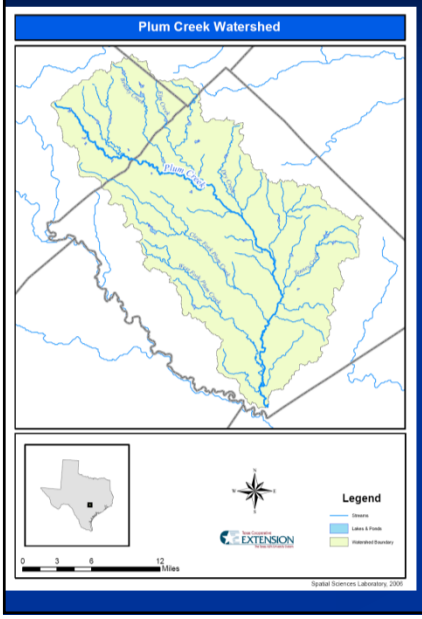
- Determine the 8-digit hydrologic unit code (HUC) for the watershed
- If you do not know your HUC, visit EPA's "Surf your Watershed" website (http://cfpub.epa.gov/surf/locate/index.cfm) to find it.
- NRCS Watershed Boundary Dataset is available at http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/water/watersheds/dataset/?&cid=nrcs143_021623
- Newly released 12 digit HUC watershed boundaries will be available

Topography



- Derives slopes of stream segments and watershed areas to identify unstable areas and to characterize segments or subwatersheds to model
- Evaluate altitude changes
- Topo Maps - http://topomaps.usgs.gov http://www.tnris.org/

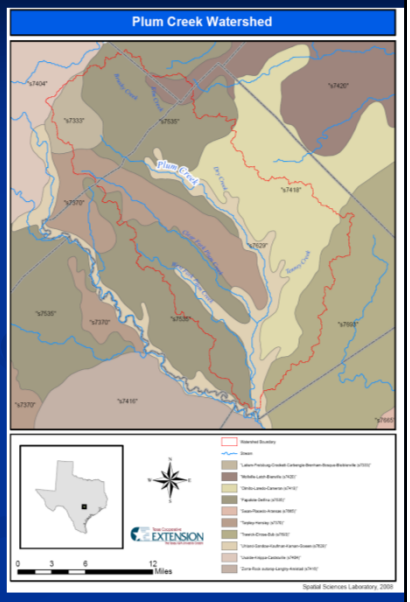
Hydrology



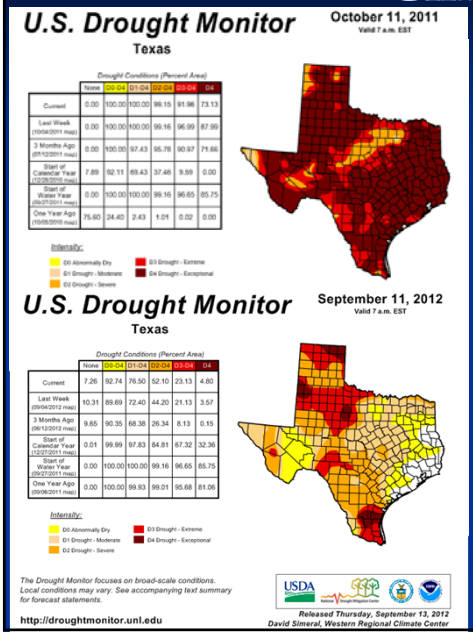
- Identify locations of waterbodies
- Many databases are organized or referenced by HUC. GIS coverages are available in EPA's BASINS modeling system www.epa.gov/ost/basins/ or USGS http://water.usgs.gov/GIS/huc.html
- Identify the spatial relationship of waterbodies and how their connected
- How water flows through the watershed
- Daily Streamflow data: http://waterdata.usgs.gov/tx/nwis/rt

Soils

- Soil characteristics will help identify high erosion prone areas, poor drainage & runoff
- STATSGO: State Soil Geographic Database, generalize the detailed soil maps at a scale of 1:250,000
- SSURGO: Soil Survey Geographic Database, at scale of 1:12,000 to 1:63,360, the most detailed level of soil mapping
- Web Soil Survey and online maps: http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm
- http://soils.usda.gov/survey/online_surveys/texas/

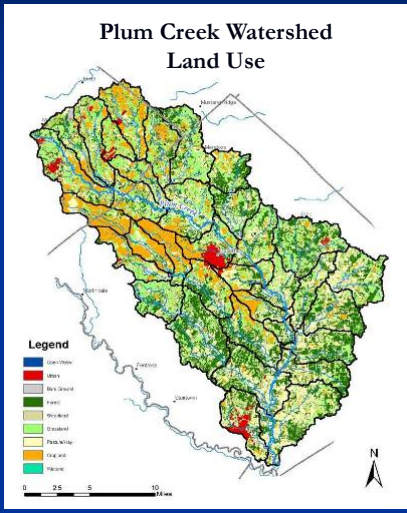


Climate



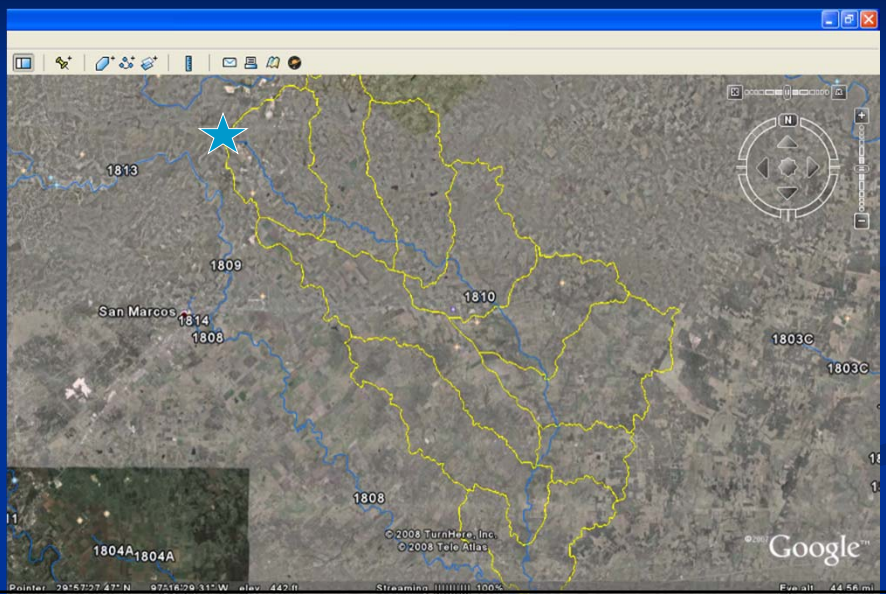
- Determine climate conditions for your watershed including annual rainfall amounts, runoff, and evaporation amounts
- Will help understand what drives the rainfall-runoff processes in watershed models
- Online sites of weather data: http://www.weather.gov/
  - www.Weather.com
  - Weather Underground http://www.wunderground.com

Land Use & Land Cover



- Land Use data can be obtained as GIS coverages from: MRLC/NLCD data – www.mrlc.gov/index.asp
- USGS's LULC data: http://eros.usgs.gov/
- May be obtained from local and regional agencies such as Counties or Council of Govts.
- Land Use data can also be updated from aerial photographs, satellite images and ground surveys.

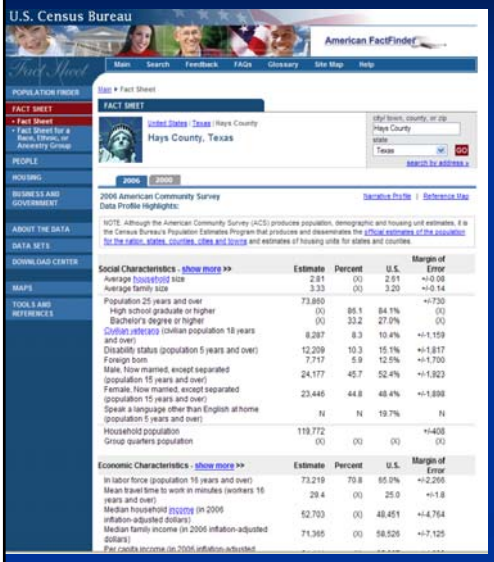
Google Earth Tour of Watershed



Habitat

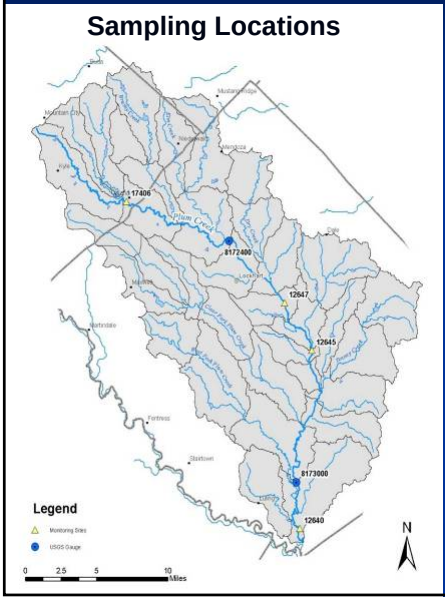
- Wetlands Inventories and Assessments: http://www.fws.gov/wetlands/data/index.html and http://www.fws.gov/wetlands/Data/Google-Earth.html
- Habitat Conservation Plans
- Fish and Wildlife
- Endangered or Threatened species
- Natural Heritage Program

Demographics



- Demographic data includes information on the people in the watershed such as:
  - Persons or families,
  - Commuting patterns,
  - Household structure
  - Age, Gender, and Race
  - Economic conditions
  - Employment and
  - Education

Water Quality Standards



- Website: http://www.tceq.texas.gov/waterquality/standards/eq_swqs.html
- The standards establish explicit water quality goals throughout the state.
- Set to maintain the quality of water in the state of Texas consistent with public health and enjoyment, protection of aquatic life, and the operation of existing industries and economic development of the state.

Water Quality Reports

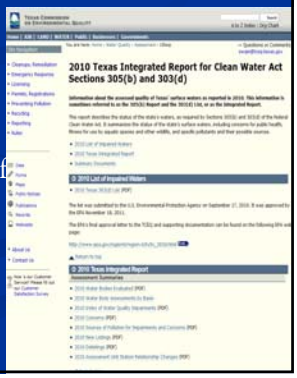
- Determine locations of concerns and impairments with in the watershed
- Find any reports completed on the watershed by others:
  - Water Quality Standards
  - 305(b) report & 303 (d) list
  - TMDL Reports
  - Source Water Assessments
  - Fish Kill Reports
  - TCEQ, TPWD, RRC, Counties, TWDB, River Authority, Universities

Water Quality Data

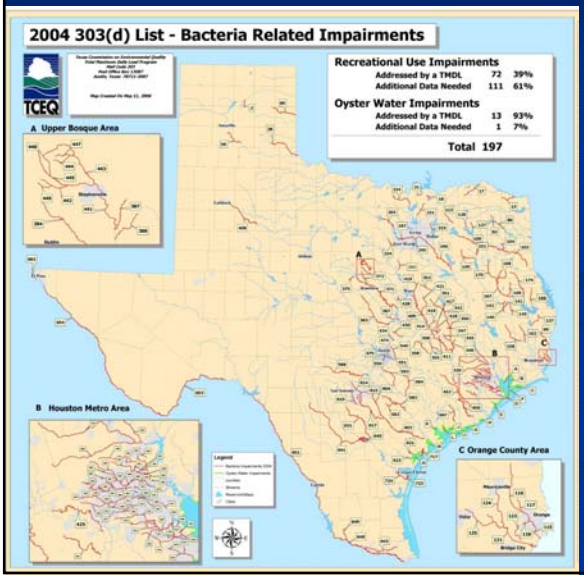
- Water Quality Data in tabular form can be obtained from:
  - Clean Rivers Partner - http://www.tceq.texas.gov/waterquality/clean-rivers
  - River Authorities are generally CRP - http://www.tceq.texas.gov/waterquality/clean-rivers/partners.html
  - TCEQ Data Clearinghouse - http://www.tceq.texas.gov/waterquality/clean-rivers/data/samplequery.html

Biannual 305(b) State Water Quality Report

- Under Section 305(b) of the Clean Water Act, states are required to prepare a report describing the status of the water quality every two years.
- If your watershed has been monitored than the report should have:
  - Status of use support with descriptions of significant water quality impairments
  - Identification of problem parameters for impaired waters, along with potential sources of
  - Priority for TMDL development

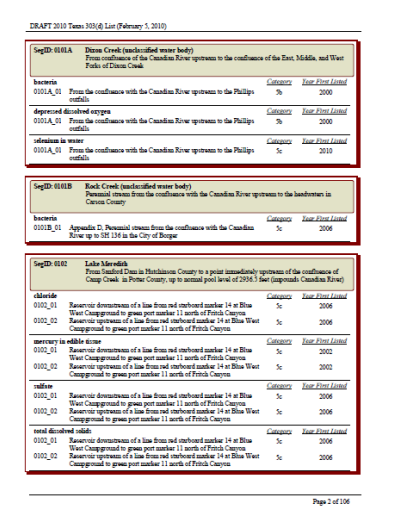


303(d) List of Impaired Waters



- 2010 Texas 303(d) List
- http://www.tceq.texas.gov/waterquality/assessment/305_303.html

303(d) List of Impaired Waters



DRAFT 2010 Texas 303(d) List (February 5, 2010)

SegID: 0101A	Dixon Creek (unclassified water body) From confluence of the Canadian River upstream to the confluence of the East, Middle, and West Forks of Dixon Creek		
bacteria		*Category*	*Year First Listed*
0101A_01	From the confluence with the Canadian River upstream to the Phillips outfalls	5b	2000
depressed dissolved oxygen		*Category*	*Year First Listed*
0101A_01	From the confluence with the Canadian River upstream to the Phillips outfalls	5b	2000
selenium in water		*Category*	*Year First Listed*
0101A_01	From the confluence with the Canadian River upstream to the Phillips outfalls	5c	2010

SegID: 0101B	Rock Creek (unclassified water body) Perennial stream from the confluence with the Canadian River upstream to the headwaters in Carson County		
bacteria		*Category*	*Year First Listed*
0101B_01	Appendix D. Perennial stream from the confluence with the Canadian River up to SH 136 in the City of Borger	5c	2006

SegID: 0102	Lake Meredith From Sanford Dam in Hutchinson County to a point immediately upstream of the confluence of Camp Creek in Potter County, up to normal pool level of 2936.5 feet (impounds Canadian River)		
chloride		*Category*	*Year First Listed*
0102_01	Reservoir downstream of a line from red starboard marker 14 at Blue West Campground to green port marker 11 north of Fritch Canyon	5c	2006
0102_02	Reservoir upstream of a line from red starboard marker 14 at Blue West Campground to green port marker 11 north of Fritch Canyon	5c	2006
mercury in edible tissue		*Category*	*Year First Listed*
0102_01	Reservoir downstream of a line from red starboard marker 14 at Blue West Campground to green port marker 11 north of Fritch Canyon	5c	2002
0102_02	Reservoir upstream of a line from red starboard marker 14 at Blue West Campground to green port marker 11 north of Fritch Canyon	5c	2002
sulfate		*Category*	*Year First Listed*
0102_01	Reservoir downstream of a line from red starboard marker 14 at Blue West Campground to green port marker 11 north of Fritch Canyon	5c	2006
0102_02	Reservoir upstream of a line from red starboard marker 14 at Blue West Campground to green port marker 11 north of Fritch Canyon	5c	2006
total dissolved solids		*Category*	*Year First Listed*
0102_01	Reservoir downstream of a line from red starboard marker 14 at Blue West Campground to green port marker 11 north of Fritch Canyon	5c	2006
0102_02	Reservoir upstream of a line from red starboard marker 14 at Blue West Campground to green port marker 11 north of Fritch Canyon	5c	2006

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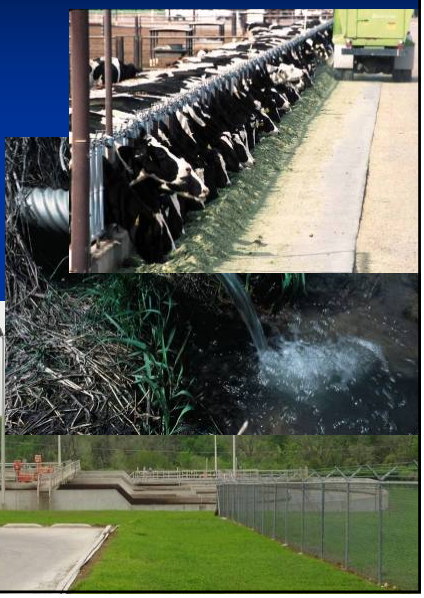
- Identify known pollutant impairments
- Identify geographic extent of impaired segments
- Identify potential causes and sources of impairments

Existing TMDL Reports & Source Water Assessments

- TMDLs provide information on:
  - watershed characteristics,
  - waterbody conditions,
  - sources, and
  - pollutant loads
  - http://www.tceq.texas.gov/waterquality/tmdl/index.html
- Source Water Assessments provide:
  - Identify water supply areas to be protected
  - Identify potential sources of contamination to the water supply
  - http://www.tceq.texas.gov/drinkingwater/SWAP/index_swa.html

Point Source Pollutant Sources

- Point Source
  - Permitted Discharges
    - Wastewater Treatment Plants
    - Industrial Facilities
    - Confined Animal Feeding Operation
- Stormwater Permit



WWTP Permit Limits

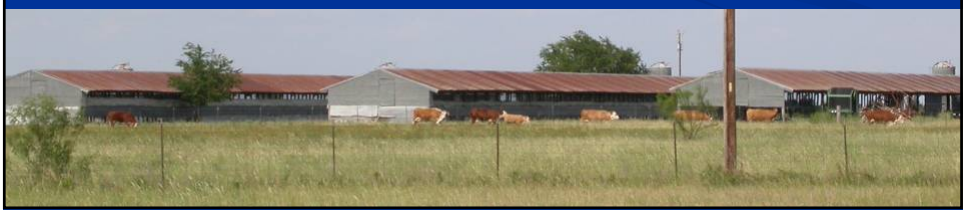
Table 4. Revised Table 7.3 in WPP. TPDES wastewater discharge permits in Plum Creek Watershed.

FACILITY NAME	Type of Disinfection	MAX PERMITTED FLOW (MGD)	PERMIT NUMBER	EFFECTIVE DATE	EXPIRATION DATE	*E. coli* effluent limit in permit?	*E. coli* effluent monitoring in permit?
KYLE	Chlorine	3/4.5	WQ0011041-002	02/04/2010	02/01/2015	no limit in either phase[1]	no monitoring requirement in either phase[1]
LOCKHART NO. 2 (FM 20 Plant)	UV	1.5	WQ0010210-002	02/04/2010	02/01/2015	126 cfu/100mL daily avg[2]; 394 cfu/100mL daily max	once per day
BUDA	Chlorine	0.6/0.95/1.5	WQ0011060-001	02/16/2010	02/01/2015	no limit in either phase[1]	no monitoring requirement in either phase[1]
LOCKHART NO. 1 (Larremore Street Plant)	Chlorine	1.1	WQ0010210-001	03/04/2010	02/01/2015	126 cfu/100mL daily avg[2]; 394 cfu/100mL daily max	once per week
LULING-NORTH	Chlorine	0.9	WQ0010582-002	05/28/2009	02/01/2014	no limit[1]	no monitoring requirement[1]
RANCH AT CLEAR FORK	Chlorine	0.33/0.7	WQ0014439-001	04/28/2008	02/01/2013	no limit in either phase[1]	no monitoring requirement in either phase[1]
NIEDERWALD (SWEETWATER)	Chlorine	0.075/0.122/0.25	WQ0014672-001	09/21/2010	03/01/2015	126 cfu/100mL daily avg[2]; 394 cfu/100mL daily max	once per quarter
RAILYARDS-PARKLAND	UV	0.35	WQ0014165-001	07/28/2005	02/01/2010	n/a – permit expired	n/a – permit expired
RAILYARDS-VILLAGE HOMES	Chlorine	0.075/0.12375	WQ0014060-001	05/11/2010	02/01/2015	126 cfu/100mL daily avg[2]; 394 cfu/100mL daily max	once per quarter
GOFORTH	Chlorine	0.0424	WQ0013293-001	04/13/2010	02/01/2015	126 cfu/100mL daily avg[2]; 394 cfu/100mL daily max	once per week
SUNFIELD	Chlorine	0.25/0.5/0.99	WQ0014377-001	08/06/2009	02/01/2014	no limit in either phase[1]	no monitoring requirement in either phase[1]
SHADOW CREEK (formerly CASTLETOP)	Chlorine	0.162/0.486	WQ0014431-001	02/22/2010	02/01/2015	no limit in either phase[1]	no monitoring requirement in either phase[1]

[1] Language in "Other Requirements" – The permittee is hereby placed on notice that the Executive Director of the TCEQ will be initiating rulemaking and/or changes to procedural documents that may result in bacteria effluent limits and monitoring requirements for this facility.
[2] Language in "Definitions" defines *daily avg* as the arithmetic average of all effluent samples as required by the permit within a period of one calendar month consisting of at least four separate measurements.

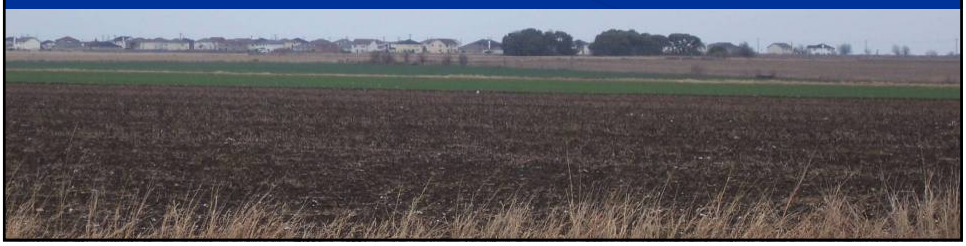
Nonpoint Sources - Livestock

- Livestock Sources
  - If Local USDA information is not available, use the Census of Agriculture to find information about the number and type of animal units per county
  - www.agcensus.usda.gov : has 2002 and 2007 data available.



Nonpoint Sources - Cropland

- Cropland Sources
  - Contact the local USDA to obtain information about types of crops and their management. The Census of Agriculture can provide crop types and fertilizer and chemical applications.
  - www.agcensus.usda.gov
  - Land use coverages can identify cropland areas



Nonpoint Sources - Urban

- Urban Sources
  - Impervious coverage information is typically used to characterize the density of and potential loading from urban areas
  - Urban areas are typically sources of pet wastes, lawn fertilizers, and pollutants from car maintenance in the stormwater runoff.

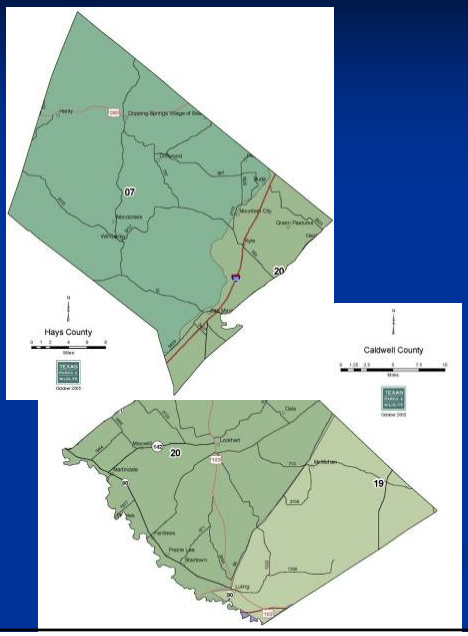
Nonpoint Sources – Onsite Sewage Facility

- On-site Sewage Facility
  - Local agencies can provide estimates of the total numbers for an area or the county and violations.
  - County level data can also be found from the Census Bureau for the 1990 Census at http://quickfacts.census.gov
  - The National Small Flows Clearinghouse has a wealth of information on Septic Systems on the website: www.nesc.wvu.edu/wastewater.cfm
  - TAMU Biological and Agricultural Engineering http://ossf.tamu.edu/
  - TCEQ : http://www.tceq.texas.gov/licensing/ossf/on-site.html

Nonpoint Sources – Silviculture

- Silviculture Sources
  - Bureau of Land Management has an Amarillo Field Office: http://www.blm.gov/nm/st/en/fo/Amarillo_Field_Office.html
  - Texas Forest Service website: http://txforestservice.tamu.edu/main/default.aspx
  - Texas State Soil and Water Conservation Board http://www.tsswcb.texas.gov/
  - All of these agencies can help you identify areas of silvicultural activity and management

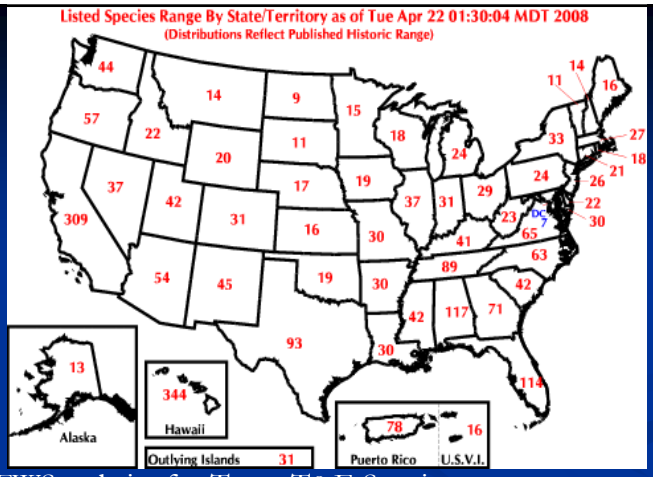
Nonpoint Sources - Wildlife



- Determine the types of wildlife to identify areas for protection
- Determine if there are any endangered or threatened species
- Local and State Parks and Wildlife Offices may be able to provide you wildlife species and distribution
- Maps indicate RMUs for Deer survey data by TPWD

Endangered Species Contacts: Texas Ecological Services Field Offices

- **Arlington**
  711 Stadium Dr. Ste 252
  Arlington, TX 76011
  Telephone: 817-277-1100
- **Austin**
  Compass Bank Bldg, 10711 Burnet Rd, Ste 200
  Austin, TX 78758
  Telephone: 512-490-0057
- **Corpus Christi**
  c/o Corpus Christi State Univ, Unit 5837, 6300 Ocean Dr.,
  Corpus Christi, TX 78412
  Telephone: 512-994-9005
- **Clear Lake**
  17629 El Camino Real, Ste 211
  Houston, TX 77058
  Telephone: 281-286-8282



- USFWS website for Texas T&E Species: http://ecos.fws.gov/tess_public/pub/stateListingIndividual.jsp?state=TX&status=listed
- TPWD website for Texas T&E Species: http://www.tpwd.state.tx.us/huntwild/wild/wildlife_diversity/texas_rare_species/listed_species/

Nonpoint Sources – Feral Hogs (Non-Domestic Animals)

- Texas Department of Agriculture (TDA)
- Texas AgriLife Extension Service
  http://feralhogs.tamu.edu/
- Texas Wildlife Services
  http://agrilife.org/txwildlifeservices/
- Texas Animal Health Commission:
  http://www.tahc.state.tx.us/
- Plum Creek Website:

http://pcwp.tamu.edu/FeralHogs

Identifying Data Gaps & Collecting Additional Data

How much data is enough?

- One of biggest challenges
- Always more data to collect
- Must balance:
  - Resources
  - Ability to reasonably characterize watershed
  - Need to keep process moving forward

First Step – Conduct Data Review

- Evaluate data you've compiled & assess:
  - If you have the right types of data to identify causes and sources
  - The quality of the data

Identify Data Gaps

- Informational Data Gaps: Does my data include all types of info needed?
  - Flow data
  - Baseline water quality or biological data
- Temporal Data Gaps: Does my data cover the time periods needed?
  - "Old data" (conditions have changed)
  - Season or hydrologic condition
- Spatial Data Gaps: Does my data provide good spatial coverage of the watershed?
  - Poor spatial coverage
  - Underrepresentation of specific areas

Determine Acceptability Of Data

- Evaluate
  - Data quality
  - Measurement quality

Evaluating Data Quality

- Main questions:
  - What were the goals of the monitoring activity? Were they consistent with yours?
  - What types of data were collected? Are they relevant to your needs?
  - How were the data collected? Were the sites selected randomly or targeted?

Evaluating Measurement Quality

- Collected under QAPP?
- Analyzed by certified lab?
- Age of data? Analysis methods different from today's?
- Is quality known?

IF NOT

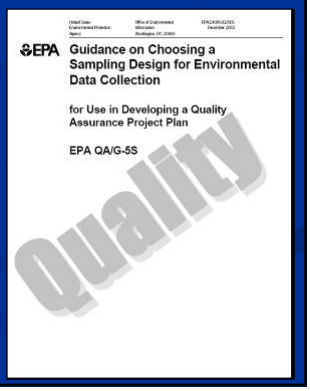
Consider data qualitative (anecdotal evidence)

Step 3 – Decide if new data needed

- Compare your available resources against your tasks:
  - Can we identify & quantify water quality problems in the watershed?
  - Can we quantify pollutant loads?
  - Can we link water quality impairments to specific sources/source areas?
  - Do we know enough to select & target mgt measures to reduce pollutant loads & address water quality impairments?

Step 4 - Design Sampling Plan

- Guidance on Choosing a Sampling Design for Environmental Data Collection
  - EPA QA/G-5S
  - http://www.epa.gov/quality/qa_docs.html
- Assess type, quantity & quality of data needed
- Consider your available resources



Steps in Designing Sampling Plans

1. Select Monitoring Design
2. Develop Data Quality Objectives
3. Develop Measurement Quality Objectives & Performance Criteria
4. Develop Plan for Data Management
5. Develop QAPP

Step 4 - Design Sampling Plan

- Focus on immediate data collection needs for completing watershed characterization
  - Monitoring to define water quality problems
  - Assess compliance with standards
  - Define critical areas
- Consider long-term monitoring needs
  - Elements developed here can be modified or expanded for the WPP monitoring component

Step 5 – Collect New Data

- Data collection techniques
  - Watershed Overview/Visual Assessment
  - Physical Characterization
  - Geomorphic Assessment
  - Hydrological Assessments
  - Water Quality Assessment
  - Assessment of Habitat Quality
  - Biological Assessment

Watershed Survey / "Visual Assessment"

- Walk, drive, and/or boat the watershed
- Observe and photograph water and land conditions
- Identify & verify pollutants & sources
- GREAT for familiarizing stakeholders with watershed
- Protocols Available:
  - NRCS Visual Stream Assessment Protocol
  - http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1044776.pdf