Field Methods : Ink's Lake State Park

3630 Park Road 4 West Burnet, TX 78611
Latitude: 30.739195 Longitude: -98.370808

Dr. Paul Mann

TAs: Dan Imrecke, Michael Stevens and Joan Blanco

February 22nd – Februay 23rd 2013

University of Houston
Department of Earth and Atmospheric Sciencs
Houston, Texas

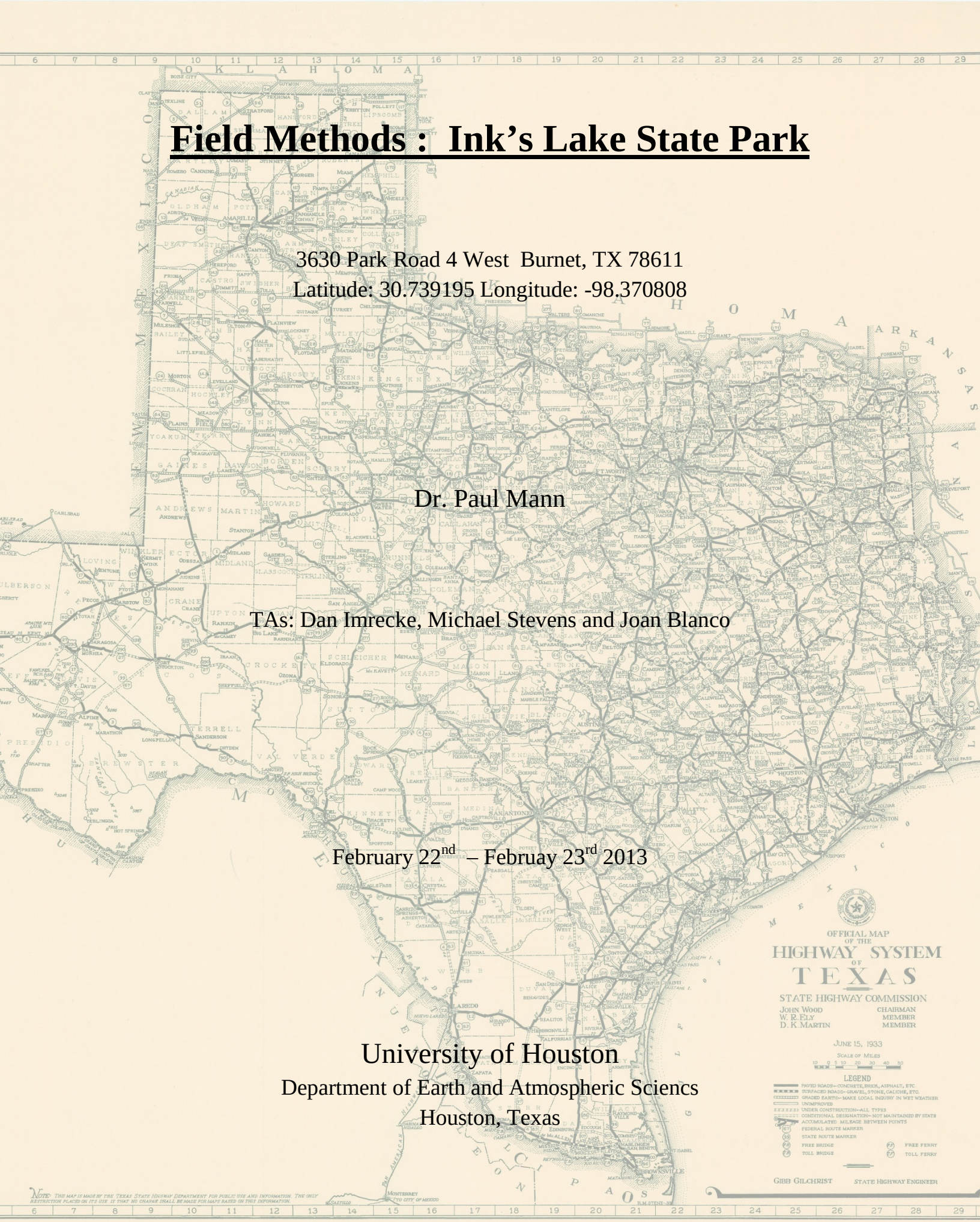


Table of Contents

Driving Directions …… 3

Schedule …….. 5

Inks Lake Mapping Project …… 6

Inks Lake Cross Section Guide ……... 7

Inks Lake State Park Official Map ……... 8

Geology of Texas …… 9

Tectonic Map of Texas …… 10

Aquifers of Texas …… 11

Ecoregions of Texas …… 12

Land Resource Map of Texas …….. 13

Oil and Gas Map of Texas ……... 14

Physiographic Map of Texas …… 15

River Basisns Map of Texas …… 16

Vegetation Cover of Texas …… 17

Inks Lake Overview ……. 18

Inks Lake Geology ……. 19

USGS Topographic Map of Inks Lake …….. 20

Cross Section of Llano County …… 21

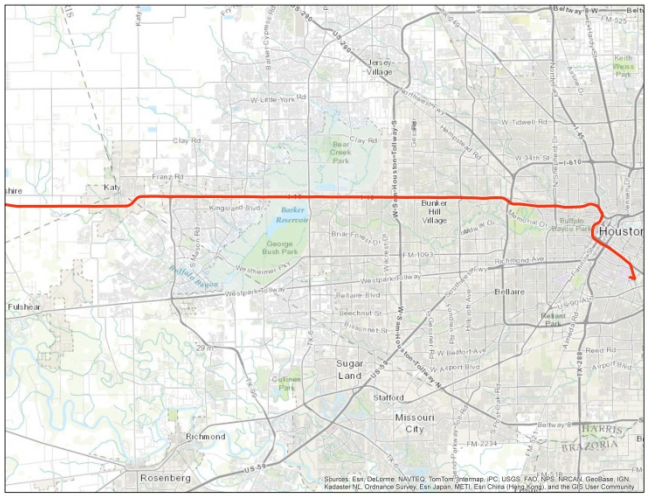
UH Rules and Regulations for Fieldtrips ……... 22

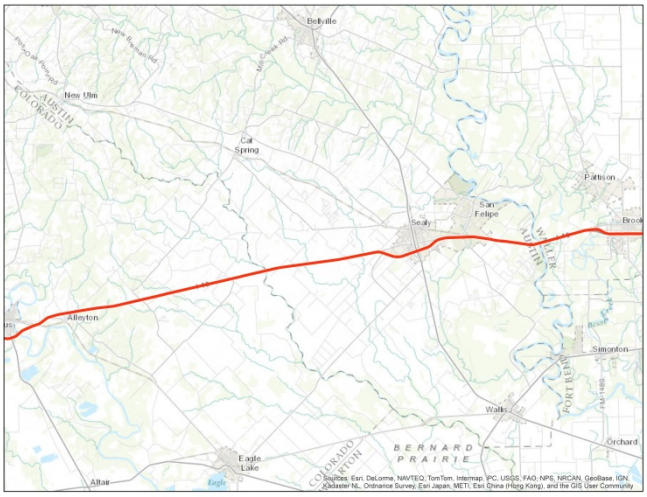
Driving directions to Inks Lake State Park

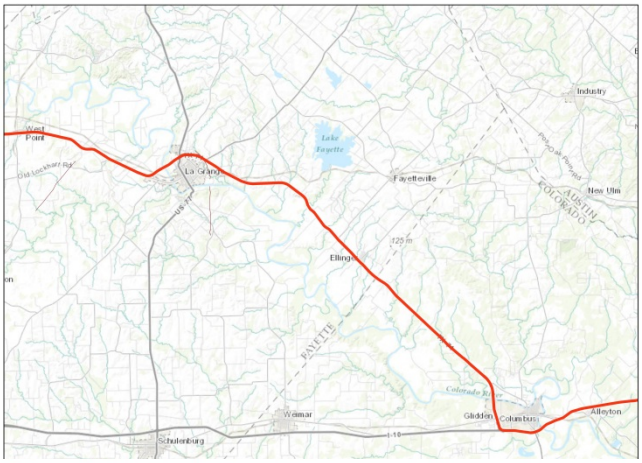
University of Houston System
4800 Calhoun Rd
Houston, TX 77004

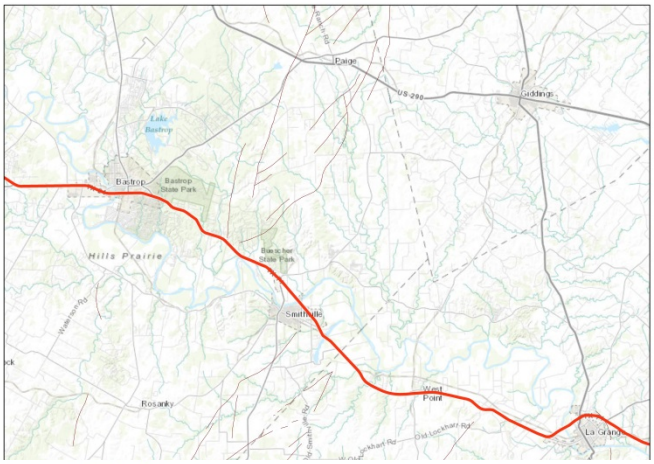
1. Head north on Calhoun Rd toward University Dr	210 ft
2. Turn right onto University Dr	0.3 mi
3. Turn left onto TX-5 Spur N	0.7 mi
4. Keep left at the fork, follow signs for Interstate 45 N/Dallas and merge onto I-45 N	4.5 mi
5. Take exit 48B on the left for Interstate 10 W toward San Antonio	0.1 mi
6. Merge onto I-10 W	73.8 mi
7. Take exit 695 to merge onto TX-71 W/Feeder Rd toward La Grange/Austin Continue to follow TX-71 W	83.1 mi
8. Continue onto E Ben White Blvd	0.4 mi
9. Take the ramp on the left onto TX-71 W	3.4 mi
10. Continue onto TX-71 W/US-290 W	7.0 mi
11. Slight right onto TX-71 (signs for Texas 71 W/Llano)	33.8 mi
12. Take the ramp onto US-281 N	13.2 mi
13. Turn left onto Park Rd 4 S Destination will be on the left	12.2 mi

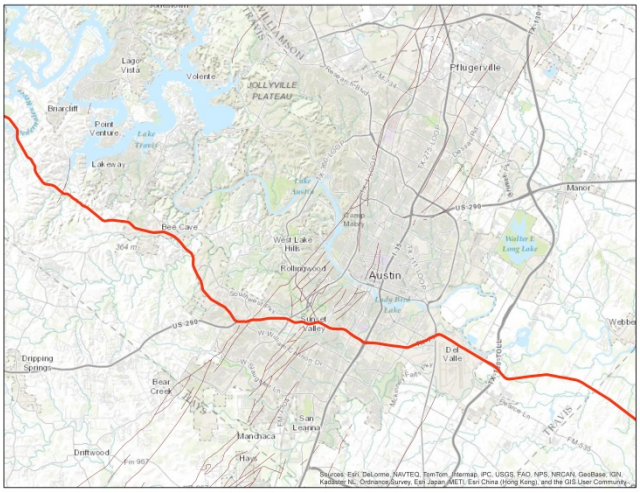
Inks Lake State Park
Burnet, TX 78611

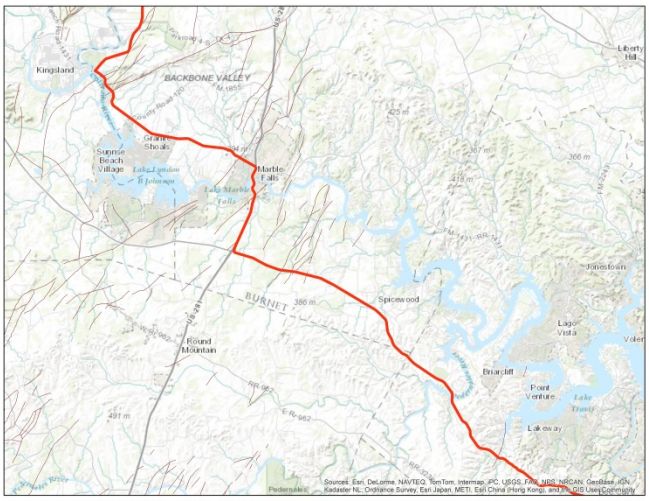

Houston
Katy
Sugar Land
Missouri City
Stafford
Bellaire
Bunker Hill Village
Jersey Village
Fulshear
Richmond
Rosenberg
Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, iPC, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), and the GIS User Community

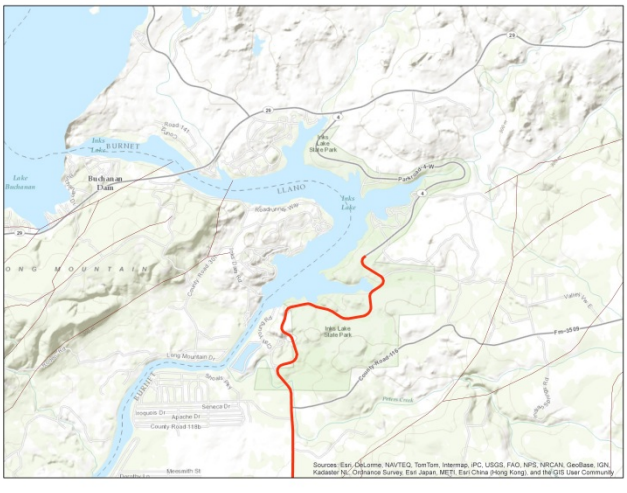

Bellville
New Ulm
Cat Spring
Sealy
Sam Felipe
Alleyton
Simonton
Wallis
Orchard
Eagle Lake
Altair
BERNARD PRAIRIE
Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, iPC, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), and the GIS User Community


Industry
West Point
La Grange
Fayetteville
New Ulm
Ellinger
FAYETTE
Weimar
Glidden
Columbus
Alleyton
Schulenburg


Paige
Giddings
Bastrop
Bastrop State Park
Hills Prairie
Buescher State Park
Smithville
Rosanky
West Point
La Grange


Lago Vista
Jonestown
Volente
JOLLYVILLE PLATEAU
Pflugerville
Briarcliff
Point Venture
Lakeway
Lake Travis
Bee Cave
West Lake Hills
Rollingwood
Austin
Manor
Webberville
Dripping Springs
Bear Creek
Driftwood
Manchaca
San Leanna
Hays
Del Valle
Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, iPC, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), and the GIS User Community


Kingsland
BACKBONE VALLEY
Liberty Hill
Sunrise Beach Village
Granite Shoals
Marble Falls
Lake Marble Falls
Spicewood
BURNET
Round Mountain
Jonestown
Lago Vista
Briarcliff
Point Venture
Lakeway
Lake Travis
Pedernales
Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, iPC, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), and the GIS User Community


BURNET
Buchanan Dam
Inks Lake State Park
Lake Buchanan
LLANO
Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, iPC, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), and the GIS User Community

Schedule

Saturday, February 23rd

5:30 AM Meet at loading zone in front of SR1

6:00 AM Depart from University of Houston

10:30 AM Arrive at Inks Lake State Park
Set up tents and camp

12:00 PM Walk to mapping area, and begin measurements

6:30 PM Sunset – finish taking last measurements of the day.
Return to camp grounds at Dusk.

Sunday, February 24th

You will be on your own as to what time you plan on waking up to continue collecting data.

12:00 PM Return from map area to finish up final maps.

2:00 PM Begin packing up camp and turn in final maps

3:00 PM Depart Inks Lake State Park

7:00 PM Return to the University of Houston

NOTE: Bring food from Houston for lunch and dinner on Saturday, and breakfast and lunch on Sunday. We will stop for fast food on return to houston after 3 pm. Vehicles will not leave campground once we arrive.

Inks Lake Mapping Project

The goal of this project is to produce a geologic map of the Devil's Waterhole area in Inks Lake State Park. On Sunday before we leave Inks Lake you are expected to turn in a: (1) colored version of your geologic map with legend, and (2) your notebook.

The following geologic features must be shown on your geologic map:

1. Contacts between rock units (felsic plutons, amphibolite, biotite gneiss and schist, quartzite, Quaternary alluvium). Rock units should be properly labeled. Use the following symbols (Qal, Ygr, Ya, Ygn, Yq). Y is the symbol for Middle Proterozoic.
2. *Attitudes of foliation in metamorphic rock units.
3. Attitude of dikes
4. Attitude of joints
5. Trend and plunge of small-scale fold hinges.

Use the symbols outlined in Coe (Appendix A10) to denote the features listed above.
*You should strive for ≥ 1 measurement per square cm.

The geologic map must contain a legend which explains the geologic symbols present on the map. In your notebook, include rock unit descriptions; general rock name, minerals and textures. In addition provide sketches of the geologic relationships at the numbered locations on the topographic map.

At the numbered locations you are expected to make detailed observations the modal composition of the rocks, observable fabrics (including grain size of individual minerals), igneous and metamorphic structures contacts and cross cutting relationships: Most of this is described well in Coe chapters 7 (Igneous Rocks) and 9 (Metamorphic Rocks) and Appendices A7 &A9. Refer to Chapter 4 in Coe for examples of what we expect in your notebooks.

Geologic Map grade sheet *Scores are out of 100 points*

Contacts & Topography (rule of V's)	_____	15
Accuracy of contacts (Location)	_____	25
Contact uncertainty (solid, dashed, dotted)	_____	10
Rock unit identification	_____	10
Surficial deposits	_____	5
Density of attitudes	_____	20
Precision of drafting (neatness)	_____	10
Labeling	_____	5
Total Score	_____	100

Inks Lake Cross section guidelines

Topographic profile (accuracy and 1:1) _____ 5

Scale (units) and profile direction _____ 5

Accuracy of Contacts on profile _____ 20

Accuracy of Attitudes (dip ticks) _____ 20

Accurate contacts at depth and above the surface (maintain constant thickness) __ 20

Legend and neatness (coloring, inking, and legibility) _____10

You are required to construct a cross section from A to A'
Follow the guidelines below:

1) Use the scale on your map (horizontal scale = vertical scale)

2) Plot all foliation measurements that lie within 1 cm of the profile line. Do not plot joints or minor folds

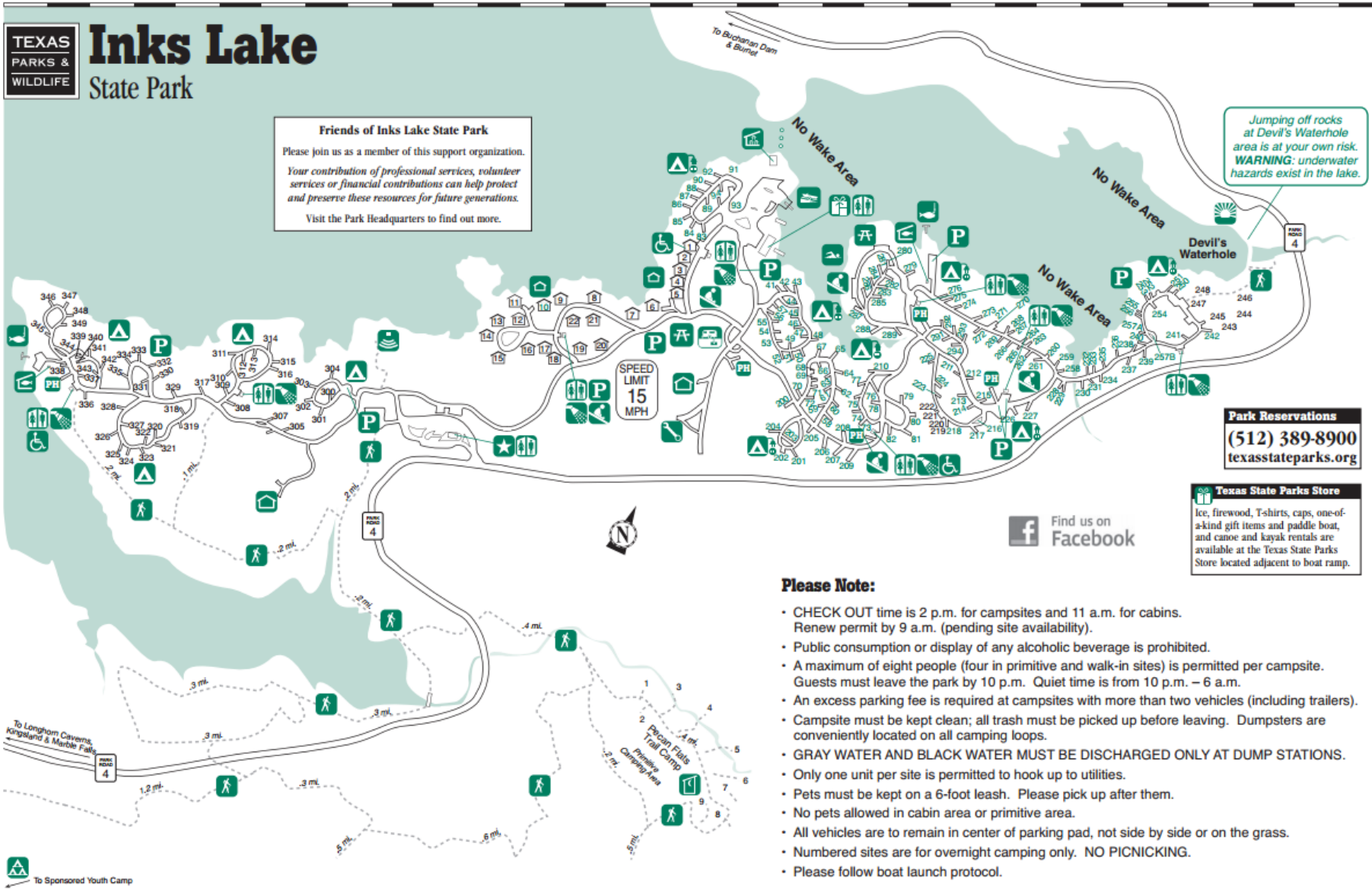
3) Plot the position of the granite-metamorphic contact that crops out on the south side of the creek.

Where it is eroded along the profile, dash its position at the appropriate elevation.

/texasparksandwildlife @TPWDparks #TxStateParks www.texasstateparks.org/socialmedia

TEXAS PARKS & WILDLIFE

Inks Lake
State Park



Friends of Inks Lake State Park

Please join us as a member of this support organization.

Your contribution of professional services, volunteer services or financial contributions can help protect and preserve these resources for future generations.

Visit the Park Headquarters to find out more.

Park Reservations
(512) 389-8900
texasstateparks.org

Texas State Parks Store
Ice, firewood, T-shirts, caps, one-of-a-kind gift items and paddle boat, and canoe and kayak rentals are available at the Texas State Parks Store located adjacent to boat ramp.

Please Note:

- CHECK OUT time is 2 p.m. for campsites and 11 a.m. for cabins. Renew permit by 9 a.m. (pending site availability).
- Public consumption or display of any alcoholic beverage is prohibited.
- A maximum of eight people (four in primitive and walk-in sites) is permitted per campsite. Guests must leave the park by 10 p.m. Quiet time is from 10 p.m. – 6 a.m.
- An excess parking fee is required at campsites with more than two vehicles (including trailers).
- Campsite must be kept clean; all trash must be picked up before leaving. Dumpsters are conveniently located on all camping loops.
- GRAY WATER AND BLACK WATER MUST BE DISCHARGED ONLY AT DUMP STATIONS.
- Only one unit per site is permitted to hook up to utilities.
- Pets must be kept on a 6-foot leash. Please pick up after them.
- No pets allowed in cabin area or primitive area.
- All vehicles are to remain in center of parking pad, not side by side or on the grass.
- Numbered sites are for overnight camping only. NO PICNICKING.
- Please follow boat launch protocol.

Legend:

- Headquarters
- Restrooms
- Showers
- Water Only
- Water/Electric
- Dump Station
- Mini Cabins
- Maintenance
- Residence
- Amphitheater
- Hiking Trail
- Picnic Area
- Group Picnic
- Swimming
- Parking
- Boat Ramp
- Fishing Pier
- Fish Cleaning
- Playground
- Composting Toilet
- Park Host Sites
- Scenic Overlook
- Handicapped Accessible
- State Parks Store
- Sponsored Youth Camp
- 230 Sites with 50 amp service
- 220 Walk-in sites with 30 amp service

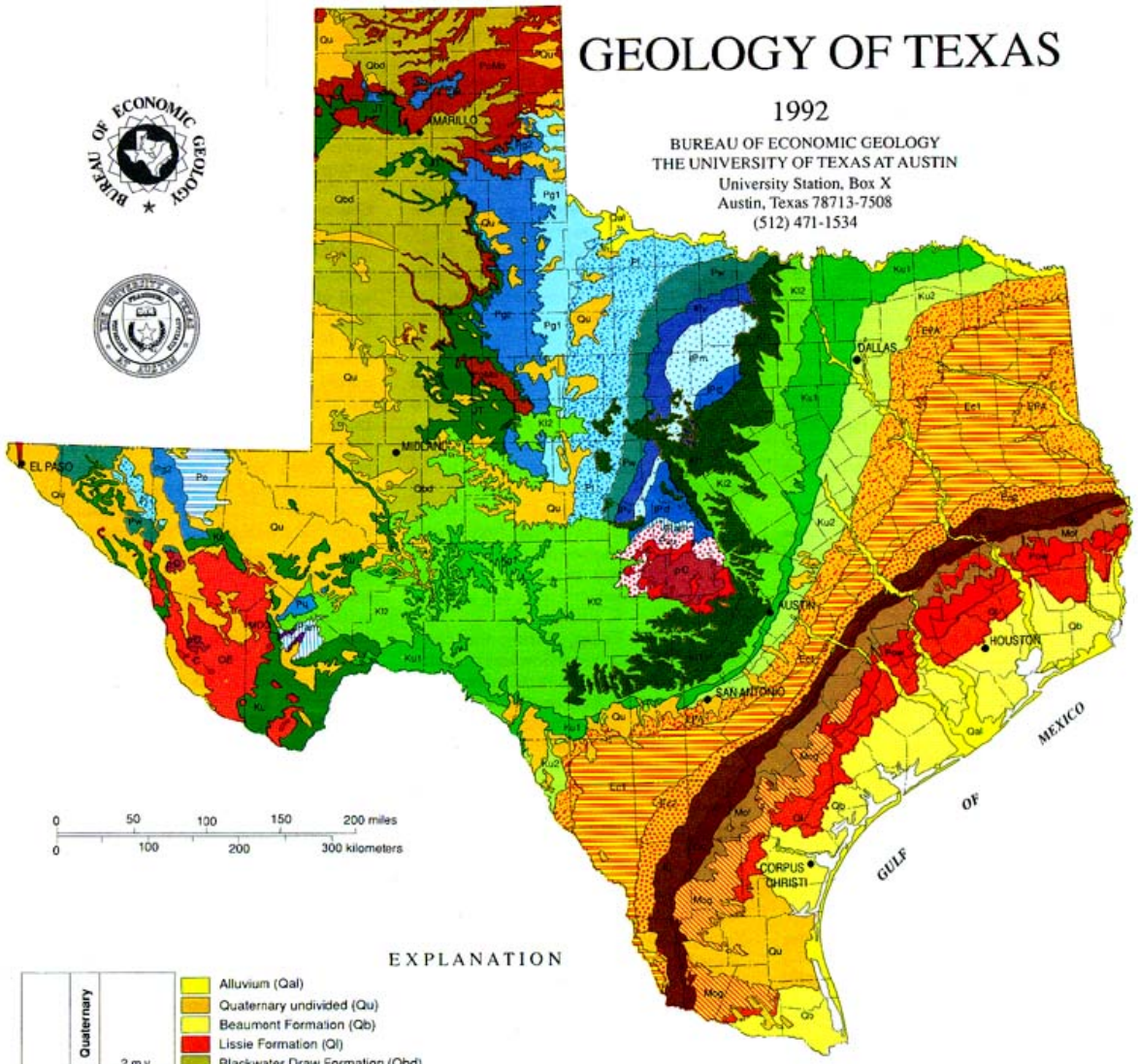
3630 Park Road 4 West
Burnet, TX 78611
(512) 793-2223

In accordance with Texas State Depository Law, this publication is available at the Texas State Publications Clearinghouse and/or Texas Depository Libraries.

GEOLOGY OF TEXAS

1992

BUREAU OF ECONOMIC GEOLOGY
THE UNIVERSITY OF TEXAS AT AUSTIN
University Station, Box X
Austin, Texas 78713-7508
(512) 471-1534



EXPLANATION

CENOZOIC
- Quaternary — 2 m.y.
  - Alluvium (Qal)
  - Quaternary undivided (Qu)
  - Beaumont Formation (Qb)
  - Lissie Formation (Ql)
  - Blackwater Draw Formation (Qbd)
- Tertiary
  - Pliocene — 5 m.y.
    - Willis Formation (Pow)
  - Miocene — 24 m.y.
    - Ogallala Formation (PoMo)
    - Goliad Formation (Mog)
  - Oligocene — 38 m.y.
    - Fleming and Oakville Formations (Mof)
    - Catahoula Formation (Oc)
    - Oligocene and Eocene undivided (OE) (volcanic rocks and conglomerates in Trans-Pecos Texas)
  - Eocene — 58 m.y.
    - Jackson Group (Whitsett, Manning, Wellborn, Caddell, Yazoo, and Moodys Branch Fms.) (Ej)
    - Claiborne Group (Yegua Formation) (Ec2)
    - Claiborne Group (Cook Mountain, Sparta, Weches, Queen City, and Reklaw) (Ec1)
  - Paleocene — 66 m.y.
    - Wilcox and Midway Groups (EPA)

MESOZOIC
- Cretaceous — 144 m.y.
  - Navarro and Taylor Groups (Ku2)
  - Austin, Eagle Ford, Woodbine, and U. Washita Groups (Ku1)
  - Fredericksburg and L. Washita Groups (Kl2)
  - Trinity Group (Kl1)
  - Cretaceous undivided (Ku)
- Jurassic Triassic — 245 m.y.
  - Jurassic Triassic undivided (JT)

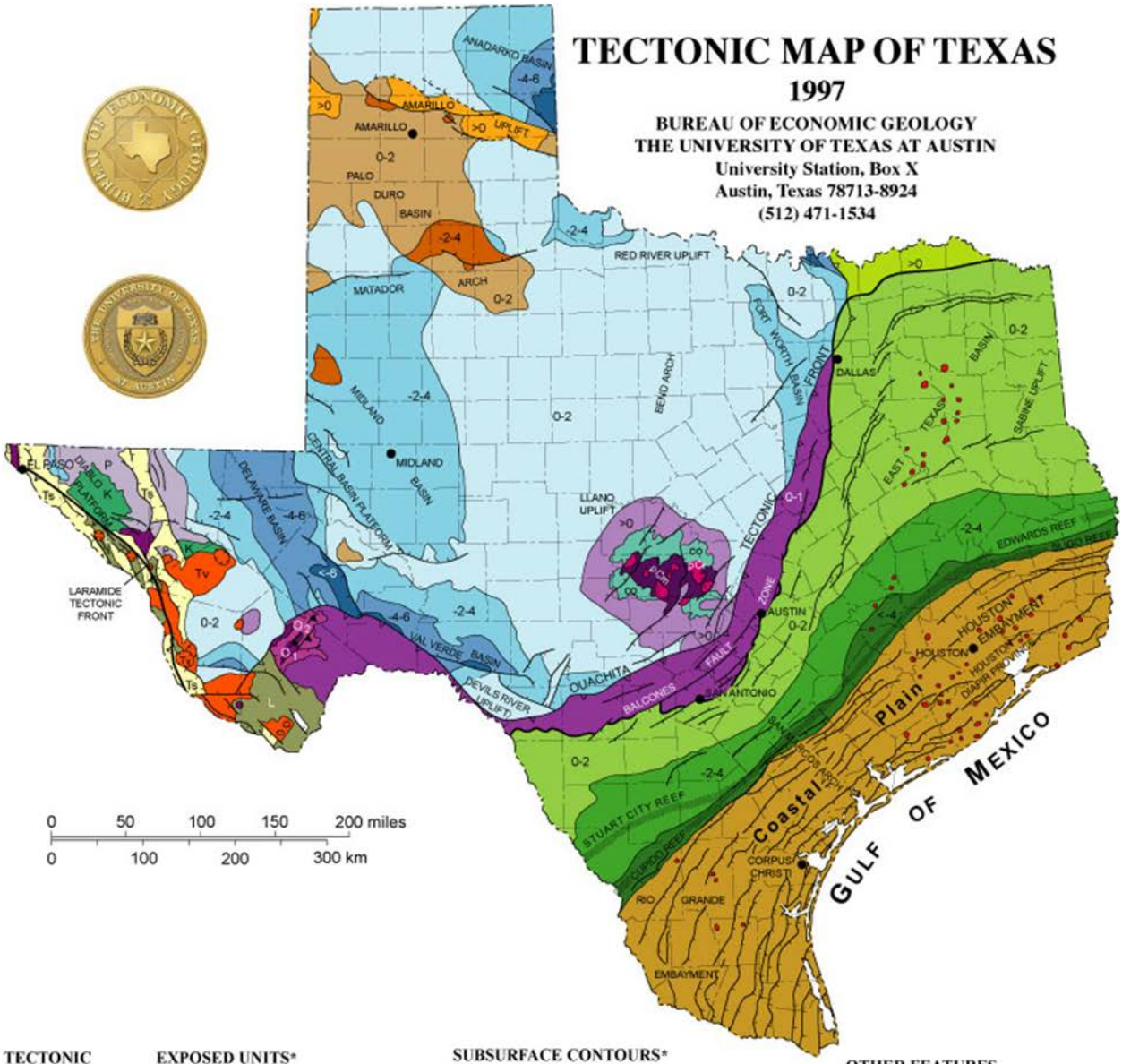
PALEOZOIC — 245 m.y.
- Ochoan Series (Po)
- Guadalupian Series (Whitehorse and Quartermaster Formations) (Pg2)
- Guadalupian Series (Blaine and San Angelo Formations) (Pg1)
- Leonardian Series (Pl)
- Wolfcampian Series (Pw) — 286 m.y.
- Permian undivided (Pu)
- Virgilian Series (IPv)
- Missourian Series (IP m) — 320 m.y.
- Desmoinesian Series (IP d)
- Atokan and Morrowan Series (IP am) — 505 m.y.
- Mississippian, Devonian, and Ordovician undivided (MDO) — 570 m.y.
- Cambrian (-C)
- Paleozoic undivided (Pau)

Precambrian — 1200 m.y. — 2000 m.y.
- Precambrian undivided (p-C)

TECTONIC MAP OF TEXAS

1997

BUREAU OF ECONOMIC GEOLOGY
THE UNIVERSITY OF TEXAS AT AUSTIN
University Station, Box X
Austin, Texas 78713-8924
(512) 471-1534



TECTONIC EPISODE / **EXPOSED UNITS***

- **Tertiary**
  - Ts — Late Tertiary extensional basin
  - Tv — Trans-Pecos igneous
- **Laramide**
  - L — Deformed Cretaceous strata
- **Gulf Coast**
  - K — Cretaceous strata
- **Ouachita**
  - **Foreland:**
  - P — Upper Paleozoic
  - CO — Lower Paleozoic
  - **Marathon:**
  - O_2 — Upper Paleozoic flysch
  - O_1 — Lower Paleozoic
- **Llano**
  - pCi — Precambrian igneous
  - pCm — Precambrian metamorphic

SUBSURFACE CONTOURS* (elevation in kilometers**)

Top of pre-Tertiary: <-4

Base of Austin Chalk or Top of Edwards Group Cretaceous: >0 | 0 to -2 | -2 to -4 | <-4

Top of Ellenburger Paleozoic: >0 | 0 to -2 | -2 to -4 | -4 to -6 | <-6

Top of Precambrian: >0 | 0 to -2 | -2 to -4

Buried Ouachita facies Paleozoic: 0 to -1

* Note changes in mapped horizon.
** >0, elevation greater than sea level; <-6, depths greater than 6 km below sea level

OTHER FEATURES

- Caldera
- Salt diapirs
- Lower Cretaceous reef trend
- Normal fault, indicating downthrown side
- Thrust fault, teeth on upper plate

TECTONIC FRONTS

- Laramide tectonic front
- Ouachita tectonic front
- Gulf Basin margin

AQUIFERS OF TEXAS

2001

(Revised 2004)

BUREAU OF ECONOMIC GEOLOGY

SCOTT W. TINKER, DIRECTOR

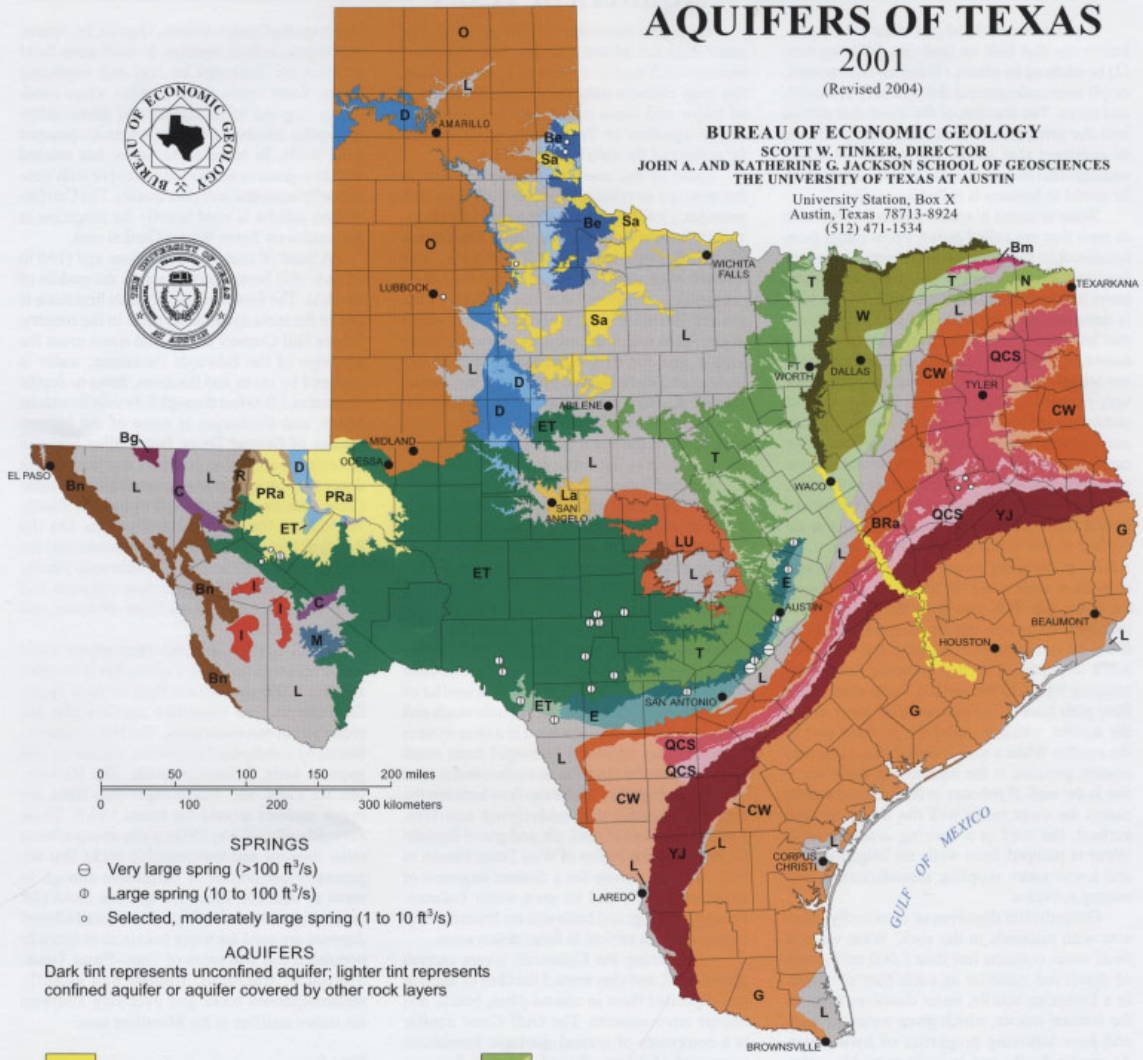
JOHN A. AND KATHERINE G. JACKSON SCHOOL OF GEOSCIENCES

THE UNIVERSITY OF TEXAS AT AUSTIN

University Station, Box X

Austin, Texas 78713-8924

(512) 471-1534



SPRINGS

- Very large spring (>100 ft³/s)
- Large spring (10 to 100 ft³/s)
- Selected, moderately large spring (1 to 10 ft³/s)

AQUIFERS

Dark tint represents unconfined aquifer; lighter tint represents confined aquifer or aquifer covered by other rock layers

BRa	Brazos River alluvium
La	Lipan alluvium
Sa	Seymour alluvium*
PRa	Pecos River alluvium* (overlies Rustler)
O	Ogallala* (overlies Dockum, High Plains Edwards-Trinity, Rita Blanca)
Bn	Bolson (Hueco-Mesilla* and West Texas)
G	Gulf Coast* (Catahoula, Jasper, Evangeline, Chicot)
I	Igneous
YJ	Yegua-Jackson (overlies Queen City and Sparta)
QCS	Queen City and Sparta (overlie Carrizo-Wilcox)
CW	Carrizo-Wilcox*
N	Nacatoch
W	Woodbine (overlies Trinity)
Bm	Blossom
ET	Edwards-Trinity (Plateau)*
E	Edwards (Balcones Fault Zone)*
T	Trinity*
D	Dockum
Be	Blaine
R	Rustler
C	Capitan Reef Complex
Bg	Bone Spring–Victorio Peak
M	Marathon
LU	Llano Uplift (Hickory, Ellenburger–San Saba, Marble Falls)
L	Local aquifers of varying quantity and quality

*Major aquifer

Texas Water Development Board

1700 North Congress Avenue

P.O. Box 13231

Austin, Texas 78711-3231

(512) 463-7847

www.twdb.state.tx.us

Aquifer units are generalized from the Texas Water Development Board digital database of major and minor aquifers of Texas.

ECOREGIONS OF TEXAS

2010

BUREAU OF ECONOMIC GEOLOGY

SCOTT W. TINKER, DIRECTOR
JACKSON SCHOOL OF GEOSCIENCES
THE UNIVERSITY OF TEXAS AT AUSTIN

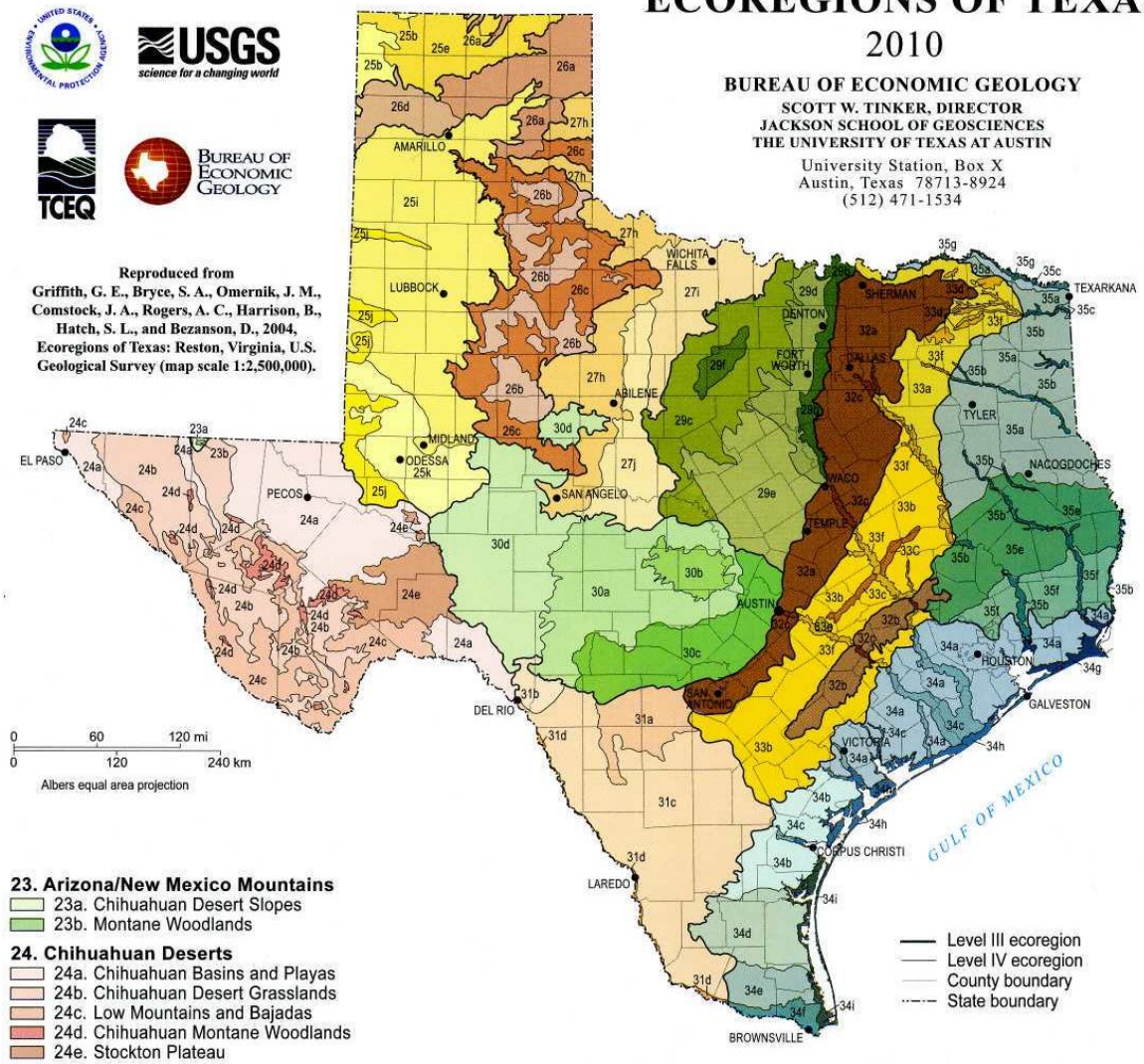
University Station, Box X
Austin, Texas 78713-8924
(512) 471-1534

USGS science for a changing world

TCEQ

Bureau of Economic Geology

Reproduced from
Griffith, G. E., Bryce, S. A., Omernik, J. M., Comstock, J. A., Rogers, A. C., Harrison, B., Hatch, S. L., and Bezanson, D., 2004, Ecoregions of Texas: Reston, Virginia, U.S. Geological Survey (map scale 1:2,500,000).



23. Arizona/New Mexico Mountains
- 23a. Chihuahuan Desert Slopes
- 23b. Montane Woodlands

24. Chihuahuan Deserts
- 24a. Chihuahuan Basins and Playas
- 24b. Chihuahuan Desert Grasslands
- 24c. Low Mountains and Bajadas
- 24d. Chihuahuan Montane Woodlands
- 24e. Stockton Plateau

25. High Plains
- 25b. Rolling Sand Plains
- 25e. Canadian/Cimarron High Plains
- 25i. Llano Estacado
- 25j. Shinnery Sands
- 25k. Arid Llano Estacado

26. Southwestern Tablelands
- 26a. Canadian/Cimarron Breaks
- 26b. Flat Tablelands and Valleys
- 26c. Caprock Canyons, Badlands, and Breaks
- 26d. Semiarid Canadian Breaks

27. Central Great Plains
- 27h. Red Prairie
- 27i. Broken Red Plains
- 27j. Limestone Plains

29. Cross Timbers
- 29b. Eastern Cross Timbers
- 29c. Western Cross Timbers
- 29d. Grand Prairie
- 29e. Limestone Cut Plain
- 29f. Carbonate Cross Timbers

30. Edwards Plateau
- 30a. Edwards Plateau Woodland
- 30b. Llano Uplift
- 30c. Balcones Canyonlands
- 30d. Semiarid Edwards Plateau

31. Southern Texas Plains
- 31a. Northern Nueces Alluvial Plains
- 31b. Semiarid Edwards Bajada
- 31c. Texas–Tamaulipan Thornscrub
- 31d. Rio Grande Floodplain and Terraces

32. Texas Blackland Prairies
- 32a. Northern Blackland Prairie
- 32b. Southern Blackland/Fayette Prairie
- 32c. Floodplains and Low Terraces

33. East Central Texas Plains
- 33a. Northern Post Oak Savanna
- 33b. Southern Post Oak Savanna
- 33c. San Antonio Prairie
- 33d. Northern Prairie Outliers
- 33e. Bastrop Lost Pines
- 33f. Floodplains and Low Terraces

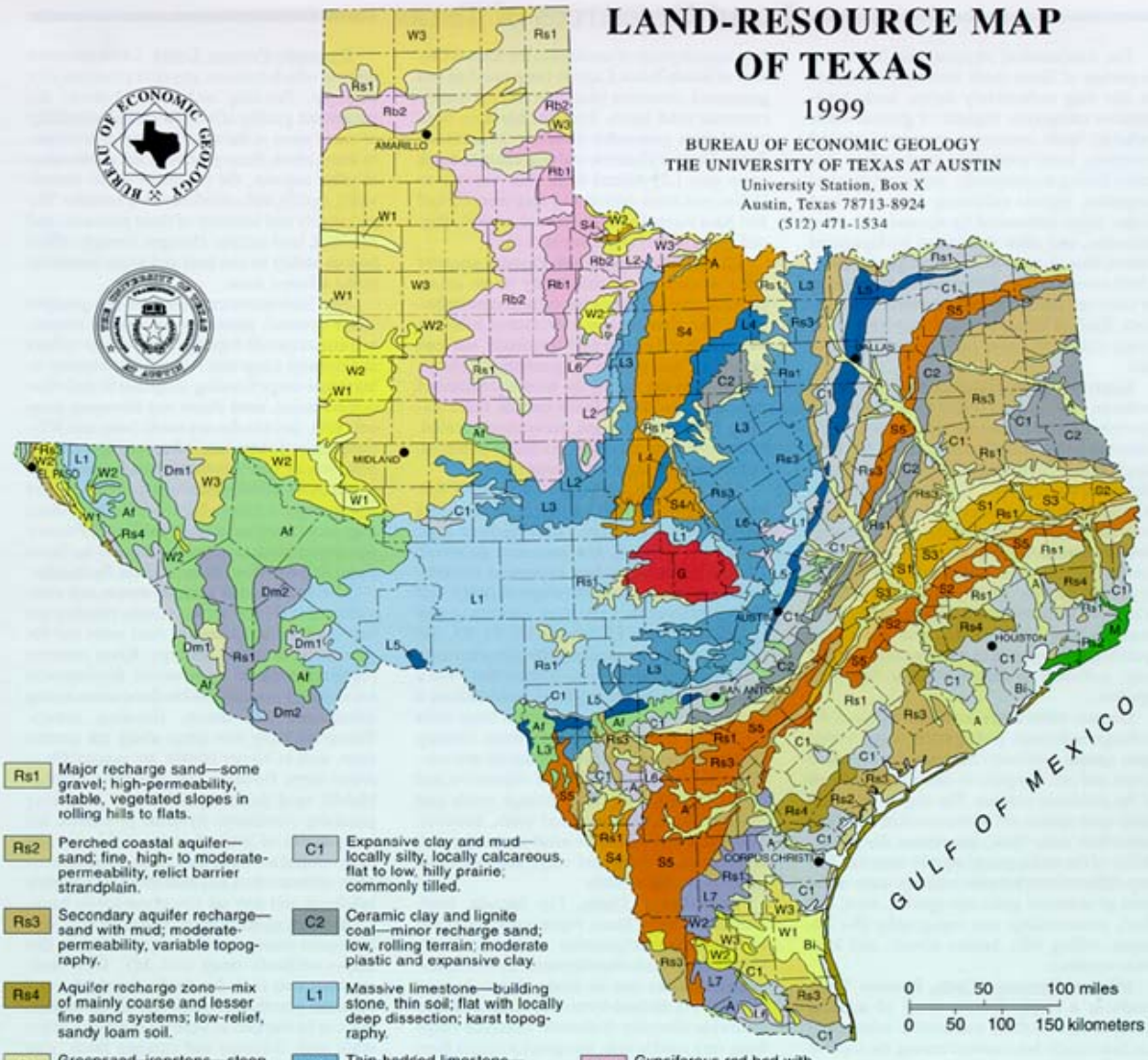
34. Western Gulf Coastal Plain
- 34a. Northern Humid Gulf Coastal Prairies
- 34b. Southern Subhumid Gulf Coastal Prairies
- 34c. Floodplains and Low Terraces
- 34d. Coastal Sand Plain
- 34e. Lower Rio Grande Valley
- 34f. Lower Rio Grande Alluvial Floodplain
- 34g. Texas–Louisiana Coastal Marshes
- 34h. Midcoast Barrier Islands and Coastal Marshes
- 34i. Laguna Madre Barrier Islands and Coastal Marshes

35. South Central Plains
- 35a. Tertiary Uplands
- 35b. Floodplains and Low Terraces
- 35c. Pleistocene Fluvial Terraces
- 35e. Southern Tertiary Uplands
- 35f. Flatwoods
- 35g. Red River Bottomlands

LAND-RESOURCE MAP OF TEXAS

1999

BUREAU OF ECONOMIC GEOLOGY
THE UNIVERSITY OF TEXAS AT AUSTIN
University Station, Box X
Austin, Texas 78713-8924
(512) 471-1534



Rs1 Major recharge sand—some gravel; high-permeability, stable, vegetated slopes in rolling hills to flats.

Rs2 Perched coastal aquifer—sand; fine, high- to moderate-permeability, relict barrier strandplain.

Rs3 Secondary aquifer recharge—sand with mud; moderate-permeability, variable topography.

Rs4 Aquifer recharge zone—mix of mainly coarse and lesser fine sand systems; low-relief, sandy loam soil.

S1 Greensand–ironstone—steep slopes and rolling hills; local hard beds; iron ore; road base; soil conditioner.

S2 Tuffaceous sand and mud—rolling, steep badlands; expansive clay; bentonite; uranium; fuller's earth.

S3 Sand and mud—lignite and bentonite; expansive clay; moderately rolling; poor strength; low permeability.

S4 Sandstone and shale—locally thin coal and limestone; poor soil; subdued stair-step topography.

S5 Sand and mud (undifferentiated)—cuesta–swale topography; colluvial, deep sand and clay loam.

G Weathered granite and schist—hard fractured rock and loose granitic sand; locally minor aquifers.

C1 Expansive clay and mud—locally silty, locally calcareous, flat to low, hilly prairie; commonly tilled.

C2 Ceramic clay and lignite coal—minor recharge sand; low, rolling terrain; moderate plastic and expansive clay.

L1 Massive limestone—building stone, thin soil; flat with locally deep dissection; karst topography.

L2 Thin-bedded limestone—crushed stone; locally poor aquifers; fractured, resistant local ledges.

L3 Hard limestone and marl—stair-step topography; stable slopes; thin clay soils; local seeps and minor springs.

L4 Thick limestone and shale—building and crushed stone; thin, stony, clay loam soils; minor sandstone beds.

L5 Chalk—potential cement material; high slope stability; black, expansive soils; rolling prairie.

L6 Caliche—bedrock and alluvium, cemented irregularly by calcite; road-base material.

L7 Karstic caliche-cemented sand—sink holes and collapse lows; hummocky terrain.

Rb1 Gypsiferous red bed with dolomite—rolling to steep slopes; collapse lows; plastic and expansive clay.

Rb2 Dissected red bed—mud and sand; local badlands with steep slopes; thin loam soils; not productive.

Dm1 Desert mountain terrain (sedimentary rock)—steep, variable rock types; loose surface rock.

Dm2 Desert mountain and canyon land (volcanic rock)—rugged; many box canyons; lava and explosive debris.

A Flood-prone valley and terrace—alluvium of sand and mud; sparse gravel; stream channels, flats, and coastal marshes.

Af Alluvial fan—Trans-Pecos: active cover; Rio Grande: relict chert gravel; Balcones Escarpment: calcareous detritus.

W1 Sand dune and blowout—mobile or stabilized by vegetation; locally deflated hollows and flats.

W2 Windblown sand—strong relict grain of leveled dunes, blowouts, playas; flat to low, rolling terrain.

W3 Loose surficial sand and silt (loess)—playas; flat to low, rolling, grassy prairie and scrub brush.

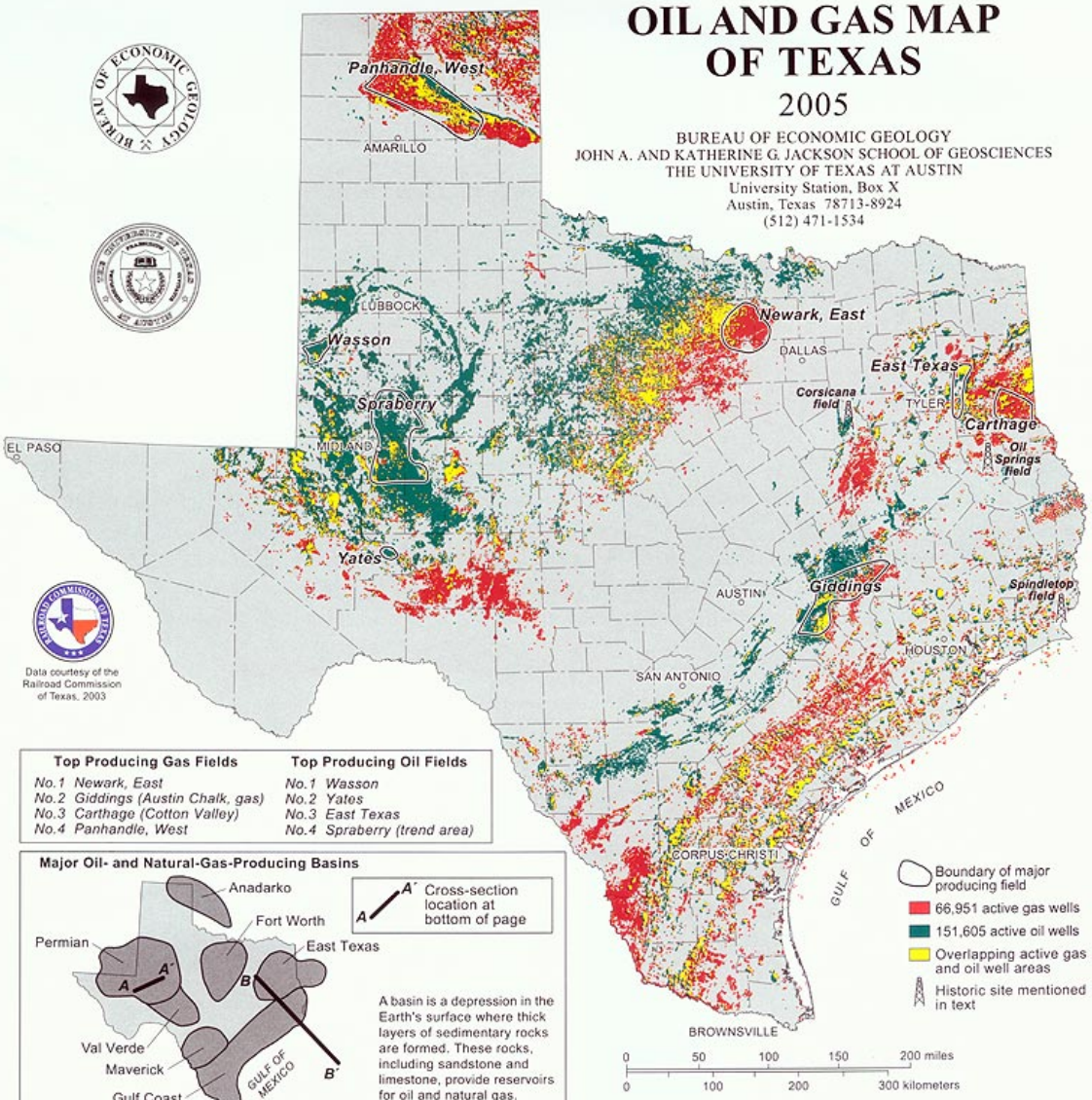
M Wetlands—fresh, brackish, and saltwater marsh and swamp—coastal and deltaic.

Bi Barrier island—sand and shell, beach, fore- and back-island dunes; back-island and tidal flats, marshes, and washovers.

OIL AND GAS MAP OF TEXAS

2005

BUREAU OF ECONOMIC GEOLOGY
JOHN A. AND KATHERINE G. JACKSON SCHOOL OF GEOSCIENCES
THE UNIVERSITY OF TEXAS AT AUSTIN
University Station, Box X
Austin, Texas 78713-8924
(512) 471-1534



Data courtesy of the Railroad Commission of Texas, 2003

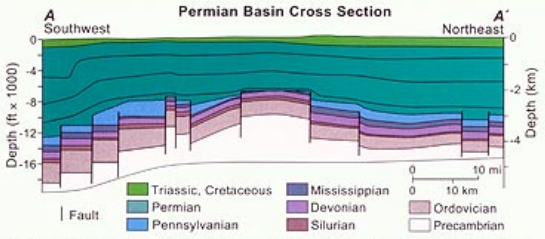
Top Producing Gas Fields	Top Producing Oil Fields
No.1 Newark, East	No.1 Wasson
No.2 Giddings (Austin Chalk, gas)	No.2 Yates
No.3 Carthage (Cotton Valley)	No.3 East Texas
No.4 Panhandle, West	No.4 Spraberry (trend area)

Major Oil- and Natural-Gas-Producing Basins

A´ Cross-section location at bottom of page

A basin is a depression in the Earth's surface where thick layers of sedimentary rocks are formed. These rocks, including sandstone and limestone, provide reservoirs for oil and natural gas.

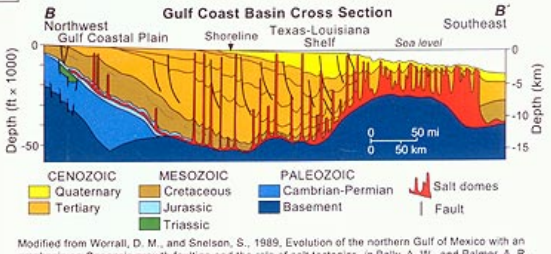
Permian Basin Cross Section



Modified from Bebout, D. G., and Meador, K. J., 1985, Regional cross sections—Central Basin Platform, West Texas: The University of Texas at Austin, Bureau of Economic Geology, 4 p., 11 pls.

More than half of the oil and gas production from Texas comes from the Permian Basin of West Texas. Nearly three-quarters of this production comes from carbonate rocks of Permian age.

Gulf Coast Basin Cross Section



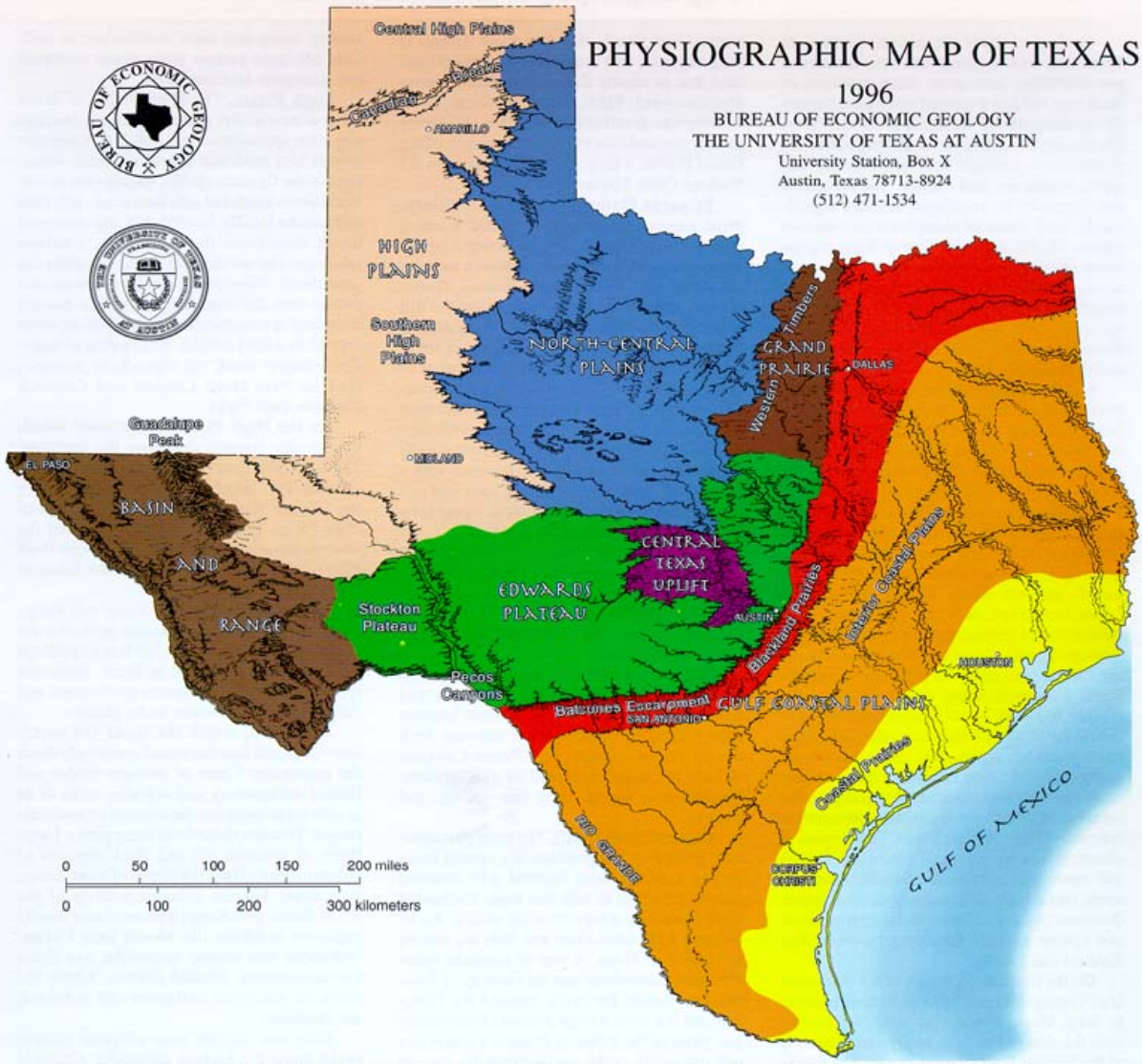
Modified from Worrall, D. M., and Snelson, S., 1989, Evolution of the northern Gulf of Mexico with an emphasis on Cenozoic growth faulting and the role of salt tectonics, *in* Bally, A. W., and Palmer, A. R., eds., The geology of North America—an overview: Geology of North America, v. A, p. 97–138.

Most oil and gas production in the Texas Gulf Coast comes from Tertiary-aged sandstones. Many reservoirs are associated with faults and salt domes.

PHYSIOGRAPHIC MAP OF TEXAS

1996

BUREAU OF ECONOMIC GEOLOGY
THE UNIVERSITY OF TEXAS AT AUSTIN
University Station, Box X
Austin, Texas 78713-8924
(512) 471-1534

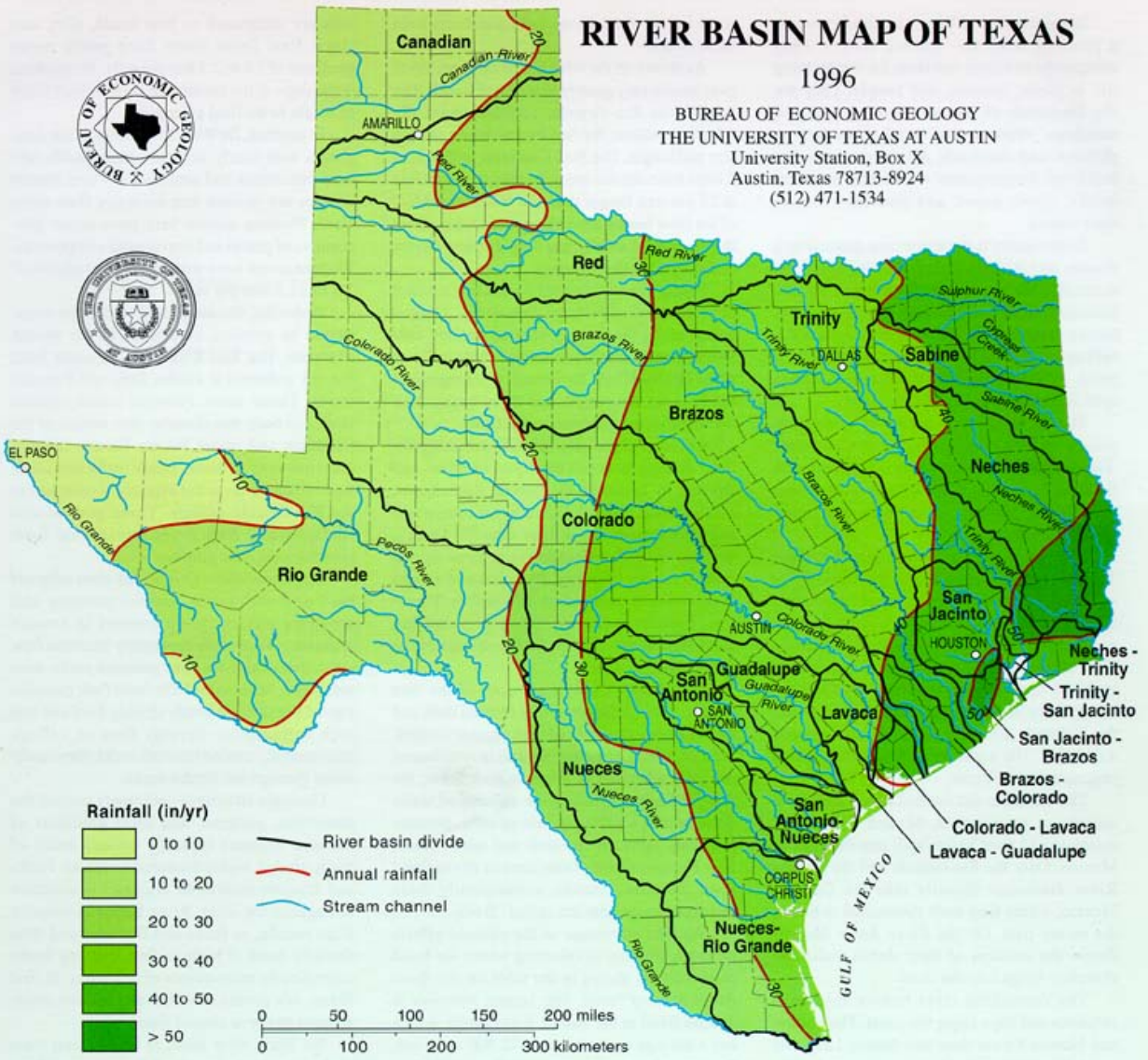


PROVINCE	MAX. ELEV. (ft)	MIN. ELEV. (ft)	TOPOGRAPHY	GEOLOGIC STRUCTURE	BEDROCK TYPES
Gulf Coastal Plains					
Coastal Prairies	300	0	Nearly flat prairie, <1 ft/mi to Gulf	Nearly flat strata	Deltaic sands and muds
Interior Coastal Plains	800	300	Parallel ridges (questas) and valleys	Beds tilted toward Gulf	Unconsolidated sands and muds
Blackland Prairies	1000	450	Low rolling terrain	Beds tilted south and east	Chalks and marls
Grand Prairie	1250	450	Low stairstep hills west; plains east	Strata dip east	Calcareous east; sandy west
Edwards Plateau					
Principal	3000	450	Flat upper surface with box canyons	Beds dip south; normal faulted	Limestones and dolomites
Pecos Canyons	2000	1200	Steep-walled canyons		Limestones and dolomites
Stockton Plateau	4200	1700	Mesa-formed terrain; highs to west	Unfaulted, near-horizontal beds	Carbonates and alluvial sediments
Central Texas Uplift	2000	800	Knobby plain; surrounded by questas	Centripetal dips, strongly faulted	Granites; metamorphics; sediments
North-Central Plains	3000	900	Low north-south ridges (questas)	West dip; minor faults	Limestones; sandstones; shales
High Plains					
Central	4750	2900	Flat prairies slope east and south	Slight dips east and south	Eolian silts and fine sands
Canadian Breaks	3800	2350	Highly dissected; local solution valleys		
Southern	3800	2200	Flat; many playas; local dune fields		
Basin and Range	8750	1700	North-south mountains and basins	Some complex folding and faulting	Igneous; metamorphics; sediments

RIVER BASIN MAP OF TEXAS

1996

BUREAU OF ECONOMIC GEOLOGY
THE UNIVERSITY OF TEXAS AT AUSTIN
University Station, Box X
Austin, Texas 78713-8924
(512) 471-1534



River basins	Texas length (miles)	Texas area (sq mi)	Number of major reservoirs*	Conservation storage (acre ft)*	Storage (acre ft/sq mi)
Brazos	840	42,800	19	3,322,880	75
Canadian	200	12,700	2	560,900	44
Colorado	600	39,893	11	3,803,900	95
Guadalupe	250	6,070	2	420,000	70
Lavaca	74	2,309	1	157,900	68
Neches	416	10,011	4	3,455,500	345
Nueces	315	16,950	2	931,640	60
Red	680	30,823	7	4,593,460	149
Rio Grande	1,250	48,259	3	3,772,000	78
Sabine	360	7,426	2	6,041,300	814
San Jacinto	70	5,600	2	570,400	102
Trinity	550	17,696	14	6,969,710	388

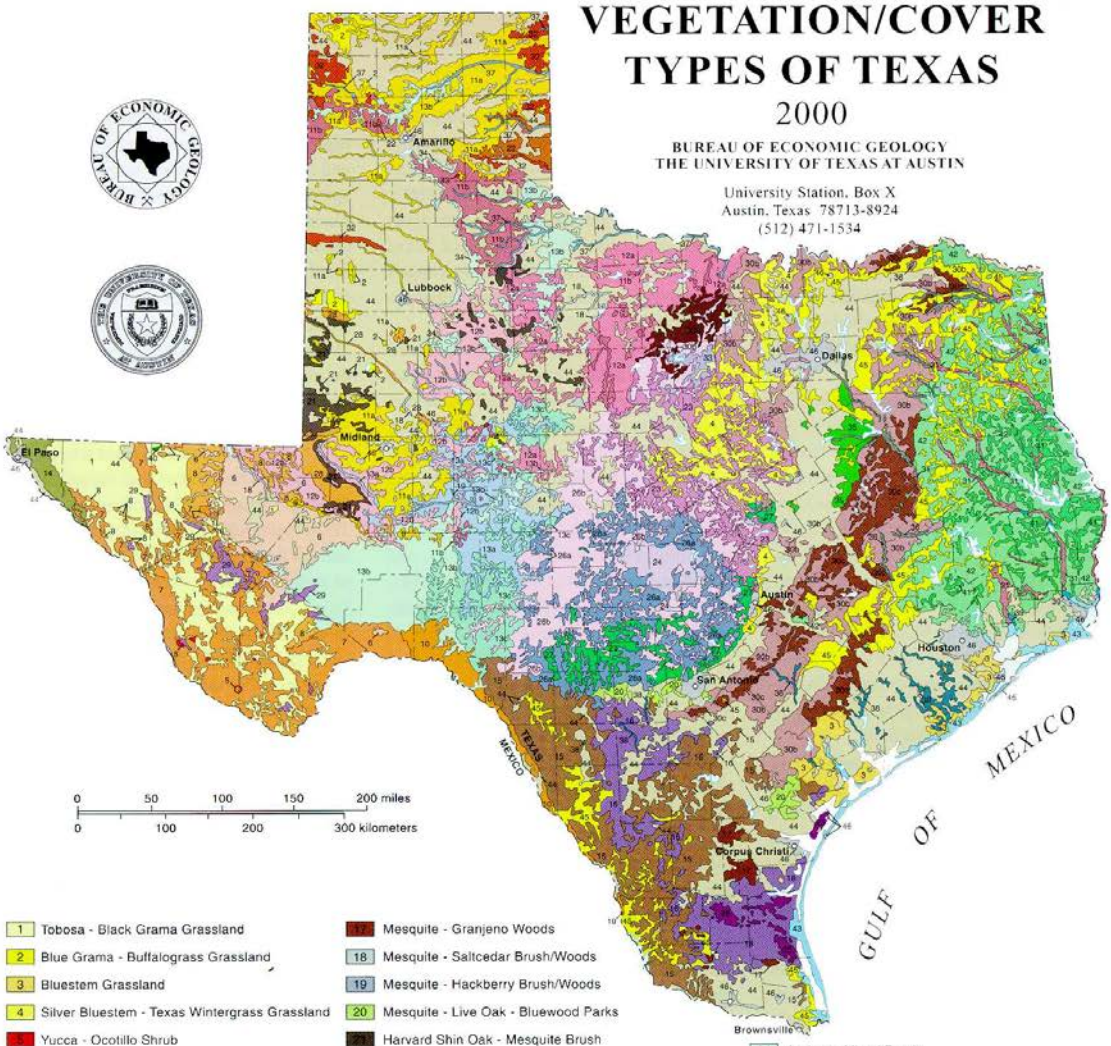
*Data from Texas Water Development Board.

VEGETATION/COVER TYPES OF TEXAS

2000

BUREAU OF ECONOMIC GEOLOGY
THE UNIVERSITY OF TEXAS AT AUSTIN

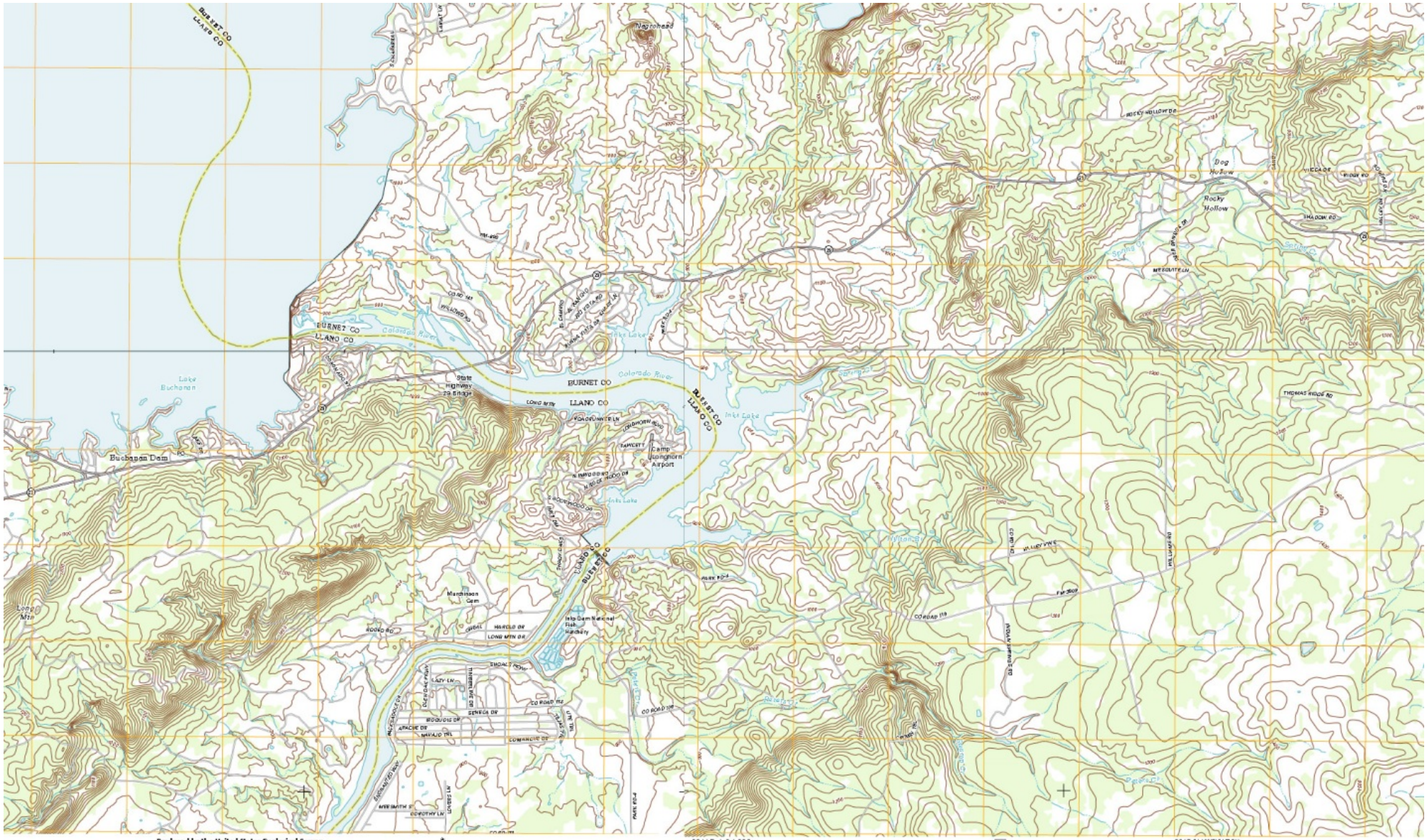
University Station, Box X
Austin, Texas 78713-8924
(512) 471-1534



1 Tobosa - Black Grama Grassland
2 Blue Grama - Buffalograss Grassland
3 Bluestem Grassland
4 Silver Bluestem - Texas Wintergrass Grassland
5 Yucca - Ocotillo Shrub
6 Creosotebush - Tarbush Shrub
7 Creosotebush - Lechuguilla Shrub
8 Creosotebush - Mesquite Shrub
9 Fourwing Saltbush - Creosotebush Shrub
10 Ceniza - Blackbrush - Creosotebush Brush
11a Mesquite Shrub/Grassland
11b Mesquite Brush
12a Mesquite - Lotebush Shrub
12b Mesquite - Lotebush Brush
13a Mesquite - Juniper Shrub
13b Mesquite - Juniper Brush
13c Mesquite - Juniper - Live Oak Brush
14 Mesquite - Sandsage Shrub
15 Mesquite - Blackbrush Brush
16 Mesquite - Granjeno Parks
17 Mesquite - Granjeno Woods
18 Mesquite - Saltcedar Brush/Woods
19 Mesquite - Hackberry Brush/Woods
20 Mesquite - Live Oak - Bluewood Parks
21 Harvard Shin Oak - Mesquite Brush
22 Sandsage - Mesquite Brush
23 Oak - Mesquite - Juniper Parks/Woods
24 Live Oak - Mesquite Parks
25 Live Oak Woods/Parks
26a Live Oak - Ashe Juniper Parks
26b Live Oak - Mesquite - Ashe Juniper Parks
27 Live Oak - Ashe Juniper Woods
28 Harvard Shin Oak Brush
29 Gray Oak - Pinyon Pine - Alligator Juniper Parks/Woods
30a Post Oak Parks/Woods
30b Post Oak Woods, Forest, and Grassland Mosaic
30c Post Oak Woods/Forest
31 Willow Oak - Water Oak - Blackgum Forest
32 Sandsage - Harvard Shin Oak Brush
33 Ashe Juniper Parks/Woods
34 Juniper - Mixed Brush
35 Elm - Hackberry Parks/Woods
36 Water Oak - Elm - Hackberry Forest
37 Cottonwood - Hackberry - Saltcedar Brush/Woods
38 Pecan - Elm Forest
39 Bald Cypress - Water Tupelo Swamp
40 Ponderosa Pine - Douglas Fir Parks/Forest
41 Young Forest/Grassland
42 Pine - Hardwood Forest
43 Marsh/Barrier Island
44 Crops
45 Other Native and/or Introduced Grasses
46 Urban

Map units are derived from the 1984 map *The Vegetation Types of Texas* published by the Texas Parks and Wildlife Department.

TEXAS PARKS & WILDLIFE



Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and
1 000-meter grid: Universal Transverse Mercator, Zone 14R
10 000-foot ticks: Texas Coordinate System of 1983 (central zone)

Imagery ..... NAIP, May 2010
Roads ..... ©2006-2012 TomTom
Names ..... GNIS, 2012
Hydrography ..... National Hydrography Dataset, 2010
Contours ..... National Elevation Dataset, 2002
Boundaries ..... Census, ESRI, IRC, USGS, 1972 - 2012

SCALE 1:24 000

1 0.5 0 KILOMETERS 1 2
1000 500 0 METERS 1000 2000
1 0.5 0 1
MILES
1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000
FEET

CONTOUR INTERVAL 20 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the
National Geospatial Program US Topo Product Standard, 2011.
A metadata file associated with this product is draft version 0.6.7

ROAD CLASSIFICATION

Interstate Route		State Route	
US Route		Local Road	
Ramp		4WD	

Interstate Route | US Route | State Route

ADJOINING 7.5' QUADRANGLES

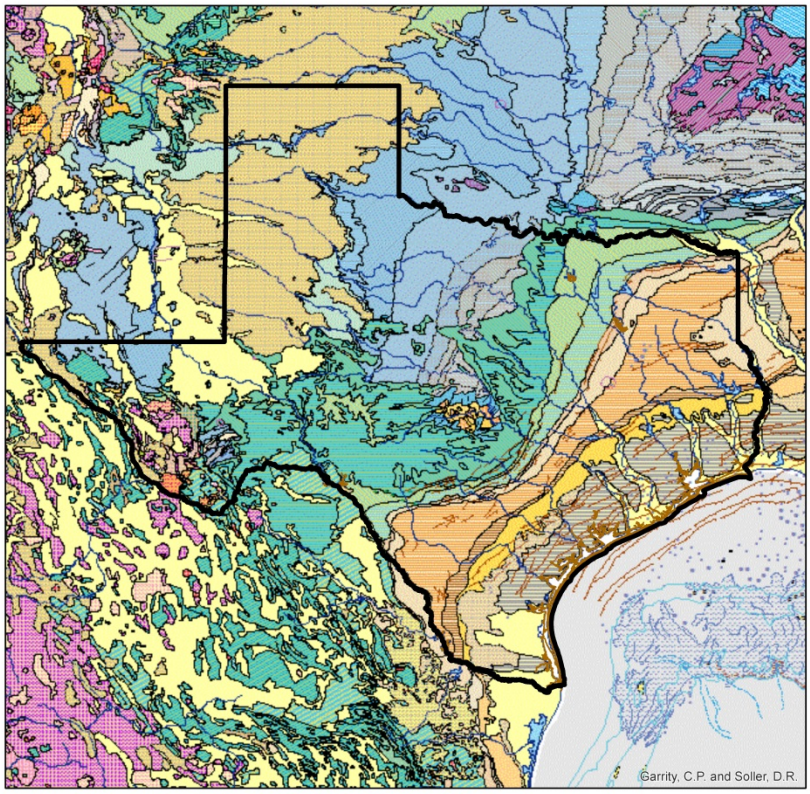
Inks Lake Overview

0 60 120 240 360 480 Miles

Coordinate System: GCS WGS 1984
Datum: WGS 1984
Units: Degree

1 inch = 727,912 feet

N



Legend

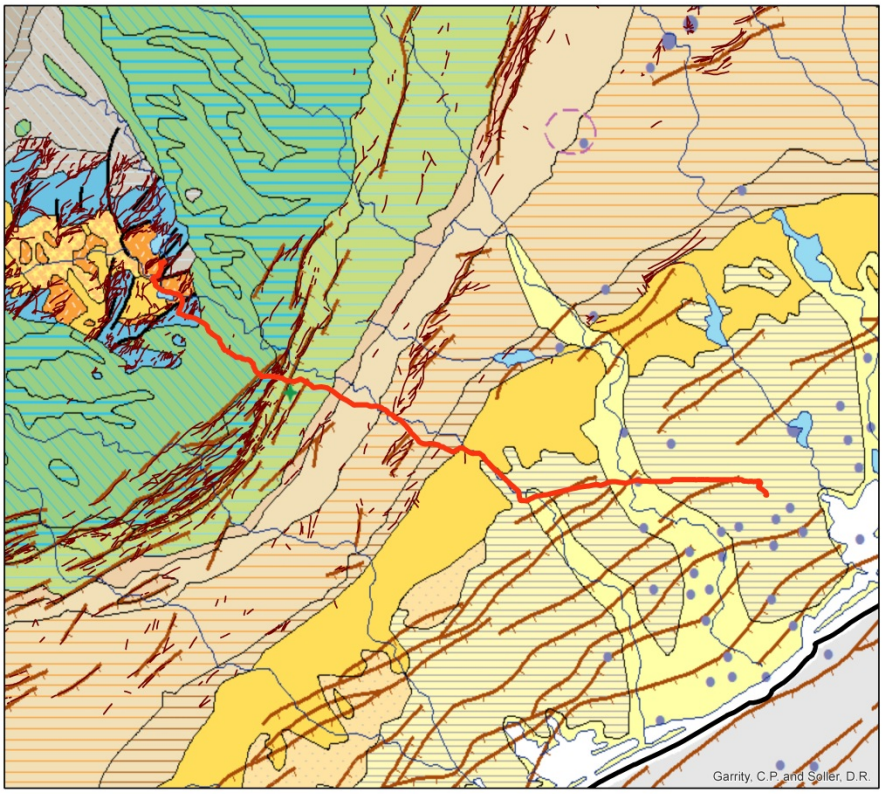
- Cinder cone or lava dome
- Volcano
- Calderas
- Alaskan type ultramafic body
- Alkaline complex
- Carbonatite
- Diatreme
- Kimberlite
- Location accurate
- Location approximate
- Location concealed
- Continental deposits
- Melange
- Metamorphic rocks
- Offshelf deposits
- Dome < 10km in diameter
- Dome > 10km in diameter

Houston to Inks Lake

0 15 30 60 90 120 Miles

1 inch = 208,652 feet

N



Legend

- Faults
- Continental deposits
- Melange
- Metamorphic rocks
- Offshelf deposits
- Cinder cone or lava dome
- Volcano
- Calderas
- Areas of abundant diapiric structures
- Alaskan type ultramafic body
- Alkaline complex
- Carbonatite
- Diatreme
- Kimberlite
- Location accurate
- Location approximate
- Location concealed
- Dome < 10km in diameter
- Dome > 10km in diameter

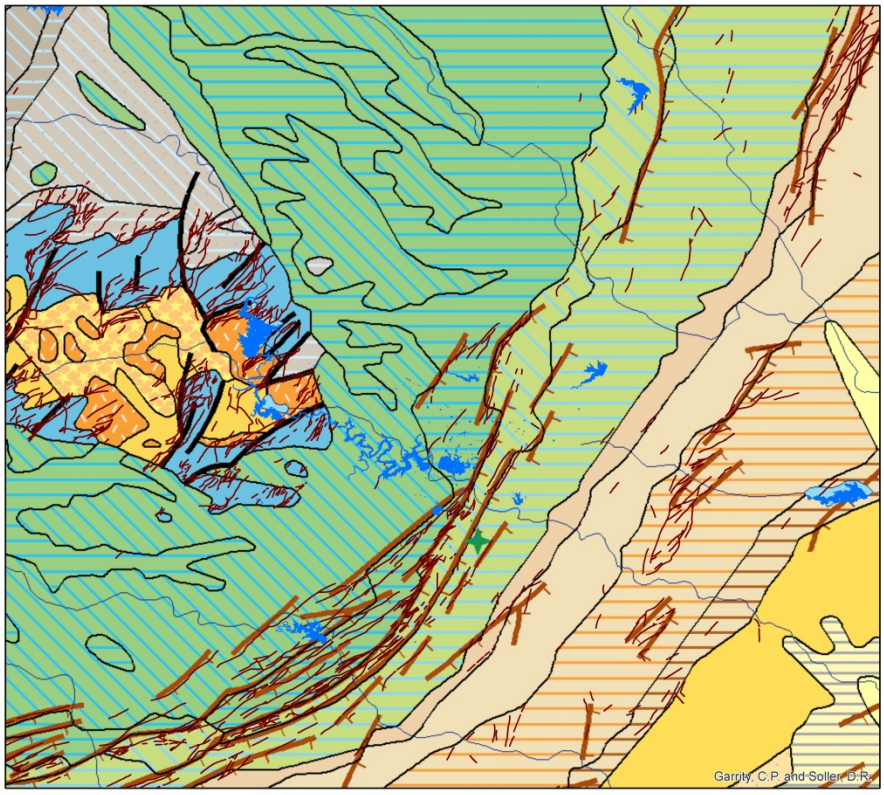
Inks Lake Overview

Coordinate System: GCS WGS 1984
Datum: WGS 1984
Units: Degree

0 10 20 40 60 80 Miles

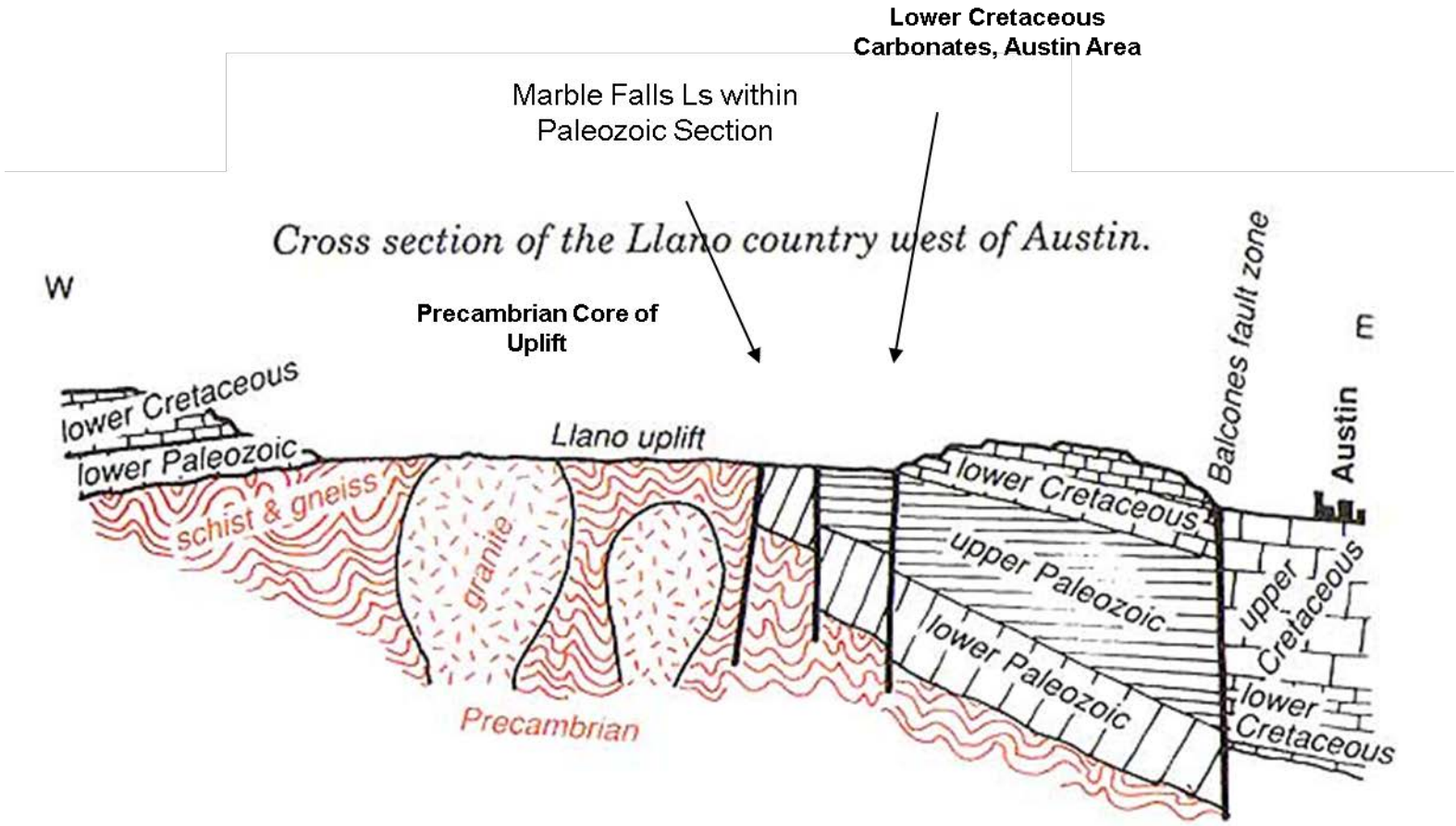
1 inch = 128,888 feet

N



Legend

- Cinder cone or lava dome
- Volcano
- Calderas
- Alaskan type ultramafic body
- Alkaline complex
- Carbonatite
- Diatreme
- Kimberlite
- Location accurate
- Location approximate
- Location concealed
- Continental deposits
- Melange
- Metamorphic rocks
- Offshelf deposits
- Dome < 10km in diameter
- Dome > 10km in diameter


Lower Cretaceous
Carbonates, Austin Area
Marble Falls Ls within
Paleozoic Section
Cross section of the Llano country west of Austin.
W
Precambrian Core of
Uplift
E
Balcones fault zone
Austin
lower Cretaceous
lower Paleozoic
schist & gneiss
granite
Llano uplift
lower Cretaceous
upper Paleozoic
lower Paleozoic
upper Cretaceous
lower Cretaceous
Precambrian

DEPARTMENT OF EARTH AND ATMOSPHERIC SCIENCES FIELD TRIP POLICY

Attention students: the information contained in this document is important. Please review carefully and follow accordingly.

The Department of Earth and Atmospheric Sciences expects all participants to conduct themselves on field trips with maturity, responsibility, respect for others, and to behave in a manner that will allow us to be welcome at field trip and lodging sites in subsequent years. Failure to do so jeopardizes field trips for future participants. In addition to this general expectation, the Department has established specific policies on a number of issues as indicated below.

1) Safety is paramount. A participant who willfully or negligently endangers the safety and welfare of himself/herself or another may be required to leave and return home at the participant's own expenses.
2) All field trips in the Geosciences Department are "dry" and drug-free. This means that participants who go on field trip agree not to consume alcoholic beverages of any kind, or to use illegal substances for the duration of the field trip, including during the evenings and off-days. Under no circumstances that any participant allowed to operate vehicles, either his/her own or those that belong to the University, when said participant is under influence.
3) Only drivers who are authorized by the University of Houston's Physical Plant, and who are covered by the University of Houston's insurance are allowed to operate vans for field trip activities, and may do so only upon prior approval by the Department, and only when accompanied by the field trip leader. The driver and all passengers must wear seat belts at all times. The number of passengers in the vehicle must not exceed the number of seatbelts available.
4) The instructors have sole authority on making any plan. Students shall not challenge the person with authority in a hostile, disrespectful or presumptuous manner. If a student becomes unruly, rude, abusive or insulting toward the instructors, customs, park officials, law officials or staff members; or, if the student refuses to follow instruction on a field trip or field camp, such student will be subject to immediate dismissal from class at the discretion of the instructor.
5) Public intoxication, substance abuse or carrying weapons are grounds for dismissal.
6) Dismissal from field camp shall lead to course drop. Two course drops caused by field trip behavior problems constitute grounds for dismissal from the University degree.
7) Participants will not be permitted to sleep in the vans during the night, nor will participants be allowed to prepare food or eat meals in the vans.
8) Participants will not be permitted to smoke or "dip" (i.e., chew tobacco) in the vans, inside tents, or when they are with the group. Participants who are of legal age, and who wish to smoke or "dip" must do so away from other people in the group, and only in places or areas as permitted by law, and that will not endanger the safety of the participant or other individuals.
9) Participants will be required to take part in activities of the field trip group, or one of the field trip subgroups at all times to help ensure field trip leaders know where participants are at all times.
10) Field trip leaders will make the final decision on whether any proposed activity is appropriate or not based on safety factors as well as interests and abilities of the participant, and the participant will abide by that decision.
11) Upon returning from field trip, each participant will be responsible for returning all equipments he or she had checked out from the Department in good condition. Each participant will be personally responsible for any damage he or she had caused to the Department's equipment. Failure to repair or pay for the damage will result in a "hold" on his or her academic record.
12) While participating in "Activity or Trip", or any "Non-Activity or Trip related activities or events", participants are expected to comply with all laws of the United States of America, the State of Texas and any other states covered on the field trip's itinerary.