URBAN ENVIRONMENTAL FIELD TRIP – 2010. Your name:
University of Utah. Genevieve Atwood, leader. GEOG3330.

This handout is due at the beginning of class **WEDNESDAY April 14.** We'll go over it in class. See page two. You'll add at least one profile you've printed out. Colored pencils encouraged.

Drivers, you also get the handout. You're required to do pages 2 and 11. I highly recommend you complete the assignment, all of it, as a learning experience.

The purpose of the trip is for you to see field evidence of Earth systems. The subsystems of Earth systems are intimately inter-related. Urbanization of the Wasatch Front is affected and affects the geosphere, hydrosphere, atmosphere and biosphere. Specifically, I want you to understand in the field the inter-relatedness of the hydrosphere and geosphere we've discussed and diagramed in class.

By the end of the field trip, you should be familiar with the following:

- With respect to the **geosphere**: recognize bedrock versus sediment; understand that earth materials affect groundwater flow; recognize and be able to indicate layering of layered bedrock; see landforms of Lake Bonneville including shorelines and deltas; see evidence of surface water erosion and deposition including stream deposits, debris flow deposits, and alluvial fans; and see landslides and rockfalls in steep terrain, and expressions of the Wasatch fault, Salt Lake segment. Memorize the five major agents of erosion – deposition are: wind (grossly over-rated); water (can't say enough about it); glacial ice (not common but impressive); ground failure (landslides, rock falls, etc); and humans.

- With respect to the **hydrosphere**:

(a) With respect to surface water, draw watersheds… they are also called drainage basins; differentiate gaining and losing streams; see flooding hazards of streams.

(b) With respect to ground water, draw cross sections showing direction of fluid flow; recognize impermeable sediments; identify flow in bedrock units; understand the concept of aquifer, recharge area, discharge area, confining beds, unconfined aquifer, confined aquifer, artesian well, flowing well, potentiometric surface, springs, water table, unsaturated zone, saturated zone.

- With respect to the **atmosphere**: recognize how Utah's location greatly influences Utah's weather, climate, and air pollution. Know the water cycle. Recognize evidence of changed climate, specifically Lake Bonneville of Ice Age time versus Great Salt Lake of present, interglacial, times.

Our general route is from the University of Utah to the mouth of Red Butte Canyon; to the mouth of Emigration Canyon; up Emigration Canyon and over the divide into Parley's Canyon; west (down) I-80 to the mouth of Parley's Canyon; down the drainage; across expressions of the Wasatch fault; to a flowing well at Nibley Park; back to campus. Before the trip… make a preventive bathroom stop. There are portapotties at the top of Emigration Canyon before we descend into Parley's Canyon. We'll make a brief stops at the Maverick stations at 2700 South and 2000 East; and at 2700 South and 700 East... and by then we're almost back to campus. Let me know if you have special needs with respect to stops.

SAFETY: Tell me know if you see what you consider dangerous conditions or behavior. I think the most dangerous part of the trip is where we stop and walk along off the side of the road. Be careful, be cautious. You must sign the UofU waiver - disclaimer. Please contribute to making the field trip safe.

PART 1… To be completed by everyone… drivers included.
DRAW THE FOLLOWING ON THE MAP ON THE BACK PAGE:

Use pencil marks that I can see, or highlighting pens.

- Show the route of the field trip. Draw it right on your map.
- Add Little Dell reservoir to the map and label it.
- Draw the general location of the Bonneville shoreline of Lake Bonneville. Highlight it from the norht margin of the map to the southern margin. How? Find the contour that is closest to the level of Lake Bonneville, 5200 ft, so… about 1600 m. If you can't see it on the map of the back page, call the area up in Googel Earth and work interactively. Recognize the break in slope by spacing of the contours: close spacings for steep above the shoreline and wider contour spacings for more gentle terrain below it. Think urban geographer thoughts. Recognize upper limits of urbanization. Generally the limit is the Bonneville level of Lake Bonneville.
- Show the drainage basin (also called a watershed) of Emigration Creek from the mouth of the canyon to its watershed divide. Outline the watershed boldly so I can recognize it. It will look something like a leaf. A watershed is the land surface that drains to a place, in this case, to the mouth of the canyon.

Print off at least one profile from "Mountain Dell" (in black type on your map, not Mountain Dell Reservoir) to the mouth of Emigration Canyon (This is the Place Monument).

Drivers… you complete this page… the route, the map info, the Bonneville shoreline; the watershed boundary of Emigration Creek; and the profile... and the information on page 3 and on page 11.

STOP #1: UofU UNION BUILDING PARKING LOT – Drivers do this page!
Geosphere: is this location dominated by bedrock or sediment?
If bedrock… what is it like?

If sediment…what is it like? (rounded or angular; big or small particles; well sorted or jumbled).
Which of the five agents of erosion – deposition is most responsible for what is here?
The five agents of erosion / deposition I want you think about are: wind, water, glacial ice, groundfailure and humans.

How thick is the sediment cover here, meaning depth to bedrock?
Approximately_____ and justify your estimate:

The campus is on a broad landform. What is its shape... list at least three words that describe it:
What is a landform?
A natural, distictive feature on Earth's surface
made of characteristic materials
by characteristic processes.
For this landform of the parking lot: A d_ _ _ _ _ is a landform that is made of sediments deposited _____ _____ _____....

General hydrology:
About how many inches of precipitation falls on this general area … (see map on following page):

How deep is the water table here ... justify your estimate:
It must be deeper than _____ because _____

It must be shallower than _____ because _____

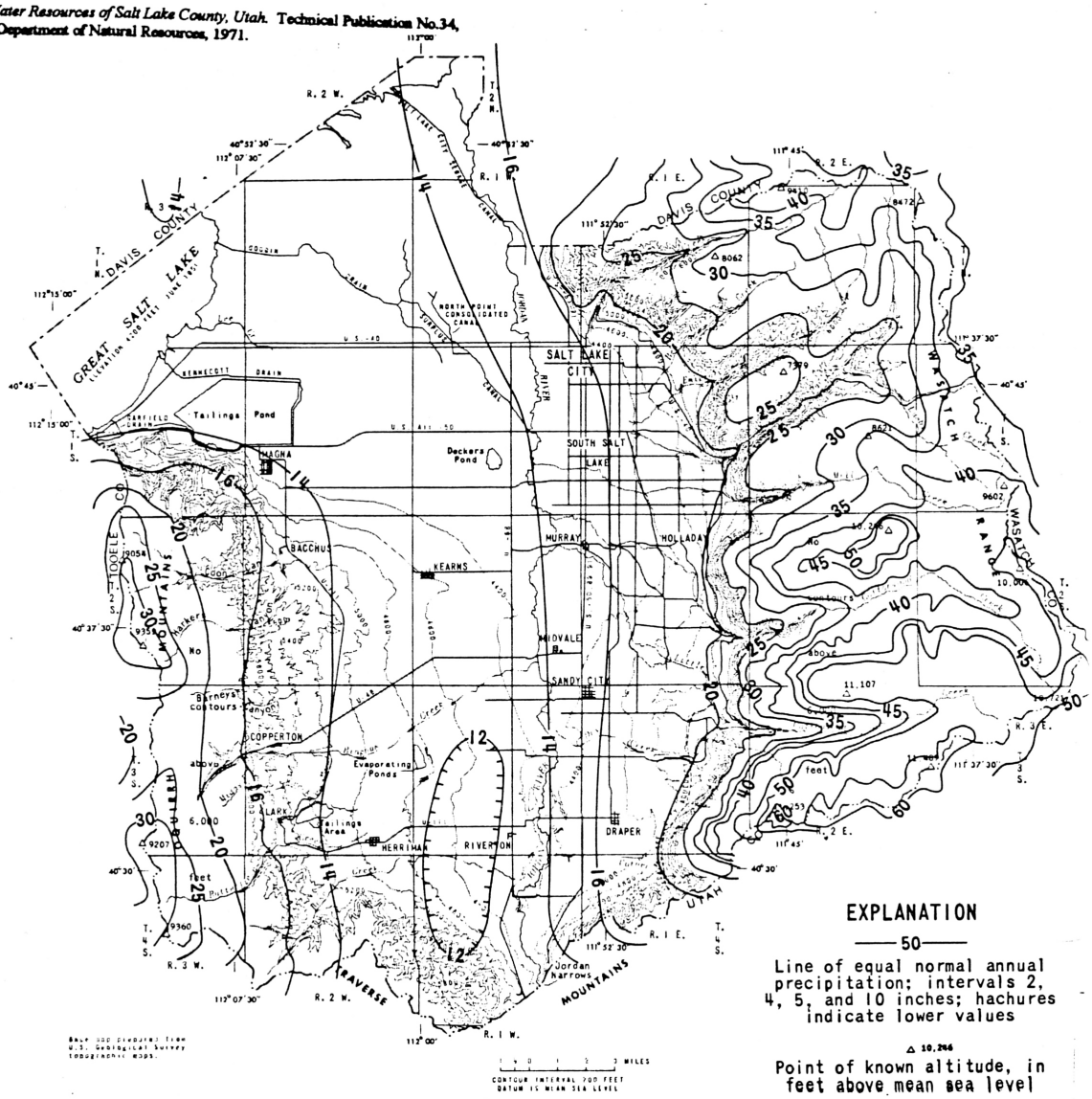
Would you expect confining beds in the sediments that underlie this site?
Why or why not?

Draw a very general West to East elevation profile and cross-section extending from the high skyline to the west side of campus. Use your eyes and your knowledge of campus and draw it. Label regions of bedrock and sediment. In the valley part, show confining beds. In the foothills, show layering of bedrock and fractures. Show general flow gradients. From the perspective of hyrology (ignore human geography) is this a good place to locate a gas station. And why?

WEST EAST

-Map showing normal annual precipitation in Salt Lake County.

Summary of Water Resources of Salt Lake County, Utah. Technical Publication No.34, State of Utah, Department of Natural Resources, 1971.



PRECIPITATION

* In the Great Salt Lake drainage basin, precipitation approximately equals evaporation.
* Precipitation varies dramatically across the county. Its average annual quantity varies. Its timing varies. The mountains receive much more precipitation per square mile than valley areas.
* Snowpack stores the water and releases it over a longer time interval than precipitation in the form of rain.
* Sudden downpours or extraordinarily rapid snowmelt can result in flooding and / or debris flows.

Route to the mouth of Red Butte Canyon…
Leave the parking area of the Union Building and Orson Spencer Hall, proceed to the light and turn right, east, to the intersection with Wasatch Boulevard. Travel south on Wasatch Boulevard passing along old Fort Douglas. At Foothill Boulevard turn left, east, and immediately turn into Research Park at Wakara Way. Drive to the stop sign that is near the entrance of Red Butte Gardens, turn left, north, and cross Red Butte Creek, and travel to the parking lot at the north entrance of Red Butte Gardens. This entails heading east and north along streets of old Fort Douglas until we are at the parking lot at the mouth of Red Butte Creek.
OBSERVE LANDFORMS: We're traveling on landforms formed by Lake Bonneville and by streams after Lake Bonneville receded. Note the broad, sloping surface of a delta surface of Lake Bonneville. This makes good real estate for a campus. Note the nearly horizontal surface of Foothill Boulevard, a prominent shoreline of Lake Bonneville. When we turn into Research Park, note the series of shoreline we travel across, then the broad smooth surface. Note excavations for buildings. Are the materials bedrock or sediment. At Chipeta way, there's an abrupt rise in topography. A scarp is a generic term that describes an abrupt step of topography. Ask yourself how you would investigate whether the cause of the change of topography here could be: a bank cut by a river channel, a downthrown portion of a fault, or an erosional cut made by waves along a shoreline.
DISTINGUISH landforms: shorelines, deltas, and alluvial fans. Show boldly and label at least one of each on this image:

Stop #2: Walk to RED BUTTE CREEK:
Geosphere: is this location dominated by bedrock or sediment:
If bedrock… what is it like?

If sediment…what is it like and which agent of erosion – deposition is most responsible for what is here?

How thick is the sediment cover here… approximately… and justify your estimate:

Why was Fort Douglas located here… list at least one reason for each subsystem of Earth systems
geosphere,
hydrosphere,
atmosphere,
biosphere, and…
politics? List one each for each of the "spheres" of Earth Systems.

General hydrology:
About how many inches of precipitation does this location receive …

How deep is the water table here today, and justify your estimate:

Would you expect confining beds in the sediments underlying this site, and what is your logic?

Draw a very general West to East elevation profile from the crest of Red Butte to campus… just use your eyes and draw it. Label bedrock versus sediment regions. Show confining beds. Show layered bedrock and imagine fracture flow in bedrock units. Show general flow gradients. Is this a good place, from ONLY the perspective of hydrology to locate gas station… and if not, why not.

WEST EAST

Onward we go… if there's an excavation for construction of a building in Research Park, we may stop and examine it for evidence of shorelines or faulting.

Route to Emigration Canyon:
From Red Butte we retrace our route to Foothill Boulevard. Internalize the "feel" of shorelines versus delta surfaces. At Sunnyside Drive, turn left, east, toward the zoo. Note the scarp just east of the intersection of Foothill and Sunnyside. Discuss...

As we pass the zoo on the south, we're traveling across landscapes dominated by sediments. The agents of deposition were surface waters of Lake Bonneville and surface waters of Emigration Creek. Think atmosphere thoughts (weather and climate): why is the location of Hogle Zoo a relatively good place for a zoo, relative for example to South Jordan?

At the mouth of the canyon… NOTE BEDROCK!!
Brief stop at the historical monument commemorating the Donner-Reed wagon party. They were forced by bedrock to detour from the creek across Donner Hill to the south.

Geosphere: note bedrock and sediment. For the bedrock units: observe layering and tilted layers. Note efforts to stabilize the materials north of the road. The hazard is rock fall, the process is ground failure (one of the five to memorize). What is the purpose of the pipes?
Which appears to have more water flowing in it today: Emigration Creek or Red Butte Creek?

This place was a hardship to the Donner-Reed wagon party as they made their way to California. Urban geographic thoughts… transportation corridors influence urbanization. Some transportation corridors, including this one, are controlled by physical geography.

Look for landforms of Lake Bonneville; of Emigration Creek.

Which is older, the landforms of the hills around here, or the rock they are made of?

Cross-cutting relationships: that which is cut is older than that which cuts it.
Superposition: if something was deposited across something else, it is younger than that which it is on top of.
Ooriginal horizontality: assuming that layered rock units were orignally horizontal, if they are tilted today, then the tilting happened after the layers were laid down and before today's hillsides were cut into their present shapes.

We continue up canyon. We pass landslides; alluvial fans; hazardous areas prone to debris flows; creek-side homes in the floodplain of the creek; new multi-million dollar homes with major problems of water supply and waste disposal; and extreme seasonal fire danger. You won't draw a hydrologic cross-section here, but imagine one and ask me questions as we drive along. Note bedrock. It's tilted. It changes color and resistance to weathering. Try to spot the impermeable units.

Brief stop: We'll pull to the side of the road at a crossing with the Donner-Reed trail.
Why did the Donner party take this route?
What other entities are use this canyon as a corridor these days?
What geosphere-hydrosphere-atmosphere conditions make this corridor?

CONTINUE TO THE CREST OF THE TERRAIN. PULL OUT AT LITTLE MOUNTAIN SUMMIT. Overlook: recognize Little Dell and Mountain Dell Reservoirs. Mountain Dell dams Parley's Creek. Little Dell dams Dell Creek. Drainage from Lamb's Canyon south and east on I-80 is diverted into Little Dell. Little Dell is a multiple use facility: flood control, water supply, and recreation. Salt Lake City filed on the surplus water of Parleys and Emigration Creeks and built a dam to capture the surplus flows. The water is treated at the Parley's treatment plant at Mountain Dell.

STOP #3: LITTLE DELL and MOUNTAIN DELL
Geosphere: is this location dominated by bedrock or sediment:
If bedrock… what is it like?

If sediment…what is it like and which agent of erosion – deposition is most responsible for what is here?

How thick is the sediment cover here… approximately… and justify your estimate:

General hydrology:
About how many inches of precipitation does this location receive?

Estimate depth to the water table here today, and justify your estimate:

Would you expect confining beds in the sediments underlying this site, and what is your logic?

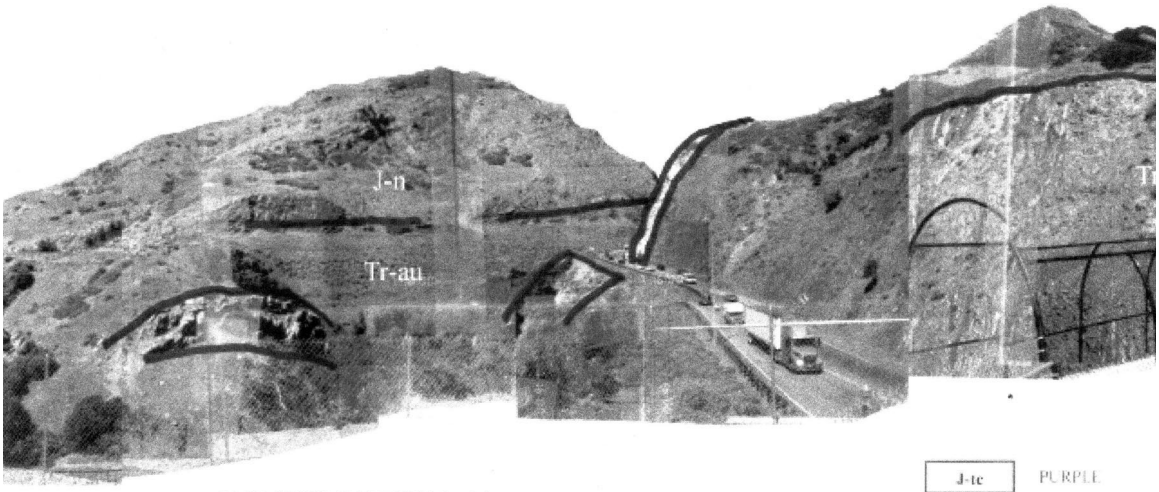
Draw a very general elevation profile from what you see to the northeast to what you see to the south of here. Use your eyes and draw it from the hills northeast of the reservoir, through the reservoir, to the drainage southwest of the reservoir. Label regions of bedrock versus sediment on the cross-section. Show fracture flow in bedrock units. Show layered rock units and tilting. Show general flow gradients. Is this a good place, from ONLY the perspective of hydrology, to isolate waste? And why?

Northeast Southwest

ROUTE FROM LITTLE MOUNTAIN SUMMIT TO THE MOUTH OF PARLEYS CANYON.
From Little Mountain Summit, continue downhill to the intersection of Route 65. Look for moose.
Turn right, west, and proceed toward I-80. Cheer at one of my favorite landslides, a favorite because it is not hurting anything yet, and it has textbook shape including a well-exposed slide plain. Cheer as we cross Parley's Creek, look for the creek and its floodplain.
.
Get onto I-80 and head west toward Salt Lake valley.
As we travel, watch the bedrock; look for signs of surface water and ground water. This is complex geology and hydrology. Drivers, drive carefully. Everyone else, practice the geologists' salute: hold you hand to show the tilt of layered bedrock. Winter is a good time to see a springs along the north side of the freeway.

EXIT onto the I-215 beltway heading south. EXIT onto 3300 South. Turn left (east) and cross over the freeway into the neighborhood east of the freeway. Travel north to a little park that is on the bicycle route that crosses Parley's Creek.

Time will determine how much of this photo you color:



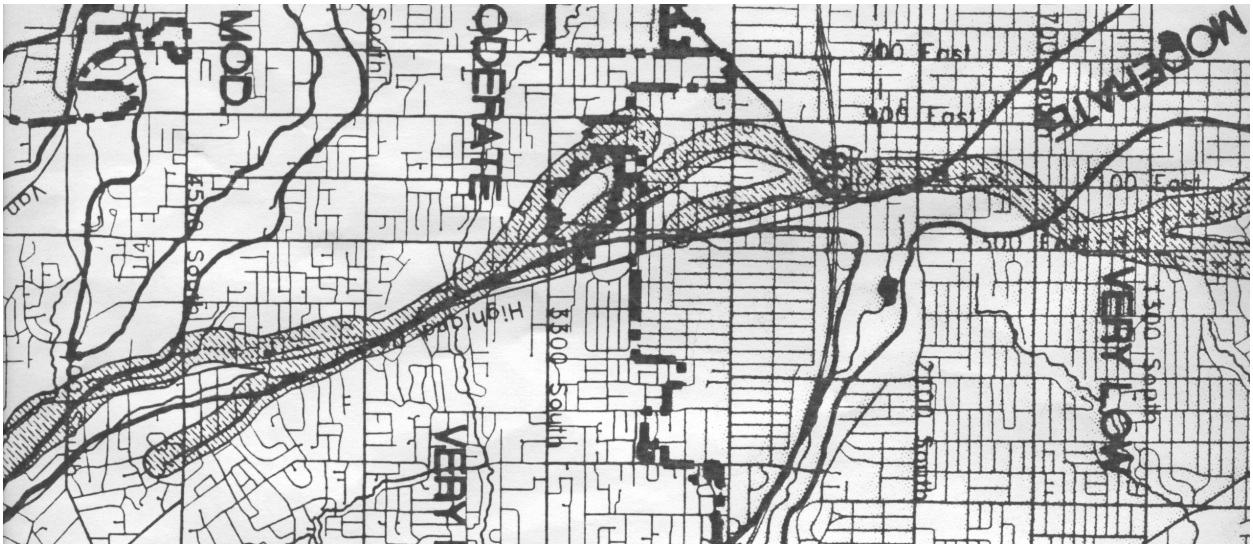
PARLEY'S CANYON looking east.
Photos taken from walkway near its south entrance.

Exercise: Color the rock units, oldest to youngest.
Look at the rocks to verify boundaries between units.

J-tc	PURPLE
J-n	YELLOW
Tr-au	DARK GREEN
Tr-ag	WHITE
Tr-am	LIGHT GREEN
Tr-t	GRAY

Two stops before we reach Nibley Park.
Retrace to 3300 South. Go north on I-215. EXIT at Exit 1 “to Foothill Drive and Parley’s Way” EXIT to Parley’s Terrace / Parley’s Way West. CONTINUE West on 2100 South. You’re on a delta. It should bring back memories of earlier in the day.
Turn south (left) on 2100 East. We’re traveling on a relatively horizontal feature. We’re traveling across the delta. Turn right and then left to cross Parley’s Creek. Cheer as we cross Parley’s Creek.
COMPARE and CONTRAST: shorelines, deltas, and creeks.
Imagine the WATER TABLE, the boundary between saturated and unsaturated ground. How deep is the water table at the creek?
How deep is the water table as we get to the south side, toward 2700 South?

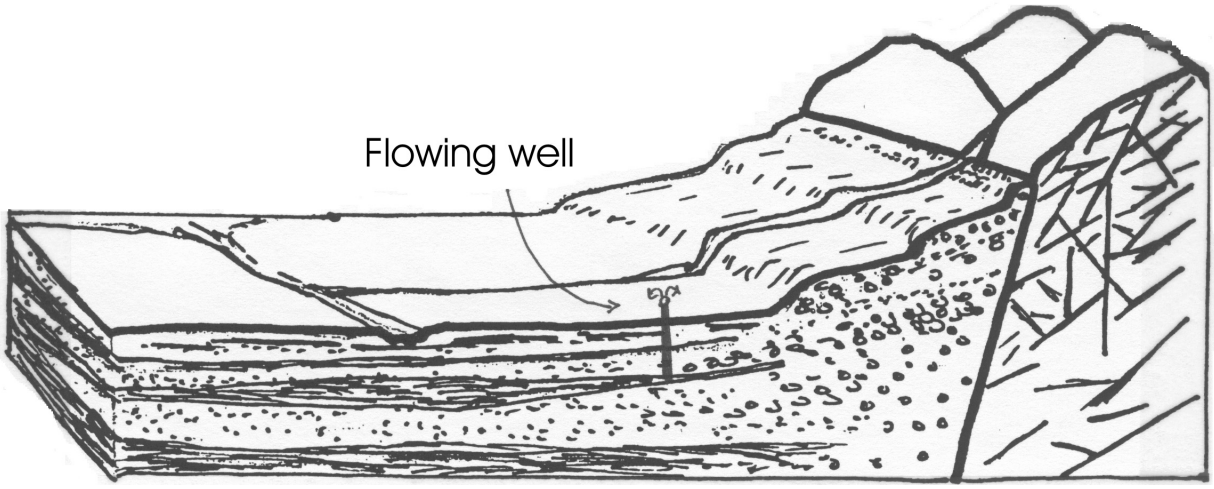
TURN right (west) on 2700 South and immediately drive into the Maverick (?) station. Ten minute break for folks with need for pit stop or coffee. Everyone discusses tectonics of Salt Lake Valley.
VISUALIZE WOODEN BLOCKS. Add a north arrow to this map. Color fault lines and study zones:



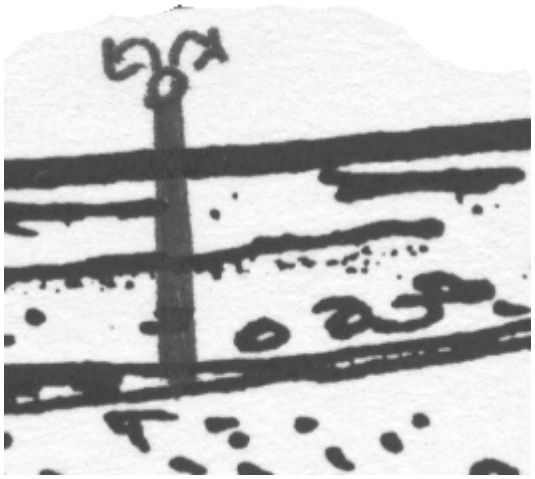
Proceed west on 2700 South
First we cross shorelines. Deliberately sense these features as we cross them. What does the ride feel like? How much braking or acceleration is necessary for us to make our way across these features?
Then, at around 1300 East… get ready to cross two strands of the Salt Lake segment (East Bench) faults of the Wasatch Fault.
Cheer as we cross the fault lines.
Memorize how the “feel” of these scarps differs from the shorelines we went across to get here.

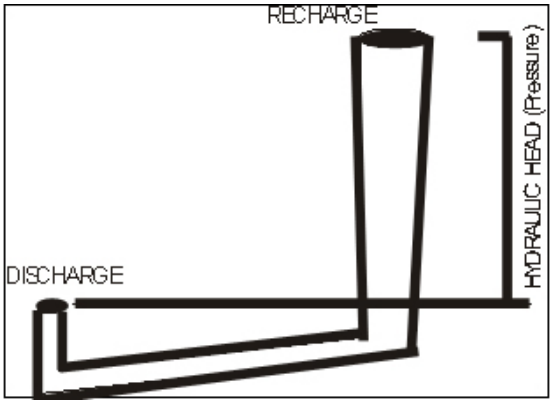
Turn into the Maverick station on the southeast of 700 East and 2700 South. I’ll ask permission to park. Then we find the flowing well at Nibley Park. Careful as you cross to the southwestern corner of the intersection. This is the northeastern corner of Nibley Park and Golf Course. Walk west about 125 along 2700 South. At the drainage, STOP and discuss the water table. Then walk south walk over the hill to the flowing well by the rickety wood-metal bridge. Watch for golfers and golf balls. SAFETY FIRST!!

<u>Fill out the details of this diagram…</u>
NOTE!!!! **DRIVERS complete this page!!** This is the MOST IMPORTANT exercise of the field trip -- HYDROLOGY OF THE FLOWING WELL AT NIBLEY PARK – GOLF COURSE:
Sketch is based on the generalized hydrology of the Wasatch Front (from T. Arnow, USGS):



Detail of flowing well. For the diagrams above and the one below: **Label the water table, confining beds, the aquifer that is being tapped, saturated and unsaturated zones, confined and unconfined groundwaters**.





STOP #4: NIBLEY PARK
Geosphere: is this location dominated by bedrock or sediment:
If bedrock… what is it like?

If sediment…what is it like and which agent of erosion – deposition is most responsible for what is here?

How thick is the sediment cover here… approximately… and justify your estimate:

The golf course is on a broad landform. What is it? And define that landform…
A _____ is a landform that is made of sediment that was deposited _____ _____

General hydrology:
About how many inches of precipitation does this location receive?

Estimate depth to the water table here today, and justify your estimate:

Would you expect confining beds in the sediments underlying this site, and what is your logic?

Draw a very general West to East elevation profile from the foothills to the valley floor… just use your eyes and draw it. Label bedrock versus sediment regions. Show confining beds. Show fracture flow in bedrock units. Show general flow gradients. Show the potentiometric surface. Is this a good place, from ONLY the perspective of hydrology to locate a gas station… and if not, why not.

WEST EAST

Route from 2700 South and 700 East to the UofU Union Building Parking lot.
Travel north on 700 East. As we approach Liberty Park, pay attention to subtleties of topography. Cheer as we cross the drainage of Red Butte Creek. Liberty Park is a flood retention facility (as is Sugar House Park for Parley's Creek).

At 400 South, turn right (east). SOMEONE BE READY WITH THE BLOCKS!! What a fault scarp!! It's world-class. Why does 400 South bend south to get up the hill? Yes it is steep… and WHY is it steep: Mentally count the 10 ft contours as we climb the hill.

At 1300 East, turn left, north and proceed to 100 South. Cheer when we pass down, across the Wasatch fault. At 100 South, turn right, east. Cheer when we pass up across the Wasatch fault. We're now traveling across a complex set of landforms. Yes they are made of sediments. Some are associated with fans from flash floods from the canyons to the east. Some are features of Lake Bonneville, shorelines and deltas and bottom sediments. And, we're back to the Union Building.

FEEDBACK:
Do you feel pretty confident that you can recognize bedrock versus sediment? Yes, No, Sort of.
Has this field trip clarified bedrock versus sediment relationships? Yes, No, Sort of.
What would have helped for the bedrock-sediment concept?

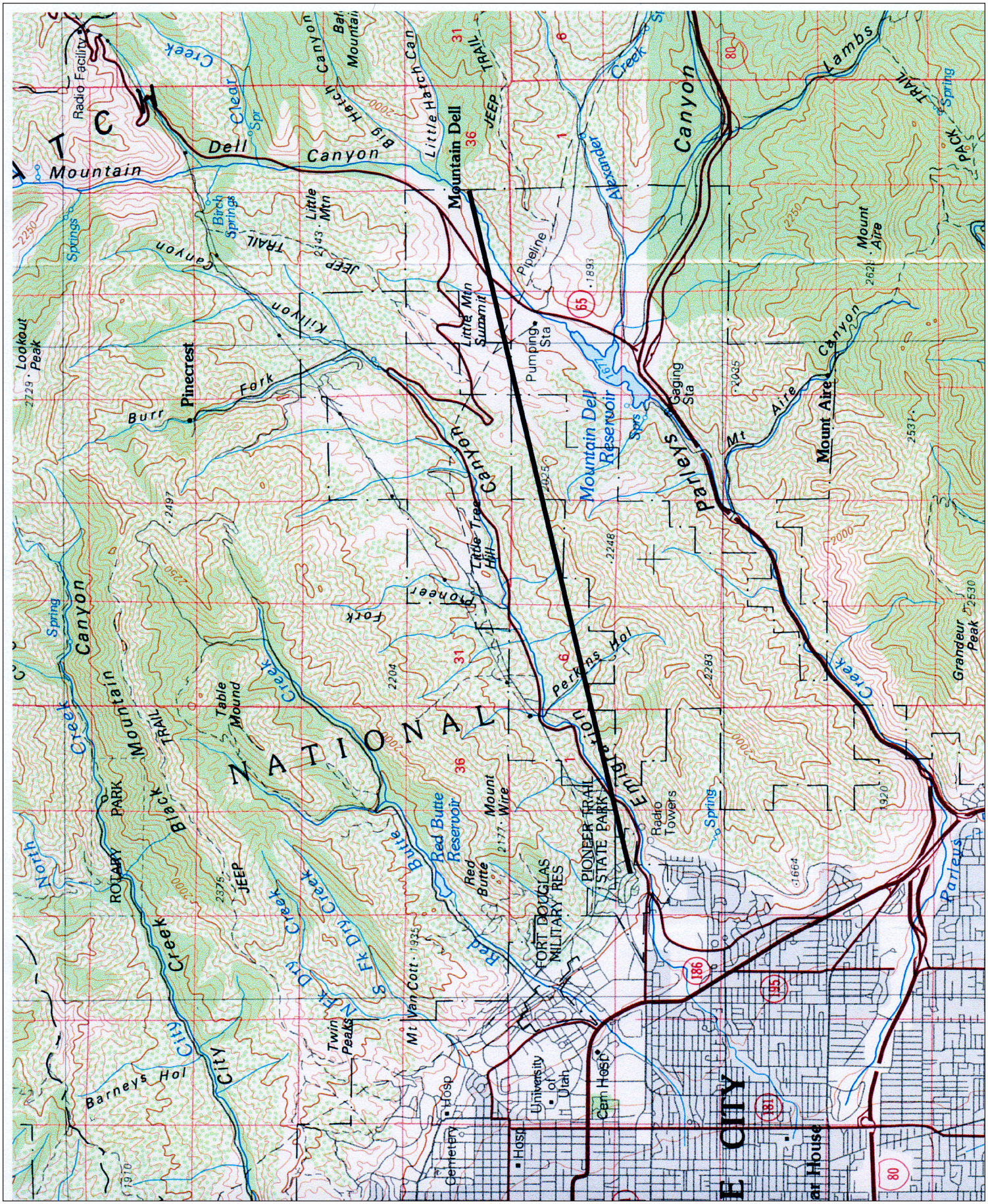
Surface water – ground water interactions… do you feel pretty confident in your understanding in exchanges of surface and ground water? Yes, No, Sort of.

Water table … does the concept make sense? Yes, No, Sort of.
Flowing well… does the concept make sense? Yes, No, Sort of.
If you tasted the water at Nibley well… what did it taste like, what are your reactions to the taste?
If you didn't taste the water at Nibley well… why not?

Go to the first page… which of those concepts isn't quite solid yet… which do you want me to review in class before the midterm?

If one stop of this field trip had to be eliminated…what stop would it be?
Other than length… how could this handout be improved?

Not counting the hours on the field trip, how long did it take to complete this field trip assignment meaning checking through the handout, making the profile, and drawing basins etc on the map? 2 hours; 4 hours; 8 hours; more than 8 hours.


Radio Facility
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Little Mtn
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Birch Springs
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Pinecrest
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Kilyon
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Pioneer
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Red Butte
Mount Wire
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Red
Fk Dry Creek
Mt Van Cott
Twin Peaks
FORT DOUGLAS MILITARY RES
PIONEER TRAIL STATE PARK
Radio Towers
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Parleys
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