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Comments on Proposed Landfill in Hansel Valley

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Abstract

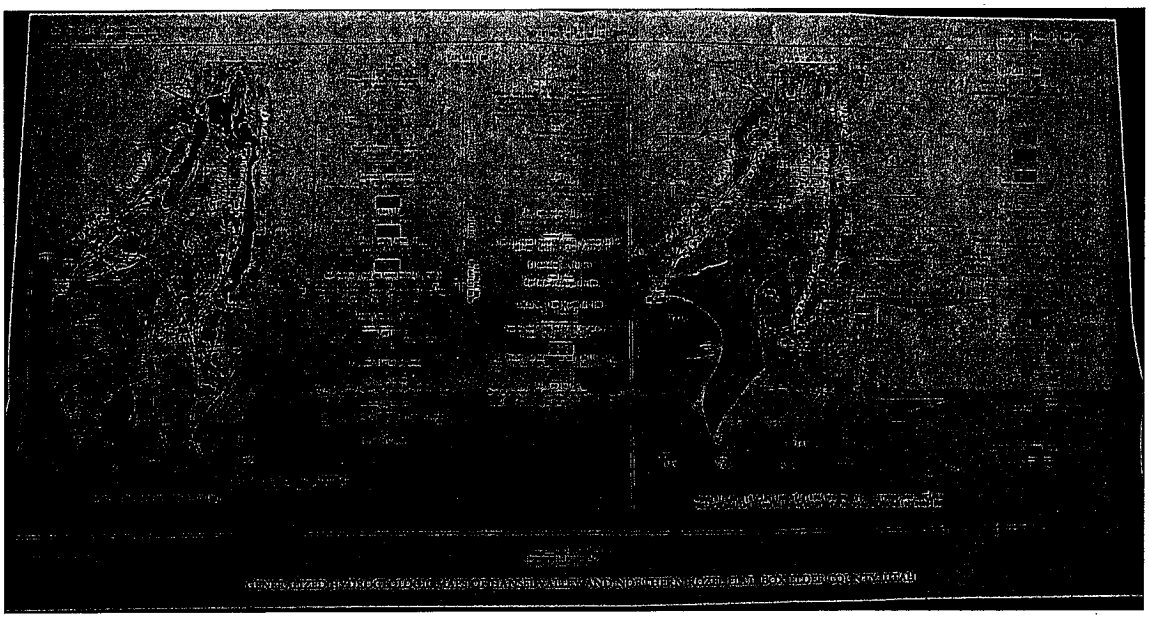
With yet another landfill being proposed to go into Hansel Valley, as a concerned local land & water owner, I have prepared a few comments. I recognize authority of the Box Elder County officials, and hope my comments will serve the best good of all.

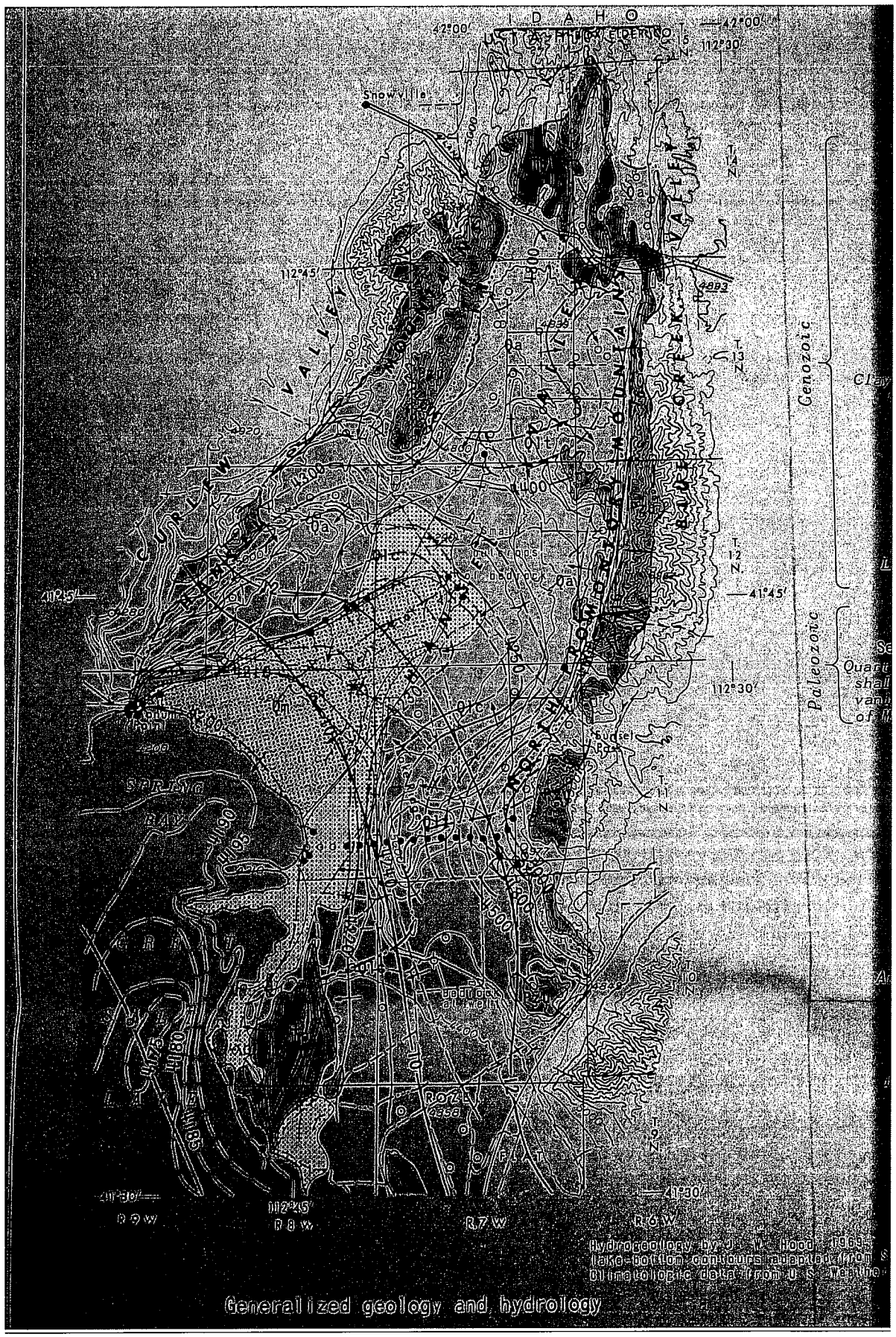
The form of this document is primarily one of commenting on statements drawn from the Hansel Valley hydrological study[1] and Box Elder land use code[2].

I am not a hydrologist or licensed engineer.

Hydrological Study of Hansel Valley

Visiting with Carl Mackley, Engineer at the DNR Water Resources office in Logan, I was provided with a Hansel Valley hydrological report[1] written in 1971 by J.W. Hood, Hydrologist, U.S. Geological Survey. In the back of the report was a map showing aquifer contours, projected flow, fault lines, and water total dissolved solids. I will start with this map. I could not obtain a scan of the map, so I have done the best I can with digital photos with the map in sections. The first photo shows the whole map for reference with subsequent images included for detail.





Generalized geology and hydrology

The map on the prior page shows the whole area of study. Note the location of I-84 across the top of the map. The Pink areas are lava flows, and as I understand it, the proposed landfill location would be in the large yellow area in the center that extends far to the North. The next map shows the upper half of the map and is a little easier to view. While here, I'll go ahead and comment on some observation on these maps.

In visiting with Carl at the DNR office in Logan, I learned that they measure the flow direction of an aquifer by observing static water levels in wells. From the static water levels they draw contour lines on the map which indicate the underground water level. Water flows from a higher to a lower level, perpendicular to the contour line. Light blue contour lines are shown on the map with little blue arrows indicating the approximate direction of flow.

If you follow the lines, they generally show water flowing from the mountains in the North and along the sides down through the valley to the lake. Note the springs along the sides of Salt Well Flat where water exits the aquifer to the Great Salt Lake.

Later, in the Groundwork section, I have included a generalized diagram that may help in visualizing the underground flow along with recharge *and* discharge *areas.*

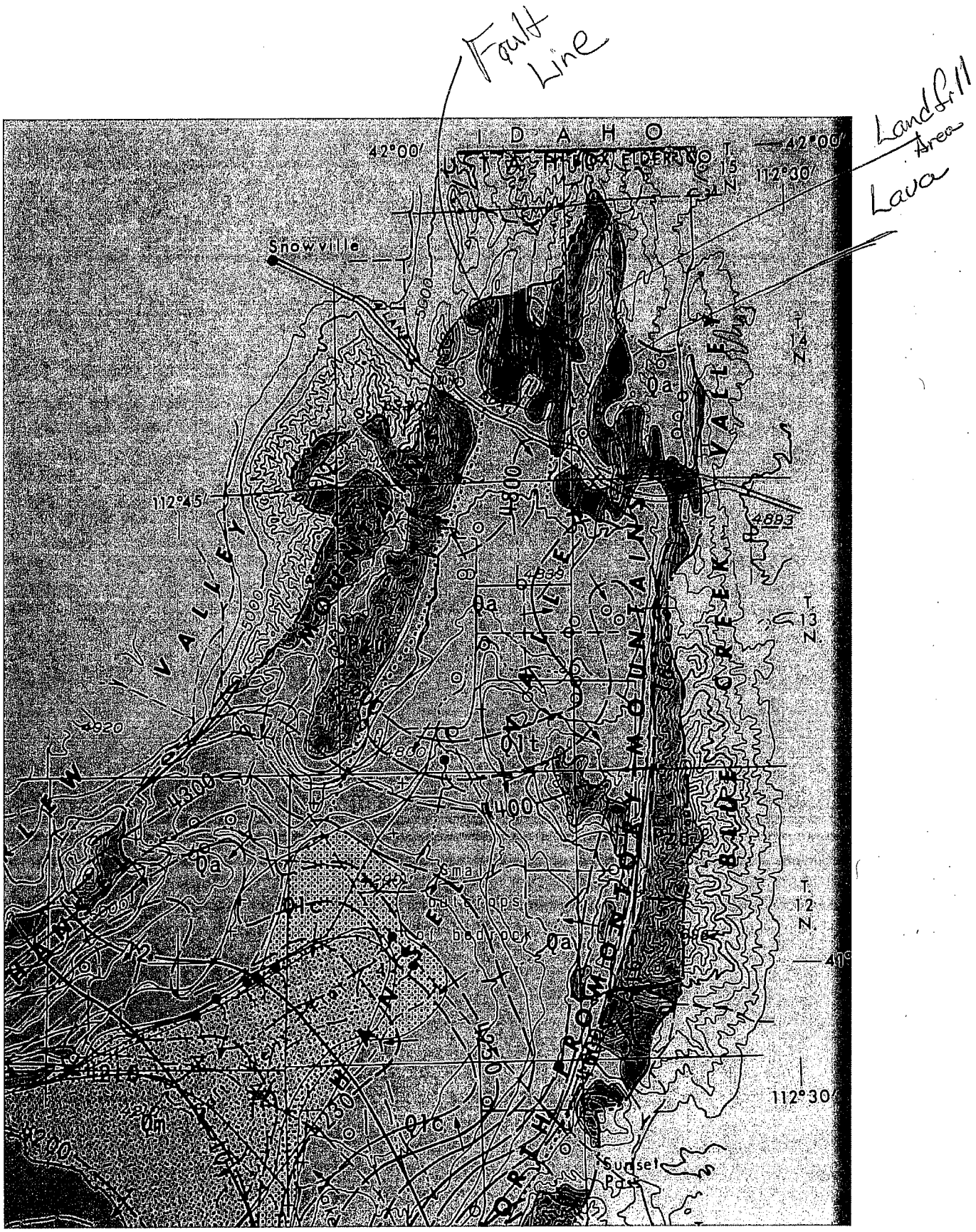
Hydrology map items of interest:

1. *This map identifies the boundaries of the Hansel Valley aquifer, including much of the area that recharges the aquifer.*
2. *Note the light blue aquifer contour lines with arrows that indicate direction of aquifer flow down through the valley.*
3. *Note the indication of fault lines in the lava beds along either side of the proposed landfill site. Also the fault lines that extend along both sides of the valley (more on this later).*
4. *Note the light blue circles indicating where water wells have been drilled.*
5. *If you study it a bit, you can see where the roads go and if you know the area, you can determine which wells make up the culinary water supply for valley residents.*

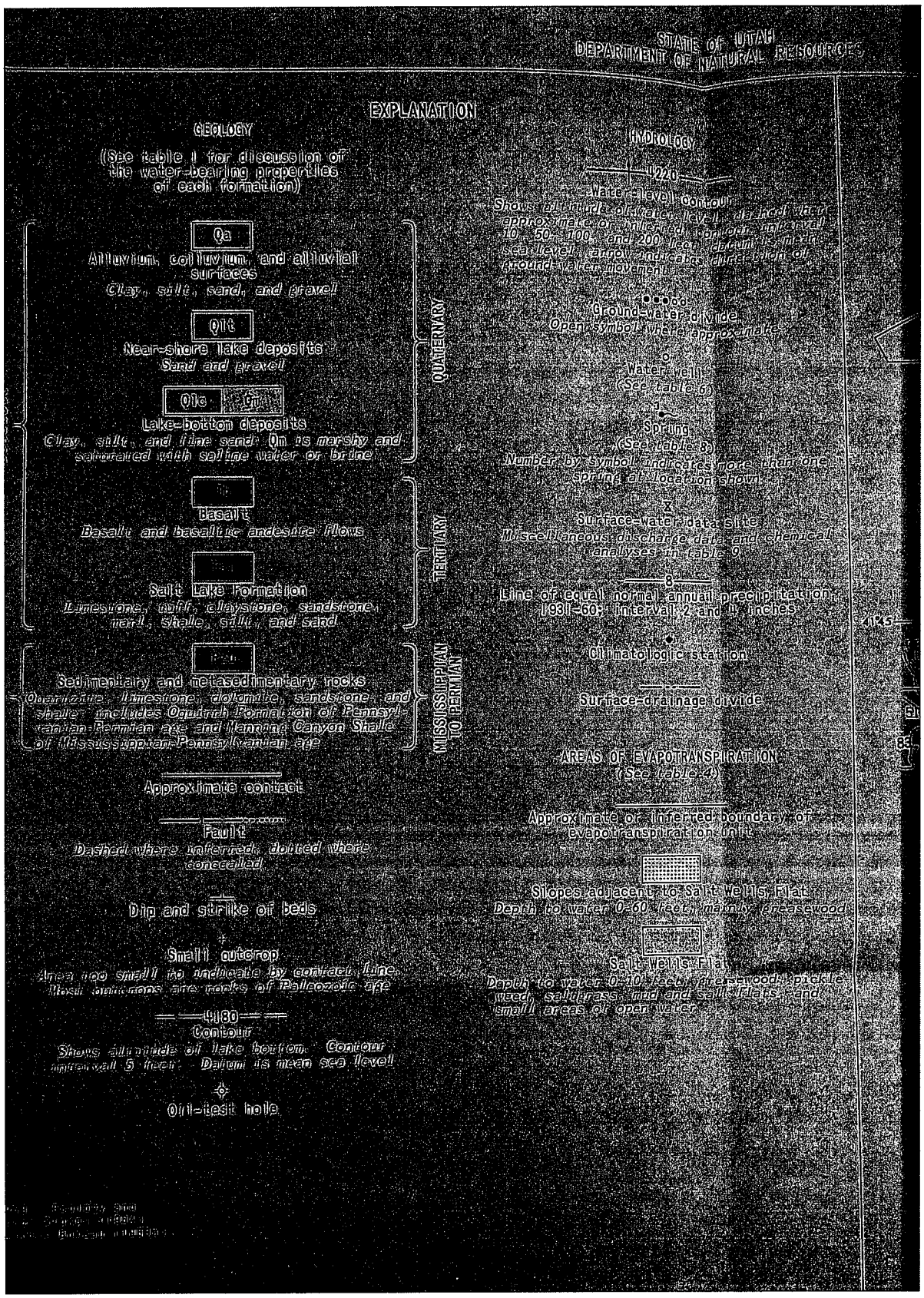
The second map (three pages down) shows total dissolved solids (TDS), which is an indicator used to help in determining water quality.

Disolved Solids map, items of interest:

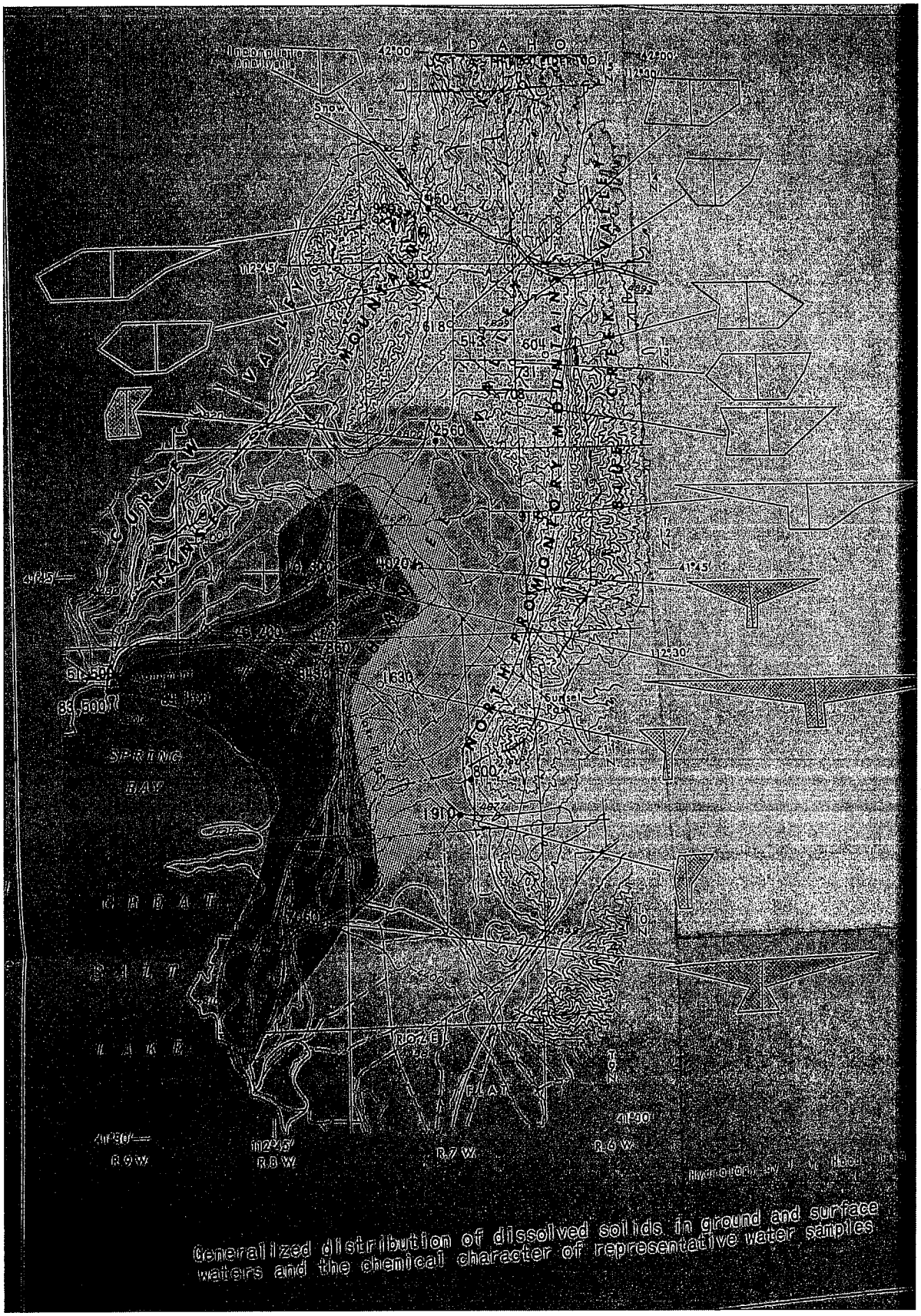
1. *The number shown by each well represents the TDS for that well.*
2. *Note the light dotted pattern over the Northern half of the valley. This indicates the area where TDS is less than 1000 mg/l. This area represents the soul source of Hansel Valleys most usable water.*



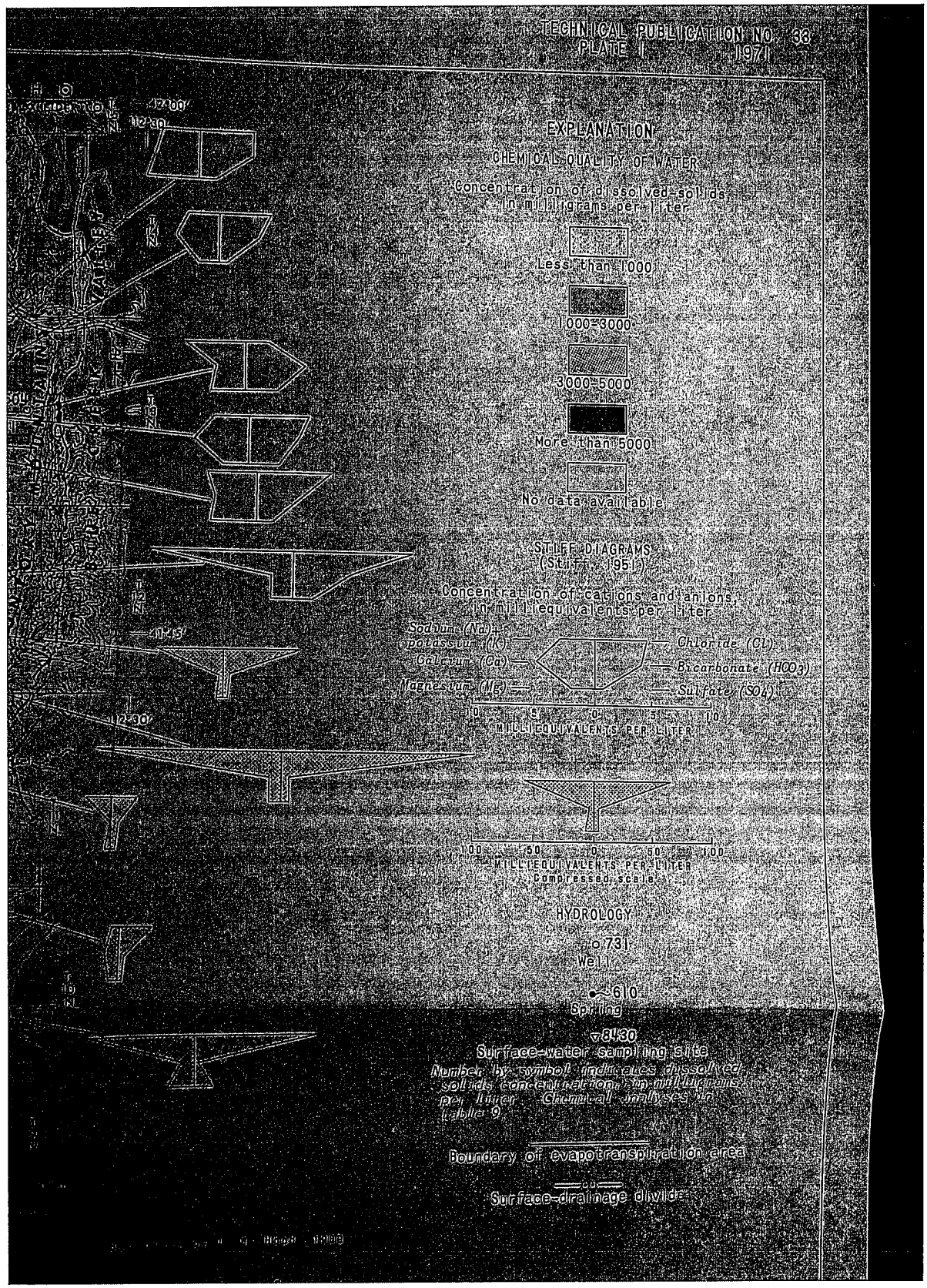
(zoomed in on the area of interest)



(key for the left side hydrology map)



Generalized distribution of dissolved solids in ground and surface waters and the chemical character of representative water samples



(key for the Dissolved Solids map)

Climate & Aquifer Recharge

In reading the hydrology report [1], I felt there were some relevant statements made that help document how the Hansel Valley aquifer is recharged. Here are some statement from the report:

> "The climate of Hansel Valley is characterized by moderately cold winters, hot summers, small to moderate amounts of annual precipitation, and moderate evaporation rates. Average annual precipitation on the drainage basin ranges from about 9 inches on the southernmost valley floor (pI. 1) to a maximum of nearly 20 inches on the highest peaks of the North Promontory Mountains (U.S. Weather Bureau, 1963a, 1963b).
>
> Most of the valley receives 12-14 inches of precipitation annually, of which about two-thirds falls in winter and spring and about one-third in summer and fall (see fig. 3). Most of the summer precipitation is consumed; the winter precipitation is more important as a source of water supply to the valley." [1, p. 8-9]
>
> "The ground-water system in Hansel Valley and northern Rozel Flat is recharged by precipitation that infiltrates the adjacent mountains and their slopes. Most of the recharge in Hansel Valley is derived from precipitation on the drainage basin; but on the basis of the estimated recharge and discharge, it seems probable that a part of the recharge is derived from outside the drainage basin." [1, p. 11]

I thought these were good statements about where our water comes from.

Water Quality

Concerning water quality, I thought these statements from the hydrology report [1] were relevant:

> "The dissolved-solids concentration in water samples from Hansel Valley and northern Rozel Flat ranges from about 400 to 94,000 mg/I (milligrams per liter). The known and inferred areas in which fresh water (containing 1,000 mg/I or less of dissolved solids) may be obtained are in the northern Hansel Valley drainage basin and a narrow strip of land along the base of the North Promontory Mountains (pI. 1)." [1, p. 18]
>
> "Most of the water in the basin is not suitable for domestic and public consumption according to the standards of the U.S. Public Health Service (1962, p. 7) because the dissolved solids exceed 500 mg/1.
>
> Much of the water in the valley can be used by livestock, because the more highly mineralized water is a chloride type and supplies a part of the salt needed by the animals. Concentrations of more than about 5,000 mg/I of dissolved solids, however, probably would render the water unpalatable to most livestock. Water with 5,000 mg/I or less of dissolved solids probably can be obtained in about half of the study area." [1, p. 20]

The upper part of the Hansel Valley aquifer shows TDS levels ranging between 450 and 708 mg/l, and has been considered suitable and used for domestic and public consumption for

generations of Hansel Valley residence. Hood's statement that says "most of the water in the basin is not suitable for domestic and public consumption" is referring to the lower portion of the valley that shows very high TDS levels.

As I have tried to understand TDS better, I have found that more than anything, it is an easy thing to measure that offers an indication *of water quality. In the range between 500 and 1,500 mg/l, it becomes a taste issue mostly. Levels above 500 mg/l indicate that further tests are needed to determine whether particular dissolved minerals are of concern. EPA limits are based on the concentrations of specific minerals, not on TDS.*

The main point is that the aquifer is the soul source of potable water for residents living in and near Hansel Valley, and thus warrants protection.

Seismic

The Hydrology report included some notes on the geology of Hansel Valley. I thought they might be relevant, so I quote:

> "The framework of Hansel Valley and its present shape are due mainly to two causes: (1) basin- and range-type faulting that created nearly parallel mountain blocks with an intervening trough-shaped valley and (2) the erosion associated with Lake Bonneville. Blocks thrown up on either side of the valley form the adjacent mountains and the downthrown block now underlies the valley floor." [1, p. 4]
>
> "Hansel Valley is a structural depression that was created by the deformation of consolidated rocks of Tertiary and earlier age. The valley is a composite graben in which the older rocks beneath the valley dropped down along major faults that bound the east and west sides of the valley proper. The shapes of contours on the bottom of Spring Bay, the several small outcrops of consolidated rocks seen in the lowlands of the valley, the apparent direction of movement and quality of ground water, and the several faults at the north end of the valley together suggest that the downthrown block consists of several nearly parallel blocks separated by faults of unknown, but probably small throw. It is probable that some cross faulting is present beneath the valley in the same manner as in the adjacent North Promontory Mountains." [1, p. 5]

In one study I read: "Well designed landfills should not cause water quality problems because leachate problems are anticipated and controlled." *I assume that seismic activity like we have in Hansel Valley would add considerable uncertainty to this statement.*

Box Elder County Land Use

I am sure you know the code. I am quoting it here only to establish context whereby I can make a few brief comments. The following quotes are from the Box Elder County Land Use Code for Municipan Waste Zones [2]

"landfill not allowed until rezoned to solid waste zone;"

"No new MSW zone...shall be located within:

1. One mile...dwelling...;
2. A ground water primary rechard area, groundwater classified as IB;
3. Located over a sole source aquifer as determined by a hydrogeologic study."

Q: What is classification "IB"?

- **CLASS IB** *ground water is referred to as IRREPLACEABLE GROUND WATER and is a source of water for an existing community public drinking water system for which no reliable supply of comparable quality and quantity is available because of economic or institutional constraints.*

Q: What is a "sole source aquifer"?

- *A sole source aquifer (SSA) is an underground water supply designated by the Environmental Protection Agency (EPA) as the "sole or principal" source of drinking water for an area.*

Q: Does Hansel Valley qualify?

- *Definitely "IRREPLACEABLE GROUND WATER";*
- *is "a source of water for an existing community", where that community's "public drinking water system" is made up of private wells;*
- *is "over a sole source aquifer as determined by a hydrogeologic study".*

There was also this quote on seismic factors:

3-8-030.3, item C. (environmental assessment) Item "7. geotechnical study on seismic factors"

Q: Why is seismic an issue?

- *(see earlir comment on seismic)*

From same "environmental assessment", item:

"12. fugitive waste control on site and during transport."

Q: Do tumble-weeds blow in Hansel Valley?

- *Yes, I would be concerned about "fugitive waste control", but again, I am not an expert on the subject.*

3-8-030.4. Item B says:

"applicant shall show a demonstrated need for the facility within Box Elder County."

- *Why unnecessarily risk environmental contamination and pollution of a soul source aquifer? Fewer points of potential contamination will significantly reduce the risk. Do we NEED another landfill for Box Elder County?*

Groundwork

You may skip or skim the rest of this document. I was just recording a few of my own thoughts for reference.

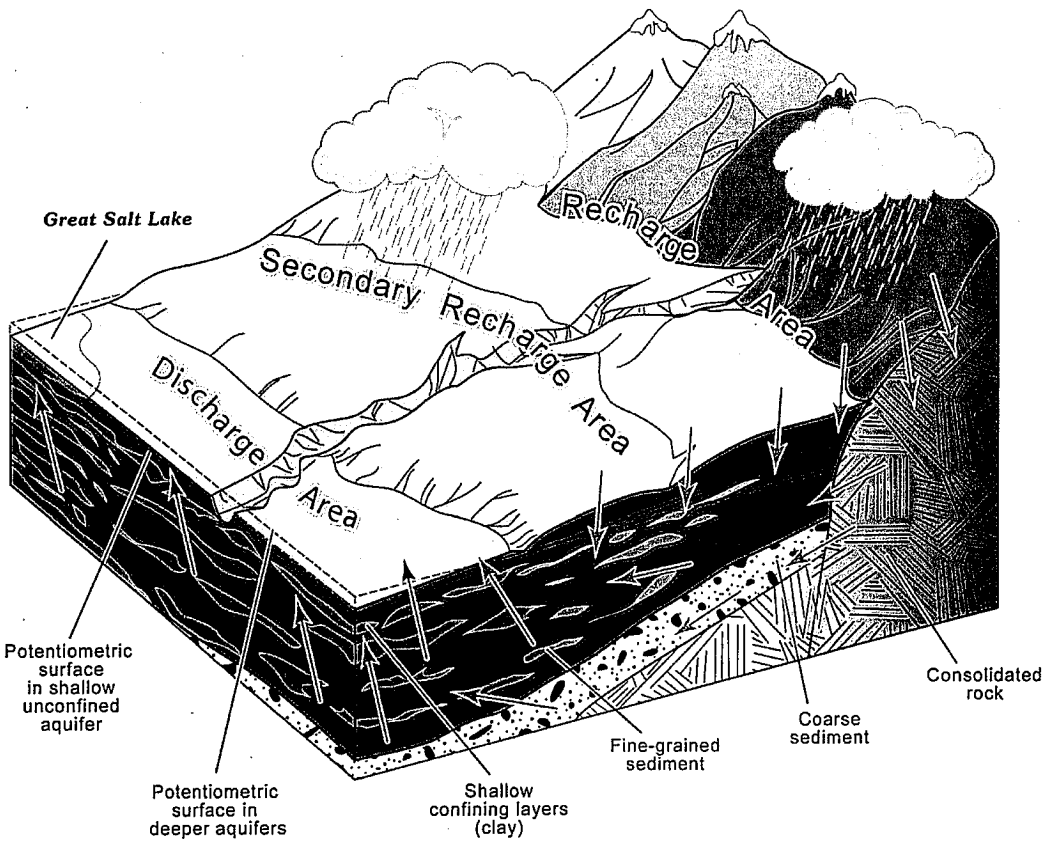
Note, Tim Munns has a list of water wells in Hansel Valley that are at risk.

Some things I've learned about water quality:

- What to look at when measuring quality of water:
  - Total Disolved Solids (TDS usually in mg/L, "ppm" is the same) is an easy measurement and is generally useful.
  - EPA recommends treatment when TDS concentrations exceed 500 mg/L, but World Health Organization leans more toward 1000 mg/L. TDS alone below 1,500 mg/l is not considered a health risk, but may effect palatability.
  - Nitrates (usually sourced from animal waste or fertilizer)
  - "The basic rule is that livestock should not drink water with total dissolved solids over 10,000 mg/l or a combination of nitrate and nitrite that exceeds 100 mg/l."
  - Groundwater classifications from **"waterquality.utah.gov"**:
    * **CLASS IA** ground water is referred to as PRISTINE GROUND WATER and is classified as such by exhibiting both of the following characteristics:
      - Total dissolved solids of less than 500 mg/l and;
      - No contaminant concentrations that exceed the ground water quality standard
    * **CLASS IB** ground water is referred to as IRREPLACEABLE GROUND WATER and is a source of water for an existing community public drinking water system for which no reliable supply of comparable quality and quantity is available because of economic or institutional constraints.
    * **CLASS IC** ground water is referred to as ECOLOGICALLY IMPORTANT GROUND WATER and is a source of ground water discharge important to the continued existence of an existing wildlife habitat.
    * "Any person may petition the Water Quality Board for classification of an aquifer" *(we may want to get Hansel Valley aquifer "classified")*
- Can landfills harm an aquifer? (random statements from Internet)
  - "The U.S. Environmental Protection Agency (EPA) estimates that between 0.1% and 0.4% of usable surface aquifers are contaminated by industrial impoundments and landfills."
  - "Dumps and landfills are a threat to water supplies when water percolates through waste, picking up a variety of substances such as metals, minerals, organic chemicals, bacteria, viruses, explosives, flammables, and other toxic materials. This contaminated water is called leachate and is produced when the waste becomes saturated with water."

- "Well designed landfills should not cause water quality problems because leachate problems are anticipated and controlled."

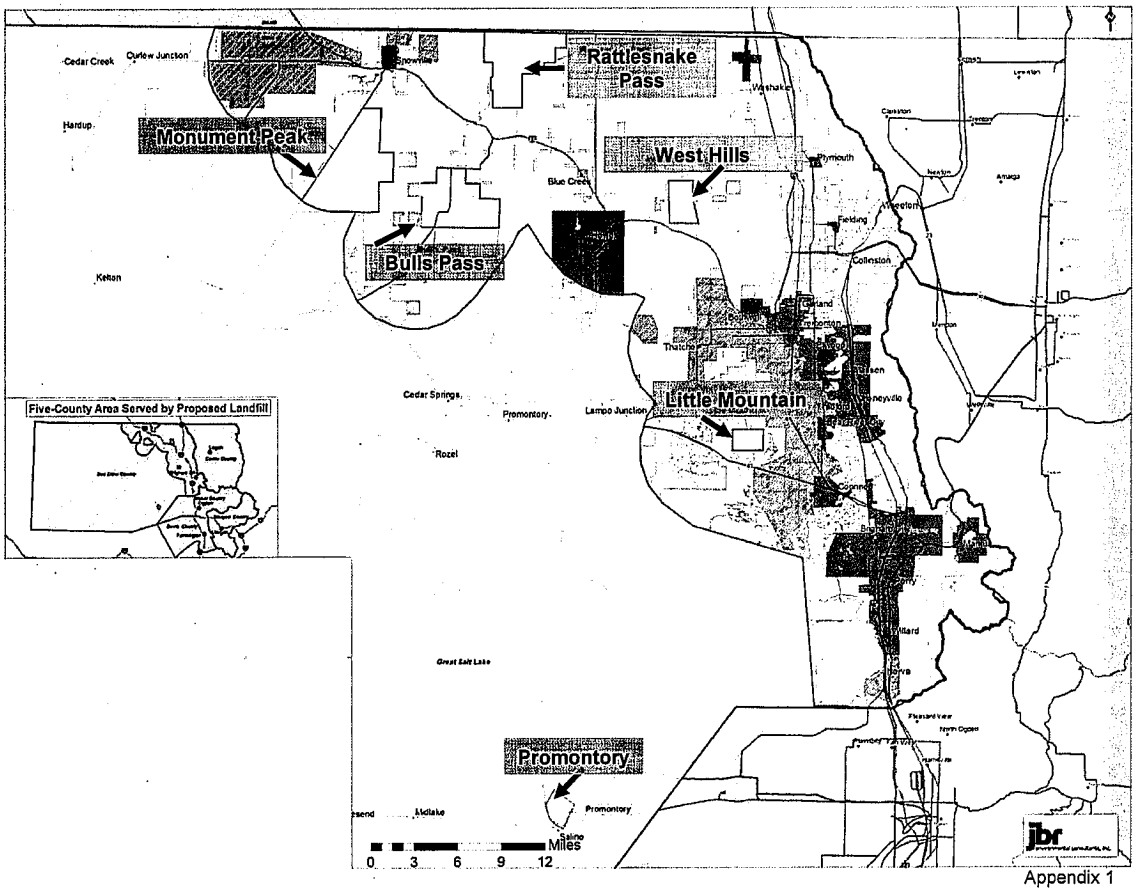
- How would you measure damage to an aquifer?
  - *(could not easily find an answer)*
  - One thing that Carl from the DNR office mentioned we need to watch out for: if we have wells that lower the static water level, that can change the direction of flow. Where we are near the Great Salt Lake, this is particularly an issue because high TDS lake water may flow into the aquifer to replace what was removed from the well.
  - We should at least:
    1. record static water levels in wells pre and post-pumping season;
    2. periodically record water quality (TDS etc.);
    3. register the Hansel Valley aquifer on Utah's water quality site;
    4. keep well records as a community that will allow us to independently verify water quality and determine what water can be used without an adverse effect on the aquifer.



This generalized diagram from the Salt Lake Valley Classification [3] expresses the idea of ground water movement with areas of recharge and discharge.

I found a old document on Box Elder County's web site titled "Regional Landfill Financial Analysis" [4]. Though the financial analysis may be correct, I believe it is very misleading with regard to hydrological study and water quality protection. It paints a target on Hansel Valley with no representation for the residents. I request that the document be removed or accompanied by the an appropriate hydrological study.

Here is the map published in the document with no accompanying hydrological information even though the information is readily available.



Appendix 1
Map of sites

Looks like we've been in the cross-hairs before

References

[1] J.W. Hood, Hydrologist, U.S. Geological Survey,
Hydrologic Reconnaissance of Hansel Valley and Northern Rozel Flat,
State of Utah, Department of Natural Resources,
Technical Publication No. 33,
1971.

[2] Box Elder County Land Use Management & Development Code
Construction & Municipal Waste Zones
Article 3: Construction & Municipal Waste Zones
Chapter 3-8. Construction & Municipal Wast Zones
Box Elder Zoning Ordinance 319 as Adopted September 29, 2009.

[3] Janae Wallace and Mike Lowe, Utah Geological Survey,
Ground-Water Quality Classification for The Principal Basin-Fill Aquifer, Salt Lake Valley, Salt Lake County, Utah
August 25, 2008

[4] Northern Utah Regional Landfill Authority,
Regional Landfill Financial Analysis,
study performed by Zions Bank,
September 13, 2007

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Summary on Hansel Valley Proposed Landfill
(after informational meetings)
5-14-14

I realize that a well designed landfill is a reasonable method of waste disposal (though I wish we didn't generate so much).

From a financial perspective it is easy to see why Hansel Valley would be a target. Proximity to the free-way, plenty of topsoil to cover the landfill, low rainfall. So, if anything, what makes the proposed site a bad choice?

It is over the recharge area of Hansel Valley's culinary grade aquifer. But, one might still provide a reasonable engineering solution for handling level 1 waste over an aquifer. More than the issue of just being over the aquifer is the issue that it is over lava fields that have a likely connection with the aquifer.

There are a couple of things about this particular site that you have to think about.

Tim Munns has shown us a significant air flow going into Jim Holmgreen's well. The airflow changes with barometric pressure. This is evidence of a large underground space that is largely capped off from above. The likely scenario is that the lava field has large underground fissures and caverns that, over time, were capped off by surface soil or mud. At one time, the fissures were probably full of water. Those fissures and caverns likely extend a considerable distance through the lava fields, and Jim's well just happened to tap into one of them.

One of the potential dangers of the landfill to the aquifer would be simply moving the basalt and soil cap. Whether it was leachate from the landfill or just any surface water poring down into the fissures, pollution of the aquifer would be a significant risk.

Another question is whether leachate or surface water might accumulate in the area as a consequence of ordinary landfill operation coupled with a precipitation event. Given the proximity of the lava fields, an earthquake could easily open up a fissure allowing such a pond to drain into the underground cavities.

Not only does Hansel Valley in general have a strong record of seismic activity, but the particular location of the proposed landfill has even more specific issues with earthquake potential. There are fault lines running through the adjacent lava fields to either side of the site. The presence of volcanic activity can also indicate a potential of higher seismic activity. I've heard that the Hansel Valley lava fields are not associated with the Yellowstone hot spot. So why are they there? Do they represent a weak spot in the earth's crust?

In the interest of preserving water quality, I would submit that the acts of digging into the basalt mountain or forming any kind of surface water or leachate pond incident to normal operation of a landfill would subject the aquifer to an unnecessary and unacceptable level of risk.

I know I am making assumptions, but they can be checked out. I will be interested to see how these risks are quantified.

Thank you for your time,
Wayne Campbell