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May 23, 2003

Donald R. Metzler, Program Manager
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SUBJECT: Response to DOE May 13, 2003 Letter Regarding Final Site Observational Work Plan for the Green River, Utah UMTRA Site

Dear Mr. Metzler:

The Utah Division of Radiation Control (DRC) has reviewed the May 13, 2003 DOE letter regarding our comments on the *Final Observational Work Plan (SOWP) for the Green River, Utah UMTRA Project Site, September 2002*. Based on your letter, we understand that any changes that are necessary as a result of our comments will be addressed in the Draft Ground Water Compliance Action Plan (GCAP), which is scheduled for distribution in June 2003. However, before the draft GCAP is completed, we want to take the opportunity to clarify some concerns we have related to the proposed alternate concentration limit (ACL) strategy and the establishment of point of exposure (POE) monitoring locations.

Ground Water Flow System

Although the inherent complexity of the Cretaceous hydrostratigraphy causes some uncertainty in the associated ground water flow regime, there is enough data available to establish a working model for ground water flow at the site. The Green River UMTRA site is located approximately 0.5 miles east of the Green River, which serves as the hydrologic discharge sink for the region. The ephemeral Browns Wash is a local extension of the Green River regional discharge and is located in a topographically low area approximately 1,000 feet north of the UMTRA disposal cell. As a result, Browns Wash serves as the local discharge sink for the Green River UMTRA site. This theory is supported by the following site data.

Pressure Head Map. As shown by the pressure head map in Attachment 1, the middle sandstone unit of the Cedar Mountain Formation is unsaturated or not present south and west of the disposal cell with increasing pressure head to the north and east. This indicates that no-flow boundaries exist in the Cedar Mountain middle sandstone unit west and south of the disposal cell. The underlying Brushy Basin Shale Member of the Morrison Formation forms a no-flow boundary for the overlying Cretaceous sandstone aquifers due to its bentonite content and extremely low permeability.

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The vertical no-flow boundary of the Brushy Basin Member coupled with the horizontal no-flow boundaries in the Cedar Mountain Middle Sandstone aquifer west and south of the cell indicate a northward ground water flow direction towards Browns Wash.

Upward Hydraulic Gradient. There is an overall upward hydraulic gradient in the sandstone aquifers of the Cedar Mountain Formation which is indicative of a ground water discharge area. Of the 12 wells that are completed in Cedar Mountain middle sandstone aquifer, nine are under confined artesian conditions while three are under semi-confined conditions. All seven existing wells completed in the lower and basal Cedar Mountain sandstone aquifers are under artesian conditions creating a strong upward hydraulic gradient. In addition, the lower and basal Cedar Mountain sandstone aquifers have greater pressure heads than wells completed in the middle sandstone aquifer.

Flowing Wells In Browns Wash. The only two wells that flow at the surface under artesian conditions are located adjacent to Browns Wash. Monitoring well 0582 is completed in the basal sandstone unit of the Cedar Mountain Formation and flows at the surface (4067 feet amsl) with a pressure head of 156.50 feet (July 2002). Monitoring well 0817 is completed in the middle sandstone unit of the Cedar Mountain Formation and flows at the surface (4084.61 feet amsl) with a pressure head of 114.36 feet (July 2002).

Fractures Patterns and Structural Dip. As indicated in Figure 5-6 of the Final SOWP, fracture and joint patterns have a predominant northwest orientation (Attachment 2). In addition, a structure contour map for the top of the middle sandstone unit indicates a northern structural gradient with a slight northwest dip component in the vicinity of the disposal cell (Attachment 3).

Discharge Features in Browns Wash. Although Browns Wash is an ephemeral stream that is normally dry and only flows during local precipitation events, the aerial photo base map shot (March 3, 2001) indicates the presence of phreatophytes along the banks of the wash. In addition, DRC staff observed seeps and salt precipitates on the banks and floor of Browns Wash during site visits. The presence of phreatophytes, seeps, and salt precipitates in an ephemeral stream are indicative of a ground water discharge area in an arid setting.

When taken together, the lines of evidence provided above support a ground water flow system at the Green River site that is seeking the path of least resistance to the closest discharge area, which is the Browns Wash. This may explain the anomalously high head in middle sandstone well 0180 and the presence of unsaturated zones west and south of the disposal cell. More importantly, this working model should provide the framework for establishing POC and POE monitoring points for an ACL compliance strategy.

Point of Exposure Wells

The POE is defined as the location where humans, wildlife, or other environmental species could reasonably be exposed to hazardous constituents from contaminated ground water, and should be located at the downgradient edge of the property boundary. As we pointed out in our January 21, 2003 comment letter, the designation of well 0182 as a POE is not valid because this well is completed in the basal sandstone aquifer of the Cedar Mountain Formation which to date, has not been contaminated by site-related activities because it has a strong upward hydraulic gradient and is therefore hydrogeologically isolated from and upgradient of the contaminated middle sandstone unit.

In your May 13, 2003 response letter, DOE proposes the establishment of appropriate and enforceable institutional controls to control and prevent access to potentially contaminated ground water in the vicinity of the Green River site. While this may be effective for preventing human exposure, these institutional controls will not prevent potential hazardous exposure to wildlife or livestock. Therefore, institutional controls alone are not adequate for an ACL strategy and one or more POE monitoring points are necessary.

Based on the site ground water flow model described above, the Browns Wash alluvium is the discharge sink for contaminated ground water in the Cedar Mountain middle sandstone unit. Therefore, DRC recommends using existing alluvial wells 0188 and 0189 as POE monitoring points for the ACL strategy. In addition, the DRC recommends installing another alluvial aquifer well on the east bank of Browns Wash in the area between surface sample locations 0710 and 0720. Because the contaminated Cedar Mountain middle sandstone unit eventually discharges to Browns Wash, these three alluvial aquifer wells can provide POE monitoring points to sufficiently monitor the ground water pathway at the downgradient edge of the State property.

Potential Land Transfer Issue

Because the spatial relationship between the POC and the POE is critical to the establishment of an ACL compliance strategy, it is important to have a good understanding of the ground water flow system at the site. Based on your May 13, 2003 letter, DOE has concluded that it is not reasonable or economic to drill additional wells to fully characterize the site hydrogeology. Instead, DOE believes that it may be better to accept the inherent uncertainties associated with the hydraulic gradient and ground water flow system of the contaminated middle sandstone unit of the Cedar Mountain Formation and implement institutional controls. If DOE maintains this position, there could be some property ownership issues associated with controlling future land use and water rights. Currently, the Utah Department of Health owns the property located between the DOE property boundary and Browns Wash. There is a possibility that the land owned by the State Health Department could be sold to a private entity, which could prevent future access for long-term monitoring or other UMTRA site activities. Therefore, under the current ACL strategy outlined in the May 13, 2003 letter, DOE may want to negotiate a property transfer with the State Health Department for the parcel of land between the DOE boundary and Browns Wash. This would ensure access to this property for future UMTRA site activities.

We appreciate the opportunity to participate in the ground water compliance strategy for the Green River, Utah UMTRA Site. If you have any questions or comments regarding this letter, please contact Rob Herbert at 801-536-4250 or rherbert@utah.gov.

Sincerely,

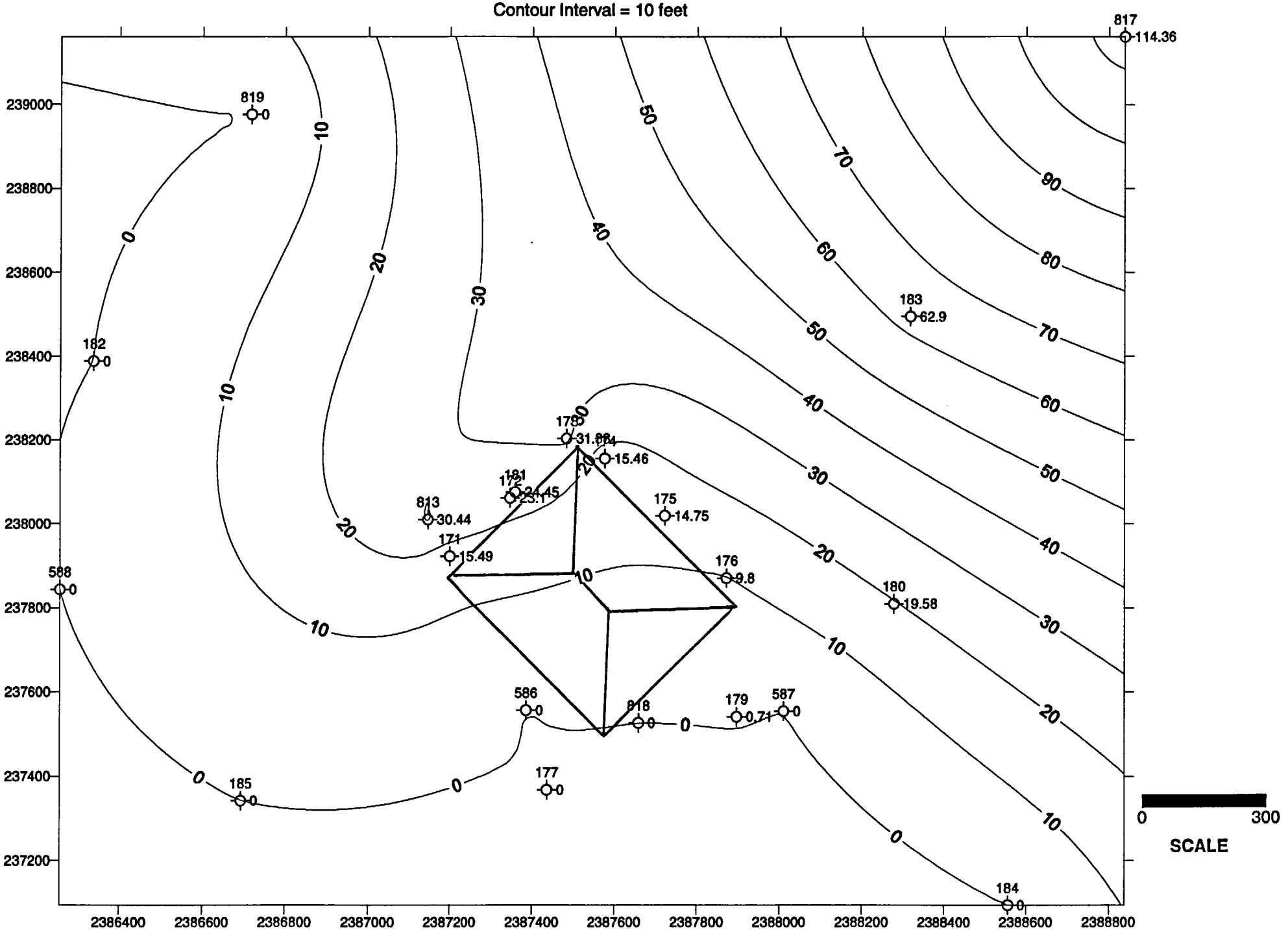
William J. Sinclair, Director
Division of Radiation Control

Attachments

Cc: Bill Von Till, NRC

Pressure Head Map of Cedar Mountain Middle Sandstone Unit
Green River UMTRA Site

Contour Interval = 10 feet



Attachment 2

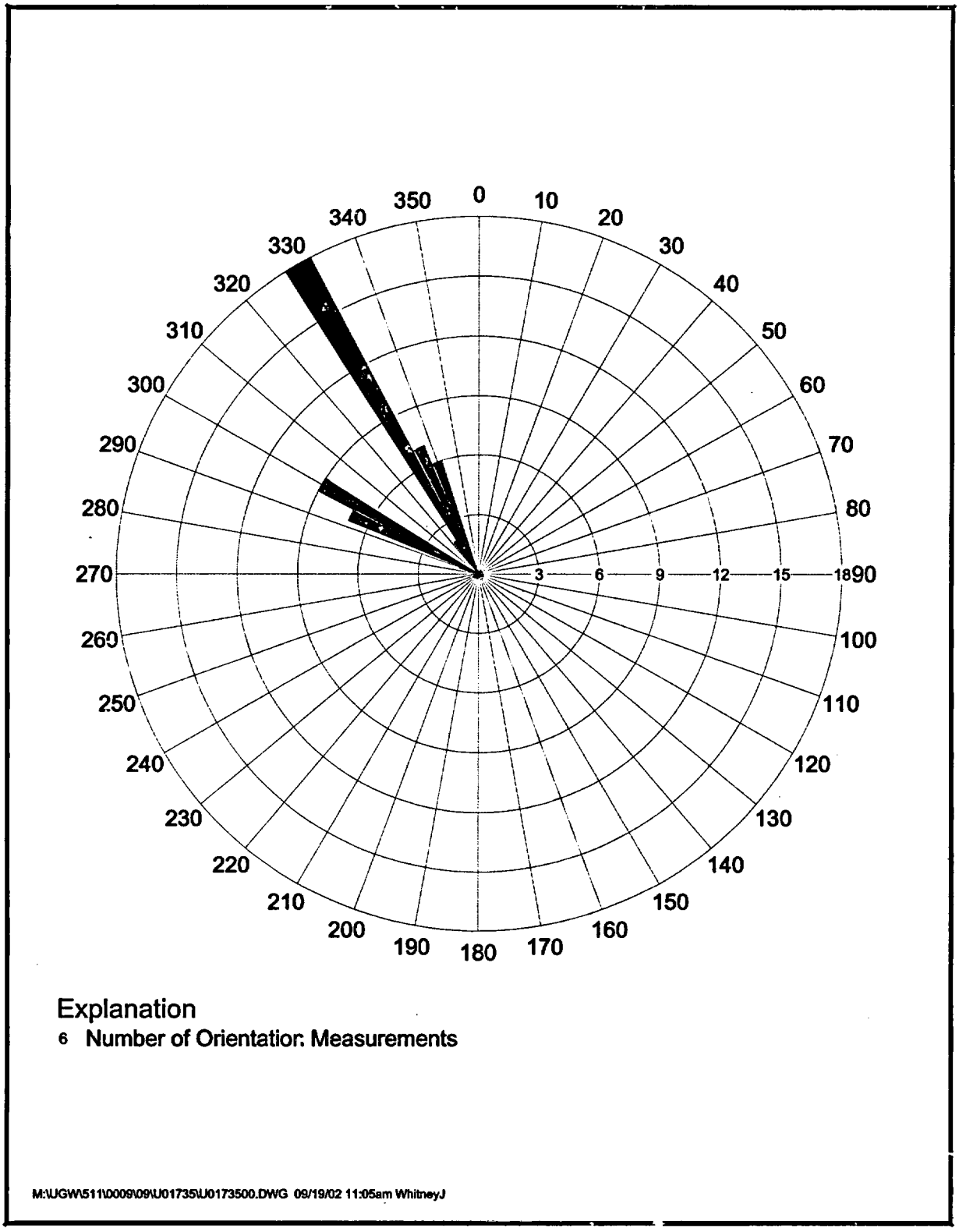


Figure 5–6. Orientation of Fracturing and Joints at the Green River Site

5.1.2 Hydrogeologic System

Historically, three distinct hydrostratigraphic units were defined in the vicinity of the Green River site within 200 ft of the ground surface (DOE 1998a). These were (1) the Quaternary alluvial deposits along Browns Wash, (2) the coarse-grained and fine-grained units of the unnamed member of the Cretaceous Cedar Mountain Formation, and (3) the underlying Buckhorn Member of the same formation. The Buckhorn Member is underlain by the Brushy Basin Member of the Jurassic Morrison Formation. Other non-water-bearing units in the area include the Cretaceous Dakota Sandstone, the Cretaceous Mancos Shale, and Quaternary terrace deposits. The unnamed member contains several interfingering sandstone units that may or may not be correlateable and connected over any distance. The previous terminology of "coarse-grained" versus "fine-grained" referred basically to either finding a sandstone unit or not, but completing a well at a relative perceived depth where the sandstone was expected to be. The Buckhorn Member is fairly distinct and correlateable and contains ground water under confined conditions.

The current interpretation of the hydrogeologic system in this document is based on previous information, observations from 2002 field investigations, and assessment of recent literature studies of the area. There are two distinct lithologic subsets, the Browns Wash alluvium and the Cedar Mountain bedrock units (Figure 5–3). The Browns Wash alluvium is limited in lateral extent and saturated thickness. Some contamination is present in what little water is available, but there is insignificant potential impact because of the limited amount of ground water in the alluvial aquifer. The hydrostratigraphy of the Cedar Mountain Formation will be redefined based on recent investigations to present a more realistic picture of what is present in the vicinity of the site. The four hydrostratigraphic units will include the upper unit, the middle sandstone unit (equivalent to the coarse-grained unit), the lower unit, and the basal sandstone unit (equivalent to the Buckhorn Member) (Figure 5–3). To facilitate discussions in the geochemistry and human health risk sections, some units of the Cedar Mountain Formation are combined as follows: (1) the "upper portion" includes the upper unit and the middle sandstone unit, (2) the "lower portion" includes the lower unit and the stringer sandstones, and (3) the basal sandstone unit remains intact.

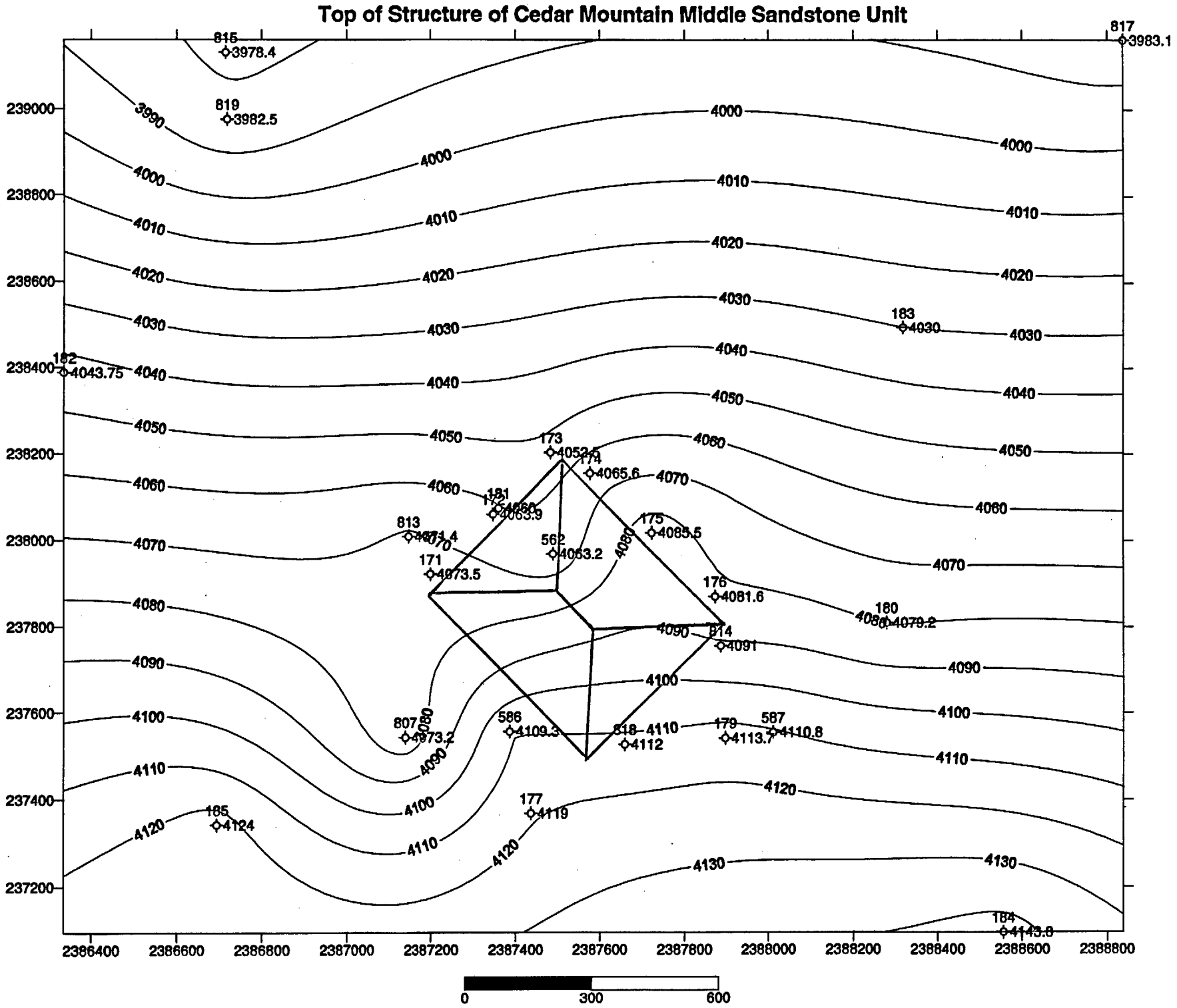
The approach to drilling during the 2002 field investigation was to complete monitor wells in the first significant water-bearing unit in the Cedar Mountain Formation. In some areas this was the middle sandstone unit, and in other areas the first significant water-bearing unit was the basal sandstone unit. This approach will provide a better measure for regulatory purposes in defining a significant water-bearing unit.

Ground water occurs in the alluvial system under unconfined conditions and in the bedrock aquifers under confined and semiconfined conditions. Permeability within the Cedar Mountain Formation is variable and is probably affected by both primary (rock matrix) and secondary (fracture) porosity. Ground water in these units will be discussed separately in the following sections. The local ground water flow system will be related to the regional hydrology in an effort to understand ground water conditions at the Green River site in Section 5.1.2.3.

5.1.2.1 Browns Wash Alluvium

The west-draining ephemeral Browns Wash is just north of the Green River site (Plate 1). The Browns Wash alluvium consists of a mixture of silt, sand, gravel, and some small cobbles. These

Attachment 3


Top of Structure of Cedar Mountain Middle Sandstone Unit
815
3978.4
817
3983.1
819
3982.5
239000
238800
238600
238400
238200
238000
237800
237600
237400
237200
3990
4000
4010
4020
4030
4040
4050
4060
4070
4080
4090
4100
4110
4120
4130
182
4043.75
183
4030
173
4052.5
174
4065.6
181
4063.9
813
4071.4
562
4063.2
175
4085.5
171
4073.5
176
4081.6
180
4079.2
814
4091
807
4073.2
586
4109.3
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