20 March 1997

NOTE TO: FILE
FROM: Harold Lefevre, NMSS/DWM/URB
SUBJECT: REVIEW OF 1995 AND 1996 PRE-LICENSING INSPECTION REPORTS FOR MEXICAN HAT, UTAH UMTRA SITE

Both documents were reviewed as follows:

1) 1995 Report - essentially no comments since deficiencies noted in this report have been addressed in the subsequent (1996) inspection report.

2) 1996 Report - several comments as follows:

a) Only one comment of note namely: Section 2.0, para 1: Attachments 1 and 2 as identified have not been attached to the report.

b) Attachment 1 included with the report is for the Lakeside (Oregon) site, not Mexican Hat.

c) Section 2.0, page 1, second to last paragraph. The word "undamanged" is misspelled. Should be "undamaged".

d) Section 3.2, Recommendation 2 - Has the Navaho Nation expressed a need to maintain the six well located outside of the site boundary?

e) Section 3.2, Recommendation 5 - NRC agrees, and has so stated in our LTSP comments to DOE of February 20, 1997.

3) The author called and spoke to Sharon Arp, DOE Project Manager at approximately 10:45 EST on March 20, 1997, regarding all the above items. For specifics on our conversation see the telephone log book , p. 326 for this conversation (it is attached).

30 March 1997; Environment; called by Ken Alperu at 9:30–9:40; Subject: (1) requesting date slippage for bio report from March 24th to April 4th; (2) this is because (a) "[illegible]" [illegible] not [illegible] to the [illegible] [illegible] was not received until today, (3) Ken [illegible] to [illegible] the [illegible] [illegible] [illegible] the [illegible] of April [illegible] receipt on the 4th; (4) [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] the [illegible]; (5) Ken [illegible] to include the [illegible] [illegible] [illegible] results on the [illegible] [illegible]; (6) [illegible] [illegible] because [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] before.

30 March 1997; Environment; I called D. Turner at 10:15 (he won't be in his office until the 24th); Subject: see above message from Ken Alperu.

30 March 1997; Mexican Hat; I called Sharon Arp at 11:00; Subject: her receipt of the 1995/1996 Mexican Hat Annual Preliminary Inspection Report and its review; (1) no problem w/ 1995 report but do have a comment on the 1996 inspection report because: (a) [illegible] [illegible] may attached "not Mexican Hat" and (b) the second attachment – [illegible] of [illegible] are [illegible] not attached; and (c) typo "undamaged" instead of "undamaged" on [illegible] of [illegible] 4 on last page. (1) Sharon also noted that there [illegible] [illegible] Mexican Hat [illegible] [illegible] [illegible] [illegible]

Junction and will get back to me, probably on Monday; (2) Grunkemeyer is spelled correctly on her copy, but not on mine - she will check w/ Brand Junction on the matter as well; (3) Sharon queried me on the Director OK Response Review to indicate that we are going well - my personal reaction to the comment: "more plus and more Clearer" [illegible] that everything is fine, can't speak for Cleare though. I anticipate no problem and hope to have the OK Response Review completed by the end of next week;

30 March 1997; FOIA; Bob Evans called at 11:14 re FOIA 97 #05; Subject: What should he do?

30 March 1997; FOIA; (1) I returned Bob's call at 10:45, Discussed (1) "A" not recorded in the FOIA [illegible] [illegible] Bob [illegible] me that the FOIA [illegible] by [illegible] [illegible] [illegible] Knowledge [illegible] March [illegible] for anything and everything [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] duplicating anything that [illegible] have a [illegible] number on [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] probably on the PDR) will be sent to [illegible] [illegible] [illegible] will be required to screen it; (3) I [illegible] the process of screening [illegible] that we do not [illegible] photocopy documents [illegible] listed on the PDR printout - we simply provide the printout to the requester who is to locate and retrieve the documents through his own [illegible].

Evaluation of HAT/MON LTSP dated June 11, 1997 for water resource protection

DOE proposes to monitor two seeps (251 and 249) in the North Arroyo; three seeps (248, 254, and 299) in Gypsum Wash: and one seep (261) designated as background in Gypsum Wash during annual inspections. DOE's proposed monitoring will entail visual inspections of the seepage, documenting seepage with photographs, and estimating seepage flow. Chemical analysis of seepage water will not be performed unless a significant increase in the seepage rate is observed. If water sampling is performed the seepage will be analyzed for ammonium, calcium, chloride, molybdenum, nitrate, potassium, radium-226 and radium-228, sodium, sulfate, total dissolved solids, uranium, and vanadium.

The primary reliance on seepage flow volume as a determinant of cell performance does not provide an adequate means of evaluating potential failure impacts that could develop over time. In addition, the lack of routine sampling and analysis of the seepage does not allow timely detection of seepage changes that may affect grazing animals or humans. This is also inconsistent with DOE's seepage monitoring commitments in the RAP.

DOE should, at a minimum, propose monitoring program that includes sampling and analysis of a limited number of indicator parameters in addition to the flow volume estimates. If analysis of the indicator parameters indicates a degradation of seepage water quality, then additional sampling of the full suite of constituents listed in the LTSP should be performed and an evaluation of whether degradation is the result of disposal cell failure. If the seep conditions change to the point of no flow, as is expected for some seeps, then the monitoring provisions of the LTSP can be amended to reflect those changes.

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4.0 GROUND WATER

4.1 GROUND WATER CHARACTERIZATION

Hydrogeologic conditions at the disposal site are summarized below and are described in detail in the remedial action plan (RAP) (DOE, 1993), and in the NRC's technical evaluation report (NRC, 1996).

4.1.1 <u>Hydrostratigraphy</u>

The Mexican Hat disposal site is approximately 1 mi (1.6 km) south of the San Juan River on a relatively flat mesa at an elevation of approximately 4300 ft (1300 m) above mean sea level. Surface drainage from the site and surrounding area is to the San Juan River. Bounding the relatively flat mesa to the north and east are the ephemeral drainages North Arroyo and Gypsum Creek. These drainages are relatively narrow and deeply incised. The terrain west of the site is similar to that to the north and east (DOE, 1995; 1993). A ridge that extends approximately 100 ft (30 m) above the site bounds the site on the south.

The Halgaito Shale, the lowermost unit of the Permian Cutler Group, is exposed at the ground surface of the site (Figure 4.1). This shale consists primarily of interbedded silty sandstone, siltstone, and shale. Calcareous, well cemented beds alternate with less-cemented beds, and there are some thin lenticular beds of limestone and conglomerate (siltstone and limestone pebbles in a silty matrix). The unit is 80 to 215 ft (24 to 66 m) thick in the site vicinity. Two sets of nearly vertical fractures trending east-west and northeast-southwest and fractures along bedding planes that dip toward the east are present in the upper portion of the Halgaito Shale at the site. The presence and size of the fractures decreases significantly with depth (DOE, 1995; 1993).

The Honaker Trail Formation is the uppermost unit of the Hermosa Group and lies beneath the Halgaito Shale (Figure 4.1). The Honaker Trail Formation consists of interbedded siltstone, limestone, shale, and sandstone. Chert and limestone nodules are found throughout the siltstone beds, and the limestone units are predominantly fine to very fine grained. The formation is more than 300 ft (90 m) thick (DOE, 1995; 1993).

The Halgaito Shale was unsaturated before the uranium processing activities at the Mexican Hat site. Nearly all of the ground water presently contained in the Halgaito Shale is a result of the former uranium processing operations (the discharge of process water and water used to place the tailings) and, to a lesser degree, transient drainage from the disposal cell. The ground water in the shale is contained primarily in fractures and is perched on underlying zones having a lower hydraulic conductivity. The unit exhibits very little primary hydraulic conductivity due to the fine-grained nature of the sediments and intergranular

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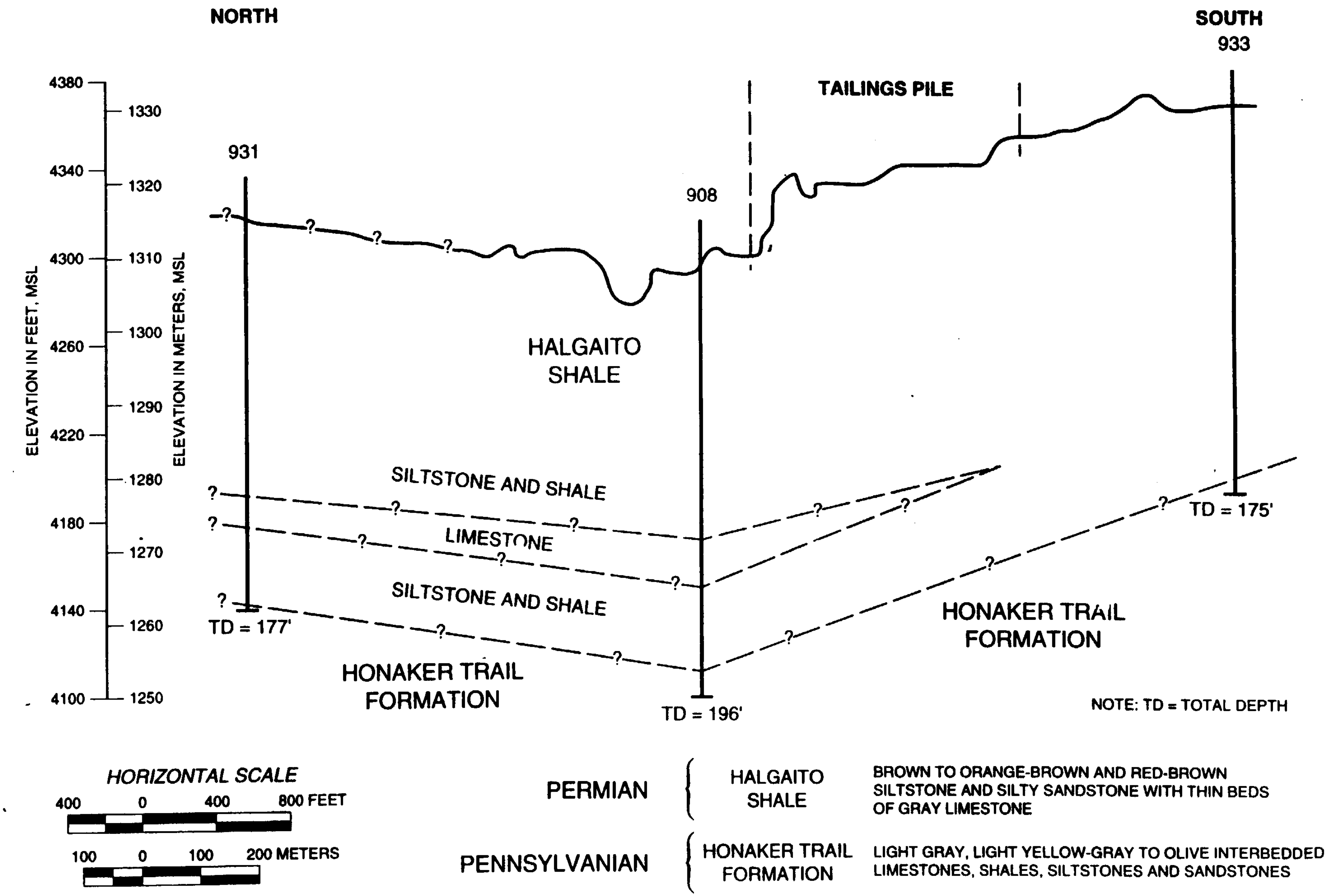

FROM DOE, 1993a.

FIGURE 4.1
TYPICAL GEOLOGIC CROSS SECTION
MEXICAN HAT, UTAH, DISPOSAL SITE

MAC: SITE/H' 'SP/GEOXSEC

cements. The hydraulic conductivity of the unit decreases with depth because of the decrease in the number and size of the fractures, and the lower portion of the unit is a very effective confining layer that significantly limits the vertical exchange of ground water between the Halgaito Shale and the underlying Honaker Trail Formation (DOE, 1995; 1993).

Recharge to the Halgaito Shale is limited by low annual precipitation (6 inches [15 cm] per year) and high evaporation. Discharge is through the fractures and on low-permeability beds as the ground water travels toward seeps in the North Arroyo and Gypsum Creek. Some recharge does occur as evidenced by an uncontaminated seep from the shale in Gypsum Creek. The ground water in the Halgaito Shale that is affected by the disposal site is limited in areal extent and yield and has no current use as a water resource (DOE, 1995; 1993).

The Honaker Trail Formation contains an aquifer below the Halgaito Shale. The aquifer is isolated from ground water in the Halgaito Shale because the lower portion of the Halgaito Shale is a very effective confining layer and an upward hydraulic gradient in the Honaker Trail Formation prevents ground water in the Halgaito Shale from entering the Honaker Trail Formation (DOE, 1995). Water levels in the confined Honaker Trail aquifer are above the perched water levels in the Halgaito Shale and above the ground surface in some locations, including at the disposal site. Ground water in the Honaker Trail aquifer flows northeast toward the San Juan River, which is the discharge area for the aquifer. Recharge to the aquifer is limited and may occur as precipitation in areas to the southwest where the formation is closer to or exposed at the ground surface. Recharge may also occur as upward flow from deeper units. The ground water in the Honaker Trail Formation is not contaminated from the uranium processing activities, but its natural quality in the vicinity of the Mexican Hat disposal site likely is unsuitable for consumption. Monitor wells at the disposal site showed the presence of hydrogen sulfide gas and naturally occurring petroleum. The Halgaito Shale and Honaker Trail Formation produced a limited amount of oil in the oil field near the town of Mexican Hat (DOE, 1995; 1993).

Three seeps (251, 249, and 255) have been identified in or near the North Arroyo in the vicinity of the Mexican Hat disposal site (Figure 4.2). Seep 251 was first noticed in December 1989 during the relocation of the upper tailings pile to the lower tailings pile; however, dense green vegetation in aerial photographs taken as early as 1974 show evidence of the earlier occurrence of near surface water at this location. The flow rate at seep 251 was measured in February 1990 at 4 gallons (gal) (15 liters [L]) per hour, but the flow decreased until it stopped in May 1990. The seep was observed to flow again during remedial action in May 1994. It is not possible to predict when the intermittent flow from seep 251 will stop (DOE, 1995; 1993).

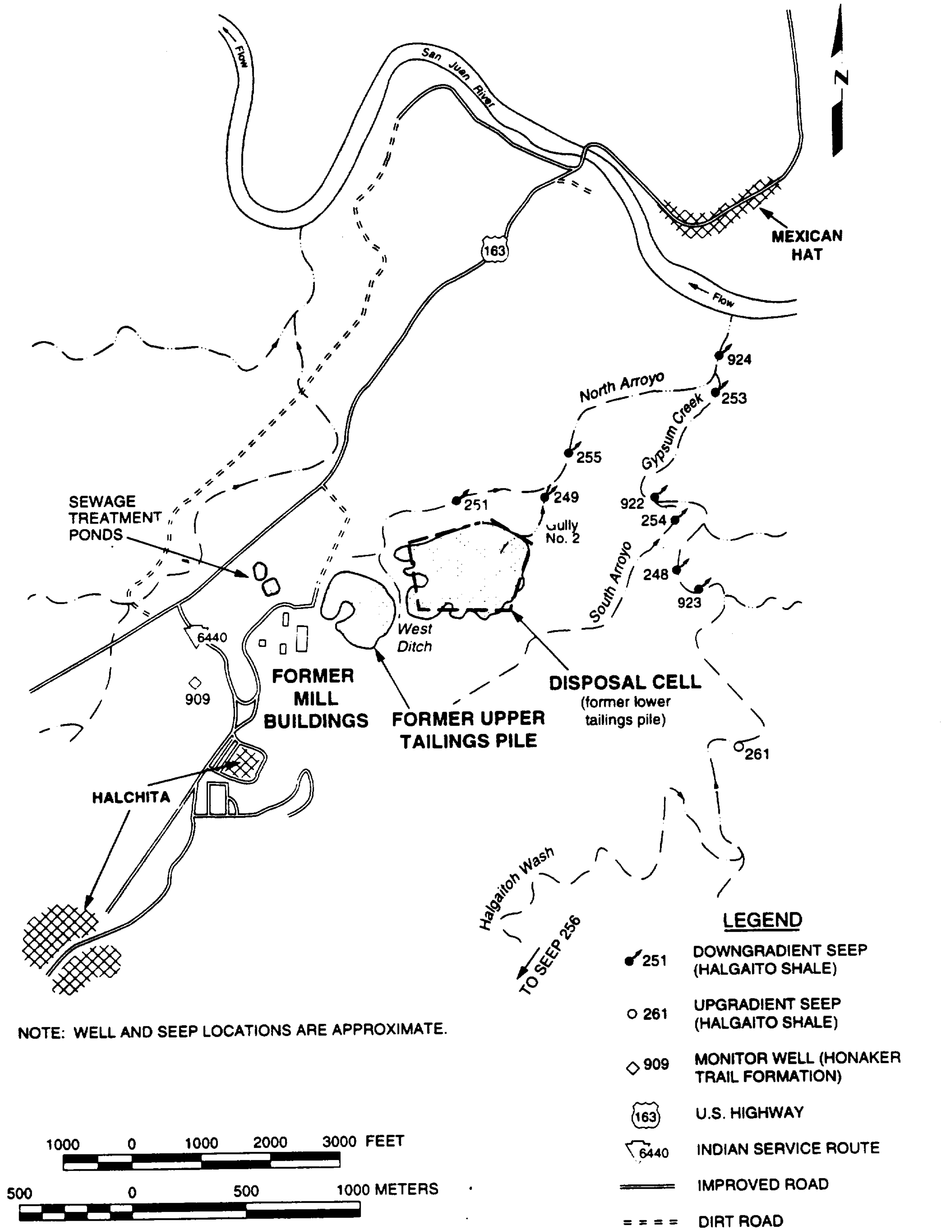

FIGURE 4.2
SEEP LOCATIONS AT THE MEXICAN HAT, UTAH, DISPOSAL SITE

Flow rates at seep 249 (Figure 4.2) were 0.5 gal (1.9 L) per hour in March 1990 and 0.35 gal (1.3 L) per hour in July 1990 (DOE, 1995; 1993). A spring in this area was documented in 1968 (Snelling, 1971), and there is no record that the seep has stopped flowing since the relocation of the upper tailings pile to the lower tailings pile. The seep was observed to flow during remedial action in May 1994. Insufficient information is available to accurately predict the continuation of seepage at this location (DOE, 1995; 1993).

Flowing water has been observed at seep 255 as far back as March 1976 (DOE, 1990), and the seep was observed from 1988 through 1990 by UMTRA Project personnel. The seep was observed to flow during remedial action in May 1994. No flow rates have been measured at seep 255, and it is not possible to predict when the seep will stop flowing (DOE, 1995; 1993).

Seven seeps (261, 923, 248, 254, 922, 253, and 924) have been identified in the Gypsum Creek drainage in the vicinity of the Mexican Hat disposal site (Figure 4.2). Flow rates from these seeps have not been determined, however, the seeps do not have continuous flows of water (DOE, 1995; 1994; 1993).

4.1.2 Background ground water quality

Background ground water quality was determined for the Halgaito Shale and underlying Honaker Trail Formation at the Mexican Hat disposal site. The Halgaito Shale contains only minor amounts of naturally occurring water, and upgradient monitor wells in the shale were dry. Therefore, background ground water quality for the Halgaito Shale was determined using seep 256 in Halgaitoh Wash and seep 261 in Gypsum Creek upgradient of the disposal site (Figure 4.2). The water quality of these seeps is very similar, and both seeps appear to be isolated from ground water contamination related to the disposal site. Background ground water quality for the Honaker Trail Formation was determined using monitor well 909 upgradient of the disposal site (Figure 4.2) (DOE, 1995; 1993).

The background ground water quality of the Halgaito Shale and Honaker Trail Formation is generally similar because both units are lithologically similar (Table 4.1). Both units contain the same calcium sulfate as the mineral gypsum, which has been positively identified in outcrops of the Halgaito Shale. This is reflected in the background ground water quality. Ground waters from both units contain relatively high concentrations of sulfate as the dominant anion (2000 to 3300 milligrams per liter [mg/L]) balanced by nearly equal equivalents of sodium, calcium, and magnesium. The pH of the ground waters is slightly alkaline, and the ground waters in both units are oxidizing. Total dissolved solids (TDS) in the ground waters range from 3200 to 5300 mg/L (DOE, 1995; 1993).

Table 4.1 Background ground water quality for the Halgaito Shale and Honaker Trail Formation, Mexican Hat, Utah, site

Constituent	Halgaito Shale[a]	Honaker Trail Formation[b]
Alkalinity	189 - 289	133 - 159
Aluminum	<0.05	<0.1 - 0.3
Ammonium	<0.01 - 0.5	<0.1 - 0.4
Antimony	<0.02	<0.003 - 0.006
Arsenic	<0.01	<0.01 - 0.02
Barium	<0.002 - 0.02	<0.01 - 0.1
Beryllium	<0.005	
Boron	0.3 - 0.4	0.1 - 1.0
Bromide	0.5 - 0.9	
Cadmium	<0.001	<0.001 - 0.005
Calcium	410 - 555	330 - 445
Chloride	109 - 181	93 - 110
Chromium	<0.01	<0.01 - 0.09
Cobalt	<0.03	<0.05
Copper	<0.01	<0.01 - 0.04
Fluoride	0.4 - 2.2	1.3 - 1.5
Iron	<0.03 - 0.2	<0.03 - 0.13
Lead	<0.005	<0.01
Lead-210 (pCi/L)	0.0 - 1.0	
Magnesium	44 - 265	141 - 190
Manganese	<0.01 - 0.66	0.01 - 0.02
Mercury	<0.0002	<0.0002
Molybdenum	<0.01 - 0.02	<0.01 - 0.20
Nickel	<0.04	<0.04 - 0.11
Nitrate	<1.0 - 8.9	0.8 - 11.1
pH	7.1 - 8.0	7.1 - 7.4
Phosphate	<0.01 - 0.01	<0.1 - 0.1
Polonium-210 (pCi/L)	0.5 - 0.7	0.0
Potassium	6 - 15	5.4 - 8.5
Radium-226 (pCi/L)	0.0 - 1.5	0.0 - 0.3
Radium-228 (pCi/L)	0.0 - 6.0	0.0 - 8.5
Selenium	<0.03	<0.005 - 0.04

Table 4.1 Background ground water quality for the Halgaito Shale and Honaker Trail Formation, Mexican Hat, Utah, site (Concluded)

Constituent	Halgaito Shale[a]	Honaker Trail Formation[b]
Strontium	10 - 13	<0.1 - 9.2
Silver	<0.01	<0.01
Silica - SiO_2	16 - 25	14 - 16
Sodium	270 - 740	397 - 470
Sulfate	2200 - 3300	1980 - 2380
Sulfide	<0.1 - 4.4	<0.1 - 64.4
Thallium	<0.03	
Thorium-230 (pCi/L)	0 - 1.7	0.0 - 0.30
Tin	<0.05	<0.005
Total dissolved solids	3700 - 5300	3170 - 3730
Total organic carbon		<1 - 31
Uranium	0.01 - 0.05	0.04 - 0.06
Vanadium	<0.01 - 0.02	<0.01 - 0.49
Zinc	<0.005 - 0.01	<0.01 - 0.03

[a]Data are from seeps 256 (Halgaitoh Wash) and 261 (Gypsum Creek) (Figure 4.2) from 1990 to 1994.
[b]Data were collected from monitor well 909 (Figure 4.2) from 1985 to 1993.

Note: All data are in milligrams per liter unless noted as picocuries per liter (pCi/L). Values given as less than (<) are below the minimum detection limit for the analysis.

Several constituents commonly found in the solutions produced by the uranium processing at the Mexican Hat site are also present naturally in ground water from the seeps upgradient of the site. However, the concentrations of these constituents in the ground water are below those in the tailings piles. Constituents that occur naturally in ground water from the upgradient seeps include ammonium, boron, magnesium, manganese, molybdenum, nitrate, silica, sulfate, and uranium (DOE, 1995; 1993).

4.2 GROUND WATER MONITORING

Most water in the Halgaito Shale was derived from uranium milling and processing activities, and to a lesser degree from transient drainage from construction of the disposal cell. The water is contained primarily in fractures within the upper portion of the Halgaito Shale and is perched on underlying zones having a lower hydraulic conductivity. Water in this unit has no current or potential use as a ground water resource because it is limited in areal extent and yield. Monitoring of water in the Halgaito Shale is not required under the current protection strategy since it is not considered a current or potential source of drinking water.

The underlying Honaker Trail Formation contains an artesian aquifer. This aquifer is hydrogeologically isolated from the Halgaito Shale and no contamination related to the Mexican Hat processing site has been detected. Monitoring is not required for this aquifer because of the hydrogeologic isolation and the upward hydraulic gradient that has protected the aquifer from processing site-related contamination. In addition, the design of the disposal cell will minimize any additional potential for the migration of contaminants into the upper portions of the Halgaito Shale.

Due to concerns raised by the Navajo Nation, the UMTRA Ground Water Project is performing additional characterization activities within these two zones to determine whether the current hydrogeologic model is correct. The information obtained from monitoring of the seeps, as discussed in the next section, will also be used to evaluate the model. Should it be determined that the current hydrogeologic model is inaccurate, the information presented in this document will be modified.

4.3 CELL PERFORMANCE MONITORING

The DOE will monitor the following seeps in the disposal cell vicinity to evaluate disposal cell performance:

1. Seep 251 and in the vicinity of seep 249 in the North Arroyo. These seeps are directly north and downgradient from the disposal cell. They potentially will flow in response to precipitation runoff from the disposal cell cover, or in response to transient drainage or other anticipated discharge from the disposal cell.

2. Seeps 248, 254, and 922. These seeps potentially could flow in response to any influx of water from the disposal cell through fractures in the Halgaito Shale to Gypsum Wash.

3. Seep 261. This seep is considered to have background-quality water. It will be monitored only if water quality sampling is required due to increased flows in the above five seeps.

The volume of flow from the seeps will be visually monitored using photographs of a baseline area to establish trends over time. The baseline area will be established using rebar to mark the current areal extent of the seeps. These measurements will be made at approximately the same time each year during the spring or summer when any potential leakage from the disposal cell would be noticeable. Water in the seeps is expected to decrease in time and return to natural conditions.

If significant increased flow from the seeps is observed, water from the seeps will be sampled. Rainfall records will also be reviewed for potential increases in fracture recharge caused by runoff into and infiltration from the north apron and drains. As appropriate, other follow-up assessment activities may be conducted, such as comparing past cell and apron inspections to current inspections. If water sampling is required, the following constituents of concern that could indicate leakage from the disposal cell will be analyzed: ammonium, calcium, chloride, molybdenum, nitrate, potassium, radium-226 and -228, sodium, sulfate, TDS, uranium, and vanadium.

Indications of cell failure, if any, will be responded to. Seeps could be monitored more frequently. In addition, sampling the San Juan River at its confluence with Gypsum Wash could be added to the monitoring program.