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SITE SELECTION AND CHARACTERIZATION OF THE SAND POINT LANDFILL SITE, EDDY COUNTY, NEW MEXICO

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Abstract—Two landfills in southern Eddy County have been closed and the remaining landfill is expected to be closed by about mid-I994. Several sites and locations for a new landfill near Carlsbad have been examined and the Sand Point site (NW$^1/_4$ sec. I 1, T2 IS, R28E) east of Carlsbad was selected for characterization. Four deeper drill holes were converted to hydrological observation wells after obtaining geological samples. Ground water depths range from about 168 ft to 222 ft below the surface. Five shallower boreholes (140 to 150 ft) were drilled to verify the geology of the interior of the site and that ground water would be more than 100 ft below the base of a landfill. Surface features show minor drainage along the southeastern corner of the site. The Mescalero caliche underlies soil from the Serino series and elongate fields of coppice dunes. The Plio(?)-Pleistocene Gatuňa Formation is nearly 300 ft thick in drill holes at the site and is underlain by the Permian Dewey Lake Formation. The Dewey Lake may be somewhat thicker under the site because of subsidence before Gatuňa erosion. The Dewey Lake– Gatuňa relationships may indicate erosion and valley fill. Sand Point meets siting criteria in New Mexico Environment Department regulations. Some additional hydrological work is expected at the site and a permit will be sought during 1993.

INTRODUCTION

In southern Eddy County, New Mexico, one active landfill currently serves Carlsbad and the surrounding area. This landfill is expected to be closed by about mid-1994. Two other landfills, operated by Carlsbad or Eddy County, have recently been closed. A potential landfill site (Sand Point site) has been identified and extensively characterized to serve Eddy County and included municipalities. By mid- 1993, this landfill site should be undergoing permitting from the State. The site should open for operation in late 1993 or early 1994 if the permitting is successful. The landfill closures and new landfill permitting are regulated by the State of New Mexico through the Environment Department (NMED). New regulations promulgated by the NMED (December 1991) and the U.S. Environmental Protection Agency govern new landfill siting and permitting, and also regulate closures.

We review here some of our experience with the regulatory requirements as well as the process and progress of siting and characterizing a potential new landfill site (as of March 1993) from a geological and hydrological perspective.

RELEVANT NEW MEXICO ENVIRONMENT DEPARTMENT REGULATIONS

Section 202 of the 1991 New Mexico Solid Waste Management regulations lists some of the requirements for permitting a landfill that have been very significant for the siting and characterization of the Sand Point site. Some of the required items (related to geology and hydrology) are maps of ground water monitor wells and landfill gas monitors, maps of water, gas and oil wells, large-scale topographic maps and a floodplain map. The regulations require detailed descriptions of the geological regime, including plans for obtaining geological information, a plan for obtaining borehole information, a ground water assessment and ground water monitoring. There are also provisions for natural clay liner systems or artificial liner materials.

Section 302 of the regulations provides some specific siting criteria that are important in locating a new landfill (Table **I).** Restricted areas include floodplains, wetlands or watercourses; areas with a seasonal high water table less than 100 ft below the bottom of fill; subsurface mine areas or areas subject to sink holes; areas within 200 ft of a fault with displacement in the last 11,000 yrs; areas within historically or archeologically significant sites; and areas on an active alluvial fan.

OTHER CRITERIA

As a practical matter, preliminary screening to locate potential sites always involves additional choices not required by regulation and the search for Sand Point included several such choices (Table 1). It was important to factor in haulage distance, so locations relatively close to Carlsbad, the center of population, would be preferred. Landownership and access were considered. "Cultural features" *were* to be avoided where possible; these are pipelines, power lines, etc., which potentially could be moved but most likely at prohibitive cost. Hard rock outcrops (mainly limestone) and national park and forest land were avoided. These criteria eliminated considerable areas of Eddy County from initial consideration.

THE SEARCH FOR SAND POINT

The first task in the search for a new site was to examine some sites (Fig. 1) that Carlsbad or Eddy County suggested because of factors such as site control and proximity to the city. Two sites northeast of La Huerta and another east of Carlsbad, near the Beker facility, were examined and found unacceptable. In all cases, literature searches or augering indicated ground water at less than 100 ft below the surface (Geohydrology Associates, unpubl. report fo Bureau of Land Management, 1978; Hendrickson and Jones, 1952; Richey, 1989). Shallow bedrock, karst and pipelines and oil or gas wells also were unacceptable conditions or were severely limiting.

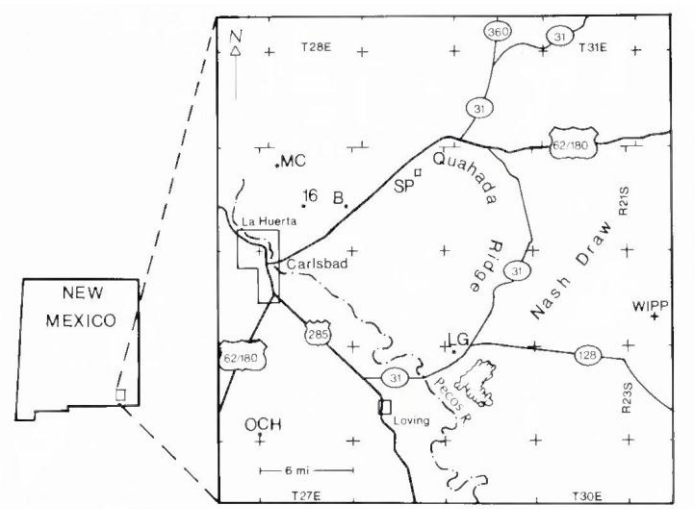

FIGURE 1. Locations and sites (*) examined during preliminary site selection for a new landfill site in the Carlsbad area. MC = "motocross site"; 16 = "section 16" site; B = Beker site; OCH = Old Cavern Highway location; LG = Laguna Grande location. The Sand Point (SP) site, within the Sand Point location, was selected for characterization and is expected to be operated as a landfill.

TABLE 1. General screening criteria used to locate the Sand Point site.

Several criteria of general use help focus on the relative merits of these sites:

depth to groundwater:	more than 100 ft below landfill excavation depth
quality of groundwater:	preferred to exceed 10,000 mg/liter (ppm)
construction quality:	minimal or no bedrock in upper 30 ft
	prefer higher clay content as infiltration barrier
topographic features:	no active sinkholes or probable karst
	moderate slopes
land ownership:	no state land
	private or BLM ownership preferred
"cultural features":	minimize oil/gas wells, pipelines
	minimize power lines, but nearby source desirable
	nearby good road desirable
distance for haulage:	minimize haulage distance for appropriate sources.

Of the above criteria, the most stringent are groundwater, bedrock, sinkholes, and land ownership. Other factors, such as pipe lines and power lines, might be overcome by rerouting if necessary, but the costs of overcoming such obstacles would have to be weighed relative to other costs.

Additional exclusions in proposed state regulations were partially considered during reconnaissance of sites and locations and were applied more stringently if potential site survived initial screening:

no floodplain locations, not within 500 ft of wetlands or within 200 ft of watercourses;
not within 200 ft of a fault that has had displacement within the last 11,000 yrs;
not within historically or archeaeologically significant sites, unless in compliance with various legislation (the Cultural Properties Act, Section 18-6-1 to 18-6-23 NMSA 1978; the Prehistoric and Historic Sites Preservation Act, Sections 18-8-1 to 180808 NMSA 1978); or
not in an active alluvial fan.

Three broader locations (Fig. 1) were examined based on probable depth to ground water, access and general geology. An area south of Carlsbad, in the vicinity of Old Cavern Highway and Bounds Road, was considered less desirable because landownership was mixed and public lands were along a narrow strip. Ground water data are scarce in the area (Hendrickson and Jones, 1952), but the depth is possibly marginally acceptable. This location was not considered further because of these factors.

Another area, located northwest of Laguna Grande de la Sal, was evaluated using available literature, personal knowledge of the geology of the area and three auger holes to supplement available data. Parts of the area were found to have shallow bedrock that would restrict landfill development. Ground water depth and quality is not well determined in the area (Robinson and Lang, 1938; Geohydrology Associates, unpubl. reports to BLM, 1978, 1979) and may be less than the depth required by regulation. A possible positive factor is that ground water ranges from very saline to much fresher water. Poor water quality might provide fewer regulatory obstacles, though this has not been tested. The Laguna Grande location has not been further explored, but remains a possible alternate location should the Sand Point site be rejected.

The third location, at the northwest end of Quahada Ridge (about 10 mi east of Carlsbad along Hwy 62/180), offered positive features such as good access, deeper ground water, negligible erosion, minimal "culture" and some geological data from previous exploration nearby. Two shallow holes augered in the area penetrated about 80 ft of Gatufia Formation and about 45 ft of Dewey Lake with about 5 ft of Rustler Formations, respectively. A further review of potash borehole data obtained from the BLM (Roswell), surficial data and gas exploration data from the area showed that much of the southern part of the 6 mi^1 area was likely to be less satisfactory. Ground water in the southern area is shallower, karst features are observed and access is very limited. Portions of sections 10, 11 and 12 (Fig. 2) were selected based on generally equal hydrological and geological characteristics and the NW$^1/_4$ sec. 11 (T21S, R28E) was finally selected as the preferred site for further characterization. This quarter section is known as the Sand Point site after the name of the nearby hill in section 10.

SITE CHARACTERIZATION FOR SAND POINT

The Sand Point site (Fig. 3) has been characterized through three principal activities:

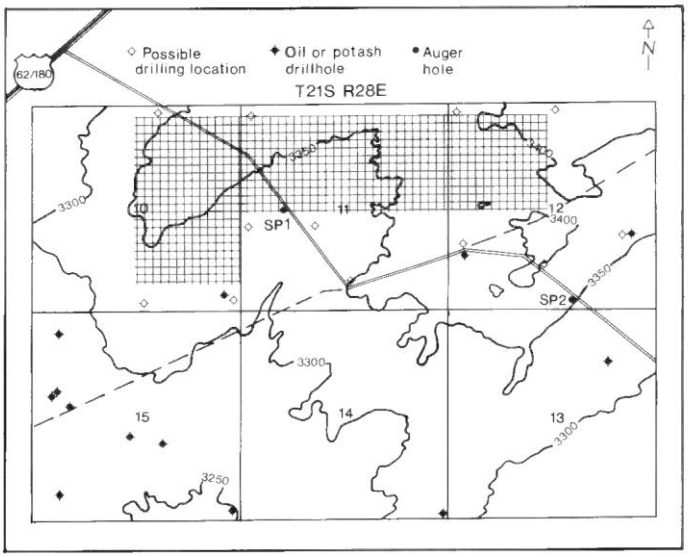

FIGURE 2. Sand Point location with generally preferred area, prior to site characterization, shown by pattern. The two auger holes were drilled to shallow depths as part of the preliminary investigation in early 1992. Oil and potash drill holes that yielded useful background information are located as well. Potential drill hole locations were suggested in early 1992 for a broad investigation of the Sand Point location. The NW$^1/_4$ sec. 11 was selected based on surface characteristics and shorter transport distances from U.S. Highway 62/180. Topographic contour elevations are in feet.

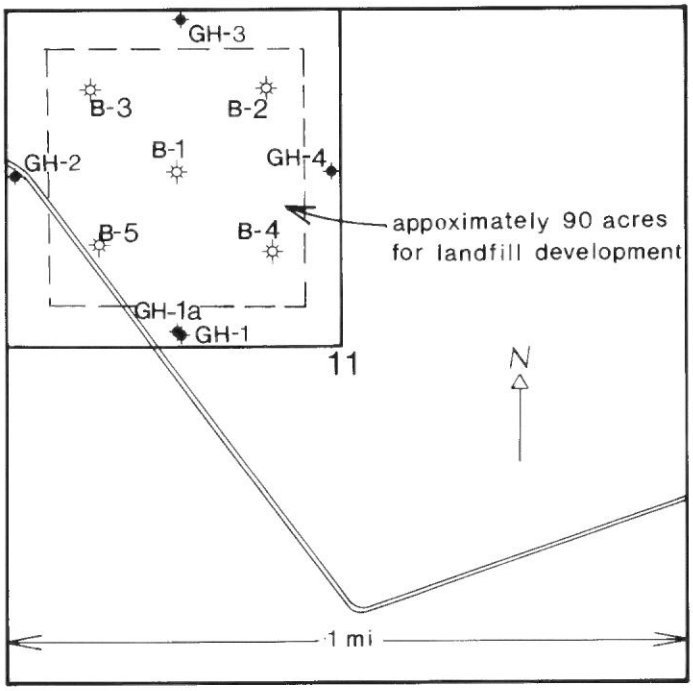

FIGURE 3. Exploratory drilling around perimeter (G/H-#) ranged from 230 to 368 ft in depth; four (G/H-1a, -2, -3, -4) were completed as hydrologic observation wells. Borehole drilling in the interior (B-#) confirmed geological observations to 140–150 ft depth and that ground water is deeper. Trenches adjacent to G/H-1, B-1 and B-3 revealed Mescalero caliche and cover.

1. a drilling program (May—June 1992) explored the geology around the perimeter of the site to depths greater than 200 ft and encountered ground water. Four drill holes were completed for hydrologic observations.
2. a drilling program (September—October 1992) of boreholes within the boundaries of the site to verify the geology within about 100 ft below the base of a landfill (140 ft from surface) and verify lack of ground water in this zone.
3. a brief program of surface mapping and examination of geomorphic features (January 1993).

The data from these activities have been reported and interpreted in consultant reports (Powers, unpubl. reports, 1992a, b; 1993) to JOAB, Inc., a company located in Sunland Park, NM, that is responsible for locating a new landfill site for Eddy County and Carlsbad. The reports will be part of the record being assembled for application for a permit from the Environment Department of the State of New Mexico.

The preliminary site characterization consisted mainly of five drill holes, at four locations around the perimeter of the site, in addition to background geology from the literature and various industrial activities. These drill holes (SP G/H-1, -1A, -2, -3 and -4) provided fundamental geological and hydrological data for the site. The borehole drilling program (B-1 through -5) verified the geology of the interior of the site to depths about 100 ft below expected landfill depth and indicated that no ground water was within 100 ft of the base of a landfill.

Basic site geology

The rocks encountered at the site include Pleistocene Mescalero caliche, Plio(?)-Pleistocene Gatuňa Formation and the Permian Dewey Lake Formation. Each of these units also crops out in the vicinity of the site. Drill hole G/H-1 returned cuttings of the Dewey Lake Formation from 213 ft to a total depth of 368 ft. A short core of the upper Dewey Lake from the bottom of drill hole G/H-2 showed bedding with apparent dips of about 15-20° in an undetermined direction. If the dip at G/H-2 applies to the Dewey Lake at G/H-1, the true minimum thickness would be about 146 ft (for 20° dip). In the SW›/4 sec. 12, potash drill hole USP 37 (Fig. 3) encountered an apparent thickness of 104 ft of Dewey Lake at an elevation of 3290 ft. Auger hole SP-2 in sec. 12 reached the top of the Rustler at an elevation of 3300 ft. These data are consistent with a nearly flat Dewey Lake in sec. 12 with a thickness of about 100 ft. At the proposed landfill site, the Dewey Lake dips significantly (probably to the west) and appears to be thicker. The dips are unlikely to be greater than observed in G/H-2, although some blocky tilting may interfere with straightforward interpretation. From regional relationships, the Dewey Lake is as thick as could be expected here. Pre-Pleistocene subsidence at sec. 11 may have partially protected it from erosion before Gatuňa deposition.

The Gatuňa Formation is nearly 300 ft thick at the landfill site. Dips are limited and this is probably a nearly true thickness. A composite section measured at Pierce Canyon had similar features and thickness. These are the maximum demonstrated thicknesses known to us from this area. The relationships at Sand Point suggest the Gatuňa may have been deposited as valley fill against the Dewey Lake surface along the southeast side of the site. The Gatuňa includes variable lithologies of fluvial deposits, probable eolian sediments and pedogenic features that overprinted several different sequences. The Gatuňa is described in more detail in another paper in this volume.

The Mescalero caliche has been examined in outcrops, drill holes, a pipeline trench and shallow pits in the vicinity of the site. It occurs under thin Berino soil (Berino series; see also Chugg et al., 1971), especially on the higher, slightly sloping north to northwestern part of the site. The Mescalero is also continuous under much thicker coppice dune sands at the site. These eolian deposits can be 10-12 ft thick at least and they are mainly deposited in elongate units oriented approximately east-northeast. These elongate deposits parallel breaks in slope and local drainage trends where a lee side eddy develops and sand is dropped. Because the Berino continues under the dune sand with modest changes, we interpret the dune sand as a later deposit.

Mescalero samples from the vicinity of the WIPP site were studied using uranium-trend methods (Rosholt and McKinney, 1980). They were interpreted by these writers as indicating an age of 570,000± 110,000 years for the lower part of the Mescalero and 420,000 -± 60,000 years for the upper part. The stratigraphic and radiometric data are consistent with an age for the Mescalero in the range of 500,000 years, though the calcrete features and radiometric ages also indicate the unit formed over a period of time. We will use the approximate age of 500,000 years for simplicity in further arguments about the significance of features at the Sand Point site. Rosholt and McKinney (1980) interpreted uranium-series data from the Berino soil samples as indicating the Berino formed about 330,000± 75,000 years. The "Berino soil" probably represents a remnant B horizon for the Mescalero (Bachman, 1980).

Site geomorphology

The main elements of the site are the slightly sloping "uplands" in the north and northwest part of the site, lower elevation drainage areas in the south and southeast and steeper (4-8%) slopes in the transition between the higher and lower areas. Dune sands have overlain and somewhat obscured the main elements. Drainage courses are almost nonexistent within the boundaries of the proposed site. The low area along the southeast corner includes some minor channels, but upgradient and downgradient areas include stretches with no definable channeling. A drainage course through thicker dune sands to the east of the site is maintained because Mescalero caliche exists at the base of the dune sand. Runoff through this area is capable of carrying a bedload because of this resistant base. Where the Mescalero is deeper, the accumulated surface water tends to seep through rather than follow a channel. The drainage area that includes the site and upstream areas from the low point of the site is estimated to be less than 1.5 mi¹. The site is naturally protected from significant erosion by resistant caliche, infiltration in unconsolidated dune sand, low rainfall and high evapotranspiration and a small drainage area.

Hydrological character

Four drill holes at the site (SP G/H-lA, -2, -3 and -4) were completed as hydrological observation wells by mid-1992 (Figs. 3, 4). No testing

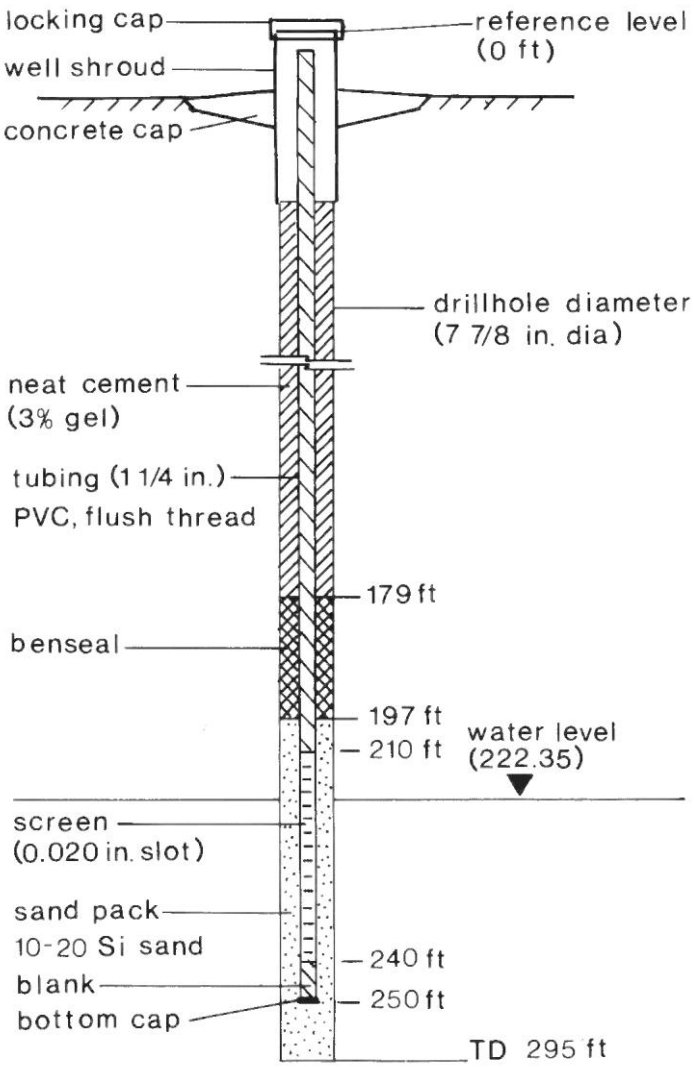

FIGURE 4. As-built configuration of SP G/H-3. SP G/H-1a, G/H-2 and G/H-4 have similar configurations.

has been conducted at the site through March 1993. The drill holes were drilled with foam where necessary. Some of the soft sands of the Gatufia, probably eolian in origin, were difficult to control during drilling. We were uncertain of the presence of ground water in the first hole (G/H-l) drilled, as the borehole was unstable and some foam and fluid were used during drilling. Subsequent drill holes provided experience and data about the ground water levels in the area and the first location was redrilled (G/H-IA) and successfully completed. Flush-threaded PVC was installed in each well with at least 30 ft of screen roughly centered at the estimated static level of ground water (Fig. 4). Sand packs were topped by a bentonite seal and the remaining tubing was grouted back to the surface. Each well was completed with a small surface concrete pad and well shroud with padlocked cover. The cover was surveyed to provide a permanent elevation reference point.

A series of water level measurements has been made since the holes were completed and the water levels are now showing only minor changes (Table 2). Rough contours of the ground water surface indicate potential flow from the southwest toward the northeast or east due to the low elevation on G/H-4 (Fig. 5). This pattern has not changed since water level measurements began. The regional ground water flow might be expected to move from north to south (Geohydrology Associates, unpubl. report to BLM, 1978), but those data are widely scattered.

Before concluding that the flow is in the indicated direction, the specific gravity of the fluid in each drill hole should be carefully determined. Modest differences can significantly affect the apparent direction of flow because many units in southeastern New Mexico have low hydraulic conductivity, it was planned before drilling that these wells would not be pumped or tested until fluid level reached stable levels. As the gradient is an important factor in locating monitor wells, it was essential to obtain early water levels; pumping low conductivity units in early testing can greatly lengthen the period to reach equilibrium. Testing after determining the ground water levels and specific gravity should greatly improve detailed knowledge of the hydrologic character of the site.

TABLE 2. Recent ground water measurements at the Sand Point site.

Borehole	Shroud Cap Elevation (ft)	Ground Water Elevations (ft) Ground Water Depths (ft) 01/07/93	03/12/93
SP G/H-1A	3322.68	**3154.30**	**3154.09**
		168.38	168.59
SP G/H-2	3372.72	**3151.93**	**3151.52**
		220.79	221.20
SP G/H-3	3372.99	**3150.64**	**3150.49**
		222.35	222.50
SP G/H-4	3343.56	**3146.75**	**3146.35**
		196.81	197.21

Mescalero caliche and other calcareous units within the Gatuňa should allow very little or no surface recharge of the ground water from the site surface.

OTHER SITE SELECTION FACTORS

Some site selection factors can readily be dismissed. The site is not on an active alluvial fan and there are no known faults of tectonic origin in the area. Resources are a minor potential problem. Exploratory potash drilling in the vicinity has not resulted in any development. There may be a loss to a potential leaseholder for oil and gas exploration, though

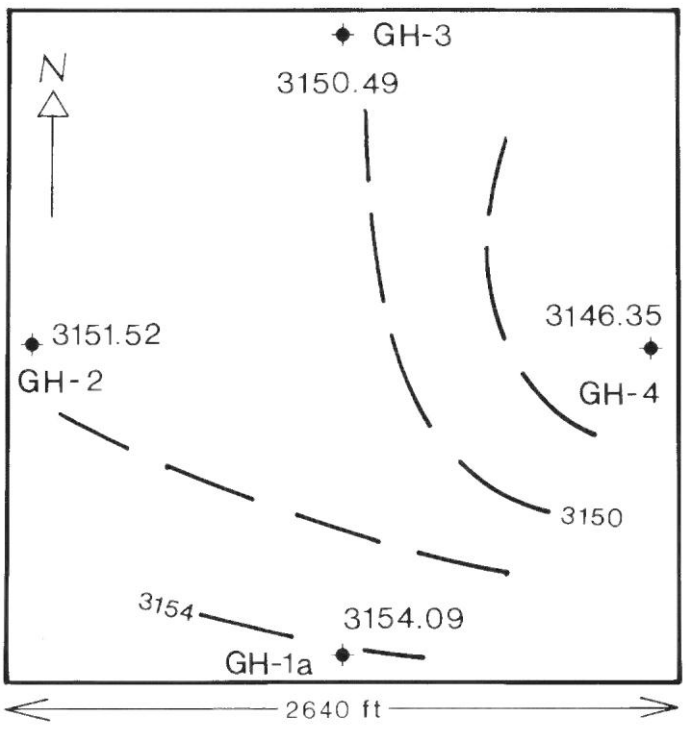

FIGURE 5. Ground water elevations (in feet; March 1993) at the proposed Sand Point landfill site uncorrected for fluid density. Contours are estimated.

it is unlikely that much (if any) resource would be lost by preventing drilling over an area of 160 acres. Wells have been drilled in adjacent sections.

A more significant geological/hydrological factor is karst. Though there are no karst features at the site or immediate vicinity, they are present in Indian Flats, to the south and Burton Flat, to the north. Nash Draw, farther east, includes sinkholes as well (Bachman, 1980, 1981). We interpret the Gatuňa —Dewey Lake relationship at the site and a modest increase in Dewey Lake thickness as evidence of some probable regional solution of Salado Formation salt and subsidence before the Gatuňa was deposited. The Mescalero, however, occurs on some slopes with gradients of a few percent, consistent with either formation on such a slope or with some very minor additional subsidence in the southeastern corner of the site in the last 500,000 years. These features indicate neither karst nor enhanced permeability related to karst.

PERMITTING

In the period between submitting this paper and the field conference, it is expected that JOAB and its consultants will apply on behalf of local governments to the State of New Mexico for a permit for a solid waste landfill at Sand Point. More hydrological testing is expected and monitor wells will need to be located.

CONCLUSIONS

Several potential or suggested sites and locations in the vicinity of Carlsbad were examined for a new landfill site to serve Eddy County and Carlsbad. A potential site at Sand Point, east of Carlsbad, has been extensively characterized and appears to be suitable. Ground water is more than 100 ft below the expected depth of a landfill and the water levels appear to have stabilized. The surface features indicate natural erosion has been limited because of caliche cover, modest slopes, small drainage area, limited rainfall and large evapotranspiration. There are no known faults and the site is not located on an alluvial fan or near other restrictive natural features: The site meets criteria in NMED and EPA regulations and it is well located with respect to population centers and access.

Drilling established that the Gatuňa Formation, which should provide reasonable material to excavate for the landfill, is nearly 300 ft thick. The Dewey Lake Formation appears slightly thicker than was expected from regional relationships and it may have been partially protected from pre- Gatuňa erosion by local subsidence.

ACKNOWLEDGMENTS

This preliminary account is based on work by the authors while consultant (Powers) to and employee (Magee) of JOAB. The official record of the project will be the information provided as part of the application for a permit. We thank Brad Dugas (JOAB) and Fred Small (GMA) for reviewing the draft.

REFERENCES

Bachman, G. 0., 1980, Regional geology and Cenozoic history of Pecos region, southeastern New Mexico: U.S. Geological Survey, Open-file Report 80-1099, 116 p.

Bachman, G. 0., 1981, Geology of Nash Draw, Eddy County, New Mexico: U.S. Geological Survey, Open-file Report 81-31, 8 p.

Chugg, J. C., Anderson, G. W., King, D. L. and Jones, L. H., 1971, Soil survey Eddy area, New Mexico: U.S. Department of Agriculture, Soil Conservation Service, 82 p.

Hendrickson, G. E. and Jones, R. S., 1952, Geology and ground-water resources of Eddy County, New Mexico: New Mexico Bureau of Mines and Mineral Resources, Ground-water Report 3, 169 p.

Richey, S. F., 1989, Geologic and hydrologic data for the Rustler Formation near the Waste Isolation Pilot Plant, southeastern New Mexico: U.S. Geological Survey, Open-file Report 89-32, 72 p.

Robinson, T. W. and Lang, W. B., 1938, Geology and ground-water conditions of the Pecos River valley in the vicinity of Laguna Grande de la Sal, New Mexico, with special reference to the salt content of the river water: Twelfth and Thirteenth Biennial Reports of the State Engineer of New Mexico, p. 77-118.

Rosholt, J. N. and McKinney, C. R., 1980, Uranium series disequilibrium investigations related to the WIPP site, New Mexico, Part II: Uranium trend dating of surficial deposits and gypsum spring deposit near WIPP site, New Mexico: U.S. Geological Survey, Open-file Report 80-879, p. 7-11.

Sink holes in Rustler Formation overlain by Plio-Pleistocene gypsite at east edge of US-285 at Milepost 12 (Day 1, mile 133.7).