Results of a Shallow Seismic Refraction Survey near Gilberts in Kane County, Illinois

Timothy H. Larson
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Open File Series 1992-12

ILLINOIS STATE GEOLOGICAL SURVEY
Morris W. Leighton, Chief

Natural Resources Building
615 East Peabody Drive
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ABSTRACT

The buried Gilberts bedrock valley is a narrow west-east-trending bedrock channel in north-central Kane County. A shallow seismic refraction survey was used to improve the definition of the channel, which occurs at a depth of 230 to 250 feet beneath the land surface. The St. Charles aquifer, a major sand and gravel aquifer, is up to 80 feet thick where it occurs at the base of the Gilberts bedrock valley. The seismic survey generally confirmed previous estimates of the location and depth of the buried valley.

INTRODUCTION

Seeking to augment its municipal water supply, Gilberts contacted the Illinois State Geological Survey (ISGS) for information concerning the groundwater potential of shallow sand and gravel aquifers and shallow bedrock aquifers underlying an area of north-central Kane County in and near the town (fig. 1). The primary study area consisted of the eastern two-thirds of Rutland Township (T42N, R7E) and the western sections of Dundee Township (T42N, R8E). This study of the shallow groundwater resources supplements a recent survey that concentrated on potable water resources of the deep bedrock aquifers (Rempe-Sharpe and Associates 1990).

Existing regional maps (Curry and Seaber 1990) suggest that a buried bedrock valley, referred to as the Gilberts bedrock valley in this report, lies beneath the area. Aquifers fill similar bedrock valleys in other areas of Kane County, thus the buried bedrock valley was a target for exploration. The ISGS conducted a detailed seismic refraction survey to define the location of the buried Gilberts bedrock valley in the study area.

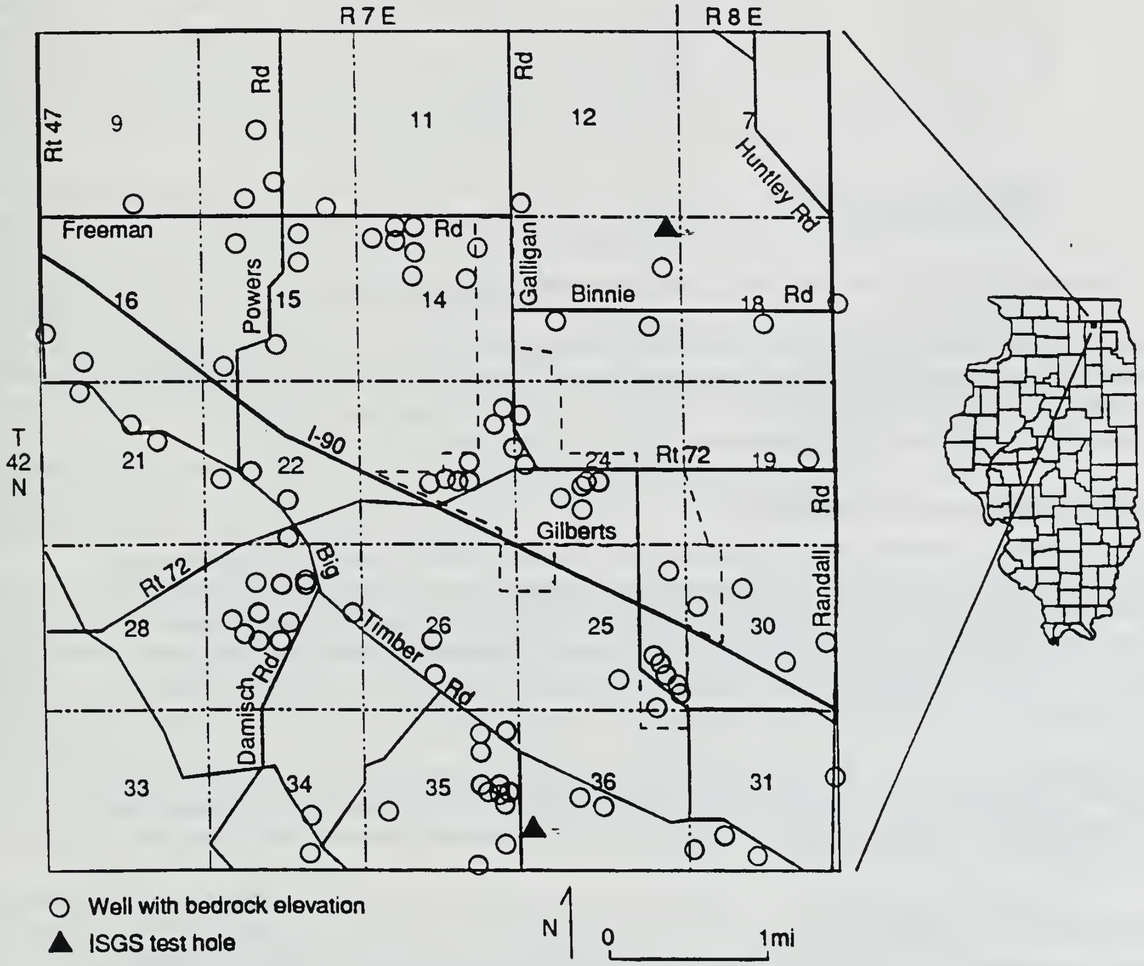

Figure 1 Location of study area. Wells used as data for preparing this report are shown as circles.

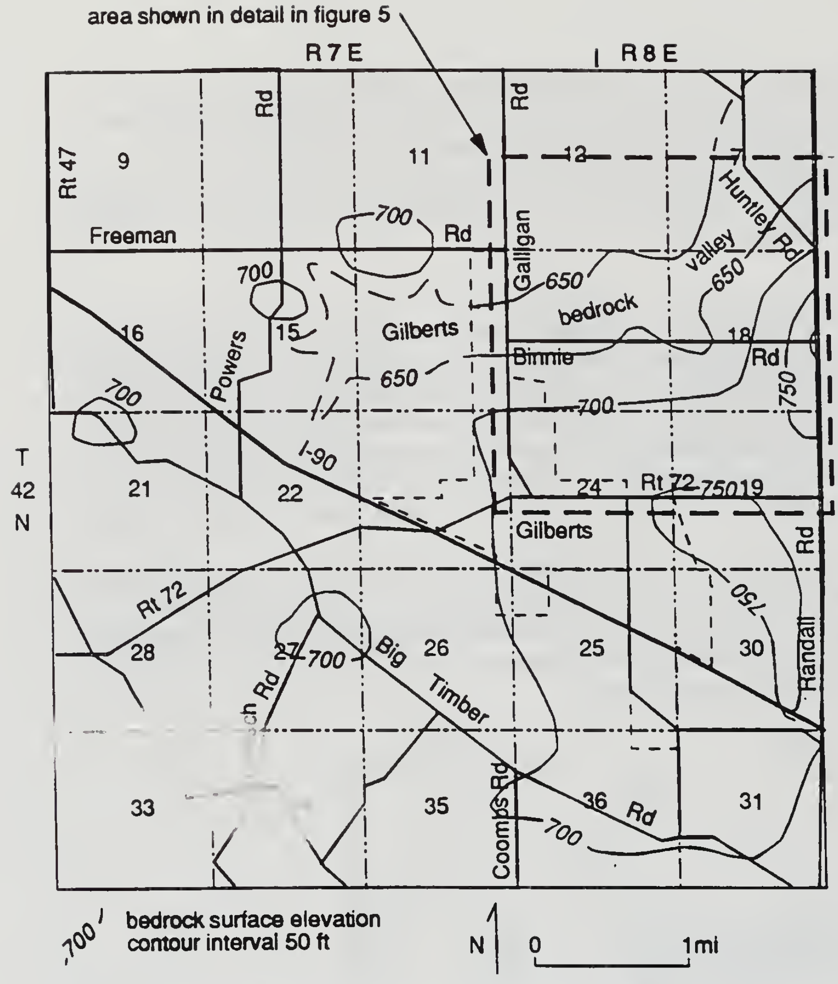

Figure 2 Bedrock surface elevations, shown as feet above mean sea level.

This report (1) reviews the existing hydrogeologic information relative to the shallow ground-water needs of the village; (2) describes the seismic investigations to locate the buried Gilberts bedrock valley; (3) refines, on the basis of the seismic data, the regional hydrogeologic framework; and (4) concludes with recommendations for siting new shallow wells.

REVIEW OF EXISTING INFORMATION

Over the past decade, the ISGS has conducted several similar investigations for Kane County and several municipalities within the county, and thus acquired a considerable database on the shallow groundwater resources of the region. Data compiled for the regional Kane County groundwater investigation (Curry and Seaber 1990) were particularly useful in preparing this report (fig. 1). Records of private water wells provided most of the data, but generally not the detailed hydrogeologic information.

The ISGS previously drilled two geologic test holes in the area (Reed 1975); these tests provide primary geologic control. One drill hole is in the Binnie Forest Preserve at the northeast corner of Section 13, Rutland Township. The other is along Coombs Road at the southwest corner of Section 36, Rutland Township.

HYDROGEOLOGIC FRAMEWORK

The shallow bedrock in Kane County consists of the Kankakee and Elwood Formations, Silurian in age and composed mostly of dolomite, and the Maquoketa Group, Ordovician in age and

Table 1 Informal classifications of the Prairie Aquigroup, as defined by Curry and Seaber (1990).

Hydrostratigraphic unit	*General characteristics*	*Comparable stratigraphic unit*
Pingree Grove aquiformation	stratified lake deposits	Cahokia Alluvium, Grayslake Peat, and Equality Formation
Valparaiso aquifer (not present in Gilberts area)	outwash sand and gravel	outwash of Haeger Till Member of Wedron Formation, and Henry Formation
Elburn aquiformation	mostly till, some outwash	Yorkville and Malden Till Members of Wedron Formation
Kaneville aquifer member	outwash sand and gravel	Henry Formation and outwash of Yorkville and Malden Till Members
Marengo aquitard	thick clayey till	Tiskilwa Till Member of Wedron Formation
Bloomington aquifer (not present in Gilberts area)	outwash sand and gravel	Henry Formation, outwash of Tiskilwa Till Member
St. Charles aquifer	sand and gravel in buried bedrock valleys	outwash of Tiskilwa Till Member of Wedron Formation, and Glasford Formation

composed of shale and argillaceous dolomite. The shallow bedrock is fractured and stores sufficient water to serve as an aquifer, which is called the shallow dolomite aquifer and formally known as the Upper Bedrock Aquigroup (Curry and Seaber 1990).

Unconsolidated sediments above the bedrock are primarily glacial in origin. The glacial deposits consist mostly of boulders and clay in a very poorly sorted mixture called till, and deposits of sand and gravel called outwash. Also present are stratified deposits of sand, silt, and clay, the remnants of ancient lakes that formed in association with the glaciers. Several episodes of glaciation in northern Illinois have resulted in 200 to 250 feet of complexly layered deposits.

The bedrock surface, although buried by Pleistocene glacial deposits, probably resembles the modern topography of hills and valleys (fig. 2). Buried bedrock valleys generally contain the thickest deposits and the greatest volume of sands and gravels of glacial-fluvial origin. Given the high hydraulic conductivity of these valley-fill sands and gravels, the bedrock valleys have the greatest potential for containing predictable and high-yielding aquifers. Also, bedrock valley aquifers can be recharged both from water infiltrating through the overlying drift and from groundwater stored in fractures in weathered bedrock of the valley walls and immediately below the glacial drift.

Not all valley-fill deposits consist of sands and gravels that are excellent aquifer materials; some deposits are fine-grained glacial till and lake bed sediments that are either poor aquifer materials or aquitards (Curry and Seaber 1990).

Data from the ISGS test hole in Binnie Forest Preserve and several other wells indicate that a small, buried bedrock valley trends west to east beneath the area north of Illinois route 72 (fig. 2). The channel occurs at a depth of about 230 to 250 feet approximately beneath Binnie Road in Section 13. The valley can be traced east and north to Algonquin beyond the study area. Previous, regional reports (Suter et al. 1959) suggested this bedrock valley extends east toward Lake Michigan and does not connect with the buried St. Charles bedrock valley to the south (Curry and Seaber 1990). Consequently, the Gilberts bedrock valley has been informally named for the village that lies immediately above it in this area. Data for the area west of Gilberts are very sparse, but apparently the valley begins beneath Sections 15 and 22 In Rutland Township.

Hydrogeologically, the glacial or surficial deposits above the bedrock are designated the Prairie Aquigroup. The Prairie Aquigroup has been informally divided into aquiformations by Curry and Seaber (1990) (table 1) and their terminology for aquifers and aquitards is followed in this report. An important hydrostratigraphic unit in the Prairie Aquigroup is the St. Charles aquifer,

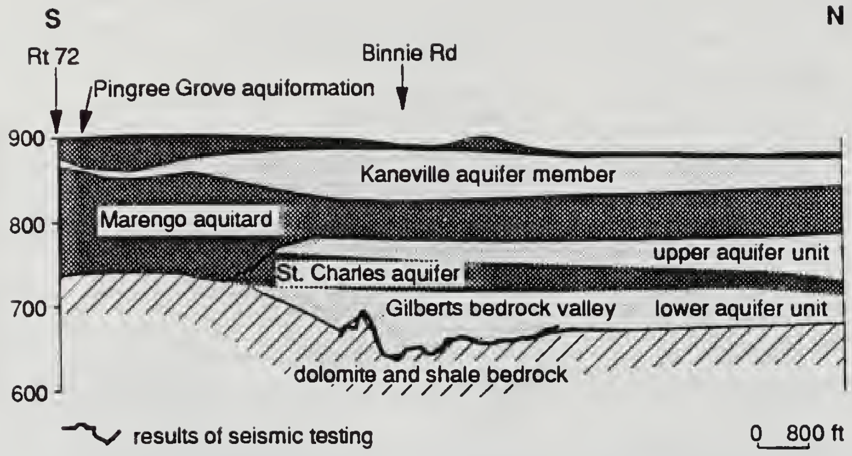

Figure 3 Simplified south-north cross section along Galligan Road.

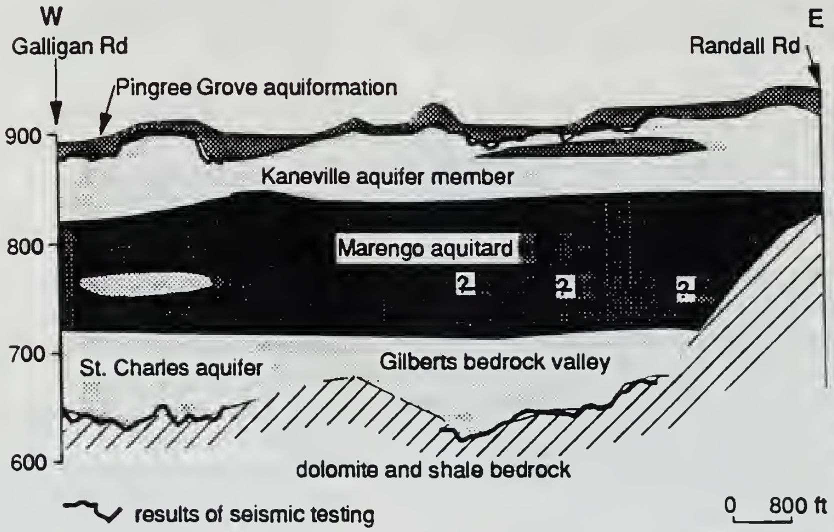

Figure 4 Simplified west-east cross section along Binnie Road.

consisting of sand and gravel that fills buried bedrock valleys, including the Gilberts bedrock valley. The Kaneville aquifer member of the Elburn aquiformation is of secondary importance. Near Gilberts, the Kaneville aquifer member is separated from the underlying St. Charles aquifer by the Marengo aquitard, a thick till unit that permits only very slow transfer of water between the two aquifers. The relationships between these hydrostratigraphic units are shown in two cross sections (figs. 3 and 4) and explained in the following text.

Upper Bedrock Aquigroup

As reported by Rempe-Sharpe and Associates (1990), the shallow bedrock consists of thin Silurian dolomite strata overlying Maquoketa Group shale and dolomite. In the west half of the area, the Silurian rocks are generally absent; only a few isolated occurrences have been reported. Normally, the Maquoketa Group rocks are not considered aquifer materials. Where they occur at or near the bedrock surface, however, they are typically fractured and sometimes yield moderate amounts of water to properly constructed wells (Visocky et al. 1985). The yield of a shallow bedrock well is often enhanced if it is located where a sand and gravel aquifer, such as the St. Charles aquifer, occurs above the bedrock.

Prairie Aquigroup

St. Charles aquifer Wells have encountered between 35 and 80 feet of sand and gravel belonging to the St. Charles aquifer at the base of the Gilberts bedrock valley. In some places, two distinct aquifer units are separated by a till unit. At other places, only one aquifer unit occurs in the bedrock valley below the Marengo aquitard.

The lower aquifer unit is the principal one in the St. Charles aquifer. At the Binnie Forest Preserve, it consists of 28 feet of sand and gravel separated from the upper aquifer unit by 7 feet of clay (Reed 1975). Other well logs for the area record up to 80 feet of sand and gravel at the base of the bedrock valley below the Marengo aquitard.

A clayey unit, in places up to 30 feet thick and containing wood and other organic material, commonly occurs below the upper aquifer unit or immediately beneath the Marengo aquitard where the upper aquifer unit is absent. Traceable throughout central Kane County, this clayey unit represents an ancient soil buried by glaciation. Radiocarbon dates obtained from the organic material show it to be 20,000 to 50,000 years old (Wickham et al. 1988).

The soil zone is significant not only because it is a local confining unit, but more importantly, because it is the most probable source of the methane gas commonly found in shallow water wells of the area. The methane (along with nitrogen and small amounts of other gases) is produced by bacterial decomposition of organic material. The gas dissolves in the groundwater, which migrates away from the soil zone. Analysis of gas samples from two bedrock wells in the area shows that the methane originated in the organic zone above the bedrock (Coleman 1976). Gas has been reported in water wells throughout the area and can be expected in any shallow well completed below the Marengo aquitard.

Several well records for the area provide evidence for more than one sand and gravel aquifer separated by a clayey unit and underlying the Marengo aquitard. Several private wells north of route 72 tap a sand and gravel aquifer just below the Marengo aquitard. Reed (1975) reported encountering an upper unit of sand at depths of 168 to 187 feet at the Binnie Forest Preserve test well. This upper unit of the St. Charles aquifer is poorly developed or absent in the south half of the area. It thickens northward, attaining a thickness of about 30 feet beneath Binnie Forest Preserve. Data are insufficient to determine its continuity and maximum extent.

Marengo aquitard The thick, clayey Marengo aquitard dominates the shallow hydrogeology of the Gilberts area. The unit, which forms the prominent Marengo Ridge several miles west of Gilberts, dips gently to the east and ranges from depths of only a few feet to greater than 50 feet in the area (Wickham et al. 1988). This 80- to 100-foot-thick aquitard greatly restricts the downward movement of water and isolates the deeper aquifers from infiltration of shallow water. Although the presence of the aquitard reduces the potential recharge to deeper aquifers, it also provides a measure of protection from surface contamination.

Elburn aquiformation, Kaneville aquifer member The higher ground south and east of Gilberts and underlying the Pingree Grove aquiformation is composed of glacial materials grouped into the Elburn aquiformation. It overlies the Marengo aquitard throughout the Gilberts region. Most of the Elburn aquiformation materials are not aquifers; however, a sand unit, the Kaneville aquifer member, has been mapped in the region. It generally occurs near the base of the Elburn aquiformation and ranges from less than 10 feet to more than 40 feet in thickness.

Although the data are too sparse to be definitive, the Kaneville appears to be thin or absent west and south of Gilberts. It is only about 10 feet thick beneath the village (at the intersection of route 72 and Galligan Road) but becomes 40 to 60 feet thick to the east and north. In some places, this aquifer may merge with sand and gravel of the Pingree Grove aquiformation. Because data are insufficient to differentiate between the two units, it was all mapped as the Kaneville aquifer member by Curry and Seaber (1990).

In the Gilberts area, unlike in other areas of Kane County, no evidence indicates that the Kaneville aquifer member is connected to the underlying St. Charles aquifer. The two aquifers are separated everywhere by the Marengo aquitard.

Many private wells in the northeastern quarter of the area use the Kaneville aquifer member. Included among these wells are those at the Randall Oaks Golf Course (Section 18, Dundee Township) and the Dundee Middle School (Section 19, Dundee Township), as listed in the engineering survey of potable water resources (Rempe-Sharpe and Associates 1990). It is likely that other wells of similar magnitude (200 to 300 gallons per minute) could be developed in this aquifer. Because the top of this aquifer occurs from 0 to about 40 feet deep, it must be protected from contamination from surface sources.

Pingree Grove aquiformation Most of the flat, swampy areas west and northeast of Gilberts are relics of glacial Lake Pingree (Willman and Frye 1970) that covered this area at the time of the last glaciation. Some geologists also interpret the hilly area west of Gilberts as part of this lake complex (Wickham et al. 1988). These lake deposits form the Pingree Grove aquiformation. Because they are not regionally extensive, they were not mapped by Curry and Seaber (1990); however, they may be as much as 30 to 40 feet thick in the Gilberts area. Very little of the Pingree Grove aquiformation can be considered aquifer materials, although some of the thick sand and gravel deposits just north of the study area (Section 1, Rutland Township) may be part of the Pingree Grove aquiformation. Detailed analysis of the materials is necessary to differentiate them from the underlying Elburn aquiformation.

DETAILED SEISMIC REFRACTION SURVEY

A seismic refraction survey was undertaken to more closely define the Gilberts bedrock valley. The seismic refraction method was chosen for this investigation because it provides information on the depth of bedrock at considerably less expense than that of drilling. The seismic refraction method cannot totally replace test drilling, but it can be used as a means of focusing attention on the most promising areas for test drilling.

The locations of the seismic refraction profiles are shown in an appendix to this report and on figure 5. These sites were chosen to determine the geometry of the buried Gilberts bedrock valley. In particular, the profiles were expected to locate the deepest portions and trace the length of the buried valley in the Gilberts area. In general, the refraction data confirmed previous maps of the buried bedrock valley.

Methodology

Seismic refraction surveys record the seismic energy produced by a small charge of explosive, transmitted through various geologic materials, refracted by an underground interface (between the glacial deposits and bedrock surface), and returned to ground surface. The recorded information is used to calculate the depth to the bedrock surface beneath the shot point and sensors. The method has been successfully employed to locate buried bedrock valleys elsewhere in northern Illinois (Gilkeson et al. 1987, Heigold 1990).

For this study, 24 14-Hz geophone sensors were laid in 1,150-foot lines, or spreads, with individual geophones spaced at 50-foot intervals along the spread. At each spread, energy was recorded from at least two and as many as five shots. At a minimum, shots were located at both ends of the spread; to obtain additional resolution, some spreads recorded energy from shots offset several hundred feet from the end of the spread or in the middle of the spread. The maximum energy source was a 1-pound charge of explosive buried in a hole 5 feet deep.

Refraction data were interpreted using the modified delay time and ray tracing methods, which were both incorporated into the computer program SIPT2 (Scott et al. 1972, Rimrock Geophysics 1992). The program calculates the elevation of the bedrock beneath each geophone and certain shot points. It automatically compensates for variations in ground surface elevation and changes in the thickness of the near surface, low velocity zone.

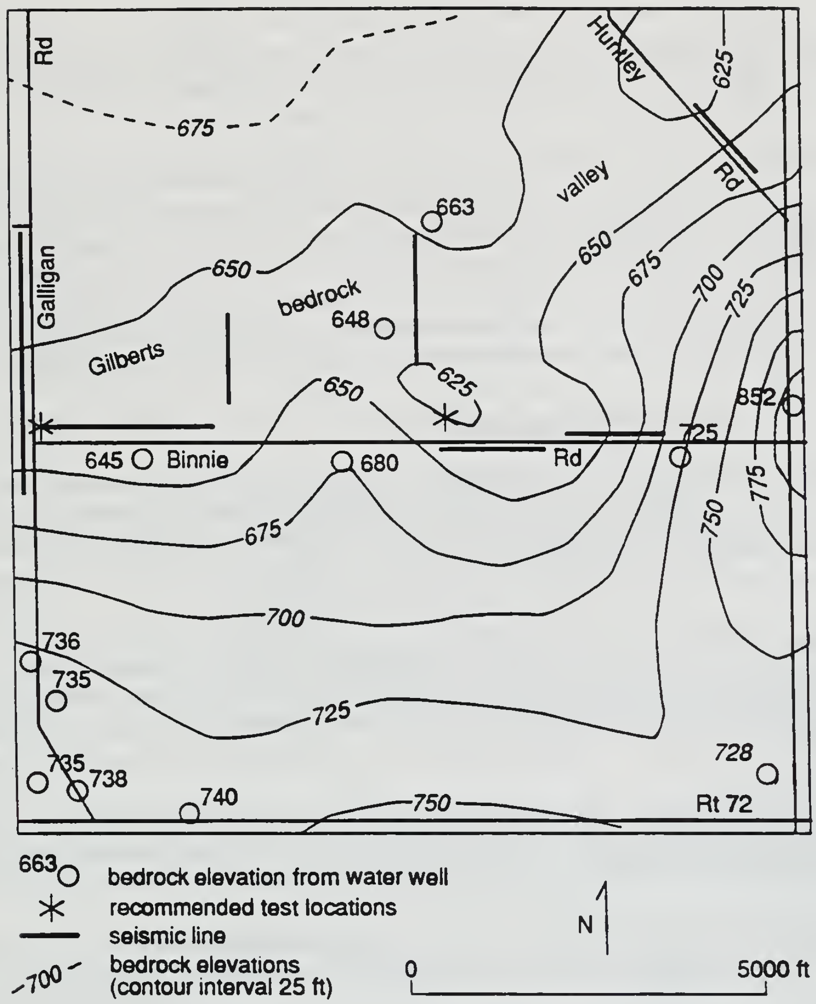

Figure 5 Detail of bedrock topography incorporating seismic data.

One shortcoming of the seismic refraction method is that it overestimates the depth to bedrock when a thick sand and gravel layer is present beneath thick till. This situation can occur where the Marengo aquitard overlies the St. Charles aquifer within a bedrock valley. The seismic refraction method fails to detect the sand and gravel layer "hidden" beneath the till. This results in a depth estimate that is too great. Because the results of the seismic testing are consistent with available well data, the "hidden" layer problem is unlikely to be significant for this area. One possible exception may be the interpeted bedrock low in the southeast corner of Binnie Forest Preserve. The bedrock elevation of 618 feet, calculated from the seismic data, may be too deep for this area.

Results

The energy from 47 shots along 11 seismic spreads was recorded in this investigation. Results from each spread appear in an appendix to this report.

The shallow earth structure was assumed to consist of three seismic layers: a thin upper layer (about 10 to 25 ft thick) representing soil, a relatively thick intermediate layer (about 200 to 250 ft thick) representing glacial deposits, and a lower layer representing bedrock. The seismic velocity of the upper layer was assumed to be 2,500 feet per second (ft/s). For each spread, the other two layers were allowed to vary in velocity and the two interfaces were allowed to vary in depth and orientation.

Seismic velocity of the glacial material ranged from 6,450 to 6,850 ft/s, averaging 6,600 ft/s for the 11 spreads. These velocities are typical of glacial materials in northern Illinois (Larson and Orozco 1991). Velocities for the bedrock are typical of carbonate rock; they range from 14,200 to 17,000 ft/s, and average 15,750 ft/s for the 11 spreads.

Depth information from these spreads was incorporated into the existing database to provide an updated map of the bedrock surface elevation. Figure 5, a revised map for part of the area shown in figure 2, incorporates the new seismic information into the existing database. For the most part, the seismic information has not changed the estimates of bedrock elevation; however, the bedrock valley is shown to be more sinuous than it was previously interpreted to be. Within this mapped area, the addition of seismic data allows the bedrock topography to be mapped at a higher resolution than otherwise possible with only the well data.

CONCLUSIONS AND RECOMMENDATIONS

Three distinct, shallow aquifer systems occur in the Gilberts area. Closest to the land surface is the Kaneville aquifer member of the Elburn aquiformation. It varies in thickness and may not be continuous over the entire area; but in places, it is between 40 and 60 feet thick. Many small and several moderately large capacity wells use this aquifer. The Marengo aquitard, 50 to 100 feet thick, separates the Kaneville from underlying aquifers.

The St. Charles aquifer beneath the Marengo aquitard occurs within the Gilberts bedrock valley. Seismic testing has improved the definition of the buried Gilberts bedrock valley north of Gilberts. The water-bearing characteristics of the sediments within the buried valley have not been determined.

Several moderately high capacity wells have been completed in the shallow bedrock, despite the shaley character of the rocks in the area. Apparently, the bedrock is fractured and, in places, hydraulically connected with overlying sand and gravel aquifers.

Methane and nitrogen gases dissolved in the groundwater cause problems throughout the area. The St. Charles and shallow bedrock aquifers are likely to contain gassy water.

The next step in a groundwater investigation would be to drill one or more test holes for detailed sampling of the geologic material and testing of the aquifers. These test holes should be drilled through the entire thickness of glacial materials and continue into the bedrock. As indicated by the results of this seismic investigation, the best locations (fig. 5) to test for the St. Charles aquifer are near the intersection of Galligan and Binnie Roads or in the south half of the Binnie Forest Preserve.

ACKNOWLEDGMENTS

This project was partially supported by the Village of Gilberts, represented by Darlene Mueller, Village Clerk, through a Scientific Research Agreement with the University of Illinois. We were assisted by William Gain of Rempe-Sharpe and Associates. We thank many officials and private citizens from Kane County and the Gilberts area for their cooperation, including Dave Grupe, Larry Leisburg, Chuck Behm, Mike Wilkerson, and Charles Swanson. Edward Smith and Robert Vaiden of the ISGS assisted in data collection.

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APPENDIX

Seismic refraction data were collected using a 24-channel signal-enhancement seismograph. This method uses a buried explosive charge as an energy source to produce seismic waves, which are recorded and interpreted. Field data were processed with a ray tracing program called SIPT-2 (Scott et al. 1972). The SIPT-2 program corrects for irregular surface terrain along the seismic profile and also calculates depth to bedrock beneath each geophone. Geophones were spaced 50 feet apart along spreads 1,150 feet in length. The shot points and spread locations are shown in figure A-1.

The tables in this appendix present input and output from the SIPT-2 program for each spread.

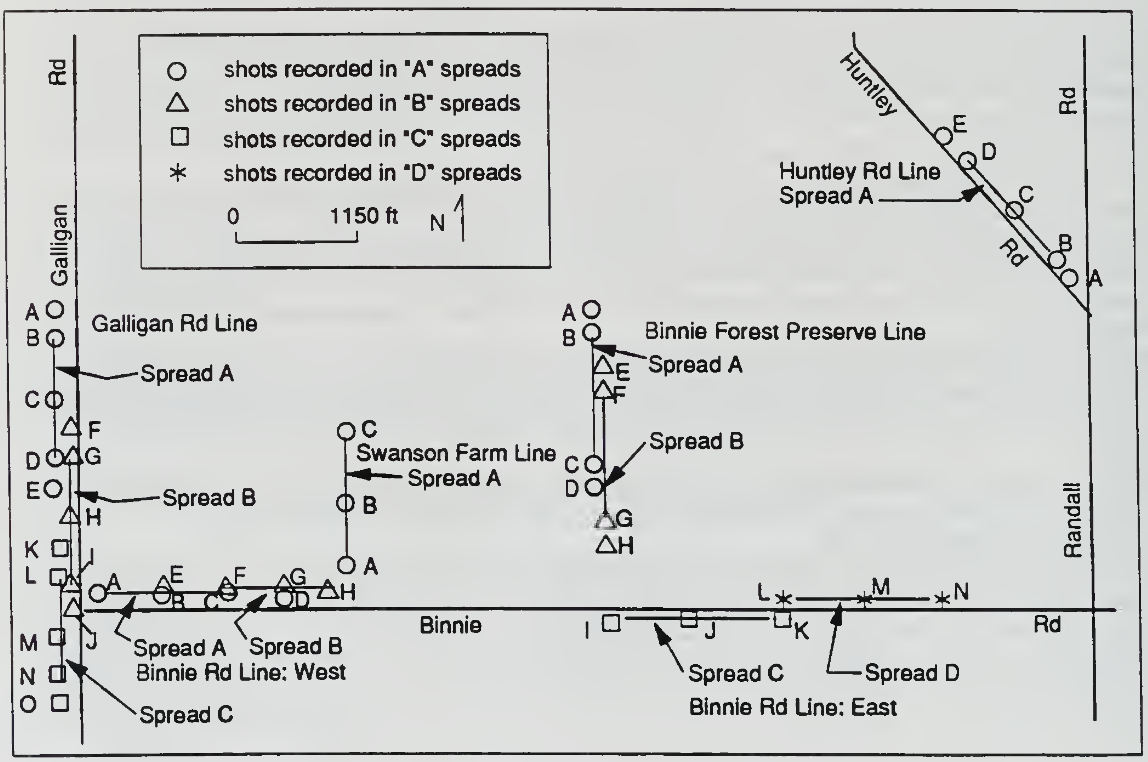

Figure A-1 Location of seismic lines showing spreads and shot points.

Gilberts -- Binney Woods FP Seismic Line GIL01-08; March 1992

SIPT2 V-3.2 --- SEISMIC REFRACTION INTERPRETATION PROGRAM

RIMROCK GEOPHYSICS, INC.

DATA FILE: a:binney1a.sip PRINT FILE: \sip\data\binney1c.fil
RUN DATE AND TIME: 5-19-1992 at 13:39

SHOTPOINT AND GEOPHONE INPUT DATA

Spread A, 4 Shotpoints, 24 Geophones, X-Shift = 0.0, X-True = 0

SP	Elev	X-Loc	Y-Loc	Depth
A	898.0	.0	.0	5.0
B	900.0	300.0	.0	5.0
C	910.0	1500.0	.0	5.0
D	906.0	1800.0	.0	5.0

Arrival Times and Layers represented

Geo	Elev	X-Loc	Y-Loc	SP A T	SP A L	SP B T	SP B L	SP C T	SP C L	SP D T	SP D L
1	900.0	325.0	.0	62.2	2	12.5	2	155.2	3	168.7	3
2	899.0	375.0	.0	73.2	2	20.2	2	152.5	3	167.0	3
3	898.0	425.0	.0	79.5	2	26.2	2	147.5	3	162.2	3
4	897.0	475.0	.0	84.2	2	32.0	2	145.0	3	158.2	3
5	896.0	525.0	.0	94.5	2	41.7	2	142.5	3	156.7	3
6	895.0	575.0	.0	102.5	2	49.5	2	139.2	3	155.0	3
7	896.0	625.0	.0	109.7	2	56.0	2	135.0	3	149.7	3
8	897.0	675.0	.0	117.5	3	64.0	2	132.0	3	147.0	3
9	898.0	725.0	.0	122.0	3	70.0	2	127.5	3	142.5	3
10	899.0	775.0	.0	124.5	3	77.5	2	123.7	3	140.0	3
11	900.0	825.0	.0	128.0	3	85.0	2	112.5	2	138.5	3
12	902.0	875.0	.0	132.5	3	97.2	2	104.5	2	135.0	3
13	904.0	925.0	.0	135.0	3	99.2	2	97.5	2	132.5	3
14	906.0	975.0	.0	137.5	3	109.7	2	88.2	2	127.5	2
15	910.0	1025.0	.0	140.0	3	115.7	2	80.5	2	120.0	2
16	910.0	1075.0	.0	142.5	3	123.7	3	75.0	2	113.5	2
17	910.0	1125.0	.0	149.0	3	127.5	3	67.5	2	107.0	2
18	910.0	1175.0	.0	151.0	3	132.5	3	62.0	2	101.0	2
19	910.0	1225.0	.0	154.7	3	135.0	3	53.2	2	93.5	2
20	910.0	1275.0	.0	158.0	3	137.2	3	45.0	2	84.7	2
21	910.0	1325.0	.0	160.5	3	141.7	3	38.7	2	78.7	2
22	910.0	1375.0	.0	163.7	3	143.5	3	30.0	2	71.2	2
23	910.0	1425.0	.0	167.5	3	150.0	3	26.2	2	67.2	2
24	910.0	1475.0	.0	171.0	3	152.5	3	17.5	2	60.0	2

Spread B, 4 Shotpoints, 24 Geophones, X-Shift = 600.0, X-True = 0

SP	Elev	X-Loc	Y-Loc	Depth
E	897.0	.0	.0	5.0
F	899.0	300.0	.0	5.0
G	902.0	1500.0	.0	5.0
H	903.0	1800.0	.0	5.0

Arrival Times and Layers represented

Geo	Elev	X-Loc	Y-Loc	SP E T	SP E L	SP F T	SP F L	SP G T	SP G L	SP H T	SP H L
1	904.0	325.0	.0	56.2	2	10.0	2	154.0	3	171.7	3
2	906.0	375.0	.0	63.7	2	18.5	2	150.0	3	170.5	3
3	910.0	425.0	.0	70.5	2	23.2	2	147.7	3	166.7	3
4	910.0	475.0	.0	77.5	2	33.0	2	145.5	3	164.7	3
5	910.0	525.0	.0	88.5	2	38.2	2	142.5	3	162.5	3
6	910.0	575.0	.0	97.5	2	48.0	2	140.2	3	159.5	3
7	910.0	625.0	.0	103.5	2	53.5	2	134.2	2	155.5	3
8	910.0	675.0	.0	110.0	2	61.2	2	127.2	2	151.7	3
9	910.0	725.0	.0	117.2	2	69.0	2	122.2	2	149.5	3
10	910.0	775.0	.0	125.0	3	77.0	2	114.0	2	147.0	3
11	910.0	825.0	.0	130.5	3	86.5	2	110.5	2	145.7	3
12	910.0	875.0	.0	133.7	3	93.2	2	102.7	2	142.7	3
13	909.0	925.0	.0	131.7	3	101.0	2	95.0	2	140.5	3
14	908.0	975.0	.0	136.7	3	104.2	2	84.0	2	133.7	3
15	907.0	1025.0	.0	141.5	3	111.5	2	78.5	2	130.7	3
16	906.0	1075.0	.0	146.0	3	121.0	2	72.8	2	128.0	3
17	905.0	1125.0	.0	147.2	3	127.0	3	64.3	2	120.0	2
18	905.0	1175.0	.0	149.5	3	129.7	3	55.3	2	111.2	2
19	905.0	1225.0	.0	153.2	3	132.7	3	50.3	2	99.8	2
20	905.0	1275.0	.0	154.7	0	136.0	3	41.5	2	91.0	2
21	904.0	1325.0	.0	161.0	0	140.2	3	37.0	2	84.5	2
22	904.0	1375.0	.0	165.0	0	143.5	3	28.5	2	77.3	2
23	903.0	1425.0	.0	169.5	0	148.7	3	21.0	2	70.5	2
24	902.0	1475.0	.0	167.5	0	150.5	0	10.8	1	59.8	2

Velocities used, Spread A

	Layer 1	Layer 2	Layer 3
Vertical	2500.	6849.	
Horizontal		6849.	15458.

Velocities used, Spread B

	Layer 1	Layer 2	Layer 3
Vertical	2500.	6849.	
Horizontal		6849.	15458.

Spread A Depth and Elev of layers directly beneath SPs and Geos

SP	Surface X-Loc	Surface Elev	Layer 2 Depth	Layer 2 Elev	Layer 3 Depth	Layer 3 Elev
B	300.0	900.0	13.3	886.7	259.4	640.6
C	1499.6	910.0	24.2	885.8	260.2	649.8
Geo						
1	325.0	900.0	15.2	884.8	235.5	664.5
2	375.0	899.0	17.9	881.1	246.4	652.6
3	425.0	898.0	15.8	882.2	257.3	640.7
4	475.0	897.0	13.7	883.3	266.7	630.3
5	525.0	896.0	19.0	877.0	265.0	631.0
6	574.9	895.0	19.8	875.2	264.6	630.4
7	624.9	896.0	18.8	877.2	265.6	630.4
8	674.9	897.0	16.6	880.4	266.9	630.1
9	724.9	898.0	14.2	883.8	266.4	631.6
10	774.9	899.0	15.3	883.7	265.1	633.9
11	824.9	900.0	19.6	880.4	263.1	636.9

12	874.9	902.0	23.6	878.4	261.9	640.1
13	924.8	904.0	18.8	885.2	260.3	643.7
14	974.8	906.0	18.0	888.0	259.5	646.5
15	1024.6	910.0	15.9	894.1	261.6	648.4
16	1074.6	910.0	18.1	891.9	260.2	649.8
17	1124.6	910.0	20.0	890.0	259.7	650.3
18	1174.6	910.0	23.5	886.5	259.4	650.6
19	1224.6	910.0	19.2	890.8	259.8	650.2
20	1274.6	910.0	18.0	892.0	259.6	650.4
21	1324.6	910.0	19.8	890.2	258.6	651.4
22	1374.6	910.0	18.1	891.9	255.6	654.4
23	1424.6	910.0	23.8	886.2	256.9	653.1
24	1474.6	910.0	24.1	885.9	259.7	650.3

Spread B Depth and Elev of layers directly beneath SPs and Geos

	Surface		Layer 2		Layer 3	
SP	X-Loc	Elev	Depth	Elev	Depth	Elev
F	899.8	899.0	17.2	881.8	257.1	641.9
G	2099.5	902.0	15.3	886.7	285.5	616.5
Geo						
1	924.8	904.0	18.8	885.2	260.3	643.7
2	974.8	906.0	18.0	888.0	259.9	646.1
3	1024.6	910.0	15.9	894.1	261.6	648.4
4	1074.6	910.0	18.1	891.9	260.2	649.8
5	1124.6	910.0	20.0	890.0	259.7	650.3
6	1174.6	910.0	23.5	886.5	259.4	650.6
7	1224.6	910.0	19.2	890.8	259.8	650.2
8	1274.6	910.0	18.0	892.0	259.6	650.4
9	1324.6	910.0	19.8	890.2	258.6	651.4
10	1374.6	910.0	18.1	891.9	255.6	654.4
11	1424.6	910.0	23.8	886.2	256.1	653.9
12	1474.6	910.0	24.1	885.9	259.7	650.3
13	1524.6	909.0	23.4	885.6	259.7	649.3
14	1574.6	908.0	15.4	892.6	256.2	651.8
15	1624.6	907.0	17.6	889.4	250.6	656.4
16	1674.6	906.0	22.8	883.2	247.1	658.9
17	1724.6	905.0	26.6	878.4	247.9	657.1
18	1774.6	905.0	26.1	878.9	250.6	654.4
19	1824.6	905.0	23.3	881.7	253.2	651.8
20	1874.6	905.0	20.8	884.2	261.0	644.0
21	1924.6	904.0	22.2	881.8	273.7	630.3
22	1974.6	904.0	23.2	880.8	287.5	616.5
23	2024.5	903.0	22.2	880.8	286.5	616.5
24	2074.5	902.0	17.3	884.7	285.5	616.5

Gilberts: Galligan Rd Seismic Line: shots:gi109-23; shot April, 1992

SIPT2 V-3.2 --- SEISMIC REFRACTION INTERPRETATION PROGRAM

RIMROCK GEOPHYSICS, INC.

DATA FILE: a:galligan.sip PRINT FILE: \sip\data\galliga5.fil
RUN DATE AND TIME: 5-20-1992 at 11:08

SHOTPOINT AND GEOPHONE INPUT DATA

Spread A, 5 Shotpoints, 24 Geophones, X-Shift = 0.0, X-True = 0

SP	Elev	X-Loc	Y-Loc	Depth
A	895.0	-675.0	.0	5.0
B	895.0	-25.0	.0	5.0
C	895.0	575.0	.0	5.0
D	895.0	1185.0	.0	5.0
E	895.0	1835.0	.0	5.0

Arrival Times and Layers represented

Geo	Elev	X-Loc	Y-Loc	SP A --T---L	SP B --T---L	SP C --T---L	SP D --T---L	SP E --T---L
1	895.0	.0	.0	109.7 3	10.0 2	99.0 2	145.5 3	187.7 3
2	895.0	50.0	.0	114.5 3	16.7 2	89.5 2	142.5 3	182.5 3
3	895.0	100.0	.0	117.2 3	24.2 2	80.5 2	139.0 3	178.7 3
4	895.0	150.0	.0	121.7 3	32.5 2	75.0 2	137.5 3	177.5 3
5	895.0	200.0	.0	126.7 3	41.5 2	70.0 2	136.2 3	176.5 3
6	895.0	250.0	.0	129.2 3	49.2 2	62.5 2	133.7 3	173.7 3
7	895.0	300.0	.0	131.2 3	56.0 2	52.7 2	128.5 3	169.2 3
8	895.0	350.0	.0	134.5 3	64.0 2	44.0 2	125.0 3	166.0 3
9	895.0	400.0	.0	138.0 3	71.7 2	37.2 2	122.5 3	163.0 3
10	895.0	450.0	.0	141.2 3	79.2 2	29.2 2	120.0 3	161.0 3
11	895.0	500.0	.0	145.2 3	87.7 2	20.0 2	113.7 2	158.5 3
12	895.0	550.0	.0	149.7 3	96.2 2	11.2 2	107.2 2	155.5 3
13	895.0	600.0	.0	152.5 3	103.7 2	10.2 2	98.2 2	151.7 3
14	895.0	650.0	.0	154.5 3	110.2 3	20.0 2	91.0 2	148.7 3
15	895.0	700.0	.0	157.7 3	115.2 3	29.0 2	82.7 2	145.0 3
16	895.0	750.0	.0	160.7 3	119.2 3	35.7 2	75.0 2	142.5 3
17	895.0	800.0	.0	164.2 3	121.7 3	42.5 2	66.5 2	138.7 3
18	895.0	850.0	.0	167.7 3	125.0 3	50.2 2	58.0 2	135.2 3
19	895.0	900.0	.0	170.0 3	128.0 3	57.2 2	51.5 2	131.7 3
20	895.0	950.0	.0	175.0 3	132.5 3	67.2 2	45.0 2	130.0 3
21	895.0	1000.0	.0	176.5 3	135.2 3	74.0 2	36.7 2	127.0 3
22	895.0	1050.0	.0	180.5 3	138.5 3	81.2 2	29.5 2	123.2 3
23	895.0	1100.0	.0	183.7 3	142.5 3	90.0 2	21.2 2	120.7 3
24	895.0	1150.0	.0	187.0 3	145.0 3	97.2 2	12.5 2	113.0 2

Spread 8, 5 Shotpoints, 24 Geophones, X-Shift = 1210.0, X-True = 0

SP	Elev	X-Loc	Y-Loc	Depth
F	895.0	-600.0	.0	5.0
G	895.0	-28.0	.0	5.0
H	895.0	575.0	.0	5.0
I	895.0	1175.0	.0	5.0
J	900.0	1775.0	.0	3.0

Arrival Times and Layers represented

Geo	Elev	X-Loc	Y-Loc	SP F	SP G	SP H	SP I	SP J
				--T---L	--T---L	--T---L	--T---L	--T---L
1	895.0	.0	.0	99.2 2	12.5 2	94.0 2	148.2 3	186.5 3
2	895.0	50.0	.0	107.0 2	18.2 2	84.5 2	143.0 3	185.0 3
3	895.0	100.0	.0	114.7 2	29.2 2	79.7 2	141.5 3	181.2 3
4	895.0	150.0	.0	119.2 3	36.2 2	71.5 2	138.0 3	176.0 3
5	895.0	200.0	.0	121.5 3	44.0 2	63.7 2	134.5 3	173.5 3
6	895.0	250.0	.0	124.0 3	49.2 2	55.0 2	129.5 3	168.0 3
7	895.0	300.0	.0	126.0 3	56.2 2	47.5 2	126.7 3	165.5 3
8	895.0	350.0	.0	130.7 3	63.7 2	40.0 2	124.0 3	161.0 3
9	895.0	400.0	.0	135.2 3	72.0 2	33.5 2	121.5 3	161.2 3
10	895.0	450.0	.0	137.5 3	78.0 2	24.7 2	116.5 3	155.5 3
11	895.0	500.0	.0	141.2 3	88.5 2	17.7 2	112.0 3	152.5 3
12	895.0	550.0	.0	145.2 3	98.0 2	10.5 2	104.7 2	150.7 3
13	895.0	600.0	.0	151.5 3	108.5 2	12.5 2	99.0 2	151.2 3
14	895.0	650.0	.0	152.5 3	114.0 3	19.2 2	87.5 2	147.7 3
15	895.0	700.0	.0	154.7 3	120.2 3	25.7 2	78.0 2	145.0 3
16	895.0	750.0	.0	158.2 3	124.7 3	34.0 2	69.5 2	142.7 3
17	895.0	800.0	.0	161.7 3	128.0 3	41.7 2	62.8 2	137.2 3
18	895.0	850.0	.0	164.7 3	129.7 3	48.8 2	54.5 2	133.0 3
19	895.0	900.0	.0	167.7 3	133.2 3	55.5 2	47.0 2	129.7 3
20	895.0	950.0	.0	171.0 3	138.7 3	65.2 2	41.5 2	128.7 3
21	895.0	1000.0	.0	175.0 3	142.7 3	73.7 2	35.8 2	125.2 3
22	895.0	1050.0	.0	178.5 3	144.5 3	81.7 2	26.8 2	119.5 2
23	895.0	1100.0	.0	179.7 3	147.5 3	86.7 2	16.3 2	112.5 2
24	895.0	1150.0	.0	181.2 3	148.0 3	94.5 2	8.5 2	104.5 2

Spread C, 5 Shotpoints, 24 Geophones, X-Shift = 2410.0, X-True = 0

SP	Elev	X-Loc	Y-Loc	Depth
K	895.0	-625.0	.0	5.0
L	895.0	-15.0	.0	5.0
M	900.0	575.0	.0	3.5
N	900.0	1050.0	5.0	5.0
O	900.0	1850.0	.0	5.0

Arrival Times and Layers represented

Geo	Elev	X-Loc	Y-Loc	SP K	SP L	SP M	SP N	SP O
				--T---L	--T---L	--T---L	--T---L	--T---L
1	895.0	.0	.0	101.5 2	7.7 2	95.5 2	151.2 3	209.7 3
2	895.0	50.0	.0	111.0 2	15.5 2	87.0 2	147.0 3	201.7 3
3	895.0	100.0	.0	117.2 2	22.2 2	79.5 2	146.2 3	198.7 3
4	895.0	150.0	.0	121.0 3	32.2 2	71.7 2	143.0 3	191.7 3
5	895.0	200.0	.0	123.2 3	38.2 2	62.7 2	139.5 3	188.5 3
6	895.0	250.0	.0	127.7 3	48.0 2	55.7 2	136.7 3	186.7 3
7	895.0	300.0	.0	129.2 3	53.5 2	47.0 2	130.7 3	180.5 3
8	895.0	350.0	.0	132.2 3	62.0 2	39.7 2	125.0 2	179.0 3
9	895.0	400.0	.0	138.2 3	71.2 2	33.0 2	115.7 2	173.0 3
10	895.0	450.0	.0	139.5 3	77.2 2	25.2 2	109.0 2	169.0 3
11	895.0	500.0	.0	145.0 3	87.5 2	19.0 2	103.7 2	165.7 3
12	900.0	550.0	.0	147.5 3	94.7 2	6.7 2	96.5 2	160.2 3
13	900.0	600.0	.0	151.0 3	102.0 2	9.5 2	87.8 2	157.5 3
14	900.0	650.0	.0	151.5 3	108.7 2	17.5 2	74.8 2	151.7 3
15	900.0	700.0	.0	155.2 3	117.2 2	25.2 2	69.3 2	150.7 3
16	900.0	750.0	.0	158.2 3	120.7 3	32.0 2	60.0 2	145.5 3
17	900.0	800.0	.0	161.5 3	124.0 3	39.2 2	53.5 2	143.0 3
18	900.0	850.0	.0	165.2 3	127.0 3	47.0 2	45.8 2	140.0 3
19	900.0	900.0	.0	169.2 3	129.7 3	55.7 2	39.0 2	136.5 3
20	900.0	950.0	.0	173.5 3	134.7 3	64.5 2	32.0 2	133.7 3
21	900.0	1000.0	.0	182.2 3	143.0 3	77.5 2	29.3 2	132.2 3

22	900.0	1050.0	.0	189.7 3	150.5 3	88.7 2	7.5 0	130.7 3
23	900.0	1100.0	.0	186.5 3	149.0 3	90.5 2	25.5 1	129.0 3
24	900.0	1150.0	.0	191.5 3	155.0 3	100.2 2	35.3 2	122.7 3

Velocities used, Spread A

	Layer 1	Layer 2	Layer 3
Vertical	2500.	6432.	
Horizontal		6432.	15800.

Velocities used, Spread 8

	Layer 1	Layer 2	Layer 3
Vertical	2500.	6432.	
Horizontal		6432.	15300.

Velocities used, Spread C

	Layer 1	Layer 2	Layer 3
Vertical	2500.	6432.	
Horizontal		6432.	14200.

Spread A Depth and Elev of layers directly beneath SPs and Gèos

	Surface		Layer 2		Layer 3	
SP	X-Loc	Elev	Depth	Elev	Depth	Elev
B	-25.0	895.0	13.2	881.8	220.3	674.7
C	575.0	895.0	13.9	881.1	234.5	660.5
D	1185.0	895.0	14.6	880.4	241.4	653.6
Geo						
1	.0	895.0	12.6	882.4	221.4	673.6
2	50.0	895.0	11.2	883.8	223.7	671.3
3	100.0	895.0	9.7	885.3	224.9	670.1
4	150.0	895.0	13.1	881.9	224.5	670.5
5	200.0	895.0	17.5	877.5	225.1	669.9
6	250.0	895.0	18.1	876.9	228.0	667.0
7	300.0	895.0	15.2	879.8	230.7	664.3
8	350.0	895.0	14.1	880.9	232.5	662.5
9	400.0	895.0	14.8	880.2	233.7	661.3
10	450.0	895.0	14.4	880.6	234.2	660.8
11	500.0	895.0	13.7	881.3	234.7	660.3
12	550.0	895.0	13.9	881.1	234.0	661.0
13	600.0	895.0	13.9	881.1	235.0	660.0
14	650.0	895.0	15.3	879.7	236.0	659.0
15	700.0	895.0	16.1	878.9	237.2	657.8
16	750.0	895.0	15.0	880.0	237.3	657.7
17	800.0	895.0	13.0	882.0	237.4	657.6
18	850.0	895.0	12.0	883.0	237.3	657.7
19	900.0	895.0	12.8	882.2	237.9	657.1
20	950.0	895.0	16.3	878.7	238.4	656.6
21	1000.0	895.0	15.4	879.6	239.6	655.4
22	1050.0	895.0	15.3	879.7	241.0	654.0
23	1100.0	895.0	15.7	879.3	241.9	653.1
24	1150.0	895.0	14.0	881.0	241.6	653.4

Spread B Oepth and Elev of layers directly beneath SPs and Geos

	Surface		Layer 2		Layer 3	
SP	X-Loc	Elev	Oepth	Elev	Oepth	Elev
G	1182.0	895.0	13.0	882.0	241.4	653.6
H	1785.0	895.0	16.1	878.9	237.5	657.5
I	2385.0	895.0	9.1	885.9	247.3	647.7
Geo						
1	1210.0	895.0	13.5	881.5	241.2	653.8
2	1260.0	895.0	11.3	883.7	240.9	654.1
3	1310.0	895.0	14.6	880.4	238.8	656.2
4	1360.0	895.0	14.5	880.5	236.9	658.1
5	1410.0	895.0	13.8	881.2	235.9	659.1
6	1460.0	895.0	10.0	885.0	234.7	660.3
7	1510.0	895.0	9.1	885.9	233.5	661.5
8	1560.0	895.0	9.2	885.8	232.9	662.1
9	1610.0	895.0	11.0	884.0	234.4	660.6
10	1660.0	895.0	8.4	886.6	236.3	658.7
11	1710.0	895.0	12.3	882.7	236.6	658.4
12	1760.0	895.0	15.2	879.8	235.9	659.1
13	1810.0	895.0	17.0	878.0	239.0	656.0
14	1860.0	895.0	14.7	880.3	244.8	650.2
15	1910.0	895.0	11.0	884.0	248.6	646.4
16	1960.0	895.0	10.6	884.4	250.8	644.2
17	2010.0	895.0	11.4	883.6	252.5	642.5
18	2060.0	895.0	10.2	884.8	253.8	641.2
19	2110.0	895.0	9.7	885.3	252.9	642.1
20	2160.0	895.0	14.5	880.5	250.1	644.9
21	2210.0	895.0	17.5	877.5	246.3	648.7
22	2260.0	895.0	15.1	879.9	245.6	649.4
23	2310.0	895.0	11.6	883.4	246.9	648.1
24	2360.0	895.0	9.9	885.1	247.2	647.8

Spread C Oepth and Elev of layers directly beneath SPs and Geos

	Surface		Layer 2		Layer 3	
SP	X-Loc	Elev	Oepth	Elev	Oepth	Elev
L	2395.0	895.0	8.7	886.3	247.4	647.6
M	2984.7	900.0	16.4	883.6	230.0	670.0
N	3459.7	900.0	28.4	871.6	224.9	675.1
Geo						
1	2410.0	895.0	10.0	885.0	247.5	647.5
2	2460.0	895.0	11.8	883.2	247.8	647.2
3	2510.0	895.0	10.7	884.3	253.0	642.0
4	2560.0	895.0	11.9	883.1	258.2	636.8
5	2610.0	895.0	9.2	885.8	261.2	633.8
6	2660.0	895.0	11.5	883.5	259.5	635.5
7	2710.0	895.0	9.0	886.0	256.1	638.9
8	2760.0	895.0	14.2	880.8	256.7	638.3
9	2810.0	895.0	16.0	879.0	255.2	639.8
10	2860.0	895.0	16.5	878.5	251.9	643.1
11	2910.0	895.0	18.1	876.9	243.1	651.9
12	2959.7	900.0	17.9	882.1	235.0	665.0
13	3009.7	900.0	15.0	885.0	224.9	675.1
14	3059.7	900.0	13.4	886.6	217.1	682.9
15	3109.7	900.0	14.8	885.2	211.7	688.3
16	3159.7	900.0	13.9	886.1	208.3	691.7
17	3209.7	900.0	14.4	885.6	209.1	690.9
18	3259.7	900.0	14.9	885.1	218.1	681.9
19	3309.7	900.0	17.2	882.8	227.0	673.0
20	3359.7	900.0	21.1	878.9	228.0	672.0

21	3409.7	900.0	28.6	871.4	227.1	672.9
22	3459.7	900.0	28.4	871.6	224.9	675.1
23	3509.7	900.0	24.9	875.1	232.4	667.6
24	3559.7	900.0	25.8	874.2	237.2	662.8

Gilberts -- Huntley Rd Seismic Line Gil24-28 April 1992

SIPT2 [illegible] -- [illegible]EISMIC REFRACTION INTERPRETATION PROGRAM

DATA FIL[illegible] [illegible] [illegible]INT FILE: c:\sip\data\huntley6.fil
RUN DATE AND TI[illegible]: [illegible]-19-1992 at 10:16

SHOTPOINT AND GEOPHONE INPUT OATA

Spread A, 5 Shotpoints, 24 Geophones, X-Shift = 0.0, X-True = 0

SP	Elev	X-Loc	Y-Loc	Depth
A	917.0	-625.0	.0	5.0
B	915.0	-25.0	.0	5.0
C	918.0	650.0	3.0	5.0
D	920.0	1175.0	.0	5.0
E	915.0	1675.0	.0	5.0

Arrival Times and Layers represented

Geo	Elev	X-Loc	Y-Loc	SP A --T---L	SP B --T---L	SP C --T---L	SP D --T---L	SP E --T---L
1	915.0	.0	.0	100.5 2	8.7 2	109.2 2	159.7 3	187.2 3
2	915.0	50.0	.0	108.0 2	17.2 2	103.0 2	158.0 3	184.5 3
3	915.0	100.0	.0	118.2 2	25.7 2	96.0 2	155.5 3	182.0 3
4	915.0	150.0	.0	123.5 2	33.2 2	88.0 2	154.0 3	176.2 3
5	915.0	200.0	.0	130.2 3	40.5 2	81.0 2	150.0 3	172.7 3
6	916.0	250.0	.0	133.0 3	47.2 2	73.0 2	148.7 3	171.2 3
7	917.0	300.0	.0	138.5 3	57.5 2	67.3 2	146.0 3	170.0 3
8	918.0	350.0	.0	141.2 3	64.2 2	57.8 2	142.7 3	167.2 3
9	918.0	400.0	.0	140.7 3	73.7 2	49.0 2	137.0 2	165.2 3
10	918.0	450.0	.0	145.7 3	80.0 2	41.5 2	130.0 2	160.0 3
11	918.0	500.0	.0	149.7 3	85.2 2	35.3 2	122.0 2	158.2 3
12	918.0	550.0	.0	155.2 3	95.0 2	29.5 2	117.7 2	157.2 3
13	918.0	600.0	.0	161.0 3	105.5 2	21.8 2	108.2 2	155.2 3
14	918.0	650.0	.0	162.[illegible]	[illegible]12.5 2	6.3 0	101.0 2	154.5 3
15	918.0	700.0	.0	1[illegible]	[illegible]2.7 2	24.3 2	94.0 2	151.5 3
16	918.0	750.0	.0	[illegible]	[illegible].2 3	30.8 2	85.3 2	146.5 3
17	918.0	800.0	.0	[illegible]	[illegible]2.0 3	36.0 2	75.5 2	143.5 3
18	919.0	850.0	.0	[illegible]	136.5 3	43.8 2	66.5 2	140.0 3
19	919.0	900.0	[illegible]	[illegible].0 [illegible]	137.7 3	50.8 2	59.8 2	136.0 3
20	919.0	950.0	[illegible]	[illegible] 3	140.7 3	58.3 2	51.5 2	131.5 2
21	919.0	1000.0	[illegible]	[illegible].0 3	144.0 3	66.3 2	42.3 2	121.5 2
22	919.0	1050.0	[illegible]	187.7 0	146.5 3	75.3 2	35.8 2	118.5 2
23	920.0	1100.[illegible]	[illegible]	193.2 0	152.2 0	83.8 2	29.0 2	109.2 2
24	920.0	115[illegible]	[illegible]0	195.7 0	155.2 0	93.5 2	17.8 2	102.5 2

Velocities used, Spread A

	Layer 1	Layer 2	Layer 3
Vertical	2500.	6449.	
Horizontal		6449.	16725.

Spread A — Depth and Elev of layers directly beneath SPs and Geos

	Surface		Layer 2		Layer 3	
SP	X-Loc	Elev	Depth	Elev	Depth	Elev
B	-25.0	915.0	10.0	905.0	249.7	665.3
C	650.0	918.0	25.7	892.3	290.8	627.2
D	1174.9	920.0	25.3	894.7	303.5	616.5
Geo						
1	.0	915.0	10.9	904.1	259.9	655.1
2	50.0	915.0	12.8	902.2	261.8	653.2
3	100.0	915.0	15.1	899.9	263.8	651.2
4	150.0	915.0	14.1	900.9	271.1	643.9
5	200.0	915.0	14.8	900.2	277.9	637.1
6	250.0	916.0	14.1	901.9	277.0	639.0
7	300.0	917.0	17.6	899.4	278.1	638.9
8	350.0	918.0	16.2	901.8	281.2	636.8
9	400.0	918.0	19.1	898.9	284.7	633.3
10	450.0	918.0	19.7	898.3	287.5	630.5
11	500.0	918.0	19.9	898.1	288.8	629.2
12	550.0	918.0	23.9	894.1	288.9	629.1
13	600.0	918.0	25.6	892.4	289.2	628.8
14	650.0	918.0	25.7	892.3	290.8	627.2
15	700.0	918.0	29.1	888.9	292.9	625.1
16	750.0	918.0	29.5	888.5	294.7	623.3
17	800.0	918.0	25.7	892.3	295.6	622.4
18	850.0	919.0	23.7	895.3	295.4	623.6
19	900.0	919.0	23.2	895.8	293.8	625.2
20	950.0	919.0	22.0	897.0	294.6	624.4
21	1000.0	919.0	20.8	898.2	300.2	618.8
22	1050.0	919.0	24.0	895.0	302.5	616.5
23	1099.9	920.0	25.7	894.3	303.5	616.5
24	1149.9	920.0	25.4	894.6	303.5	616.5

Gilberts: Binnie Road Line May 1992 West half

SIPT2 V-3.2 --- SEISMIC REFRACTION INTERPRETATION PROGRAM

RIMROCK GEOPHYSICS, INC.

DATA FILE: a:wbinrd.sip PRINT FILE: \sip\data\wbinrd2.fil
RUN DATE AND TIME: 6-05-1992 at 9:59

SHOTPOINT AND GEOPHONE INPUT DATA

Spread A, 4 Shotpoints, 24 Geophones, X-Shift = 0.0, X-True = 0

SP	Elev	X-Loc	Y-Loc	Depth
A	892.0	-25.0	.0	5.0
8	900.0	575.0	.0	5.0
C	912.0	1160.0	.0	5.0
D	912.0	1750.0	.0	5.0

Arrival Times and Layers represented

Geo	Elev	X-Loc	Y-Loc	SP A --T---L	SP B --T---L	SP C --T---L	SP D --T---L
1	892.0	.0	.0	8.5 1	95.5 2	147.5 3	184.0 3
2	893.0	50.0	.0	17.5 2	88.5 2	144.2 3	182.0 3
3	894.0	100.0	.0	24.0 2	78.3 2	140.5 3	177.0 3
4	895.0	150.0	.0	31.5 2	72.3 2	137.2 3	173.7 3
5	896.0	200.0	.0	39.2 2	62.8 2	131.7 3	171.0 3
6	897.0	250.0	.0	46.7 2	57.5 2	132.7 3	169.2 3
7	898.0	300.0	.0	54.0 2	50.5 2	127.5 3	166.2 3
8	898.0	350.0	.0	62.7 2	43.8 2	127.7 3	165.2 3
9	898.0	400.0	.0	70.0 2	37.5 2	126.5 3	162.0 3
10	898.0	450.0	.0	79.5 2	30.5 2	119.2 2	159.2 3
11	899.0	500.0	.0	86.7 2	22.0 2	111.7 2	155.2 3
12	900.0	550.0	.0	94.2 2	12.0 1	104.2 2	152.5 3
13	900.0	600.0	.0	100.7 2	11.5 0	96.0 2	149.2 3
14	900.0	650.0	.0	110.2 2	21.0 2	87.3 2	146.0 3
15	900.0	700.0	.0	117.2 2	28.3 2	79.0 2	144.0 3
16	901.0	750.0	.0	124.7 3	37.8 2	74.0 2	141.5 3
17	902.0	800.0	.0	128.0 3	45.8 2	66.5 2	139.2 3
18	906.0	850.0	.0	130.2 3	51.8 2	56.0 2	135.0 3
19	910.0	900.0	.0	133.7 3	59.8 2	47.5 2	131.2 3
20	911.0	950.0	.0	138.5 3	68.8 2	42.5 2	130.0 3
21	912.0	1000.0	.0	139.7 3	74.0 2	33.5 2	121.7 2
22	912.0	1050.0	.0	144.0 3	83.0 2	27.0 2	115.7 2
23	912.0	1100.0	.0	146.0 3	88.0 2	15.8 2	107.7 2
24	912.0	1150.0	.0	147.0 3	94.3 2	7.3 0	97.8 2

Spread B, 4 Shotpoints, 24 Geophones, X-Shift = 1150.0, X-True = 0

SP	Elev	X-Loc	Y-Loc	Depth
E	900.0	-625.0	.0	5.0
F	912.0	-10.0	.0	5.0
G	912.0	575.0	.0	5.0
H	895.0	1055.0	.0	5.0

Arrival Times and Layers represented

Geo	Elev	X-Loc	Y-Loc	SP E --T---L	SP F --T---L	SP G --T---L	SP H --T---L
1	912.0	.0	.0	105.2 2	7.2 2	95.0 2	141.0 3
2	912.0	50.0	.0	113.5 2	17.2 2	87.5 2	138.7 3
3	912.0	100.0	.0	119.7 2	23.7 2	79.5 2	134.5 3

4	912.0	150.0	.0	124.2 3	31.0 2	71.2 2	131.2 3
5	912.0	200.0	.0	128.0 3	39.2 2	65.0 2	130.2 3
6	912.0	250.0	.0	131.0 3	46.5 2	57.7 2	126.5 3
7	912.0	300.0	.0	132.0 3	54.0 2	49.5 2	118.0 2
8	912.0	350.0	.0	136.2 3	60.7 2	41.7 2	109.7 2
9	912.0	400.0	.0	140.0 3	68.7 2	35.0 2	104.2 2
10	912.0	450.0	.0	142.7 3	77.5 2	28.0 2	97.3 2
11	912.0	500.0	.0	148.2 3	84.7 2	19.5 2	89.3 2
12	912.0	550.0	.0	150.7 3	92.0 2	10.2 1	81.5 2
13	912.0	600.0	.0	154.5 3	100.7 2	11.2 1	75.0 2
14	913.0	650.0	.0	155.7 3	106.5 2	19.5 2	65.8 2
15	914.0	700.0	.0	159.2 3	115.0 2	28.0 2	60.0 2
16	918.0	750.0	.0	163.7 3	124.7 2	37.5 2	54.3 2
17	910.0	800.0	.0	166.5 3	130.5 3	45.0 2	46.8 2
18	905.0	850.0	.0	171.5 3	134.7 3	53.7 2	40.8 2
19	900.0	900.0	.0	171.7 3	135.7 3	59.0 2	31.5 2
20	895.0	950.0	.0	174.5 3	137.7 3	64.7 2	24.0 2
21	895.0	1000.0	.0	176.5 3	139.5 3	71.2 2	13.8 2
22	895.0	1050.0	.0	180.2 3	145.2 3	80.7 2	6.5 0
23	894.0	1100.0	.0	184.5 3	149.0 3	90.7 2	16.0 1
24	893.0	1150.0	.0	186.0 3	148.7 3	96.0 2	20.8 2

Velocities used, Spread A

	Layer 1	Layer 2	Layer 3
Vertical	2500.	6617.	
Horizontal		6617.	17000.

Velocities used, Spread B

	Layer 1	Layer 2	Layer 3
Vertical	2500.	6617.	
Horizontal		6617.	16500.

Spread A Depth and Elev of layers directly beneath SPs and Geos

	Surface		Layer 2		Layer 3	
SP	X-Loc	Elev	Depth	Elev	Depth	Elev
A	-25.0	892.0	13.4	878.6	251.1	640.9
B	574.9	900.0	21.2	878.8	264.3	635.7
C	1159.6	912.0	9.4	902.6	273.1	638.9
Geo						
1	.0	892.0	13.5	878.5	242.8	649.2
2	50.0	893.0	16.9	876.1	251.8	641.2
3	100.0	894.0	14.0	880.0	257.4	636.6
4	150.0	895.0	14.6	880.4	258.1	636.9
5	200.0	896.0	13.0	883.0	257.8	638.2
6	249.9	897.0	14.9	882.1	255.9	641.1
7	299.9	898.0	15.7	882.3	255.8	642.2
8	349.9	898.0	17.9	880.1	256.3	641.7
9	399.9	898.0	19.8	878.2	258.4	639.6
10	449.9	898.0	22.1	875.9	261.9	636.1
11	499.9	899.0	22.4	876.6	265.0	634.0
12	549.9	900.0	21.8	878.2	265.1	634.9
13	599.9	900.0	20.6	879.4	263.5	636.5
14	649.9	900.0	19.8	880.2	262.4	637.6
15	699.9	900.0	19.3	880.7	263.4	636.6
16	749.9	901.0	21.6	879.4	267.6	633.4
17	799.9	902.0	20.6	881.4	271.3	630.7

18	849.7	906.0	16.1	889.9	276.8	629.2
19	899.6	910.0	14.4	895.6	280.9	629.1
20	949.6	911.0	16.9	894.1	279.3	631.7
21	999.6	912.0	13.5	898.5	278.1	633.9
22	1049.6	912.0	14.5	897.5	275.8	636.2
23	1099.6	912.0	10.4	901.6	274.8	637.2
24	1149.6	912.0	9.1	902.9	273.5	638.5

Spread 8 Depth and Elev of layers directly beneath SPs and Geos

SP	Surface X-Loc	Surface Elev	Layer 2 Depth	Layer 2 Elev	Layer 3 Depth	Layer 3 Elev
F	1139.6	912.0	9.4	902.6	273.8	638.2
G	1724.6	912.0	12.3	899.7	276.8	635.2
H	2203.0	895.0	19.6	875.4	262.2	632.8
Geo						
1	1149.6	912.0	9.2	902.8	273.5	638.5
2	1199.6	912.0	10.5	901.5	271.8	640.2
3	1249.6	912.0	8.7	903.3	270.1	641.9
4	1299.6	912.0	8.3	903.7	266.2	645.8
5	1349.6	912.0	10.7	901.3	263.7	648.3
6	1399.6	912.0	10.8	901.2	263.5	648.5
7	1449.6	912.0	9.7	902.3	265.9	646.1
8	1499.6	912.0	8.5	903.5	272.3	639.7
9	1549.6	912.0	11.1	900.9	277.5	634.5
10	1599.6	912.0	13.0	899.0	282.2	629.8
11	1649.6	912.0	12.1	899.9	280.0	632.0
12	1699.6	912.0	12.4	899.6	278.4	633.6
13	1749.6	912.0	12.2	899.8	275.1	636.9
14	1799.5	913.0	11.5	901.5	277.9	635.1
15	1849.5	914.0	13.8	900.2	281.5	632.5
16	1899.4	918.0	20.1	897.9	286.4	631.6
17	1948.7	910.0	21.7	888.3	278.5	631.5
18	1998.5	905.0	25.4	879.6	272.5	632.5
19	2048.2	900.0	24.1	875.9	268.7	631.3
20	2098.0	895.0	21.5	873.5	266.5	628.5
21	2148.0	895.0	18.9	876.1	265.8	629.2
22	2198.0	895.0	19.4	875.6	262.8	632.2
23	2248.0	894.0	20.8	873.2	256.3	637.7
24	2298.0	893.0	21.5	871.5	255.3	637.7

Gilberts: Binnie Road Line May 1992 East End

SIPT2 V-3.2 --- SEISMIC REFRACTION INTERPRETATION PROGRAM
RIMROCK GEOPHYSICS, INC.

DATA FILE: a:ebinrd.sip PRINT FILE: \sip\data\ebinrd.fil
RUN DATE AND TIME: 6-05-1992 at 9:10

SHOTPOINT AND GEOPHONE INPUT DATA

Spread C, 3 Shotpoints, 24 Geophones, X-Shift = 0.0, X-True = 0

SP	Elev	X-Loc	Y-Loc	Depth
I	927.0	-100.0	.0	5.0
J	909.0	575.0	.0	5.0
K	908.0	1250.0	.0	5.0

Arrival Times and Layers represented

Geo	Elev	X-Loc	Y-Loc	SP I --T---L	SP J --T---L	SP K --T---L
1	927.0	.0	.0	30.7 2	98.5 2	157.5 3
2	923.0	50.0	.0	35.2 2	90.2 2	156.2 3
3	920.0	100.0	.0	48.5 2	79.7 2	154.7 3
4	918.0	150.0	.0	54.5 2	70.5 2	147.5 3
5	916.0	200.0	.0	60.5 2	63.0 2	144.7 3
6	914.0	250.0	.0	66.0 2	55.0 2	140.7 3
7	912.0	300.0	.0	72.2 2	47.0 2	137.0 3
8	911.0	350.0	.0	79.7 2	38.7 2	133.0 3
9	910.0	400.0	.0	94.0 2	33.5 2	132.0 3
10	910.0	450.0	.0	99.7 2	25.5 2	128.5 3
11	909.0	500.0	.0	105.0 2	17.2 2	123.7 3
12	909.0	550.0	.0	116.2 2	6.7 2	114.2 2
13	909.0	600.0	.0	124.0 2	8.5 2	105.2 2
14	909.0	650.0	.0	133.5 2	19.5 2	99.5 2
15	909.0	700.0	.0	139.2 3	24.7 2	93.8 2
16	909.0	750.0	.0	141.7 3	34.0 2	85.0 2
17	909.0	800.0	.0	143.0 3	39.5 2	76.0 2
18	909.0	850.0	.0	143.2 3	46.0 2	65.8 2
19	909.0	900.0	.0	147.0 3	54.2 2	58.3 2
20	909.0	950.0	.0	150.7 3	60.5 2	51.5 2
21	908.0	1000.0	.0	152.7 3	67.2 2	43.3 2
22	908.0	1050.0	.0	155.2 3	75.0 2	36.8 2
23	908.0	1100.0	.0	158.5 3	83.2 2	29.5 2
24	908.0	1150.0	.0	162.0 3	92.0 2	25.2 1

Spread D, 3 Shotpoints, 24 Geophones, X-Shift = 1645.0, X-True = 0

SP	Elev	X-Loc	Y-Loc	Depth
L	908.0	-100.0	.0	5.0
M	921.0	575.0	35.0	5.0
N	925.0	1250.0	35.0	5.0

Arrival Times and Layers represented

Geo	Elev	X-Loc	Y-Loc	SP L --T---L	SP M --T---L	SP N --T---L
1	909.0	.0	35.0	28.7 2	96.0 2	160.0 3
2	910.0	50.0	35.0	36.7 2	86.7 2	156.5 3
3	911.0	100.0	35.0	42.5 2	75.7 2	153.7 3
4	912.0	150.0	35.0	49.0 2	70.7 2	150.0 3
5	913.0	200.0	35.0	54.5 2	62.5 2	144.7 3

6	914.0	250.0	35.0	63.0 2	55.2 2	142.5 3
7	915.0	300.0	35.0	69.7 2	48.0 2	139.5 3
8	916.0	350.0	35.0	76.0 2	41.0 2	136.2 3
9	917.0	400.0	35.0	82.5 2	33.2 2	131.5 3
10	918.0	450.0	35.0	90.5 2	26.5 2	130.2 3
11	919.0	500.0	35.0	98.0 2	18.5 2	123.0 2
12	920.0	550.0	35.0	107.5 2	10.0 1	117.2 2
13	922.0	600.0	35.0	115.0 2	8.5 2	109.2 2
14	924.0	650.0	35.0	125.5 2	20.7 2	104.0 2
15	924.0	700.0	35.0	131.0 3	29.7 2	95.5 2
16	924.0	750.0	35.0	134.7 3	38.0 2	91.0 2
17	924.0	800.0	35.0	137.7 3	45.0 2	83.5 2
18	924.0	850.0	35.0	140.7 3	52.2 2	76.5 2
19	924.0	900.0	35.0	144.5 3	60.2 2	70.0 2
20	924.0	950.0	35.0	148.5 3	67.0 2	61.5 2
21	925.0	1000.0	35.0	151.0 3	75.0 2	54.7 2
22	925.0	1050.0	35.0	153.7 3	81.0 2	46.5 2
23	925.0	1100.0	35.0	154.5 3	87.5 2	34.2 2
24	925.0	1150.0	35.0	157.5 3	94.2 2	25.5 2

Velocities used, Spread C

	Layer 1	Layer 2	Layer 3
Vertical	2500.	6595.	
Horizontal		6595.	16000.

Velocities used, Spread D

	Layer 1	Layer 2	Layer 3
Vertical	2500.	6595.	
Horizontal		6595.	14500.

Spread C Depth and Elev of layers directly beneath SPs and Geos

	Surface		Layer 2		Layer 3	
SP	X-Loc	Elev	Depth	Elev	Depth	Elev
I	-100.0	927.0	16.9	910.1	298.4	628.6
J	574.6	909.0	18.4	890.6	282.2	626.8
K	1249.5	908.0	.0	908.0	262.1	645.9
Geo						
1	.0	927.0	19.3	907.7	298.4	628.6
2	49.8	923.0	16.5	906.5	294.1	628.9
3	99.7	920.0	18.9	901.1	290.9	629.1
4	149.7	918.0	17.2	900.8	294.6	623.4
5	199.7	916.0	15.5	900.5	297.1	618.9
6	249.6	914.0	13.1	900.9	294.1	619.9
7	299.6	912.0	11.3	900.7	290.1	621.9
8	349.6	911.0	11.7	899.3	287.6	623.4
9	399.6	910.0	20.1	889.9	286.9	623.1
10	449.6	910.0	20.2	889.8	285.5	624.5
11	499.6	909.0	17.0	892.0	283.6	625.4
12	549.6	909.0	17.3	891.7	283.1	625.9
13	599.6	909.0	19.5	889.5	281.2	627.8
14	649.6	909.0	23.0	886.0	279.9	629.1
15	699.6	909.0	21.9	887.1	277.1	631.9
16	749.6	909.0	21.1	887.9	275.5	633.5
17	799.6	909.0	17.4	891.6	273.7	635.3
18	849.6	909.0	13.0	896.0	273.4	635.6
19	899.6	909.0	13.2	895.8	271.3	637.7
20	949.6	909.0	12.8	896.2	268.3	640.7
21	999.5	908.0	11.3	896.7	265.0	643.0

22	1049.5	908.0	12.8	895.2	263.4	644.6
23	1099.5	908.0	13.8	894.2	261.1	646.9
24	1149.5	908.0	12.0	896.0	261.4	646.6

Spread D Depth and Elev of layers directly beneath SPs and Geos

	Surface		Layer 2		Layer 3	
SP	X-Loc	Elev	Depth	Elev	Depth	Elev
---	-----	----	-----	-----	-----	-----
L	1544.5	908.0	.0	908.0	264.0	644.0
M	2219.4	921.0	11.7	909.3	270.1	650.9
N	2894.3	925.0	3.9	921.1	252.5	672.5
Geo						

1	1644.5	909.0	8.5	900.5	265.6	643.4
2	1694.5	910.0	19.9	890.1	266.9	643.1
3	1744.5	911.0	15.8	895.2	269.7	641.3
4	1794.5	912.0	15.9	896.1	268.4	643.6
5	1844.5	913.0	13.3	899.7	267.0	646.0
6	1894.5	914.0	14.0	900.0	264.1	649.9
7	1944.5	915.0	13.3	901.7	264.1	650.9
8	1994.5	916.0	12.1	903.9	264.3	651.7
9	2044.5	917.0	10.5	906.5	266.7	650.3
10	2094.5	918.0	11.3	906.7	269.1	648.9
11	2144.4	919.0	10.1	908.9	269.8	649.2
12	2194.4	920.0	11.0	909.0	269.7	650.3
13	2244.4	922.0	12.3	909.7	270.6	651.4
14	2294.4	924.0	16.4	907.6	268.9	655.1
15	2344.4	924.0	17.2	906.8	264.1	659.9
16	2394.4	924.0	20.7	903.3	260.4	663.6
17	2444.4	924.0	21.2	902.8	259.8	664.2
18	2494.4	924.0	21.6	902.4	258.5	665.5
19	2544.4	924.0	22.7	901.3	256.3	667.7
20	2594.4	924.0	21.7	902.3	252.5	671.5
21	2644.3	925.0	22.0	903.0	251.0	674.0
22	2694.3	925.0	19.0	906.0	251.5	673.5
23	2744.3	925.0	12.5	912.5	252.2	672.8
24	2794.3	925.0	9.6	915.4	252.5	672.5

Gilberts: Swanson Farm Line May 29, 1992

SIPT2 V-3.2 --- SEISMIC REFRACTION INTERPRETATION PROGRAM

RIMROCK GEOPHYSICS, INC.

DATA FILE: a:swanson.sip PRINT FILE: a:swanson2.fil
RUN DATE AND TIME: 6-01-1992 at 14:08

SHOTPOINT AND GEOPHONE INPUT DATA

Spread A, 3 Shotpoints, 24 Geophones, X-Shift = 0.0, X-True = 0

SP	Elev	X-Loc	Y-Loc	Depth
C	900.0	-25.0	10.0	5.0
B	906.5	575.0	15.0	5.0
A	900.0	1175.0	.0	5.0

Arrival Times and Layers represented

Geo	Elev	X-Loc	Y-Loc	SP C --T---L	SP B --T---L	SP A --T---L
1	900.0	.0	.0	8.5 2	91.5 2	147.7 3
2	901.0	50.0	.0	16.0 2	85.0 2	145.0 3
3	902.0	100.0	.0	25.0 2	77.3 2	141.7 3
4	906.0	150.0	.0	32.2 2	70.5 2	139.0 3
5	903.0	200.0	.0	40.5 2	64.5 2	136.2 3
6	904.0	250.0	.0	46.2 2	56.0 2	133.5 3
7	904.0	300.0	.0	52.7 2	48.0 2	129.5 3
8	905.0	350.0	.0	60.0 2	41.3 2	127.5 3
9	905.0	400.0	.0	67.2 2	34.5 2	122.2 2
10	906.0	450.0	.0	73.5 2	26.8 2	114.7 2
11	906.0	500.0	.0	82.2 2	19.0 2	109.7 2
12	906.0	550.0	.0	93.7 2	10.3 2	100.7 2
13	907.0	600.0	.0	101.5 2	13.3 2	93.5 2
14	908.0	650.0	.0	108.5 2	21.0 2	85.8 2
15	910.0	700.0	.0	117.0 2	29.8 2	78.5 2
16	910.0	750.0	.0	123.0 2	37.0 2	70.8 2
17	911.0	800.0	.0	125.5 2	44.0 2	63.3 2
18	911.0	850.0	.0	132.0 3	55.0 2	57.8 2
19	912.0	900.0	.0	136.7 3	64.0 2	51.5 2
20	913.0	950.0	.0	136.0 3	67.0 2	41.8 2
21	915.0	1000.0	.0	140.0 3	75.5 2	34.5 2
22	915.0	1050.0	.0	142.0 3	82.3 2	26.3 2
23	905.0	1100.0	.0	144.0 3	87.0 2	16.0 2
24	900.0	1150.0	.0	146.5 3	94.0 2	8.3 2

Velocities used, Spread A

	Layer 1	Layer 2	Layer 3
Vertical	2500.	6660.	
Horizontal		6660.	16322.

Spread A Depth and Elev of layers directly beneath SPs and Geos

	Surface		Layer 2		Layer 3	
SP	X-Loc	Elev	Depth	Elev	Depth	Elev
C	-25.0	900.0	9.7	890.3	251.8	648.2
B	574.7	906.5	17.4	889.1	265.0	641.5
A	1173.3	900.0	14.6	885.4	265.2	634.8
Geo						
1	.0	900.0	10.0	890.0	251.8	648.2
2	50.0	901.0	11.5	889.5	252.8	648.2
3	100.0	902.0	12.5	889.5	256.1	645.9
4	149.8	906.0	13.7	892.3	260.6	645.4
5	199.7	903.0	15.1	887.9	256.2	646.8
6	249.7	904.0	13.1	890.9	255.4	648.6
7	299.7	904.0	11.0	893.0	256.0	648.0
8	349.7	905.0	11.8	893.2	258.5	646.5
9	399.7	905.0	13.9	891.1	260.6	644.4
10	449.7	906.0	14.2	891.8	263.7	642.3
11	499.7	906.0	15.9	890.1	264.3	641.7
12	549.7	906.0	16.5	889.5	264.4	641.6
13	599.7	907.0	18.2	888.8	265.6	641.4
14	649.7	908.0	19.3	888.7	266.7	641.3
15	699.6	910.0	20.7	889.3	268.9	641.1
16	749.6	910.0	18.7	891.3	268.4	641.6
17	799.6	911.0	16.8	894.2	266.2	644.8
18	849.6	911.0	25.3	885.7	261.1	649.9
19	899.6	912.0	28.2	883.8	260.6	651.4
20	949.6	913.0	23.7	889.3	263.8	649.2
21	999.6	915.0	23.3	891.7	273.4	641.6
22	1049.6	915.0	22.6	892.4	279.5	635.5
23	1098.6	905.0	16.7	888.3	270.2	634.8
24	1148.3	900.0	13.7	886.3	265.2	634.8