An Interpretation of the Stratigraphy in the Waterbury Reservoir, in Waterbury, Vermont

Angela Rogers and Matt Guerino
Geomorphology
November 19, 2001

Abstract

The objective of this study was to examine the stratigraphy of the Waterbury Reservoir, located in Waterbury, Vermont. Five sediment cores and one pit were dug in a transect of four sites across a piece of the drained reservoir. The cores and pit were dug to varying depths of 102 cm to 320 cm. The deposits indicate a fining upward sequence, with stream deposits overlain by finer sediments. There is an organic contact in the stratigraphy, which could represent the beginning of sedimentation in the reservoir. There are also rythmites below this contact which could indicate the presence of glacial Lake Mansfield.

Introduction

The study examined the stratigraphy of the sediments in the Waterbury Reservoir. The Waterbury Reservoir is located in Waterbury, Vermont, at an elevation of 592' asl (figure 1). The dam was built from 1935 to 1938, as an attempt to control floods after the 1927 flood tore apart much of Vermont (http://www.state.vt.us/anr/fpr/). The surface area of the reservoir was maintained at 860 acres, with a flood control capacity of 9 billion gallons of water (http://www.state.vt.us/anr/fpr/). The reservoir was drained from July 10th, 2001 to August 9th, 2001, at a rate of one foot per day (http://www.vermontstreams.com/reports/messages/7.htm). The drained reservoir creates an opportunity to examine the sediments that were once covered in many feet of water.

Methods

Four sediment cores and one pit were dug in a transect across a section of the reservoir (figure 2). A GPS was used to obtain the location of each of the cores and the pit. The cores were collected using a sediment auger. A 1m by 1m pit was dug at site 1, to a depth of 102 cm. The grain size, color, and contacts in the sediment column were recorded for the cores and the pit, and the depth of the sediments was measured. The datum were then used to create stratigraphic columns for each of the sites (figures 3a, 3b, 3c, 3d, 3e). A cross section was constructed using the data from the stratigraphic columns (figure 4).

Data

The uppermost layers in the cross section (figure 4) are alternating sand and silt or clay layers. The stratigraphy in the bottom of the cross section represents a fining upward sequence, from rounded pebbles and coarse sand to clay (figure 4). There was a well-defined organic layer in three of the sites, and a 1929 penny was found approximately 72 cm below the surface at site 1. The southwest wall of the reservoir was approximately 13.9 meters high, and the northwest wall was approximately 7.1 meters high (appendix 1). The total length of the transect was 95.5 meters (appendix 1). An approximate value for aggradation is 1.2 cm/year in site 1, and 1.7 cm/yr at site 2 (appendix 2).

Discussion

The stratigraphic columns vary greatly. The bottommost layer in the stratigraphy consists of rounded pebbles and coarse sand (figure 4). This could indicate the presence of a stream. These sediments could also be the result of glacial meltwater streams since this area has experienced a glacial history (Easterbrook, 1993).

Three of the four sites contained an organic layer in the sediment. One hypothesis for the formation of this layer could be the filling of the reservoir. As the reservoir was filled, the grass and pastureland was suddenly submerged under water. The decomposition of these plants could have been preserved as an organic layer. If this hypothesis is true, one would expect to find a consistent contact of the organic layer and the overlying sediments. However, since the organic layer was only found at three of the sites, we cannot conclude that this is a definite contact between pre and post reservoir sediments.

Silt and clay rhythmic layers (figure 4) directly overlie the organic layer site 2. Rhythmic layers are the result of changes in deposition, which are usually attributed to seasonal variations. The sediment deposition is limited during the winter, because the lake is usually frozen. Therefore, fine-grained sediments, such as clay, are usually deposited in the winter. The lake is open during the summer, and the accumulated sediments are coarser grained. One can assume that the rhythmic layers were deposited after the reservoir filled, since the depositional environment was altered to a lacustrine basin.

The lack of rhythmites in site 4, on the northeast side, could be due the presence of a delta. Deltas are generally formed where the topography of the land changes from steep to shallow (Boggs, 1995). This hypothesis is supported by the topography seen in figure 2. The topography also indicates the presence of erosion. There appears to be a V-shaped cut into the side of the reservoir, which could be due to concentrated runoff or an ephemeral stream. This stream could be responsible for the erosion of the upper layers, leaving the organic layer closer to the surface in site 4.

There were also rhythmic sediments observed below the organic layer in site 1 and site 4 (figure 4). Rhythmic layers are also indicative of glacial lakes, and could have been formed by glacial Lake Mansfield (Connally, 1971). These layers were also darker than the rythmites found above the organic layer.

Vermont was heavily farmed through the formation of the Waterbury Reservoir (Bierman, 1997). Vermont was also deforested in the early 1900's, which makes land clearing a possible mechanism for increased sedimentation and erosion prior to the building of the reservoir. If the land was deforested, large machinery would have been used to haul lumber. The large machinery could have disturbed the contacts in the sediment, making it difficult to connect layers from site to site.

The large machinery could have also disturbed the layers in site 3. This could explain why we could not find an organic layer in site 3. Another hypothesis for the absence of this layer is that the core was not dug deep enough to find the organic layer.

An estimate for aggradation can be achieved by using the organic contact in sites 1and 2. Assuming the organic contact in sites 1 and 2 indicates the beginning of the reservoir, the sedimentation was approximately 1.2 cm/yr at site 1 and 1.7 cm/yr at site 2 (appendix 2).

Summary

This study examined the stratigraphy at the Waterbury Reservoir. The stratigraphic columns indicate a variation in the depositional environment. The bottom-most layer consists of rounded pebbles and coarse sand, which could have been deposited by an ancient or glacial outwash stream. An organic layer and finer grained sediments overlie this layer. The organic layer could indicate the initial sedimentation of the reservoir, when the plant life was submerged underwater. There are also rhythmic layers found in the stratigraphy. There is one set below and one set above the organic layer. The rythmites above the organic layer could have been deposited by seasonal sediment fluxes in the reservoir. Glacial Lake Mansfield could have deposited the rythmites below the contact.

Works Cited

Bierman, Paul et al. "Postglaical Ponds and Alluvial Fans: Recoerders pf Holocene Landscape History", GSA Today, v.17, no.10, pp1-8

Boggs, Sam. Principles of Sedimentology and Stratigraphy, Prentice Hall; New Jersey, 1995

Connally, Gordon G.. "Pleistocene Mountain Glaciation, Northern Vermont: Discussion", Geological Society of America Bulletin, v.82, pp1763-1766, 1971

Easterbrook, Donald. Surface Processes and Landforms, Macmillian Publishing Company; New York,1993

http://www.state.vt.us/anr/fpr/

http://www.vermontstreams.com/reports/messages/7.htm

Mapquest.com (location map)

Matech inc., 1997 (Site map)

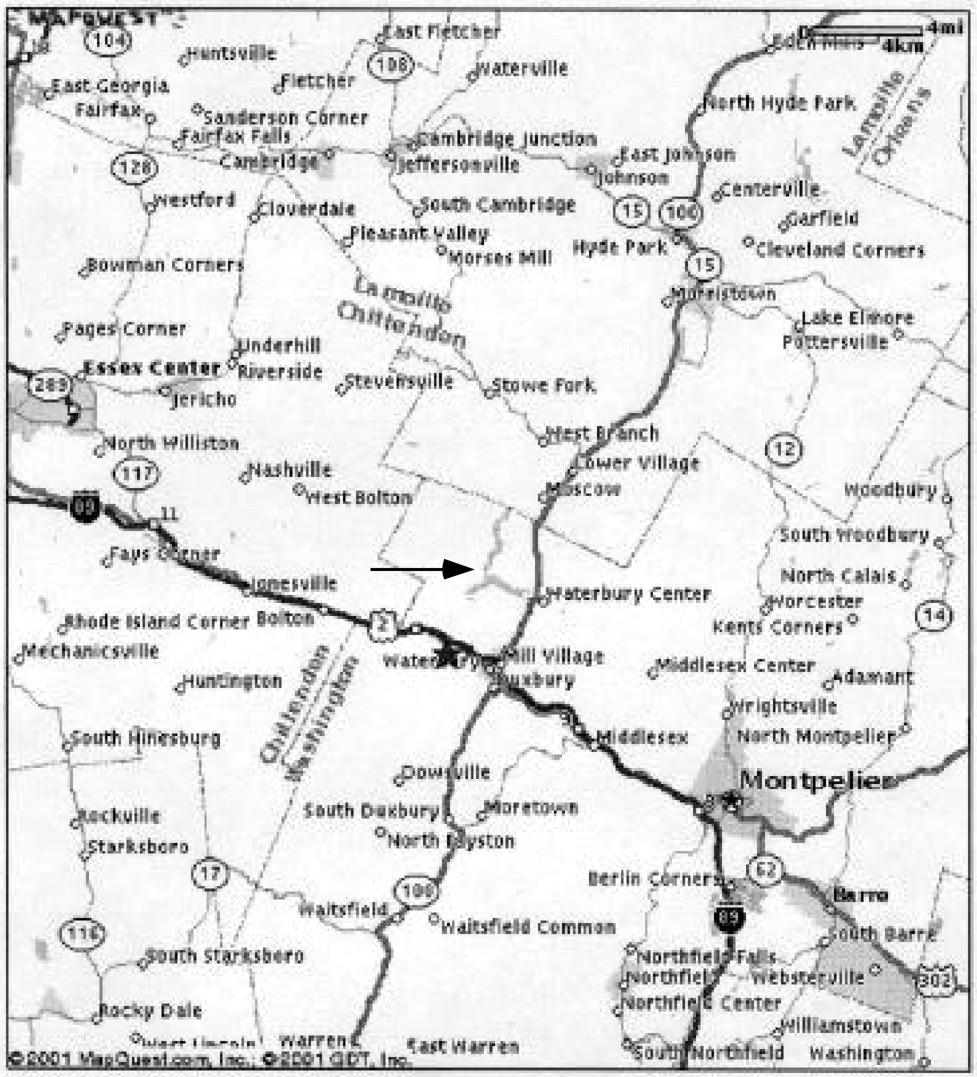
Figure 1

MAPQUEST
WWW.MAPQUEST.COM

< Back SEND TO PRINTER

Print Options

[900-999]WATERBURY STOWE RD, WATERBURY, VT, US



All Rights Reserved. Use Subject to License/Copyright NAVTECH ON BOARD

MAPQUEST
where to go
how to get there!

This map is informational only. No representation is made or warranty given as to its content. User assumes all risk of use. MapQuest and its suppliers assume no responsibility for a loss or delay resulting from such use.

Figure 1 - This map shows the location of the Waterbury Reservoir, indicated by the arrow. Notice the location major highways.

Figure 2

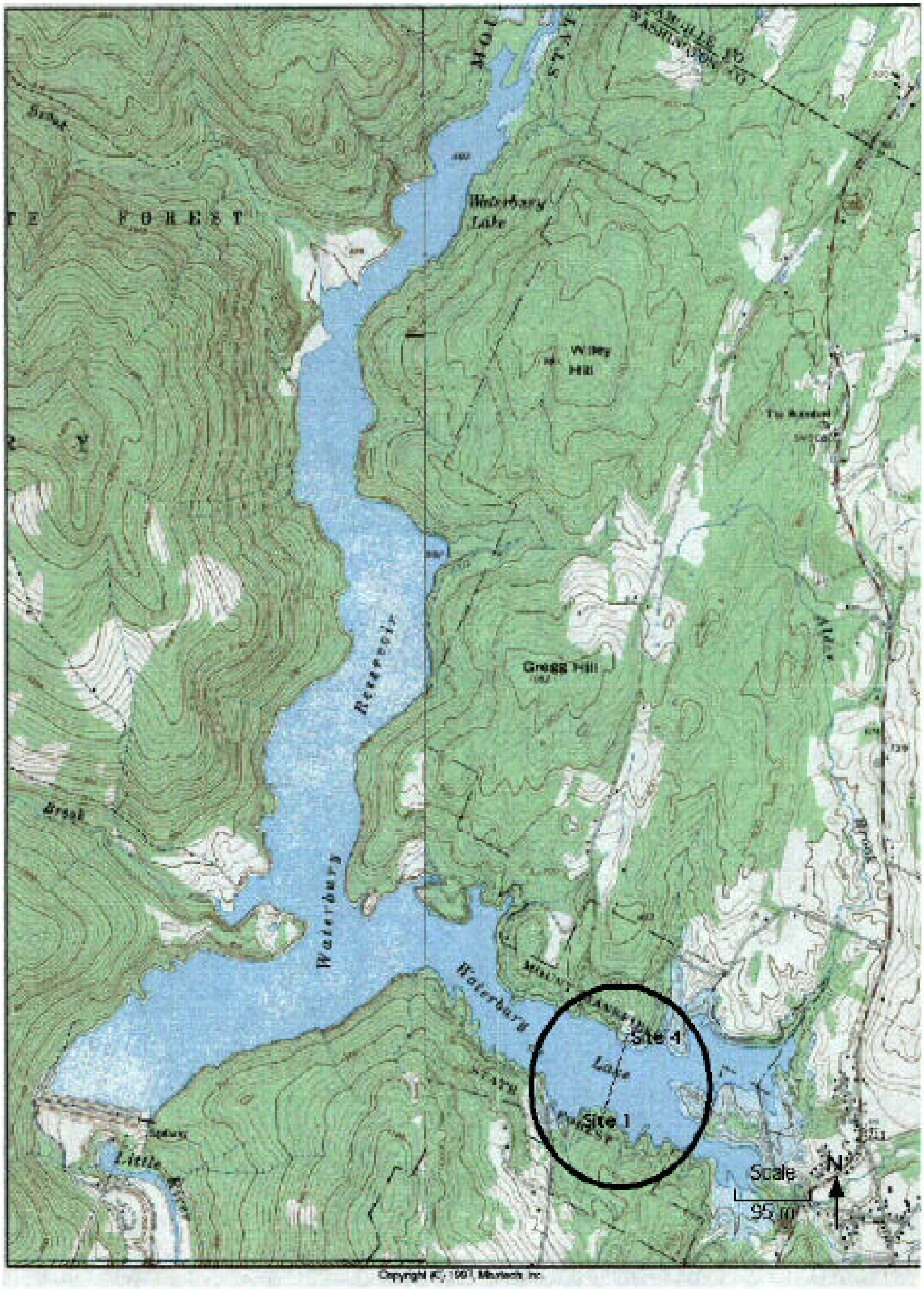


Figure 2 - This map shows the location of the study sites, site1 through site 4. The sites made a transect across the drained reservoir.

Figure 3a

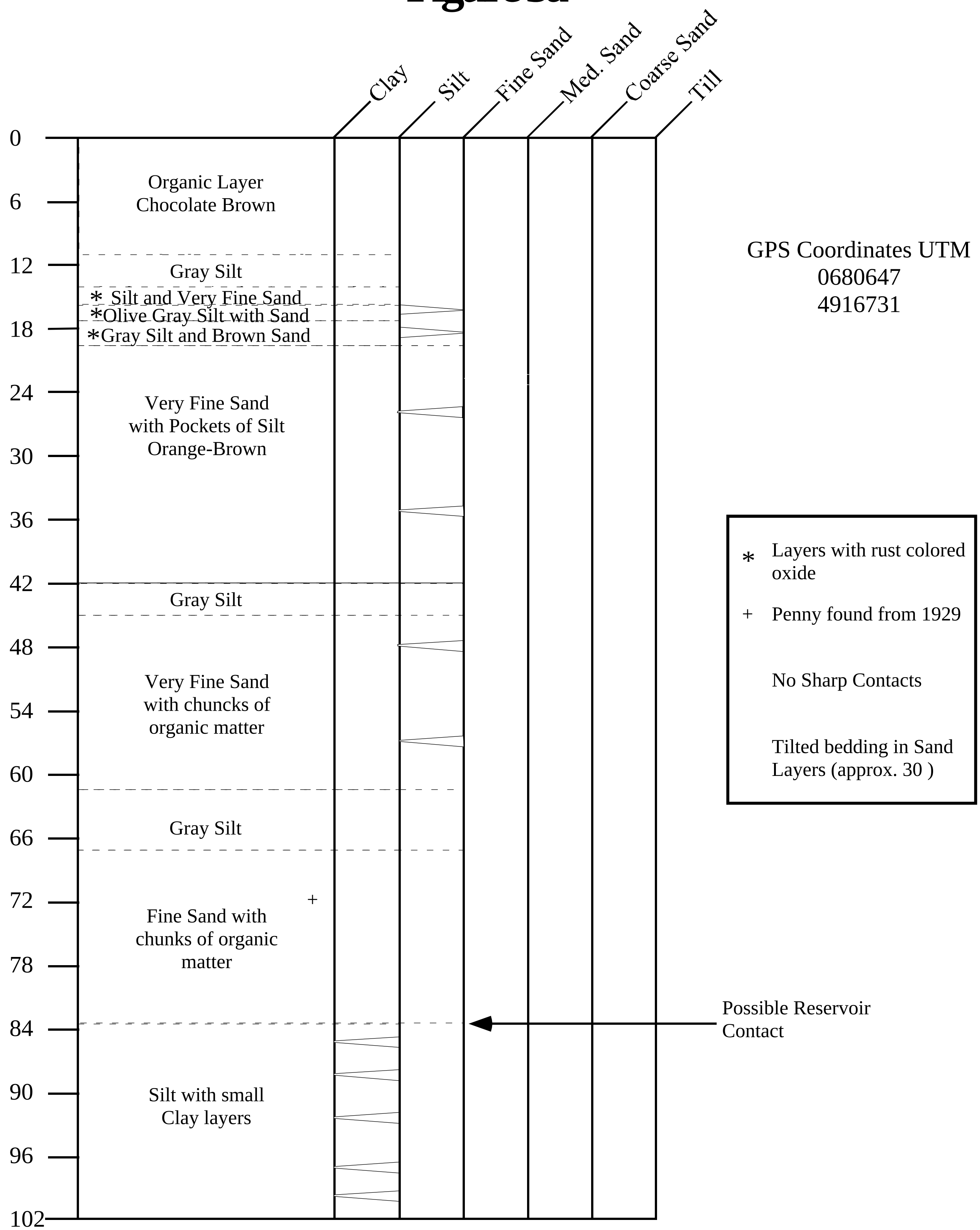


Figure 3a: This is the pit that was dug on the Northwest side of the Waterbury Reservoir. The pit consists of alternating layers of fine sand and silt. The fine sand contains some pockets of silt, the silt layers also contain some pockets of clay. The contact that is marked as a Possible Reservoir Contact has some distinguishing characteristics. The penny and the change from organic layering to silt and clay are the main findings that make this contact reasonable.

Figure 3b

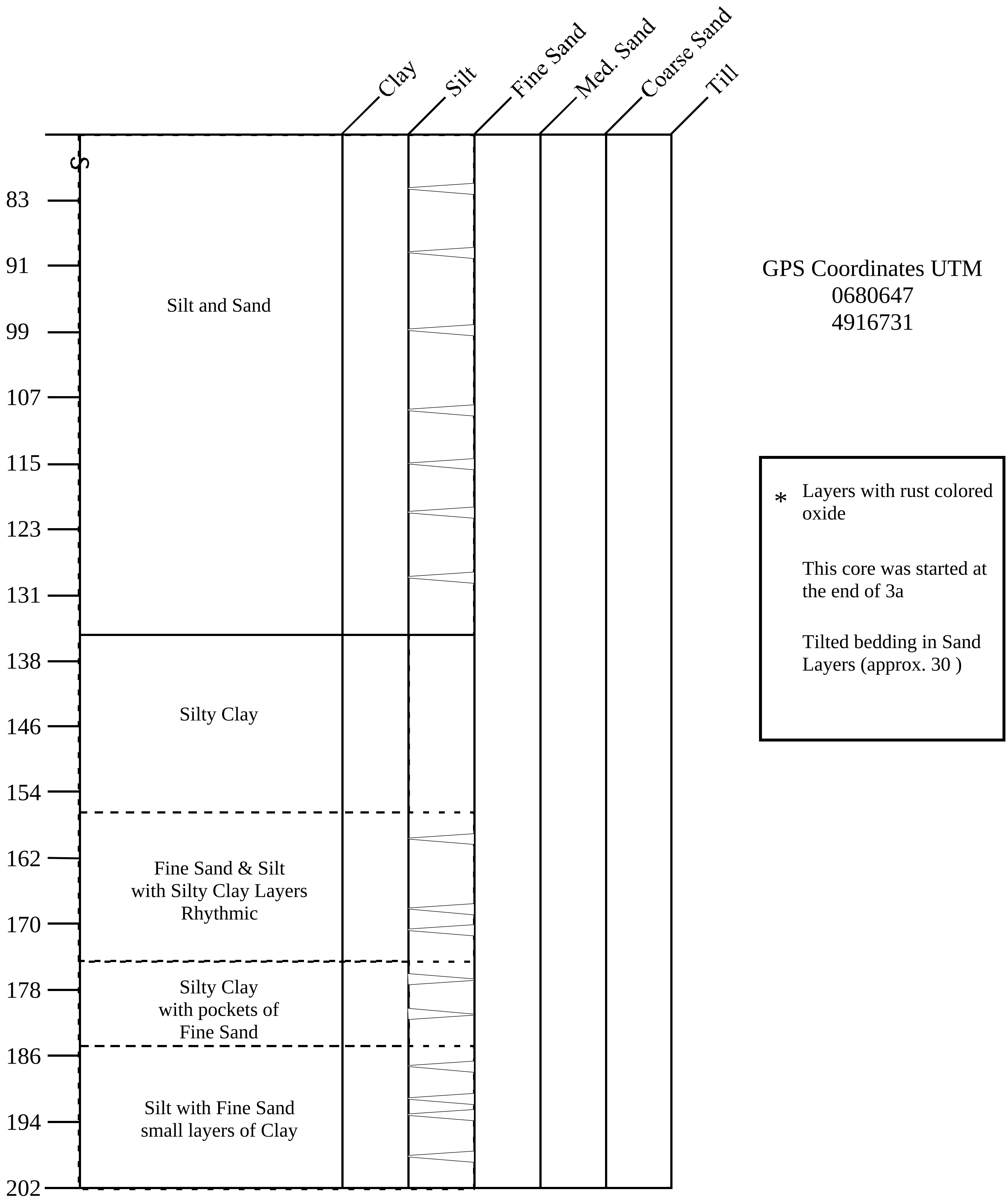


Figure 3b: The bucket auger was used to continue the pit from Figure 3a. This core shows a continuation of alternating layers of fine sand and silt. The difference in this core is there is no longer any clay pockets. The fine sand layers contain some pockets of silt and the silt layers contain fine sand layers.

Figure 3c

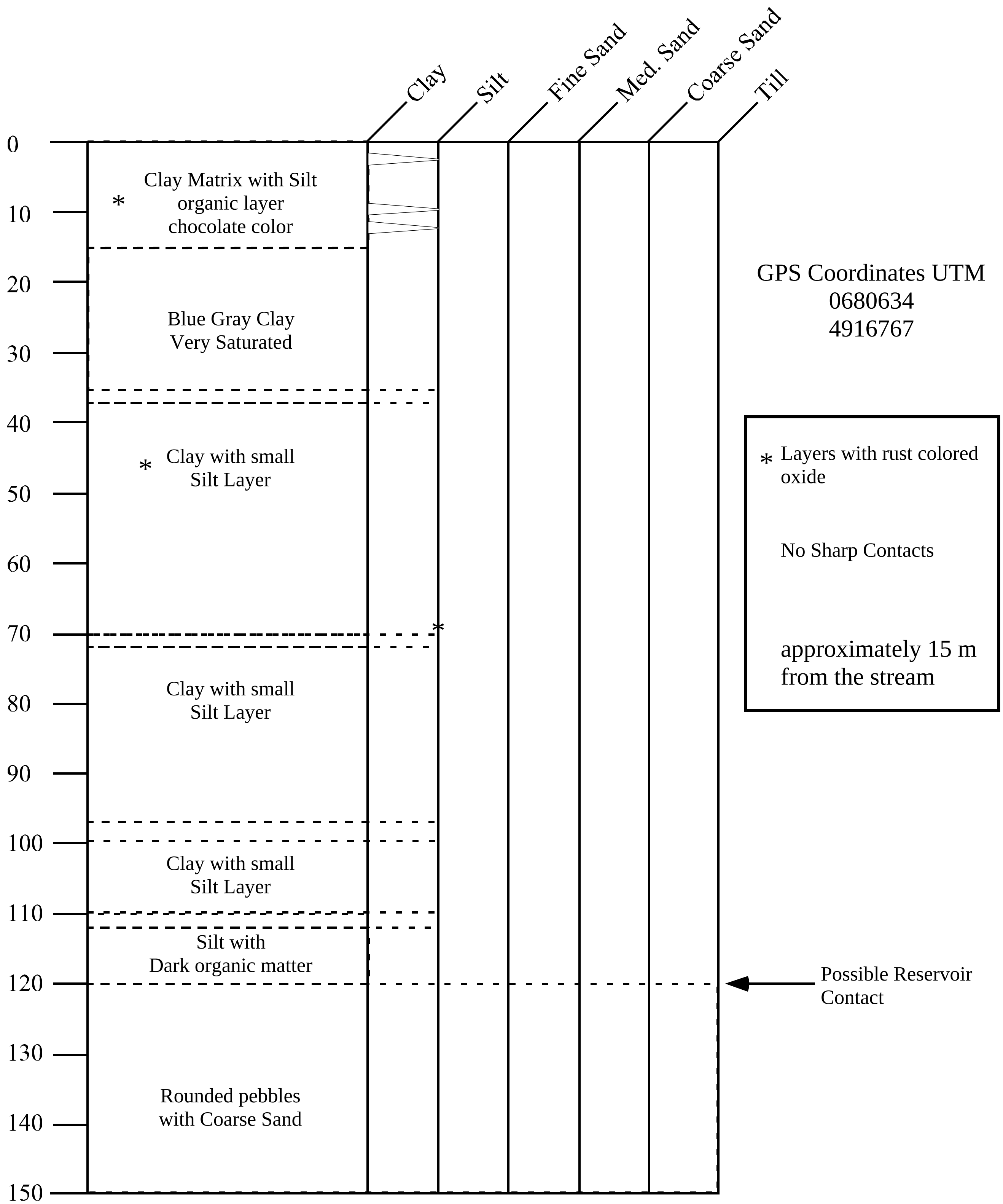


Figure 3c: This stratigraphic column was all done with the bucket auger, no pits were used to make up the section. The figure has altering layers of clay and silt until about 1.2 meters. The layers of silt are noticibly smaller than all figures 3a, 3b, 3d, and 3e. The layer of till is made up of coarse sand and some silt with unstratified rounded pebbles. The Possible Reservoir Contact is made by the change from organic matter to rounded pebbles and coarse sand.

Figure 3d

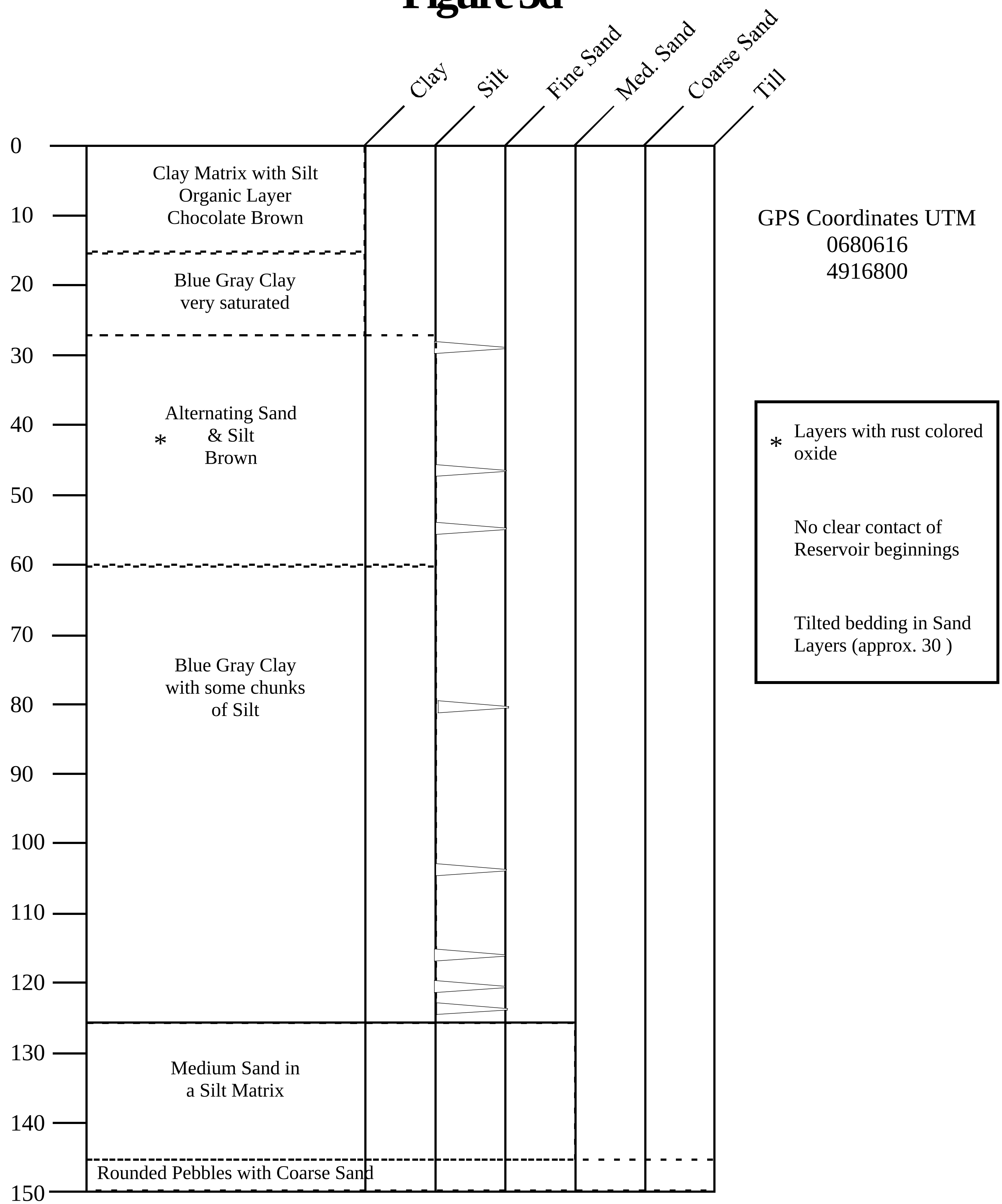


Figure 3d: This figure is a core done with a bucket auger and no pit. The first section shows a small layer of clay. The next layers are silt with pockets of fine sand that increase as the layers grade downward. The medium fine sand lies above the silt, which shows an increase in depositional energy from the silt layers. There are no clear Possible Reservoir contact in this core.

Figure 3e

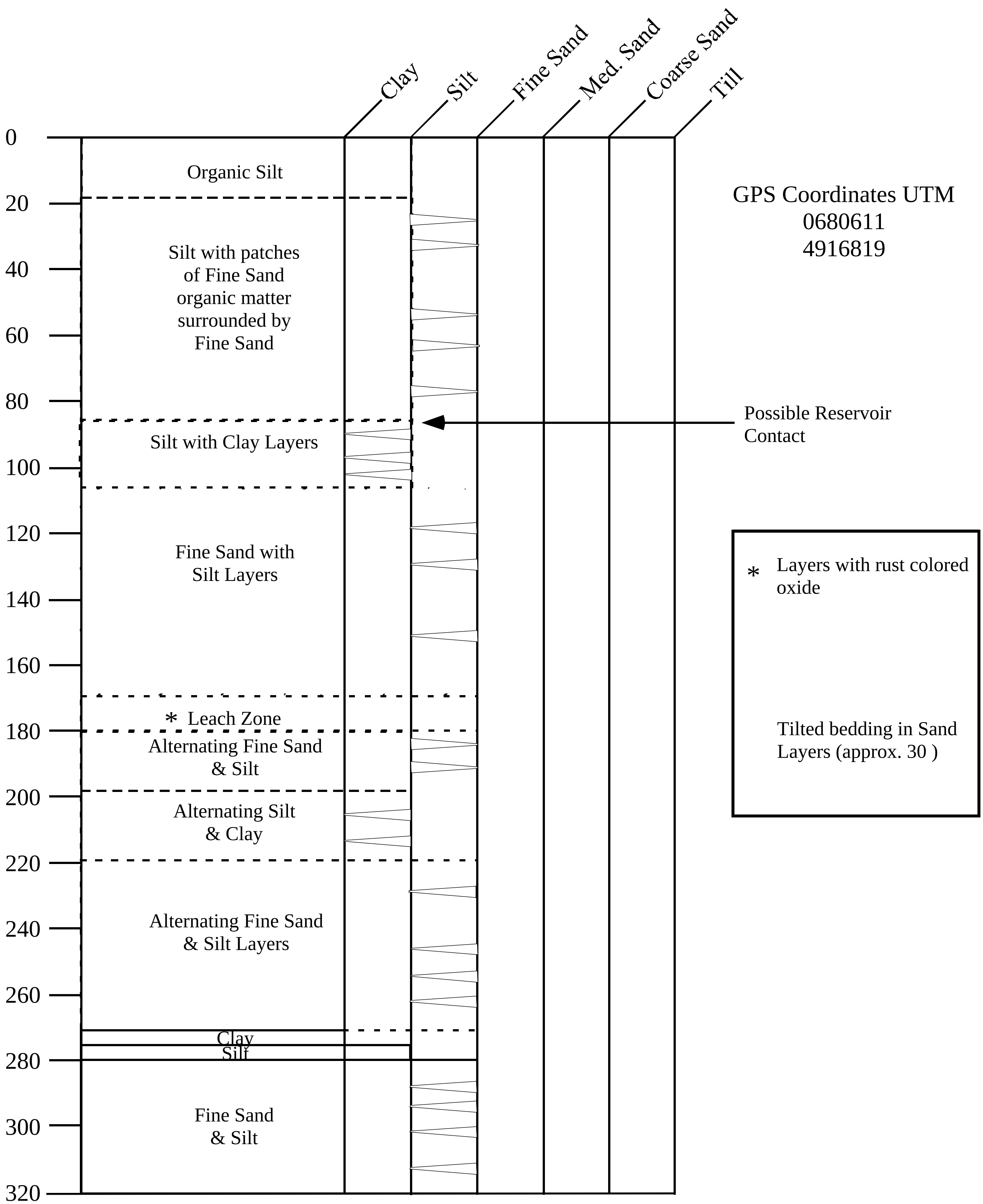


Figure 3e: This core was done with a bucket auger and no pits were made. This figure shows alternating layers of silt and fine sand. The silt layers contain either pockets of fine sand or clay, but each layer does not contain both clay and fine sand. The fine sand layers contain pockets of silt. The Possible Reservoir Contact is a contact between the organic layer and the silt and fine sand layers.

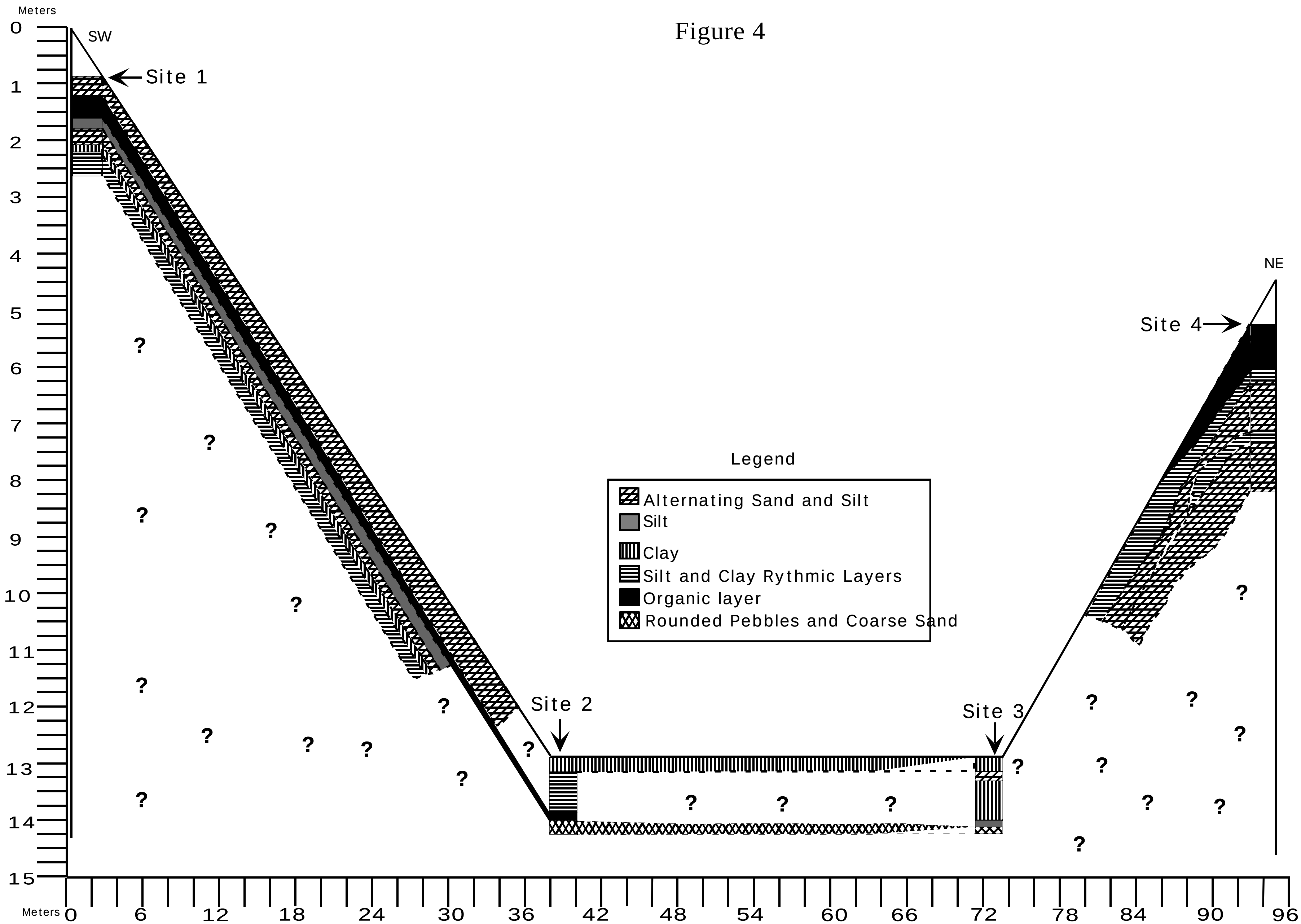
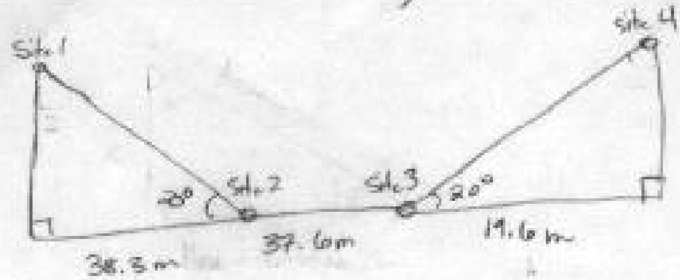


Figure 4 - This figure is a cross section of the study site. The stratigraphic sequence was obtained from cores and a sediment pit. The overall trend of the stratigraphy is a fining upward sequence of sediments, from rounded pebbles and coarse sand to sand.clay, and silt. Notice the organic layer in the cores. This could be the initial sedimentation of the reservoir. Also note the presence of the silt and clay rythmic layers. The rythmic layers on top of the organic contact could be attributed to seasonal sediments fluxes in the reservoir, and the rythmic layers below could be due to glacial Lake Mansfield.

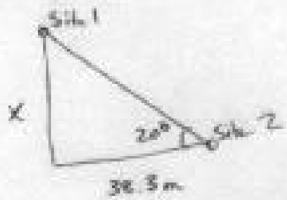
Appendix I

Calculations For Determining Δ Elevation of Sites



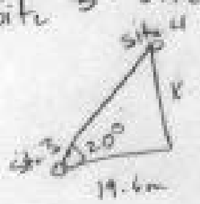
$$\tan\theta = \frac{opp}{adj}$$

Site 1 – Site 2 (Northeast Wall)



$$\tan 20^\circ = \frac{x}{38.3m} = 13.9m$$

Site 3 – Site 4 (Southwest Wall)



$$\tan 20^\circ = \frac{x}{19.6m} = 7.1m$$

Total Length of Transect:

38.3m + 37.6m + 19.6m = 95.5m

Appendix 2
Calculation of Aggradation

Site	Distance between Organic Contact and Surface (cm)	Distance/72 years of reservoir (cm/yr)
Site 1	83 cm	1.2
Site 2	120 cm	1.7
Site 3	NA*	NA
Site 4	0cm**	0

*Site 3 did not contain a visible organic layer
**Site 4 contained a large organic layer at the surface