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## APPENDIX E

Several ASCII files with extension .dlt (stands for Define Lithology) have special meaning in the GWW package. These files are:

- SCREEN.DLT,
- LITH.DLT, and
- ANNULUS.DLT.

The files with the default extension .dlt contain preprogrammed symbols for various lithological units, for well screen, and for materials filling the annular space between the drilled hole and casing. You can use these symbols without modification, or you can make your own.

Each symbol is defined with symbol name, which is the first word in a .dlt file (e.g. CLAY, SILT; up to 10 characters, sensitive to the case of letters, that is upper case and lower case are not the same), and description which will show on the printed log. This is one or more words after the symbol name.

The file SCREEN.DLT is the shortest and is fully reproduced below.

```
SCREEN Screen
2 2 255 255 127 0 0 0
2 0.00 1.00
1 0.00 2.00
2 1.00 0.00
1 1.00 1.00
*
EMPTY Empty
10 10 255 255 191 0 0 0
2 0.00 0.00
*
```

In this file there are only two symbols; one for screen defined as SCREEN, the other for blank casing defined as EMPTY. You must not change this file's coded names. You may change the way in which a symbol is designed.

The file ANNULUS.DLT is also fully reproduced below.

```
CEMENT CONDUCTOR\PIPE
4.6 3.9 255 191 191 127 0 127
2 0.3 0
1 5 0
2 0 0.5
1 5 0.5
```

2 0 1.1  
 1 4.9 1.1  
 2 0 1.8  
 1 4.9 1.8  
 2 0 2.4  
 1 4.9 2.4  
 2 0 3.1  
 1 5 3.1  
 2 0 3.7  
 1 5 3.7  
 \*  
 CLAYH CLAY hard  
 3 1 127 255 63 191 63 63  
 2 0 0.5  
 0 0.8 1  
 1 1.5 0.5  
 0 2.3 0  
 1 3 0.5  
 \*  
 GWS GRAVEL pack\gravel & sand  
 4 5 63 255 255 63 0 127  
 2 0 4  
 0 1 5  
 1 2 4  
 0 1 3  
 1 0 4  
 2 2 1  
 0 3 2  
 1 4 1  
 0 3 0  
 1 2 1  
 2 1 2  
 1 1.1 2  
 2 3 3  
 1 3.1 3  
 2 0.5 1  
 1 0.6 1  
 2 2 2.5  
 1 2.1 2.5  
 2 3 4  
 1 3.1 4  
 2 0.5 0.5  
 1 0.6 0.5  
 \*  
 SAND SAND  
 2 2 191 255 255 0 0 127  
 2 0 0  
 1 0.3 0  
 1 0.3 0.3  
 1 0 0  
 2 1 1  
 1 1.3 1  
 1 1.3 1.3  
 1 1 1  
 2 1.3 0.5  
 1 1.4 0.5  
 1 1.3 0.6  
 2 0.3 1.1  
 1 0.4 1.1  
 1 0.3 1.3  
 2 0.7 1.5  
 1 0.9 1.5  
 1 0.9 1.7  
 1 0.7 1.7  
 2 0.8 0.2  
 1 0.7 0.4

1 0.8 0.4  
 1 0.8 0.3  
 2 1.7 1  
 1 1.6 1.2  
 1 1.7 1.2  
 1 1.8 1  
 2 1.6 1.5  
 1 1.5 1.6  
 1 1.7 1.7  
 1 1.7 1.5  
 2 0.4 0.6  
 1 0.4 0.8  
 1 0.6 0.7  
 2 0.1 1.6  
 1 0.1 1.7  
 1 0.2 1.7  
 2 1.6 0.1  
 1 1.6 0.3  
 1 1.7 0.3  
 \*

This file contains several symbols that may be used to fill the annular space between the walls of the drilled hole and casing. You may add more symbols, rename codes and type another description.

Only a portion of the file LITH.DLT is reproduced below. This file contains codes and description for lithological units that may appear on a well log.

CLAY CLAY  
 3 1.5 255 255 191 255 0 0  
 2 0.00 0.75  
 0 0.75 1.50  
 1 1.50 0.75  
 0 2.25 0.00  
 1 3.00 0.75  
 \*  
 SILT SILT  
 2 2 255 255 191 255 0 0  
 2 0 0  
 1 1 1  
 \*  
 CWIOS CLAY with interbeds of sand  
 3 4 255 255 191 127 0 63  
 2 0 2.9  
 0 0.8 3.6  
 1 1.5 2.9  
 0 2.3 2.1  
 1 3 2.9  
 2 0 1.4  
 0 0.8 2.1  
 1 1.5 1.4  
 0 2.3 0.6  
 1 3 1.4  
 2 0 2.0  
 1 0.4 0.2  
 2 1.2 0  
 1 1.4 0.2  
 2 2.2 0  
 1 2.4 0.2  
 \*

## DOLO DOLOMITE

3 4 191 255 127 0 0 63

2 0 1

1 3 1

2 0 3

1 3 3

2 0.3 3

1 0 2

2 3 2

1 2.7 1

2 1.2 3

1 1.5 4

2 1.5 0

1 1.8 1

\*

## GRAVEL GRAVEL

4 5 127 255 255 0 0 127

2 0 4

0 1 5

1 2 4

0 1 3

1 0 4

2 2 1

0 3 2

1 4 1

0 3 0

1 2 1

2 1 2

1 1.1 2

2 3 3

1 3.1 3

2 0.5 1

1 0.6 1

2 2 2.5

1 2.1 2.5

2 3 4

1 3.1 4

2 0.5 0.5

1 0.6 0.5

\*

## GWS GRAVEL with sand

5 191 255 255 0 0 127

2 0 4

0 1 5

1 2 4

...

\*

## LIME LIMESTONE

3 4 255 255 191 0 0 0

2 0 1

1 3 1

2 0 3

1 3 3

2 0 1

1 0 3

2 1.5 0

1 1.5 1

2 1.5 3

1 1.5 4

\*

## ROCK1 Rock1

2 2 255 255 255 0 0 0

2 0 1

1 2 1

\*

## ROCK2 Rock2

1 1 255 255 255 0 0 0

2 0 0.5

1 1 0.5

\*

ROCK3 Rock3

0.5 0.5 255 255 255 0 0 0

2 0 0.3

1 0.5 0.3

\*

ROCK4 Rock4

2 2 255 255 255 0 0 0

2 0.5 1

1 1.5 1

2 1 1.5

1 1 0.5

\*

ROCK5 Rock5

1 1 255 255 255 0 0 0

2 0.3 0.5

1 0.8 0.5

2 0.5 0.3

1 0.5 0.8

\*

ROCK6 Rock6

3 3 255 255 255 0 0 0

2 1 1.5

1 2 1.5

2 1.5 1

1 1.5 2

\*

ROCK7 Rock7

2 2 255 255 255 0 0 0

2 0.5 1.5

1 1 1

2 1 1

1 1.5 1.5

\*

ROCK8 Rock8

3 3 255 255 255 0 0 0

2 0 0

1 3 3

\*

ROCK9 Rock9

2 2 255 255 255 0 0 0

2 0 0

1 2 2

\*

SAND SAND

2 2 191 255 255 0 0 127

2 0 0

1 0.3 0

1 0.3 0.3

1 0 0

2 1 1

1 1.3 1

1 1.3 1.3

1 1 1

\*

The meaning and creation of symbols will be explained using simple examples from the file LITH.DLT. Take for example the symbol for SILT. The block for silt is copied here below.

```
SILT SILT
2 2 255 255 191 255 0 0
2 0 0
1 1 1
*
```

The first line contains the code for silt "SILT", and the default description that will be typed in well log if you do not override the default. (You can also modify this default by adding a word or more to Silt to better identify the unit. This will then become the default for SILT. Or, you may translate this word into another language, say, Spanish, in which case the word would be probably LIMO or POLVO.) The code may have up to 10 characters. The description may be any combination of up to 100 characters. You may break the description with a backslash character, \. This is the instruction to the program to start with the next line after the backslash character is encountered.

The second line contains two numbers which define the size of a block, followed by six numbers that define the color of the background field and of the symbol itself. The philosophy of creating symbols is related to the size of blocks. One block is repeated in both horizontal and vertical direction in the log. One may think of small building blocks, such as bricks of exactly the same size and shape, which are laid on top and side one from the other to fill the whole space. The numbers 2 2 imply a square, so that any symbol defined in such a square shall be symmetrically repeated horizontally and vertically. We will demonstrate this concept later.

The six numbers defining the color are, in the following order, Red, Green, Blue (RGB) for the background, and Red, Green, Blue (RGB) for the symbol. Remember that the number 0 is black, and the number 255 white. The combination 255,0,0 is red; the combination 0,255,0 is green; the combination 0,0,255 is blue.

The combination 255,255,191 is interpreted as light yellow background, while the combination 255,0,0 is red symbol for silt.

The block for silt, as well as any other symbol, terminates with \*. Between the second line and the asterisk sign, there may be one or many lines. The first number in each such line can be 2,

1 or 0. The number 2 defines the starting point, number 1 means "connect this point with the previous", number 0 means "make an arc through this point without actually passing through it". In the third line of the SILT block, the remaining two numbers (0,0) define X and Y coordinates of the starting point within the block defined by 2 by 2. The number 1 on the next line is interpreted as "connect the starting point with this point", and the coordinates of this second point are 1.0 and 1.0. When this is interpreted, the diagonal line appears in the lower one half of the square, connecting the point with coordinates (0,0) with the point with coordinates (1,1). Since the small block which defined the symbol is repeatedly used, the final appearance of this symbol is as is usually used for SILT. If you want to create a symbol for horizontal lines widely spaced, such as the default symbol ROCK1, the design would be as follows:

```
ROCK1 Rock1 (you may type something else)
2 2 255 255 255 0 0 0 (white background, black line)
2 0 1
1 2 1
*
```

This is equivalent to saying "draw a straight line from starting point with X,Y coordinates (0,1) to ending coordinates (2,1)", which is along the middle of the block of size 2,2. If you want denser horizontal lines, the block to define should be smaller, and so will be the spacing between repeating blocks. For example,

```
ROCK2 Rock2
1 1 255 255 255 0 0 0
2 0 0.5
1 1 0.5
*
```

Very narrowly spaced horizontal lines can be obtained by assigning even smaller size to the block, say 0.5 by 0.5. Thus the design for ROCK3 may be as follows:

```
ROCK3 Rock3
0.5 0.5 255 255 255 0 0 0
2 0 0.25
1 0.5 0.25
*
```

This is interpreted as "connect the point with coordinates 0,0.25 with point coordinates 0.5,0.25".

In addition to connecting two points with straight lines, you may create an arc between two points. This is done by inserting

a line with the first number 0 between two lines starting with the number 2 or 1. Suppose you want to create a sinusoidal line with amplitude 1.5 and period 3.0. The block to define shall be 3 by 1.5. The fixed points should be at coordinates (0,0.75), (1.5,0.75), (3,0.75). These will be the three lines with starting number either 2 (for the first point) or 1 (for the remaining two points). The top of arc shall be at the point (0.75,1.5), and the bottom of arc at the point (2.25,0). Thus the block to define a sinusoidal line, which may be used to describe clay, may look as follows:

```
CLAY Clay
3 1.5 255 255 255 0 0 0
2 0 0.75
0 0.75 1.5
1 1.5 0.75
0 2.25 0
1 3 0.75
*
```

By reducing the height of the block from 1.5 to 1.0 the waves will become more "ironed" and lines closer. For example, one may design the following block for schist or shale:

```
SCHIST Paleozoic Schist
3 1.0 255 255 255 0 0 0
2 0 0.5
0 0.75 1
1 1.5 0.5
0 2.25 0
1 1.5 .5
*
```

You may connect several points to create a circle, or any rounded or semirounded object. Let us create a design for semirounded fine gravel. Define this block as 3 by 2.

```
SRGRAV Semi-rounded gravel
3 2
2 0.7 0.4
1 0.7 1.5
0 1.4 1.9
1 1.9 1.4
0 2 1
1 1.6 0.5
0 1.15 0.2
1 0.7 0.4
*
```

As an exercise, double the size of this block and create gravel grains in checkered position, i.e. second line shifted to middle between two grains in lines above and below.

Now we will create a symbol for "Clay alternating with fine sand". Define block as 3 by 2.5, and use the upper 1.5 units for

clay (actually, duplicate the design of CLAY), and lower one unit for sand. Start with "Clay line" in the upper 1.5 units. The starting point will be at coordinates (0.00,1.75), and fixed points at (1.50,1.75) and (3.00,1.75). The arc should pass through the points (0.75,2.50) and (2.25,1.00). Thus, the upper part of the block would be as follows:

```
3 2.5 255 255 255 0 0 (red line on white background)
2 0 1.75
0 0.75 2.5
1 1.5 1.75
0 2.25 1
1 3 1.75
```

The "sand" portion of the design will be in the lower 1.0 unit, i.e. within the block defined by coordinates 0,0; 0,1; 3,1;3,0. The "sand" grains are created by connecting points through small distance. For example,

```
2 0 0
```

```
1 0.1 0
2 0.5 0
1 0.6 0
2 1 0
1 1.1 0
etc.
```

The final design for "Alternating bands of clay with fine sand" could be as shown here below. (In your file, this should be typed line after previous line, continuously, not in three columns.)

ABOCWFS Alternating\bands of clay\with fine sand

3 2.5 255 255 255 0 0 0 (Line #1, followed by:)

2	0.00	1.75	2	2.50	0.00	2	0.00	0.80
0	0.75	2.50	1	2.60	0.00	1	0.10	0.80
1	1.50	1.75	2	0.20	0.40	2	0.50	0.80
0	2.25	1.00	1	0.30	0.40	1	0.60	0.80
1	3.00	1.75	2	0.70	0.40	2	1.00	0.80
2	0.00	0.00	1	0.80	0.40	1	1.10	0.80
1	0.10	0.00	2	1.20	0.40	2	1.50	0.80
2	0.50	0.00	1	1.30	0.40	1	1.60	0.80
1	0.60	0.00	2	1.70	0.40	2	2.00	0.80
2	1.00	0.00	1	1.80	0.40	1	2.10	0.80
1	1.10	0.00	2	2.20	0.40	2	2.50	0.80
2	1.50	0.00	1	2.30	0.40	1	2.60	0.80
1	1.60	0.00	2	2.70	0.40	*		
2	2.00	0.00	1	2.80	0.40			
1	2.10	0.00						

Of course, you may create symbols in an easier way, using the On-Screen editing option in the **Well Log and Lithology** application. But for that you will need some practice.

The important thing to remember is that the program will stop you from attempting to type a non-existing symbol. In the Well Log and Lithology application you first tell the program which file with lithological symbols you are going to use, then you type depths and codes.