

# CHASM 4 HELP

## File format

Knowledge of the structure of CHASM 4 input data files may prove helpful when linking to other data sources such as digital elevation models from which the slope profile could be generated.

CHASM 4 input data files are simple ASCII file with a default extension .chr [or .CHR]. It is advisable to keep this extension otherwise CHASM 4 might not find the saved file at a later stage.

The file used in this example is the file used all throughout this help file. Browse the other section to find out how soils were created, vegetation defined etc ... Note that to make the file more readable, the cells have been created 1m by 1m.

### Commented file:

The original file data is written in a **black bold font**.  
Text in **blue** indicates the signification of the input data.  
Text in **red** notes important comments about the structure of the file.  
Text in **green** illustrates the input data in plain english.

Simulation duration (hrs); time step (s)

**10 60**

The simulation will be for ten hours with a time step of 60 seconds.

Detention capacity (m); Maximum soil evaporation rate (m/s); Hour of rainfall start; Hour of rainfall end

**0.015 5e-07 0 10**

For this simulation, the detention capacity is of 0.015m and the maximum soil evaporation of 0.000005m/s. The rainfall event starts at hour 0 and finishes at hour 10.

Hourly rainfall data (m/hr)for each hour of the rainfall event

**0.01 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02**

11 hourly rainfall rate are required (from hour 0 to hour 10).

A rainfall rate of 0.01m/hr is imposed for the first hour and 0.02 mm/hr after that.

Number of soils

**4**

This simulation will make use of four soil types.

(NOTE: in this example, the four soil types will use the same parameters)

Ksat(m/s); Saturated moisture content (m<sup>3</sup>/m<sup>3</sup>); Sat bulk density (kN/m<sup>3</sup>); Unsat bulk density (kN/m<sup>3</sup>), Cohesion (kPa), friction angle (degrees)

**1e-05 0.43 19 18 0 33.0**

Number of points on suction-moisture curve

**12**

Moisture content on suction-moisture curve (-)

**0.209 0.218 0.227 0.251 0.267 0.295 0.308 0.324 0.348 0.376 0.4 0.42**

Pore water pressure on moisture curve (m)  
-10 -8 -6 -4 -3 -2 -1.6 -1.2 -0.8 -0.4 -0.2 -0.1

Basically, this means that the soil moisture curve for soil zero is made of 12 points. The first point has a moisture content of 0.209 for a pore water pressure of -10m. The last point a moisture content of 0.42 for a pore pressure of -0.1m. (Please note that the saturated moisture content is 0.43 for pore pressure of 0m and above as defined for the saturated moisture content).

The definition of the remaining three soils (soils 1, 2 and 3) follows:

1e-05 0.43 19 18 0 33.0  
12  
0.209 0.218 0.227 0.251 0.267 0.295 0.308 0.324 0.348 0.376 0.4 0.42  
-10 -8 -6 -4 -3 -2 -1.6 -1.2 -0.8 -0.4 -0.2 -0.1  
1e-05 0.43 19 18 0 33.0  
12  
0.209 0.218 0.227 0.251 0.267 0.295 0.308 0.324 0.348 0.376 0.4 0.42  
-10 -8 -6 -4 -3 -2 -1.6 -1.2 -0.8 -0.4 -0.2 -0.1  
1e-05 0.43 19 18 0 33.0  
12  
0.209 0.218 0.227 0.251 0.267 0.295 0.308 0.324 0.348 0.376 0.4 0.42  
-10 -8 -6 -4 -3 -2 -1.6 -1.2 -0.8 -0.4 -0.2 -0.1

Number of columns in the slope profile  
20

(NOTE: the following 2 lines of data are required for EACH column)  
Number of cells in column; Height of water table; Column width; Column depth; Initial surface suction  
(Note: Column width along x axis; Column depth along z-axis)  
20 9 1.0 1 -1

The first column contains 20 cells. The water table is located 9 cells from the bottom. The column depth (along z-axis) is 1m and the initial surface suction is 1m at the top of the column.

Couple Cell height/ Soil type starting from the top cell in the column and repeated for each of the declared number of cells in the column.  
For instance,  
1.0 0 1.0 0 1.0 0 1.0 0 1.0 0 1.0 1 1.0 1 1.0 1 1.0 1 1.0 1 1.0 1 1.0 2 1.0 2 1.0 2  
1.0 2 1.0 2 1.0 2

This reads from left to right as:  
- top cell as a height of 1m and contains soil number 0  
- bottom cell has a height of 1m and contains soil number 2

(NOTE: soils are numbered from 0. For instance if 4 soils have been defined, the first soil is number 0 and the last is number 3)

(NOTE: the above 2 lines have completed the entry for the first column; this pattern of data entry is now repeated for the remaining columns - 19 in this case)

20 8 1.309375 1 -1  
1.0 0 1.0 0 1.0 0 1.0 0 1.0 0 1.0 0 1.0 1 1.0 1 1.0 1 1.0 1 1.0 1 1.0 1 1.0 2 1.0 2 1.0 2  
1.0 2 1.0 2 1.0 2  
19 8 1.309375 1 -1

1.0 0 1.0 0 1.0 0 1.0 0 1.0 3 1.0 0 1.0 0 1.0 1 1.0 1 1.0 1 1.0 1 1.0 1 1.0 1 1.0 1 1.0 1 1.0 2 1.0 2 1.0 2  
 1.0 2 1.0 2  
 19 8 1.309375 1 -1  
 1.0 0 1.0 0 1.0 0 1.0 3 1.0 3 1.0 0 1.0 0 1.0 1 1.0 1 1.0 1 1.0 1 1.0 1 1.0 1 1.0 1 1.0 1 1.0 2 1.0 2 1.0 2  
 1.0 2 1.0 2  
 18 7 1.309375 1 -1  
 1.0 0 1.0 0 1.0 0 1.0 3 1.0 0 1.0 0 1.0 0 1.0 1 1.0 1 1.0 1 1.0 1 1.0 1 1.0 1 1.0 1 1.0 2 1.0 2 1.0 2 1.0 2  
 1.0 2  
 16 7 1.309375 1 -1

(NOTE: note the soil lense of soil number 3 in the above 3 records)

1.0 0 1.0 0 1.0 0 1.0 0 1.0 0 1.0 1 1.0 1 1.0 1 1.0 1 1.0 1 1.0 1 1.0 1 1.0 1 1.0 2 1.0 2 1.0 2 1.0 2  
 15 6 1.309375 1 -1  
 1.0 0 1.0 0 1.0 0 1.0 0 1.0 0 1.0 1 1.0 1 1.0 1 1.0 1 1.0 1 1.0 1 1.0 1 1.0 2 1.0 2 1.0 2 1.0 2  
 14 6 1.309375 1 -1  
 1.0 0 1.0 0 1.0 0 1.0 0 1.0 0 1.0 1 1.0 1 1.0 1 1.0 1 1.0 1 1.0 1 1.0 2 1.0 2 1.0 2 1.0 2  
 13 5 1.309375 1 -1  
 1.0 0 1.0 0 1.0 0 1.0 0 1.0 1 1.0 1 1.0 1 1.0 1 1.0 1 1.0 1 1.0 2 1.0 2 1.0 2  
 12 5 1.309375 1 -1  
 1.0 0 1.0 0 1.0 0 1.0 1 1.0 1 1.0 1 1.0 1 1.0 1 1.0 1 1.0 2 1.0 2 1.0 2  
 12 4 1.309375 1 -1  
 1.0 0 1.0 0 1.0 0 1.0 1 1.0 1 1.0 1 1.0 1 1.0 1 1.0 2 1.0 2 1.0 2 1.0 2  
 12 4 1.309375 1 -1  
 1.0 0 1.0 0 1.0 0 1.0 1 1.0 1 1.0 1 1.0 1 1.0 2 1.0 2 1.0 2 1.0 2  
 10 3 1.309375 1 -1  
 1.0 0 1.0 0 1.0 1 1.0 1 1.0 1 1.0 2 1.0 2 1.0 2 1.0 2 1.0 2  
 8 3 1.309375 1 -1  
 1.0 1 1.0 1 1.0 2 1.0 2 1.0 2 1.0 2 1.0 2 1.0 2  
 7 3 1.309375 1 -1  
 1.0 1 1.0 2 1.0 2 1.0 2 1.0 2 1.0 2 1.0 2  
 5 2 1.309375 1 -1  
 1.0 2 1.0 2 1.0 2 1.0 2 1.0 2  
 4 2 1.309375 1 -1  
 1.0 2 1.0 2 1.0 2 1.0 2  
 4 2 1.309375 1 -1  
 1.0 2 1.0 2 1.0 2 1.0 2  
 4 2 1.309375 1 -1  
 1.0 2 1.0 2 1.0 2 1.0 2  
 4 2 1.309375 1 -1  
 1.0 2 1.0 2 1.0 2 1.0 2

(NOTE: by tilting your head by 90 degrees clockwise, you can "see" the structure of the slope on the above entries. This can be useful for tracking geometrical errors, although the slope is inverted. The bottom cells are on the left)

Soil type for the boundary condition at the toe of the slope; Water table height in cells for boundary conditions  
 2 2

Soil number 2 will be used to calculate the boundary condition at the toe of the slope. the water table height imposed on the right hand side is of 2 cells.

Type of stability analysis

(NOTE: only Bishop is available on the commercial windows version)

## Bishop

Definition of the grid: xstart; ystart; x increment; y increment; initial radius; radius increment  
Xstart-Ystart being the bottom left point of the grid

**16.6875 13.25 1 1 10 10 3 0.5**

Number of points that define the slope surface

**6**

List x-y of the points on the surface

**0 15.4375 4.5625 14.5625 11.1875 9.875 15.4375 8.9375 21.125 2.9375 26.1875 2.9375**

The surface of the slope is made of 6 points of coordinates (0;15.4375) to (26.1875;2.9375)

Reinforcement section:

**REINFORCEMENT**

Eartnails section:

**EARTHMAIL**

number of earth nails

**number 3**

random text (no spaces)

**text**

Inclination (degrees) ; Length (m) ; Xstart (m); Ystart (m); lateral friction (kPa) ; strength (Nm) and FOS for each nail

**59.400024 6.752893 7 12.8125 0.5 100 2**

**57.578932 5.479008 9.375 11.1875 0.5 100 2**

**59.858617 4.480862 10.9375 9.9375 0.5 100 2**

Three earth nails are defined, the first one starts from the location (X=7;Y=12.81) with a length of 6.75 m and an inclination of 59 degrees. Its lateral friction is 0.5 kPa, its strength 100 Nm and its design factor of safety 2.

NOTE: had there been geotextiles, a very similar section would exist before the EARTHMAIL block with the following syntax:

**GEOTEXTILE**

number 2

text

**25.820992 6.457191 8.1875 10.5 0.5 100 2**

**11.604762 7.146076 20.625 3 0.5 100 2**

where the last three parameters for each geotextile are the interaction (-), strength (Nm) and FOS

NOTE: the reinforcement section is written regardless of whether reinforcement is switched on or off within CHASM as long as some reinforcement has been drawn in the "Draw" window.

Leakage section:

**LEAKAGE**

0=no, 1=yes

**1**

Column; Leakage value per column (m/hr)

1 0  
2 0  
3 0.02  
4 0  
5 0  
6 0  
7 0  
8 0  
9 0  
10 0  
11 0  
12 0  
13 0  
14 0  
15 0  
16 0  
17 0  
18 0  
19 0  
20 0

Leakage will be used and we find a leakage point of 0.02 m/hr at the top of column 3. This could account for a pipe or a leaky drain.

Initial conditions section:

#### **INITIAL\_CONDITIONS**

Type of initial conditions; top pressure condition

Type 1: use current values -> top pressure condition ignored

Type 2: imposed surface suction -> surface suction

Type 3: hydrostatic -> maximum suction at the top

2 -1

An imposed surface suction of -1m will be used for the initial conditions. The initial pore pressure distribution will be hydrostatic below the drawn water table and interpolated between 0m at the water table and -1m at the surface for the unsaturated zone.

Upslope recharge section:

#### **UPSLOPE\_RECHARGE**

Value of upslope recharge in m/s

0

There is no upslope recharge.

(NOTE: the 0 above is for 0 m/s this is NOT an integer flag [0 or 1] for switching on or off the recharge. So basically, upslope recharge is **always on** and a value of 0 m/s is used when upslope recharge is not to be used.)

Fredlund's Phi b section:

#### **PHI\_B**

0=no, 1=yes; phi\_b friction angle in degrees

0 15

Fredlund's equation will NOT be used. Default value of Phi b ("unsaturated friction angle") is 15 degrees.

Cut off value for the pressure in the Bishop equation:

#### **MAXIMUM\_HEAD**

0=no, 1=yes ; Value of maximum suction

1 -2

A suction limiter of -2m will be used in Bishop's equation, all suction values below -2m will be

replaced by -2m in the Bishop equation.

Vegetation section:

**VEGETATION**

0=no, 1=yes

1

Tensile strength (kPa) and root area ratio (-) for custom grass

0 0

Tensile strength (kPa) and root area ratio (-) for custom tree

0 0

Column number; vegetation depth; vegetation type (see note below); tensile strength (kPa); root area ratio; increased conductivity (m/s); tree(2) or grass (1)

1 0 0 30 0.06 6e-06 2

2 0 0 30 0.06 6e-06 2

3 4 2 37 0.06 6e-06 2

On column 3, some vegetation of type 2 (Birch) of depth 4 cells is defined

The characteristics of the vegetation are: tensile strength: 37kPa, root area ratio 0.06, increase soil conductivity 6e-6 m/s and birch is a tree ...

4 0 0 30 0.06 6e-06 2

5 0 0 30 0.06 6e-06 2

6 0 0 30 0.06 6e-06 2

7 0 0 30 0.06 6e-06 2

8 0 0 30 0.06 6e-06 2

9 0 0 30 0.06 6e-06 2

10 0 0 30 0.06 6e-06 2

11 0 0 30 0.06 6e-06 2

12 0 0 30 0.06 6e-06 2

13 0 0 30 0.06 6e-06 2

14 0 0 30 0.06 6e-06 2

15 0 0 30 0.06 6e-06 2

16 0 0 30 0.06 6e-06 2

17 0 0 30 0.06 6e-06 2

18 0 0 30 0.06 6e-06 2

19 0 0 30 0.06 6e-06 2

20 0 0 30 0.06 6e-06 2

(NOTE: the list of vegetation types is: Accacia (0), Alfafa (1), Birch (2), Bare soil (3), Couch grass (4) Radiata pine (5), User defined grass (6), User defined tree (7), Vetiver cropped (8) and Vetiver uncropped (9))

(NOTE: by default, CHASM defined vegetation of type 0 (Accacia) for each column with a depth of 0 cells as illustrated above.)

Signal to mark the end of the file:

**End\_of\_data**

(NOTE: This "End\_of\_data" statement is required. If not, CHASM 4 will NOT work)