CLEVE HILL SOLAR PARK

OTHER DEADLINE 4 SUBMISSIONS
WRITTEN REPRESENTATION BY THE APPLICANT - PUSH / PULL TEST REPORT

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CLEVE HILL
SOLAR PARK

Solar plant

Cleve Hill

Borough of Swale, Kent, South East England

United Kingdom

Expertise for the determination of the necessary ramming depth for steel profiles as founding elements

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Enclosure 6 Determination of the necessary ramming-depths

1 Location and proceedings, geological situation

On 29/01/2018, the Büro Boden und Wasser has been tasked to conduct the survey according to the offer of 09/11/2017.

The Büro Boden und Wasser has conducted the investigation on site from week 07/2018 to week 09/2018 (taking soil samples, light penetration tests, geo-electric measurements, soil moisture measurements and geological survey).

The survey area has been precised by the client with plans and maps (see also the plans in enclosure 1).

The area has been geologically examined, the soil types important for the founding have been charted, 181 penetration-tests have been conducted, 36 soil samples were taken with the slotted rod and 6 hand test excavations have been made for chemical analysis (results are shown in enclosure 2 and enclosure 5). In addition, the specific soil resistance according to the 'Wenner's method' has been determined at 19 test locations together with moisture measurements of the ground (for results see enclosure 1.3 and enclosure 4).

The survey area is situated about 0.4 km northwest of Graveney, approximately 2.5 km northeast of Faversham and about 37 km northwest of Dover. The northern border is marked by the coast of "The Swale". To this side, the area site is defended from tidal flooding by a sea wall and coastal flood defences. Although the western and southwestern border is built by a river estuary. To the south follows a solar field and in the west lies the "Cleve Hill Substation" and in the northwest a wildlife reserve is located (see enclosure 1.1).

The polygonal shaped field is used as arable land (partly harvested and or laying fallow or freshly cultivated and sown).
The ground surface is nearly flat and level. Elevations occur only at the southeastern end and in the southwest. The hill in the southeastern end is probably eponymous for the whole area. It dips up to 8 ° to SW, SE and NE. Here, most of the area dips gently with 5° - 6° towards SW. The field is characterised by numerous 2 m wide drainage ditches surrounded by 3 m greenery, which drain surface water (and groundwater) towards the coast. At the time of the fieldwork the several drainage ditches were full of water. The water level was approximately 1.5 m below ground surface. The ditches seem to drain the terrain relatively well, but in the southern part of the extreme western end of the field there exist areas with marshy terrain. During heavy rain, however, the water probably will accumulate in terrain depressions because the seepage is poor.

According to the geological map, the deeper ground of the area is part of the "London Clay Formation" of Paleogene age which is composed of clay and silt. At this place, these sediments are

covered by young alluvial superficial deposits of Quaternary age consisting of clay, silt, sand and peat (see enclosure 1.3).
As a result of our own geological investigations in the study area the coverage soil near the surface consists of organic silty CLAY, partially with some pebbles and sand of predominantly dark-brown colour.

The necessary length for the profiles, which have to be rammed into the soil, had to be determined. Furthermore, the influence of the determined soil types on the stability of the profiles regarding corrosion and long-time stability has to be checked.

For the founding advice, we used the current standards and the knowledge the Büro Boden und Wasser has accumulated during previous expertises. For the determination of the ramming depth, we mainly used Eurocode 7-1 and calculations according to ZTV-Lsw88 and ZTV-Lsw06 for the determination of the lengths of the poles. In addition to that, we controlled the resulting ramming depths with measurements of horizontal and vertical forces on objects in similar soils.

2 Outcrops, on-site examinations

The survey area has been observed and geologically examined in its entity. At 181 locations (designated DPL C01 – C181) the soil density and consistency according to the depth have been determined with the light penetration tool. At 36 points (C03, C10, C18, C20, C21, C24, C31, C36, C42, C46, C51, C54, C59, C63, C66, C70, C75, C76, C77, C79, C82, C84, C86, C88, C91, C95, C99, C104, C110, C120, C124, C129, C134, C143, C151, C172), soil samples were taken with the slotted rod. The samples for the analysis about the corrosivity of the soil against steel profiles and concrete were taken at 6 locations (C06 (sample PNCo 06), C50 (sample PNCo 50), C64 (sample PNCo 64), C72 (sample PNCo 72), C83 (sample PNCo 83) and C89 (sample PNCo 89) from a hand test excavation. The outcrops are shown in enclosure 1.4 according to the position of the ramming points. At 20 locations (C07 (SR 1), C17 (SR 2), C19 (SR 3), C20 (SR 4), C24 (SR 5) , C28 (SR 6), C37 (SR 7), C43 (SR 8), C46 (SR9), C103 (SR 103), C106 (SR 106), C110 (SR 110), C121 (SR 121), C136 (SR 136), C143 (SR 143), C155 (SR 155) and C172 (SR 172), soil resistivity tests according to the ‘Wenner’s method’ were executed together with moisture measurements of the ground. The positions were determined through markers on site and GPS positioning. Additionally, the particle size distribution of the soil was determined at 5 locations (C21 (sample KV 21), C55 (sample KV55), C67 (sample KV 67), C77 (sample KV 77) and C85 (sample KV 85).

The outcrops are shown in enclosure 1.4 according to the position of the ramming points. The positions were determined through markers on site and GPS positioning.
In enclosure 2.1 and 2.2, the results of the light penetration tests are shown in detail as a table and diagrams.
The results of the particle size distribution are shown in enclosure 2.3

The appraisal of the results of the soil characteristics is shown in enclosure 3.
The results of the geo-electric soil resistivity measurements are shown in enclosure 4.

The soundings with the light penetration tool were conducted down to a depth of 1.7 m – 5.9 m where the light penetration tool reached a sufficient resistance of the soil.

The 'light penetration tool' consists of a rod assembly with a tip of 5 cm², which is released with a weight of 10 kg from a height of 0.5 m. The number of impacts needed to achieve a penetration of 10 cm is counted and indicates the density or consistency of the soil. When a number of impacts > 10 is reached, a sufficiently high density or, at least, firm consistency has been reached.

For the determination of the soil type, a slotted rod replaces the ramming tip. This rod does not allow the determination of the ramming resistance, but a sample of the soil is taken in the slot. Thanks to that, the soil type can be determined geologically. With these tests together with the hand test excavations, the particle size distribution, the geoelectric measurements and the geological observation of the field, there is enough data for an appraisal of the building ground.

The outcrops show relatively homogeneous conditions in the survey area.

Two characteristic types of soil layers have to be distinguished.
Under an approx. 0,2 - 0.4 m thick TOPSOIL layer consisting of soft organic silty CLAY of dark-brown colour, partially with some pebbles and sand, follows layer **S1** of brown or grey-brown silty CLAY. Layer **S1** shows in some places fine laminations and reddish mooted spots as well as lenses of grey fine sand. Its consistency increases with the depth from soft to stiff. In the most parts of the area the penetration tests were completed inside that layer **S1**. No desiccation cracks have been found during fieldwork.

Only in the south-eastern corner of the field (surroundings of "Cleve Hill"), in a subsection along the north-eastern border, along the southern part and in subsections of the south-western part of the area layer **S2** was hit underneath layer **S1**. It is suggested, that layer **S2** forms an older relief, which was covered by layer **S1**. Layer **S2** consists of clayey sandy SILT of brown-grey colour. The consistency of layer **S2** increases with the depth from firm to very stiff.

Layers in even greater depth are not important for the foundation.

Groundwater is expected at a depth of approximately 1.5 m below ground level. Temporarily the level of ground water can rise up to the surface.

3 Appraisal of the soil-types

Apart from the TOPSOIL, the foundation of the solar plant has to be carried out in the upper two soil layers **S1** and **S2** (described in chapter 2).

The non-marked area (enclosure 1.4):
The foundation of the solar plant has to be carried out in layer **S1** (described in chapter 2). The thickness of layer **S1** is more than 3.0 m thus layer **S2** probably will not be hit. Pre-drilling will not be necessary.

The orange-marked area (enclosure 1.4):
The foundation of the solar plant has to be carried out in the upper two soil layers **S1** and **S2** (described in chapter 2). Layer **S2** reaches up to ≤ 1.0 m below ground level. Normally there should not be any problem to reach the necessary ramming depth without pre-drillings.

The brown-marked area (enclosure 1.4):
The foundation of the solar plant has to be carried out in the upper two soil layers **S1** and **S2** (described in chapter 2). Layer **S2** reaches up to 1.1 m to ≤ 2.0 m below ground level. Normally there should not be any problem to reach the necessary ramming depth without pre-drillings.

The green-marked area (enclosure 1.4):
The foundation of the solar plant has to be carried out in the upper two soil layers **S1** and eventually **S2** (described in chapter 2). Layer **S2** reaches up to 2.1 to ≤ 3.0 m below ground level. Normally there should not be any problem to reach the necessary ramming depth without pre-drillings.

The encountered soil types are very well suitable for the construction of rammed steel pole foundations.

The clayey soil has a good capacity to fix the profiles dependably. The conditions for ramming the profiles will be good, too. Predrilling will not be required.

The soil shows a penetration resistance that is high enough to deduce a high enough consolidation and consistency to receive the forces from the solar panels, especially close to the surface.

All recommended ramming depths are listed in enclosure 6.

4 Initial values for the calculations

The soil characteristics used for the calculations are listed in enclosure 3.

The profiles which the calculations are based upon can be found in enclosure 6.

The loads and moments of the profiles which must be transmitted to the soil are also listed in enclosure 6.

For the determination of the vertical carrying capacity of the profiles, the pressure of the soil and the resulting friction between the profile surface and the soil were used. With this type of calculations, the tip resistance of the profile is not taken into account. This way, the maximal pressure downwards can be determined at the same time as the maximal pressure upwards. Since the tip pressure is still in effect, the calculated values have a safety margin, which does not appear in numbers.

Normally, the forces determining the ramming depth are the horizontal forces (wind) at the upper end of the profile, which have to be transmitted into the ground.

5 General information

5.1 Information on the assessment of the determined values

A new, zinc coated steel profile with smooth surface is the base for the calculations. Thanks to the oxidation of the zinc coating in the lower parts of the area during the first few months, the profile will have a much better connection to the ground than immediately after construction. The so increased friction is not taken into account for the calculations. This way, there is an additional safety factor.

The same is true for the soil close to the profiles loosened up by the ramming. In the first few months after construction, the soil consolidates in comparison to the moment of the construction. This way the force transfer is improved. This non-quantifiable process is also not taken into account for the calculations and forms another safety factor.

5.2 Information on the chemical soil conditions

The soil samples which were taken near locations C06 (sample PNCo 06), C50 (sample PNCo 50), C64 (sample PNCo 64), C72 (sample PNCo 72), C83 (sample PNCo 83) and C89 (sample PNCo 89) were analysed for steel corrosive soil characteristics according to DIN 50929 part 3 and for concrete corrosive soil characteristics according to DIN 4030-2.

The results of the chemical analyses of the soil samples are shown and explained in enclosure 5.

5.3 Information on the ramming of the steel profiles

Experience shows that during the ramming process, there are not only vertical forces on the steel profiles, but also horizontal deviations up to 1 cm. These deviations, probably caused by a twisting of the profile between the ground and the ramming tip, result in the horizontal densification of the ground, forming a 'ramming canal'. One of the important factors in the creation of such a ramming canal is the size of the grains in the soil.

The bigger the grains, the faster the canal collapses.

Therefore, in fine sand, the ground does not envelope the whole length of the profile, but just the lower end immediately after the ramming. This means that immediately after the ramming, the skin friction does only apply in the lower parts of the poles. Since the resistance towards upward vertical forces mainly comes from skin friction, this resistance can be rather low in the beginning.

Normally, the ramming canal collapses relatively fast, so that the force transmission is established on the whole length of the profile shortly after the ramming. The calculated values apply to this condition.

Within layers S1 and S2 strongly developed ramming canals are very likely to form. These will only collapse entirely after a few weeks. Nevertheless, the steel profiles will be able to bear the whole forces and loads after a certain time. This should be given until the end of the construction period.

The collapsing of the ramming canal is accelerated through drying rain, dew, frost/dew changes in the ground.

Should the ramming canal not collapse rapidly enough, it is possible to wash small quantities of fine sand into the canal to establish the force transmission between ground and steel profile.

Do not drive piles deeper than the calculated foundation depth in any case. Driving piles too deep and pulling up them afterwards would be cause a weak zone at the lower end of the piles and raise the risk of later settlement to the original ramming depth.

If the load carrying capacities of the poles need to be proved via pull-out tests, we emphasize that due to the above mentioned soil conditions, exclusively vertically performed tests are NOT sufficient. In case such tests are planned, it is necessary to coordinate the

planning and the work on site with Büro Boden und Wasser in order to gain interpretable results.

5.4 Information on the foundation of transformer and inverter stations

Near-surface founding

For transformer or inverter stations we recommend to take off approx. 0.3 m of top soil and to replace it with a 0.5 m thick layer of compactable mineral grain mixture or recycling material 0/16 or 0/32 (application in two layers). Between the ground (subbase) and the replaced earth, a simple non-woven geo textile should be applied. This filling should have a degree of compaction of 98% standard Proctor density. The plane needs to be levelled before the transformer and inverter stations are installed. If desired, a sand bed or lean concrete layer can be applied on the plane.

The excavation of soil must be designed to drain water and to prevent standing water by producing a water drain down the slope.

If the soil is prepared in the above described way, it can bear loads of 120 kN/m² without any problem.

Founding block on an excavation pit filled with concrete

Excavation of the pit down to the necessary depth and filling it with concrete (strength class C16/20 or better).

For layer **S1** the following bearing pressure can be applied without any further tests:

depth [m]	admissible bearing pressure [kN/m²]
0.50	100
0.75	120
1.00	150

5.5 Information on the establishment of construction roads

Non-permanent construction roads

Those roads can be built directly on the topsoil layer. Removing the humus layer is not required. We propose compacting the loosened topsoil by a roller compactor on all construction roads built later on before further activities.

We recommend building up this plane with a well compacted sand-gravel mixture or crushed concrete 0/32. To separate the materials from the topsoil use a simple non-woven geotextile

combined with a geogrid. This material should have a thickness of approx. 0.3 m and be compacted in one layer.

Permanent construction roads

For construction roads able to bear the loads from heavy goods vehicles, the vegetation cover and 0.3 m of the underlying topsoil need to be taken away completely and a plane with a homogeneous slope of > 3° needs to be established. On this plane, a simple geotextile combined with a geogrid has to be installed. We recommend building up this plane with a well compacted sand-gravel mixture or crushed concrete 0/32. This material should have a thickness of approx. 0.3 m and has to be compacted in two layers. On the top of this coarse-grained filling material another geotextile (without geogrid) has to be installed. Above this geotextile a layer of a well compacted sand-gravel mixture or crushed concrete 0/16 of 0.4 m thickness has to be built. The filling should have a degree of compaction of 98% standard Proctor density.

5.6 Information on the drivability in general

During wet conditions do not drive with wheeled vehicles on site before building construction roads! Also, not for testing the drivability! Any driving will cause deep tracks and ruts, immediately filling with stagnating water, and will disintegrate the upper part of the soil in total. Such a destroyed soil will never reconsolidate during the construction works. Swampy conditions on site will occur in consequence.
Construction roads must be covered with a protection layer over the geotextile / geogrid before driving with machines or transport devices on that road. Textile and protection layer must be placed in front of the wheeled vehicles, they shall only drive on the road itself.

For driving on site off roads use only tracked vehicles. Generally, reduce the movements there to the absolute minimum. If tracks of vehicle appear during the construction work they have to be filled and replanted with grass after finishing the construction work to avoid standing water inside the tracks.

Do not block any drains or ditches with construction roads. At intersections, passages in the form of culverts have to be built below the construction roads.

5.7 Results of the geo-electric soil resistivity measurements

On the 22nd, 23rd of February 2018 and on the 04th of March 2018 the Büro Boden und Wasser has conducted geo-electric soil resistivity tests at 20 locations together with moisture measurements of the ground. These locations (C07 (SR 1), C17 (SR 2), C19 (SR 3), C20 (SR 4), C24 (SR 5) , C28 (SR 6), C37 (SR 7), C43 (SR 8), C46 (SR 9), C57 (SR 57), C103 (SR 103), C106 (SR 106), C110

(SR 110), C121 (SR 121), C136 (SR 136), C143 (SR 143), C155 (SR 155), C160 (SR 160), C173 (SR173) and C181 (SR 181), are marked in the plan in enclosure 1.4.
The tests were made under dry conditions. These results should be used for the whole area where the solar plant will be constructed (red framed area in enclosure 1.4). The electrode spacing of 1 m, 2 m, 3 m, 4 m and 5 m gives the ground resistivity for the upper layer (down to 4 m below ground level). The results of the tests are shown in enclosure 4.

5.8 Results of the moisture measurements

On 22th 23th of February 2018 and on 04th of March 2018 the Büro Boden und Wasser has conducted moisture measurements of the ground at 19 locations together with geo-electric soil resistivity tests. These locations (C07, C17, C19, C20, C24, C28, C37, C43, C57, C103, C106, C110, C121, C136, C143, C155, C160, C173 and C181), are marked in the plan in enclosure 1.4. The results of the measurements are shown together with the resistivity tests in enclosure 4.

5.9 Information on particle size distribution

The particle size distribution tests of the soil were carried out on selected samples from 5 locations (C21 (sample KV 21), C55 (sample KV55), C67 (sample KV 67), C77 (sample KV 77) and C85 (sample KV 85). The combined sieve and hydrometer analysis after DIN 18123 show a particle distribution mainly in the clay and silt fraction (more than 95 %). Only the sample near location C85 (sample KV 85) has a broader particle size distribution from clay/silt (60 %) up to sand fraction. The locations are marked in the plan in enclosure 1.4. The results of the tests are presented graphically in enclosure 2.3.

As explained in chapter 2, intense desiccation cracks (as a typical indicator of high swelling and shrinking capacity of the ground) were not found during the fieldwork. Dry soil of layer **S1** has a crumbly look.
At the moment it seems that the ground has nearly no relevant swelling and shrinking capacity and therefore, the factor “expansive soil” is negligible in the determination of the ramming depths.

5.10 Flooding

Two extracts of the British EA flood map for the study area are presented in enclosures 1.5.1 and 1.5.2. As illustrated, there is a medium risk of flooding from rivers and sea for the whole site.

Although the site is defended from tidal flooding by a sea wall and coastal flood defences, it is not possible to prevent the whole site from flood from river or sea water in an economic way. Therefore, all facilities in the area should be built in a way to get not harmed by the flood.

Inverter stations and similar sensitive equipment must be placed high enough to be untouched by water during flooding events.

The cohesive soil (clay) absorbs water only to a limited extent. Therefore, over the whole area stagnating water can extensively be formed particularly after heavy rain or when snow melts in shallow depressions.

The existing numerous drainage ditches inclusive their greenery on both sides should be left intact and kept open in any case.

Do not block any drains or ditches with construction roads. At intersections, passages in the form of culverts have to be built below the construction roads.

5.11 Additional information

The soil reacts very sensitive to changes in water content. Under wet conditions it quickly becomes very mushy and is therefore inaccessible with wheeled vehicles and is difficult to drive with tracked vehicles. In dry condition the soil is hard and compact and good drivable with all vehicles.

Cable trenches can be excavated without additional measures and refilled with the excavated soil material. The distance of the trench edge from the posts should be at least equal to the depth of the trench. Cable trenches, which are closer than double digging depth on the posts, must be filled with well compacted soil material.

After finishing the construction work, it should be taken care that a coherent grass cover can grow on the field. The root horizon of this vegetation is very positive for the stability of the foundation as the soil can take on more horizontal forces. This increases the safety margin. Such vegetation also represents a suitable protection against erosion that might be caused by outflowing rainwater.

The best time to build the solar plant is the dry season during the late summer. Do not disturb the vegetation before the beginning of the construction work because the vegetation makes it easier to drive on site with construction machines.
The ground has to be treated very carefully after rainfalls to harm the vegetation cover as less as possible.

The risk of soil expansion due to swelling / shrinking of clay minerals is not relevant for foundation of DNO-stations and other buildings, because the building protects the ground from rainwater.

The risk of soil expansion due to swelling / shrinking of clay minerals is also not relevant for a foundation on rammed steel profiles. The detected soil layers are not likely to shrink / swell very

strong in general. The soil expansion just happens in the upper 10 cm to 20 cm and the profiles will be driven much deeper.

The mobility of water inside the soil is very poor due to the fine and dense structure of the material. The water content of the soil never changes from completely dry to completely water saturated conditions. Especially in a depth of more than 30 cm, which is relevant for the foundation on driven piles, the water content will vary about 10 % also under extreme weather conditions over the seasons. In worst case maximal shrinking / swelling of the soil under those conditions can cause a displacement of the driven piles of less than 2 mm.

Seismic activity has occasionally been recorded in Kent, though the epicentre is offshore. In 1382 and 1580 there were two earthquakes exceeding 6.0 on the Richter Scale. In 1776, 1950, and April 28th 2007 there were earthquakes of around 4.3. The 2007 earthquake caused physical damage in Folkestone.

The recommended ramming depths in enclosure 6 are calculated for soil under earth moist condition, but not for wet soil. If the soil is flooded / submerged over a very long period (several months) the **recommended ramming depth should be lengthened by 0.3 m on minimum**. For further information see enclosure 6.

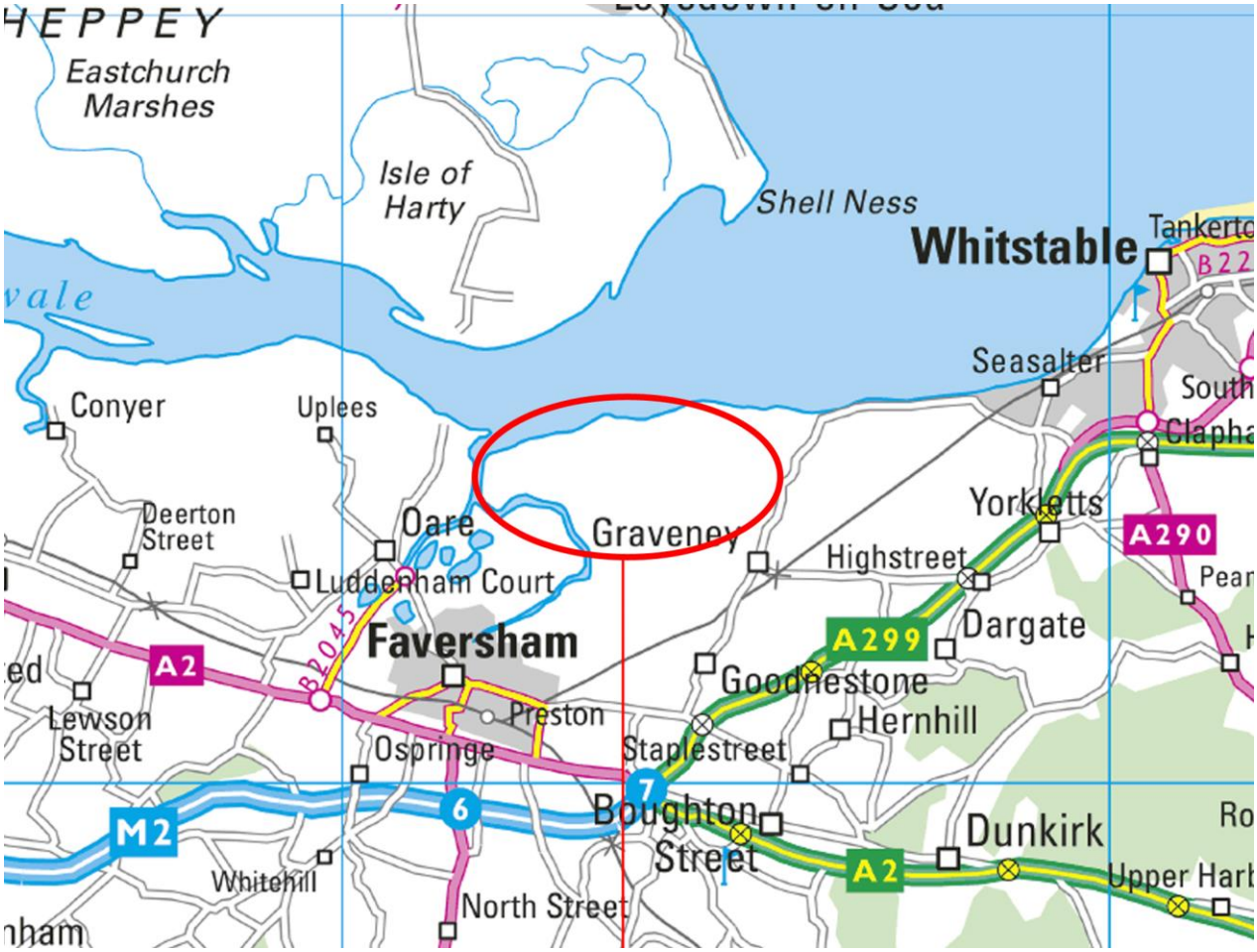
Aichach, 23/03/2018

R. Hurler, Dipl.-Geol.

Enclosures

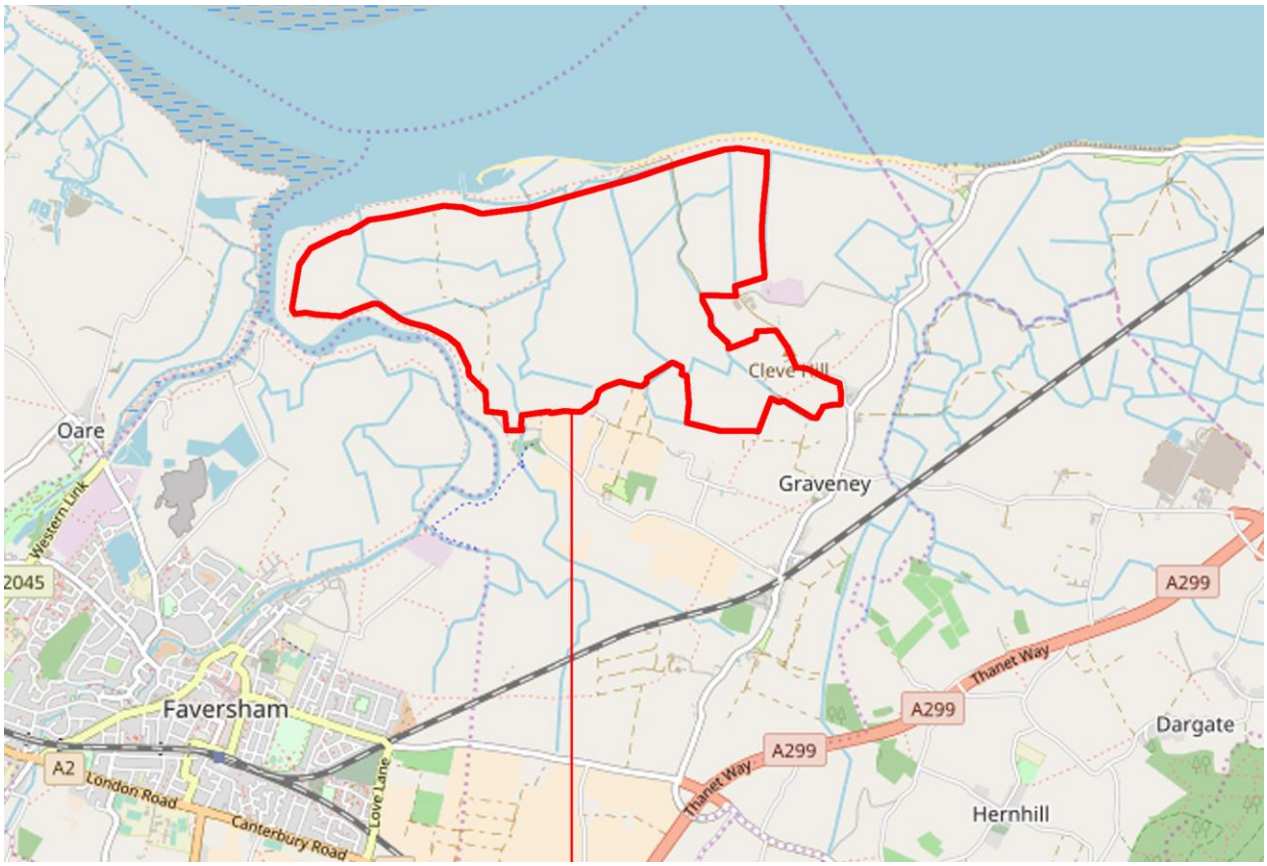
Enclosure 1 Site plans

Enclosure 1.1 Overview map scale 1 : 100,000



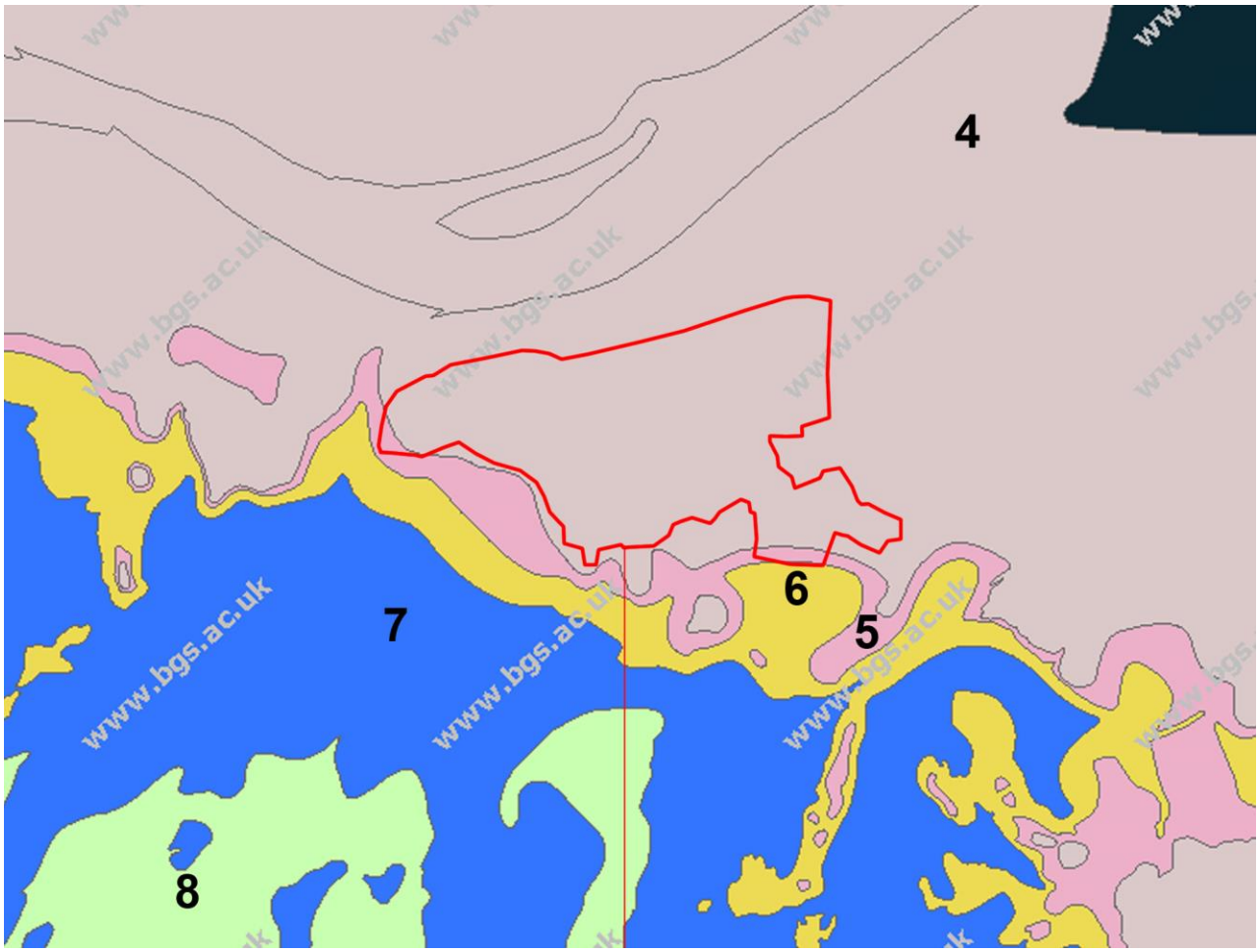
Working area

Enclosure 1.2 Overview map **scale 1 : 50,000**



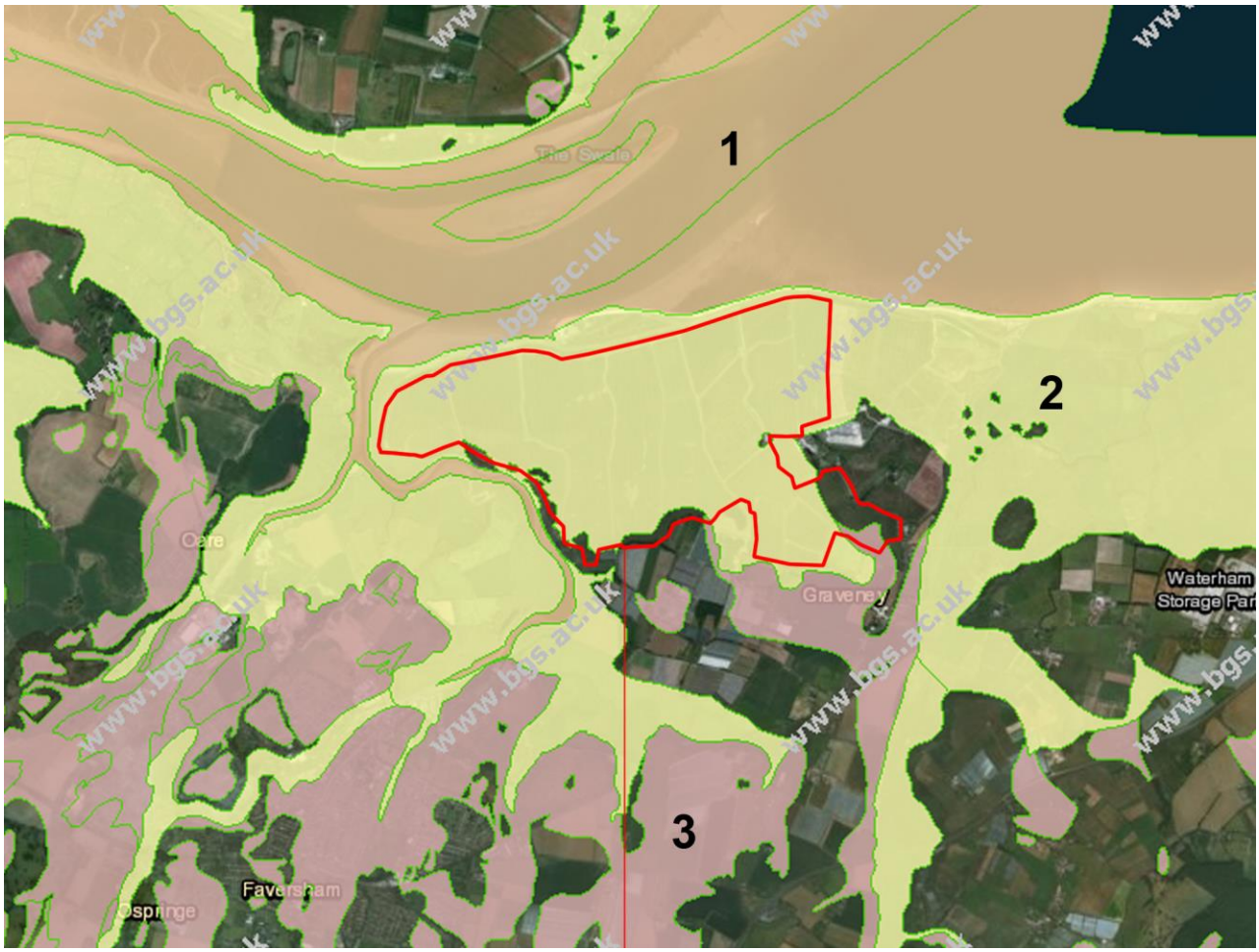
Working area

Enclosure 1.3.1 **Geological map (Bedrock Geology)** **scale 1 : 50,000**



Working area

Enclosure 1.3.2 **Geological map (Superficial Deposits)** **scale 1 : 50,000**



Working area

Legend

Superficial deposits description:

1 Beach and Tidal Flat Deposits (undifferentiated) - Clay, Silt And Sand. Superficial Deposits formed up to 3 million years ago in the Quaternary Period. Local environment previously dominated by shorelines (U).

2 Alluvium - Clay, Silt, Sand and Peat. Superficial Deposits formed up to 2 million years ago in the Quaternary Period. Local environment previously dominated by rivers (U).

3 Head - Clay and Silt. Superficial Deposits formed up to 3 million years ago in the Quaternary Period. Local environment previously dominated by subaerial slopes (U).

Bedrock geology description:

4 London Clay Formation - Clay and Silt. Sedimentary Bedrock formed approximately 48 to 56 million years ago in the Palaeogene Period. Local environment previously dominated by deep seas

5 Harwich Formation - Sand and Gravel. Sedimentary Bedrock formed approximately 48 to 56 million years ago in the Palaeogene Period. Local environment previously dominated by shallow seas.

6 Lambeth Group - Sand. Sedimentary Bedrock formed approximately 48 to 59 million years ago in the Palaeogene Period. Local environment previously dominated by swamps, estuaries and deltas.

7 Thanet Formation - Sand, Silt and Clay. Sedimentary Bedrock formed approximately 56 to 59 million years ago in the Palaeogene Period. Local environment previously dominated by shallow seas.

8 Seaford Chalk Formation - Chalk. Sedimentary Bedrock formed approximately 84 to 90 million years ago in the Cretaceous Period. Local environment previously dominated by warm chalk seas.

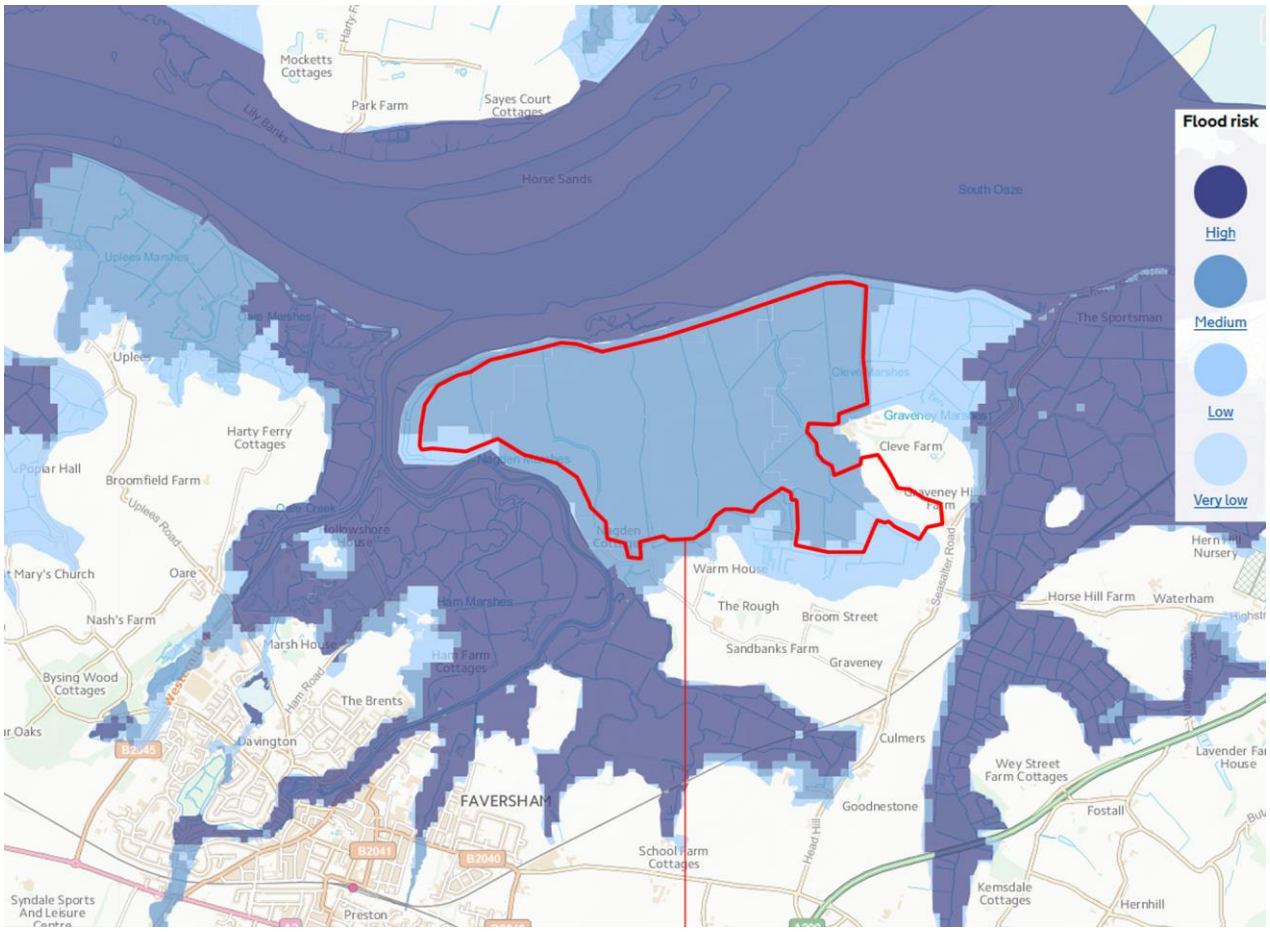
Enclosure 1.4 Detailed plan scale 1 : 20,000

Red border = Working area Marked points = Location of DPL-Tests;
Orange marked area = bottom of layer S1 ≤ 1.0 m; Brown marked area = bottom of layer S1 ≤ 2.0 m;
Green marked area = bottom of layer S1 ≤ 3.0 m below surface.

At locations C06, C50, C64, C72, C83 and C89, soil samples have been taken for chemical analyses.
At locations C21, C55, C64, C67, C77 and C85, soil samples have been taken for analyses of the particle size distribution.
At locations C07, C17, C19, C20, C24 , C28, C37, C43, C103, C106, C110, C121, C136, C143, C155 and C172 geo-electric soil resistivity measurements and moisture measurements of the ground were done.

Coordinates of the approx. center of the field: 51°20’19.72’’N 0°55’23.50’’E

Enclosure 1.5.1 **Risk of flooding from rivers and sea** **scale 1 : 50,000**



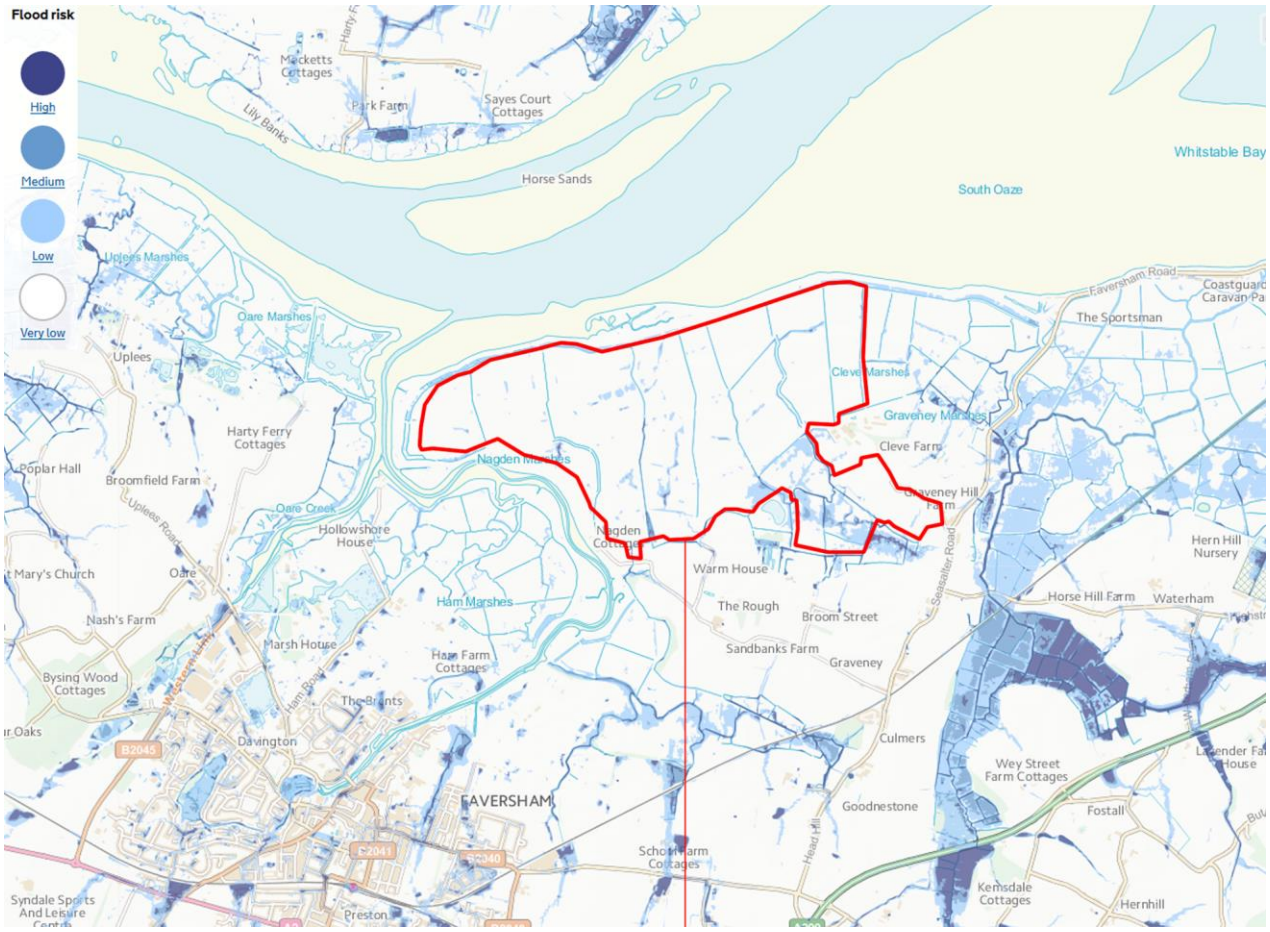
Red border = working area

Dark blue: High Risk Area: the chance of flooding from rivers or the sea in this area is greater than once every 30 years (> 3.3% each year)

Medium blue: Medium Risk Area: the chance of flooding from rivers or the sea in this area is between once every 100 and 30 years (1 – 3.3 % each year)

Light blue: Low Risk Area: the chance of flooding from rivers or the sea in this area is between once every 1000 and 100 years (0.1 – 1 % each year)

Enclosure 1.5.2 **Risk of flooding from surface water** **scale 1 : 50,000**



Red border = working area

Dark blue = high (flooding chance > 3.3 %)

Medium blue = medium (flooding chance > 1.0 % and ≤ 3.3 %)

Light blue = low (flooding chance > 0.1 % and ≤ 1.0 %)

Non marked = very low (flooding chance ≤ 0.1 %)

Enclosure 2 Outcrops

Enclosure 2.1 Table with the results of the light penetration tests

Light penetration tool DPL-5

Number of strokes for penetration of 10 cm Numbers in headline: location of soil test

depth	C01	C02	C03	C04	C05	C06	C07	C08	C09	C10	C11	C12
0.1	0	0	0	0	0	0	0	0	0	0	0	0
0.2	0	1	0	2	2	0	0	1	3	4	1	0
0.3	2	3	0	4	3	0	1	2	4	5	3	1
0.4	3	4	2	4	3	1	4	3	3	6	2	2
0.5	3	4	3	5	2	3	4	5	4	6	3	3
0.6	5	4	3	4	3	4	4	5	4	5	4	2
0.7	4	5	4	5	3	5	5	7	5	6	3	4
0.8	4	7	5	5	3	6	7	8	6	6	4	5
0.9	5	9	4	5	4	9	9	8	7	5	4	7
1.0	6	13	5	6	6	11	10	11	9	7	6	14
1.1	8	14	6	7	7	16	11	13	10	7	7	15
1.2	8	16	7	8	8	18	13	13	10	7	9	17
1.3	11	20	7	7	9	15	14	14	10	7	10	16
1.4	13	21	8	9	14	27	18	15	11	6	9	15
1.5	15	18	18	8	15	38	23	16	11	7	11	2
1.6	14	17	19	11	14	52	25	16	15	8	10	25
1.7	12	16	20	10	15	35	26	15	14	7	8	31
1.8	11	15	34	14	15		28	15	16	9	10	30
1.9	11	19	49	18	15		32	15	19	12	8	33
2.0	11	19	36	26	19		33	17	21	16	9	
2.1	15	19		32	23		36	19	22	20	10	
2.2	17	18		38	22			19	24	21	15	
2.3	15	17		37	24			22	20	24	15	
2.4	16	18			21			23	25	2	15	
2.5	16	19			24			25	21	29	13	
2.6	18	15			24			29	24	31	12	
2.7	15	16			25			32	32	34	13	
2.8	16	14			26			33	26	33	16	
2.9	15	17			25			35	25		16	
3.0	18	19			29				42		18	
3.1	19	18			31				43		19	
3.2	22	20			30				43		20	
3.3	20	19			27						22	
3.4	23	19			25						24	
3.5	21	20			32						30	
3.6	20	20									42	
3.7	22	19									40	
3.8	23	23										
3.9	24											
4.0												

Follow-up of table from previous page

depth	C13	C14	C15	C16	C17	C18	C19	C20	C21	C22	C23	C24
0.1	0	0	1	1	0	0	0	0	0	0	1	0
0.2	0	2	3	3	0	2	1	2	3	0	4	1
0.3	1	4	3	4	1	4	2	3	4	0	3	1
0.4	2	5	4	4	2	3	3	3	4	1	4	2
0.5	4	7	3	6	3	4	3	3	4	2	4	2
0.6	3	8	4	8	3	5	4	4	5	3	3	4
0.7	4	10	5	10	4	4	5	4	6	3	5	4
0.8	6	12	6	13	3	6	4	6	6	5	4	5
0.9	7	12	7	15	5	11	7	8	8	7	4	6
1.0	9	14	9	19	6	12	12	8	13	8	5	7
1.1	15	18	12	20	8	15	11	11	14	12	5	7
1.2	17	21	15	22	9	17	12	11	15	13	6	7
1.3	20	27	16	22	9	17	14	11	14	13	6	6
1.4	24	27	13	21	8	16	14	11	16	12	6	5
1.5	27	28	12	20	9	18	15	11	17	13	6	4
1.6	28	30	13	19	9	16	14	12	18	13	7	3
1.7	30	31	14	17	10	11	13	13	22	11	8	3
1.8	30	35	11	18	11	17	14	13	23	12	7	3
1.9	34		12	18	12	18	14	13	20	10	8	3
2.0			14	22	15	17	18	14	25	11	9	4
2.1			13	24	17	20	18	18	29	13	10	6
2.2			14	26	18	26	15	20	28	15	11	7
2.3			12	26	22	24	13	18	28	16	9	11
2.4			11	27	25	24	12	16	25	18	9	11
2.5			11	27	26	23	10	17	21	15	9	9
2.6			12	25	24	22	9	18	16	11	10	8
2.7			11	23	25	29	7	16	17	12	9	10
2.8			12	28	24	30	11	17	16	10	10	10
2.9			12	26	23	31	12	17	17	9	10	11
3.0			10	27	18	30	12	18	21	11	11	12
3.1			14	31	27		11	20	25	13	11	12
3.2			15	30	28		13	23	22	13	12	13
3.3			16	34	26		12	22	24	14	12	14
3.4			16		30		10	22	27	13	12	15
3.5			15		30		8	23	30	13	11	16
3.6			17		32		9	23	30	12	12	16
3.7			16				8	20	33	12	11	17
3.8			19				10	23		13	11	17
3.9			21				11	27		12	12	18
4.0												

Follow-up of table from previous page

depth	C25	C26	C27	C28	C29	C30	C31	C32	C33	C34	C35	C36
0.1	0	0	0	0	1	0	0	1	0	0	0	1
0.2	1	0	1	0	2	1	1	1	0	1	3	2
0.3	1	0	2	1	3	1	4	2	1	2	3	2
0.4	3	1	2	2	2	4	5	4	1	2	3	3
0.5	3	3	3	3	3	3	6	3	2	2	4	4
0.6	4	3	5	5	4	3	3	4	3	3	4	4
0.7	4	4	5	6	5	4	4	3	3	4	4	6
0.8	5	4	7	8	6	4	6	3	4	4	4	5
0.9	5	6	8	8	6	5	7	4	4	5	3	6
1.0	7	7	10	11	8	6	7	5	8	5	4	6
1.1	8	9	10	12	7	7	8	6	10	11	4	7
1.2	10	8	11	11	7	7	10	7	12	10	5	6
1.3	8	8	13	11	7	8	9	8	11	8	5	6
1.4	7	9	13	12	8	9	7	8	12	9	4	7
1.5	11	8	12	12	7	10	8	7	12	9	4	6
1.6	9	9	10	10	8	9	7	7	11	7	5	6
1.7	8	7	11	9	8	9	7	6	10	6	5	6
1.8	9	7	10	8	9	9	8	5	10	6	6	6
1.9	8	7	10	7	9	8	8	7	9	6	6	7
2.0	10	8	11	10	13	8	10	7	10	5	6	6
2.1	12	8	13	10	15	10	11	8	13	6	7	6
2.2	13	10	14	11	14	10	11	8	14	7	7	7
2.3	14	10	14	10	14	9	10	9	14	7	7	11
2.4	13	9	13	9	12	11	9	9	15	8	6	20
2.5	13	10	12	12	12	11	8	9	15	8	5	22
2.6	12	9	11	12	12	11	8	10	14	9	6	25
2.7	12	9	10	10	11	10	8	9	13	8	5	24
2.8	10	7	10	9	12	10	7	7	11	7	6	17
2.9	10	7	9	7	13	8	7	8	12	6	7	12
3.0	10	6	11	9	12	9	10	8	11	6	6	14
3.1	9	7	10	8	13	8	9	9	13	6	6	13
3.2	11	8	11	9	12	9	9	10	13	7	7	12
3.3	12	8	12	10	12	10	9	10	12	7	8	13
3.4	10	9	13	10	13	9	10	9	13	7	7	11
3.5	15	9	14	9	12	10	10	11	15	7	7	12
3.6	13	8	13	8	11	11	9	9	15	8	5	11
3.7	12	8	12	8	11	10	8	9	14	7	7	10
3.8	11	9	12	8	11	10	10	10	14	9	8	10
3.9	12	10	12	9	12	11	10	10	13	11	9	11
4.0											7	
4.1											9	
4.2											9	
4.3											10	
4.4											10	
4.5											11	
4.6											11	
4.7											10	
4.8											11	
4.9											12	
5.0												

Follow-up of table from previous page

depth	C37	C38	C39	C40	C41	C42	C43	C44	C45	C46	C47	C48
0.1	1	0	0	0	0	0	0	0	0	0	1	0
0.2	1	1	1	1	1	2	1	0	2	1	4	2
0.3	2	0	5	3	2	2	2	0	3	1	7	2
0.4	3	0	7	3	3	3	3	3	3	2	6	3
0.5	2	1	6	4	4	4	4	3	3	3	5	4
0.6	3	2	5	3	3	5	3	3	6	3	5	6
0.7	4	3	5	4	4	4	3	3	7	4	9	5
0.8	3	3	5	5	4	3	3	2	8	4	9	1
0.9	4	3	5	4	3	4	4	3	8	3	8	1
1.0	7	5	7	5	3	5	3	6	6	5	5	1
1.1	7	7	8	5	4	4	3	7	6	5	4	2
1.2	8	7	8	5	4	4	4	6	4	5	2	3
1.3	8	9	8	6	4	4	4	6	4	5	3	3
1.4	7	10	9	6	5	5	4	7	5	6	2	4
1.5	8	11	8	7	5	5	4	7	5	6	2	4
1.6	7	10	9	6	7	6	3	8	4	6	3	5
1.7	5	12	8	7	7	5	3	7	4	6	3	5
1.8	5	11	8	5	8	6	3	7	5	7	3	6
1.9	6	10	8	5	7	5	2	6	4	7	3	5
2.0	6	11	9	5	8	5	3	6	4	6	2	6
2.1	7	10	10	5	7	5	3	7	5	6	4	7
2.2	7	10	11	5	7	5	3	8	5	7	3	7
2.3	7	11	11	6	7	5	4	8	5	6	3	6
2.4	9	12	10	6	8	6	3	7	4	8	5	8
2.5	8	11	10	5	7	5	3	6	5	12	4	8
2.6	8	10	8	6	8	6	4	6	4	13	3	9
2.7	7	10	8	5	7	5	3	7	4	8	4	8
2.8	7	8	8	6	9	6	4	6	5	9	3	8
2.9	7	9	6	6	6	6	4	6	5	7	4	9
3.0	7	11	7	6	7	6	4	5	5	9	3	9
3.1	8	11	7	7	9	7	5	6	5	10	4	8
3.2	8	11	8	8	9	6	4	6	5	11	5	8
3.3	7	12	8	9	9	6	5	7	6	12	5	7
3.4	8	12	9	17	10	7	5	6	5	12	4	10
3.5	8	12	8	18	9	6	5	7	7	13	4	10
3.6	8	11	8	10	11	7	5	7	5	14	5	10
3.7	7	11	7	11	11	8	5	7	6	13	5	9
3.8	8	10	8	12	12	8	5	7	6	11	6	10
3.9	9	11	8	11	13	8	6	7	5	10	6	11
4.0	9		9			8	5	8	6		6	
4.1	9		10			8	6	6	6		7	
4.2	8		10			8	5	7	6		7	
4.3	7		10			7	6	7	5		7	
4.4	10		11			8	5	8	7		7	
4.5	10		11			9	6	7	7		9	
4.6	9		11			10	6	8	7		8	
4.7	10		1			11	6	8	6		10	
4.8	10		11			10	7	8	6		8	
4.9	11		13			11	6	9	10		11	
5.0							6	9				
5.1							8	11				
5.2							7	12				
5.3							7					
5.4							10					
5.5							12					
5.6							16					
5.7							10					
5.8							8					
5.9							9					
6.0												

Follow-up of table from previous page

depth	C49	C50	C51	C52	C53	C54	C55	C56	C57	C58	C59	C60
0.1	0	1	0	0	0	0	0	0	0	0	0	0
0.2	1	3	2	0	2	1	1	1	2	2	2	4
0.3	1	4	2	1	2	2	2	0	1	2	3	5
0.4	0	6	3	3	1	2	4	2	0	2	4	6
0.5	1	8	3	3	2	2	4	3	3	3	4	6
0.6	0	8	3	3	2	3	4	3	3	3	4	6
0.7	4	8	4	4	2	2	3	5	4	3	4	7
0.8	3	7	4	3	4	2	3	4	4	4	3	6
0.9	4	8	5	5	3	2	5	5	4	5	4	6
1.0	5	6	6	5	4	3	6	5	4	5	4	7
1.1	9	5	5	5	5	4	6	6	5	6	4	6
1.2	5	6	4	5	6	3	7	5	4	5	4	6
1.3	5	7	5	6	6	4	6	5	4	7	4	7
1.4	6	6	4	6	7	3	7	6	4	8	4	6
1.5	6	7	5	6	7	3	8	9	5	7	6	5
1.6	5	8	5	5	7	4	10	8	7	6	6	6
1.7	6	8	6	5	6	5	10	7	6	6	5	6
1.8	6	7	6	6	6	4	10	6	7	7	5	6
1.9	6	8	7	6	6	5	11	7	8	7	5	5
2.0	6	9	6	6	6	5	10	9	9	8	6	6
2.1	6	11	8	7	8	7	10	10	9	8	12	9
2.2	7	10	10	6	8	6	10	9	10	9	12	8
2.3	8	10	10	7	9	6	11	12	9	8	9	8
2.4	8	10	9	6	8	6	13	13	11	9	10	8
2.5	8	9	9	6	8	6	11	12	10	10	12	7
2.6	7	8	9	6	7	6	11	12	12	9	12	7
2.7	9	8	10	7	6	7	12	11	14	8	11	8
2.8	9	9	9	6	9	7	11	11	12	8	12	8
2.9	10	9	8	5	9	8	10	13	13	8	8	10
3.0	9	9	8	8	8	7	11	13	13	8	8	9
3.1	16	10	11	11	10	9	12	16	14	10	10	12
3.2	12	11	10	9	9	8	14	15	14	12	8	11
3.3	14	11	11	10	10	10	17	16	15	12	11	11
3.4	10	12	14	9	11	8	17	15	17	11	11	9
3.5	13	11	15	10	13	8	18	16	21	12	11	7
3.6	11	12	14	9	11	9	19	13	21	11	12	8
3.7	12	12	13	8	12	10	21	11	23	13	11	7
3.8	11	12	13	9	11	10	20	11	24	12	12	8
3.9	12	12	12	10	12	10	24	12	20	13	11	10
4.0												

Follow-up of table from previous page

depth	C61	C62	C63	C64	C65	C66	C67	C68	C69	C70	C71	C72
0.1	0	0	1	0	0	0	1	2	0	0	0	0
0.2	2	0	2	2	1	1	4	3	2	1	0	1
0.3	3	4	4	3	3	3	3	4	2	3	2	2
0.4	4	3	3	4	3	3	4	4	4	2	3	3
0.5	5	5	4	4	4	4	5	4	4	3	2	4
0.6	5	4	4	3	4	3	7	5	4	3	3	3
0.7	4	3	4	4	4	3	8	5	5	3	2	4
0.8	4	5	5	4	4	5	7	6	6	4	4	5
0.9	4	4	4	5	5	5	8	6	7	4	4	5
1.0	6	4	5	6	5	7	8	7	8	5	5	5
1.1	5	4	6	4	6	6	8	8	12	5	4	7
1.2	6	4	5	4	6	6	8	8	10	5	6	6
1.3	6	3	6	5	5	6	9	8	9	6	5	8
1.4	5	5	7	5	5	7	8	7	10	7	6	9
1.5	5	5	7	5	5	6	7	7	9	7	6	10
1.6	5	4	8	4	6	7	7	6	7	6	7	10
1.7	6	5	8	3	6	8	7	7	7	6	8	9
1.8	6	6	8	4	6	7	7	7	8	5	8	8
1.9	8	7	9	5	7	8	7	8	8	6	8	8
2.0	9	8	11	6	9	7	8	9	10	8	9	9
2.1	9	10	10	8	9	10	8	10	11	10	8	12
2.2	10	12	10	8	10	11	7	10	11	11	9	10
2.3	9	12	10	8	8	11	8	10	10	11	9	11
2.4	9	10	9	7	9	11	8	13	11	12	9	10
2.5	10	9	9	7	7	11	9	11	12	11	9	15
2.6	8	9	9	7	6	11	8	9	11	12	8	14
2.7	9	8	9	7	7	10	9	8	10	11	11	14
2.8	9	9	9	7	8	10	9	7	9	12	12	13
2.9	9	9	10	8	8	10	10	8	9	12	12	13
3.0	9	9	9	8	9	14	11	13	11	9	11	12
3.1	10	10	11	12	9	12	14	11	13	10	14	14
3.2	10	11	11	13	9	11	13	10	13	11	13	17
3.3	11	13	11	15	9	13	13	11	14	13	13	15
3.4	10	12	13	14	9	15	13	12	12	15	13	14
3.5	11	13	11	12	10	16	10	10	13	15	12	12
3.6	10	11	11	11	10	16	10	11	12	15	12	12
3.7	11	8	11	10	10	16	10	9	11	14	11	12
3.8	14	8	10	10	9	15	9	8	10	15	10	12
3.9	14	10	10	11	10	14	11	11	11	15	10	13
4.0												

Follow-up of table from previous page

depth	C73	C74	C75	C76	C77	C78	C79	C80	C81	C82	C83	C84
0.1	0	0	0	1	0	0	2	0	0	0	0	0
0.2	2	3	1	3	0	3	3	0	1	0	0	0
0.3	5	5	3	4	4	4	3	2	2	3	1	3
0.4	4	5	4	5	2	5	3	2	3	4	2	2
0.5	4	6	4	6	3	4	5	2	4	5	3	4
0.6	5	5	3	18	3	4	9	2	4	4	4	5
0.7	5	7	3	21	2	5	6	3	5	4	5	5
0.8	6	7	5	26	2	7	5	5	6	5	4	6
0.9	7	7	5	9	2	7	4	5	5	6	6	5
1.0	7	7	6	6	3	9	7	5	6	6	4	6
1.1	11	12	6	9	5	12	7	5	7	7	6	7
1.2	10	10	5	7	6	12	8	6	7	7	9	7
1.3	11	11	7	7	7	13	10	6	6	9	11	8
1.4	13	10	6	4	7	15	11	7	7	9	13	10
1.5	13	11	5	5	7	17	9	6	7	8	14	13
1.6	11	10	6	4	6	15	8	6	7	7	13	16
1.7	11	9	5	2	7	12	7	5	8	8	13	17
1.8	10	9	6	3	6	9	7	6	10	9	12	16
1.9	9	10	6	4	5	7	13	7	9	11	13	19
2.0	11	10	7	3	7	9	12	8	11	10	15	24
2.1	15	11	8	4	6	12	16	11	13	15	18	29
2.2	20	12	8	4	7	14	14	10	14	12	19	31
2.3	22	13	8	5	7	14	18	16	16	14	18	34
2.4	23	12	8	4	7	12	16	16	14	13	21	36
2.5	22	11	9	5	6	11	16	17	13	12	20	
2.6	23	8	8	6	7	11	17	18	13	12	19	
2.7	23	10	8	5	8	10	17	16	15	13	17	
2.8	23	13	8	1	6	10	18	16	17	14	18	
2.9	24	14	9	1	8	10	20	17	18	12	17	
3.0	27	16	9	2	9	9	19	27	25	19	21	
3.1	34	17	10	2	10	10	25	31	27	22	24	
3.2	33	17	12	1	10	11	31	34	33	28	22	
3.3	36	17	9	2	12	11	32	35	32	34	27	
3.4		18	10	2	11	12	34		34	39	30	
3.5		15	10	3	12	13				47	31	
3.6		13	10	3	12	13					34	
3.7		14	8	2	12	13						
3.8		14	9	3	13	14						
3.9		15	11	4	12	13						
4.0				4								
4.1				4								
4.2				5								
4.3				5								
4.4				5								
4.5				5								
4.6				5								
4.7				4								
4.8				5								
4.9				6								
5.0				8								
5.1				8								
5.2				12								
5.3				11								
5.4				9								
5.5				7								
5.6				7								
5.7				8								
5.8				7								
5.9				6								
6.0												

Follow-up of table from previous page

depth	C85	C86	C87	C88	C89	C90	C91	C92	C93	C94	C95	C96
0.1	0	0	0	0	0	0	1	1	0	0	0	0
0.2	0	0	1	1	1	3	3	2	1	0	0	0
0.3	3	2	2	2	1	2	3	4	1	2	0	2
0.4	3	2	3	2	4	3	4	4	3	2	1	3
0.5	6	3	3	3	4	3	4	3	3	4	2	2
0.6	10	5	4	5	3	5	4	4	4	4	4	3
0.7	10	6	8	7	5	5	4	5	4	6	4	4
0.8	9	6	10	12	7	5	4	6	5	8	5	3
0.9	6	7	10	10	8	5	4	6	6	11	4	4
1.0	5	8	10	10	7	5	6	8	12	10	4	5
1.1	6	12	11	10	10	6	6	9	10	11	4	6
1.2	8	11	10	11	11	6	7	10	9	12	5	7
1.3	9	20	12	12	11	7	6	10	10	13	5	7
1.4	9	16	12	12	12	7	7	11	13	13	7	7
1.5	10	17	15	14	11	8	7	10	12	15	7	8
1.6	13	16	13	17	11	9	7	11	10	14	6	9
1.7	13	14	14	15	12	9	7	10	11	12	7	8
1.8	11	14	13	15	12	10	7	12	11	11	7	9
1.9	11	12	14	16	11	9	8	12	9	11	6	9
2.0	14	12	17	17	13	11	11	12	9	12	6	10
2.1	16	15	18	21	16	13	12	14	9	12	7	12
2.2	17	19	18	22	18	15	13	15	9	13	8	13
2.3	17	15	20	23	16	15	14	15	10	13	8	14
2.4	20	17	23	23	17	16	12	16	10	12	9	14
2.5	24	16	24	24	17	18	13	16	12	13	10	14
2.6	25	17	25	33	17	17	13	17	11	11	10	14
2.7	27	16	25	30	19	19	14	18	12	12	11	13
2.8	28	15	24	31	19	21	14	18	12	9	9	15
2.9	28	16	25		20	23	15	19	13	11	8	9
3.0	30	17	27		24	29	17	20	15	11	8	14
3.1	32	20	32		25	31	19	23	17	13	8	20
3.2	35	20	35		30	57	19	23	18	12	9	21
3.3		21	37		30		17	25	18	15	10	22
3.4		20			29		18	26	18	14	13	25
3.5		23			31		20	24	19	13	16	27
3.6		24					19	27	20	12	20	30
3.7		27					24	28	20	11	22	31
3.8		24					59	30	26	10	21	34
3.9		25					67	32	27	9	24	
4.0												

Follow-up of table from previous page

depth	C97	C98	C99	C100	C101	C102	C103	C104	C105	C106	C107	C108
0.1	0	0	0	0	0	0	0	0	0	0	0	1
0.2	1	2	2	1	1	0	0	3	2	1	0	2
0.3	1	2	1	1	1	2	2	3	3	2	3	3
0.4	1	3	2	1	2	3	2	3	2	2	3	3
0.5	2	2	3	1	3	3	3	2	5	2	3	4
0.6	1	1	3	2	5	4	4	3	5	2	4	5
0.7	2	2	2	2	5	3	4	3	4	3	3	5
0.8	1	3	3	3	3	4	5	4	6	3	4	4
0.9	3	3	4	4	4	4	6	5	6	4	3	6
1.0	4	3	4	4	4	3	5	5	4	3	4	6
1.1	4	4	4	4	5	4	6	4	5	6	4	6
1.2	5	4	4	4	5	7	7	4	5	4	5	7
1.3	6	5	5	6	4	7	8	4	6	5	6	7
1.4	8	7	5	6	5	8	8	5	5	3	8	7
1.5	9	10	6	7	5	9	9	4	5	2	7	6
1.6	10	10	5	8	5	8	8	4	5	3	8	7
1.7	10	9	6	6	6	8	7	5	6	2	7	7
1.8	8	8	7	7	5	8	6	5	5	2	8	6
1.9	7	10	8	6	6	7	7	6	5	3	7	8
2.0	9	9	8	8	7	10	7	6	8	3	7	7
2.1	9	10	10	6	7	13	8	20	8	2	9	9
2.2	12	10	10	8	6	14	10	34	8	4	10	8
2.3	14	13	10	7	6	14	10	21	8	3	9	7
2.4	15	12	14	9	7	15	10	16	8	4	11	7
2.5	15	13	14	9	6	15	12	11	7	3	8	6
2.6	19	13	13	9	8	12	11	10	7	3	10	8
2.7	18	16	15	8	7	11	11	9	7	3	11	8
2.8	16	16	14	8	7	10	11	10	7	4	10	7
2.9	19	18	14	9	8	11	10	9	8	4	9	7
3.0	23	20	13	8	8	10	13	10	9	2	10	8
3.1	23	27	15	10	10	11	15	10	10	3	10	10
3.2	28	31	15	11	9	15	17	19	10	5	10	10
3.3	28	34	16	15	10	12	17	15	11	4	12	10
3.4	37	44	20	17	9	13	20	16	10	4	13	8
3.5	39		20	18	11	14	21	16	9	4	13	8
3.6	42		25	20	17	11	20	17	9	4	11	8
3.7			27	21	16	15	22	15	10	5	13	7
3.8			23	23	19	16	24	16	9	4	12	8
3.9			29	26	19	18	24	18	11	4	13	8
4.0										5		10
4.1										6		9
4.2										6		12
4.3										6		12
4.4										4		12
4.5										5		11
4.6										9		
4.7										6		
4.8										7		
4.9										6		
5.0										7		

Follow-up of table from previous page

depth	C109	C110	C111	C112	C113	C114	C115	C116	C117	C118	C119	C120
0.1	0	0	0	0	0	0	0	0	0	0	0	0
0.2	1	1	0	1	0	1	1	1	0	1	0	3
0.3	2	1	1	2	1	2	1	3	2	2	1	4
0.4	3	2	1	3	2	3	2	3	3	2	2	5
0.5	3	2	2	4	2	4	3	2	4	2	3	4
0.6	3	2	2	5	3	3	4	3	3	3	4	5
0.7	3	2	3	4	4	4	5	3	4	4	3	5
0.8	3	4	3	4	2	4	4	2	3	3	4	5
0.9	4	5	3	5	2	4	5	4	3	4	3	6
1.0	4	6	4	6	3	4	7	5	3	3	3	5
1.1	3	6	6	6	3	5	7	8	3	3	4	5
1.2	4	7	6	6	4	6	8	6	4	2	4	4
1.3	6	8	5	7	5	7	9	6	4	3	4	4
1.4	7	7	8	7	5	8	11	7	5	3	5	5
1.5	6	7	8	7	6	8	11	8	6	3	5	4
1.6	5	8	7	7	6	8	10	6	6	2	4	5
1.7	5	6	7	7	5	8	10	7	4	3	5	4
1.8	5	6	8	8	5	7	7	7	5	3	3	6
1.9	5	5	6	7	6	6	10	7	6	4	4	5
2.0	4	6	8	10	6	7	12	9	5	4	5	7
2.1	5	9	8	10	6	9	10	9	6	5	6	8
2.2	6	8	9	10	8	10	10	9	7	5	7	7
2.3	8	8	9	9	8	9	12	8	7	5	7	7
2.4	8	7	8	14	9	12	13	12	7	6	7	8
2.5	8	7	9	12	12	12	13	10	6	6	7	7
2.6	9	8	8	15	14	13	12	9	7	6	8	8
2.7	8	6	9	11	8	11	12	9	7	6	7	8
2.8	7	8	9	11	8	11	11	10	8	5	7	7
2.9	7	7	7	13	10	11	10	8	7	5	6	8
3.0	7	7	6	15	12	13	9	10	10	5	7	9
3.1	9	10	8	12	12	13	9	9	7	7	8	10
3.2	10	10	9	13	12	15	11	9	8	7	9	10
3.3	11	9	8	13	12	17	11	11	7	7	9	11
3.4	11	8	8	14	1	19	11	10	8	8	9	11
3.5	9	9	9	15	10	17	14	11	9	8	10	12
3.6	11	8	10	17	13	16	14	12	8	7	8	11
3.7	10	9	10	16	14	15	16	12	8	7	9	11
3.8	9	9	11	16	15	17	15	12	9	7	8	11
3.9	9	9	12	15	15	18	13	14	10	7	9	11
4.0	9	8			13					9		
4.1		12								8		
4.2		15								9		
4.3		14								9		
4.4										10		
4.5										10		
4.6										10		
4.7										9		
4.8										11		
4.9												
5.0												

Follow-up of table from previous page

depth	C121	C122	C123	C124	C125	C126	C127	C128	C129	C130	C131	C132
0.1	0	0	1	0	0	0	0	0	0	0	0	0
0.2	2	3	4	2	0	0	0	0	3	1	0	0
0.3	2	5	4	3	1	1	1	1	3	2	3	3
0.4	4	3	5	4	2	3	3	3	4	3	3	4
0.5	3	6	8	3	3	3	4	4	4	4	2	4
0.6	4	6	7	4	5	4	4	5	5	3	4	3
0.7	4	5	8	5	5	4	3	4	5	4	2	4
0.8	4	5	8	5	5	5	4	4	6	5	3	3
0.9	3	6	7	5	6	6	5	5	5	5	5	4
1.0	4	4	8	5	6	5	4	5	5	4	6	3
1.1	4	5	8	6	6	4	5	6	5	5	6	4
1.2	4	3	7	6	7	7	6	6	5	8	7	5
1.3	3	4	7	5	8	7	7	7	6	9	8	6
1.4	4	4	6	5	8	8	7	8	5	9	10	8
1.5	4	5	6	4	8	9	7	8	5	10	11	7
1.6	4	5	7	5	8	8	6	10	6	7	12	8
1.7	3	4	7	4	7	8	7	9	5	6	15	9
1.8	4	5	7	4	7	7	5	9	6	7	18	9
1.9	4	5	5	4	8	8	7	9	6	5	19	10
2.0	4	5	7	5	8	8	7	8	8	7	25	10
2.1	6	8	7	6	7	7	10	8	8	11	24	14
2.2	4	8	5	6	8	8	9	9	7	11	24	14
2.3	6	7	6	6	10	8	8	10	8	11	25	14
2.4	6	8	7	6	10	9	8	13	8	11	26	14
2.5	7	8	8	6	10	9	9	13	8	12	26	14
2.6	7	8	6	7	9	8	8	14	8	8	27	15
2.7	7	8	7	7	9	8	8	14	8	11	30	13
2.8	7	8	9	6	8	8	7	13	9	10	30	14
2.9	6	7	8	7	7	8	6	11	11	11	30	13
3.0	8	9	7	7	7	10	8	12	11	10		14
3.1	7	10	8	7	10	10	9	13	12	12		13
3.2	8	10	10	8	10	12	10	12	14	14		16
3.3	9	9	9	7	10	14	10	11	15	15		19
3.4	8	10	11	8	14	13	11	14	13	13		19
3.5	9	11	11	9	13	15	10	14	14	14		19
3.6	10	10	11	9	11	14	10	15	14	14		20
3.7	12	11	8	9	12	15	10	14	13	13		19
3.8	14	11	10	9	10	14	10	14	15	15		19
3.9		10	10	8	12	15	11	15	15	15		19
4.0				9								
4.1				9								
4.2				8								
4.3				9								
4.4				10								
4.5				11								
4.6												
4.7												
4.8												
4.9												
5.0												

Follow-up of table from previous page

depth	C133	C134	C135	C136	C137	C138	C139	C140	C141	C142	C143	C144
0.1	0	0	0	0	0	0	0	0	0	0	0	0
0.2	0	0	1	1	0	1	2	0	3	0	0	1
0.3	2	2	2	2	1	3	1	2	3	2	1	6
0.4	2	3	2	3	3	4	2	2	2	3	2	6
0.5	3	2	4	3	4	6	3	3	3	3	3	6
0.6	3	3	3	4	4	8	3	3	3	3	2	7
0.7	3	4	4	4	4	7	4	3	4	3	2	7
0.8	4	3	4	4	4	8	4	6	4	2	3	6
0.9	6	5	3	5	5	7	4	5	4	3	3	9
1.0	6	4	5	4	5	8	5	5	5	4	4	10
1.1	7	4	5	4	5	13	6	7	6	4	4	12
1.2	8	4	8	5	6	12	8	7	7	6	4	8
1.3	10	5	8	6	7	21	12	13	7	8	2	4
1.4	11	5	10	8	9	21	13	14	11	8	5	5
1.5	13	7	11	8	9	22	16	13	19	4	5	5
1.6	12	8	17	9	10	15	14	20	16	5	5	4
1.7	13	8	22	9	12	11	13	15	17	7	5	3
1.8	11	10	16	13	16	11	10	15	16	7	5	4
1.9	10	11	15	20	16	13	10	18	13	8	6	5
2.0	12	13	20	11	15	15	13	15	15	9	6	5
2.1	15	13	19	12	17	13	12	22	13	11	7	7
2.2	15	14	22	12	17	11	12	20	14	11	6	10
2.3	17	14	22	15	20	14	12	19	12	11	7	13
2.4	18	25	21	16	45	20	12	22	13	12	7	10
2.5	19	30	24	18	18	24	12	19	13	10	8	12
2.6	19	31	24	15	16	16	13	19	14	10	8	14
2.7	20	17	19	16	17	23	14	20	14	10	9	12
2.8	19	17	17	17	16	27	13	21	15	13	7	8
2.9	19	18	16	17	17	25	14	22	14	11	8	10
3.0	27	20	20	16	17	30	15	27	13	16	6	11
3.1	23	17	16	15	17	33	18	30	18	13	6	15
3.2	23	20	17	17	18	34	21	30	18	16	8	15
3.3	23	16	18	18	17		17	31	20	14	12	14
3.4	23	17	17	18	17		20		24	17	17	15
3.5	24	16	19	18	16		23		23	17	14	14
3.6	24	14	18	19	17		23		20	14	14	15
3.7	24	14	18	19	15		25		28	14	13	16
3.8	24	13	18	19	18		23		23		20	14
3.9	24	15	19	20	16				25		15	15
4.0												

Follow-up of table from previous page

depth	C145	C146	C147	C148	C149	C150	C151	C152	C153	C154	C155	C156
0.1	0	0	0	0	0	0	0	0	0	0	0	0
0.2	0	1	1	0	1	2	0	1	1	0	0	0
0.3	4	2	2	0	2	3	0	2	2	2	1	1
0.4	4	2	3	2	2	2	3	2	2	4	1	2
0.5	3	2	2	2	3	4	4	3	3	4	2	3
0.6	4	3	3	2	4	4	3	3	4	3	2	2
0.7	4	5	4	4	3	3	3	3	4	3	2	3
0.8	4	7	4	3	4	3	2	3	3	4	2	4
0.9	6	8	4	3	4	4	4	3	4	4	2	5
1.0	5	6	4	3	4	3	3	4	5	4	3	4
1.1	4	6	5	3	5	5	4	3	5	4	2	4
1.2	5	7	4	4	4	5	5	4	5	2	3	4
1.3	7	7	5	6	5	3	5	4	5	3	3	4
1.4	6	6	6	6	6	4	5	3	7	2	2	4
1.5	5	7	7	7	6	4	7	4	7	4	3	4
1.6	6	6	6	8	8	4	7	4	6	4	3	4
1.7	4	7	6	8	8	4	5	4	5	4	5	6
1.8	7	6	6	7	12	4	5	5	6	4	6	4
1.9	6	5	6	6	15	3	6	6	6	5	6	5
2.0	9	8	9	8	12	6	5	6	8	7	6	6
2.1	9	8	9	10	11	6	7	5	8	5	6	7
2.2	10	7	8	10	11	6	8	6	10	4	7	7
2.3	14	8	9	12	13	6	11	7	10	4	7	6
2.4	11	8	8	10	13	6	7	7	9	6	8	7
2.5	12	8	9	11	14	10	7	8	10	7	8	7
2.6	9	9	9	10	13	11	9	6	9	7	7	7
2.7	11	7	11	9	14	14	8	8	10	7	7	8
2.8	11	9	11	9	13	15	9	9	10	7	7	7
2.9	8	8	10	9	15	18	8	10	10	8	7	9
3.0	11	8	12	10	20	20	8	9	11	8	10	8
3.1	18	8	12	12	21	17	7	10	12	8	11	6
3.2	20	10	11	11	20	23	8	11	11	9	11	8
3.3	21	10	14	13	20	30	9	9	14	8	10	8
3.4	21	10	14	14	20	30	10	11	12	9	8	9
3.5	20	10	13	12	26	29	10	10	12	8	9	9
3.6	21	11	11	11	27		10	11	11	9	8	12
3.7	19	10	14	11	20		10	9	10	9	8	11
3.8	20	9	11	11	22		10	10	11	9	10	9
3.9	21	10	12	11	22		10	10	10	10	10	9
4.0	21											

Follow-up of table from previous page

depth	C157	C158	C159	C160	C161	C162	C163	C164	C165	C166	C167	C168
0.1	0	0	0	0	1	0	0	0	0	0	0	0
0.2	0	3	0	2	2	2	0	0	1	1	0	0
0.3	1	2	1	2	3	2	2	3	3	2	2	1
0.4	2	2	3	3	4	3	3	3	2	2	2	2
0.5	4	3	3	4	4	3	3	3	3	4	3	2
0.6	4	3	3	4	4	2	3	3	3	4	4	4
0.7	3	3	3	4	5	3	4	3	3	4	3	6
0.8	4	4	4	3	4	3	3	4	3	4	4	4
0.9	4	4	3	5	5	5	5	5	3	6	6	7
1.0	4	6	5	5	12	7	6	4	6	6	8	8
1.1	4	5	5	5	12	7	5	4	8	6	9	7
1.2	4	5	6	6	11	7	6	5	9	7	9	7
1.3	6	7	8	6	12	9	5	5	10	8	8	8
1.4	7	6	9	6	12	10	5	8	12	8	10	8
1.5	7	5	9	5	12	11	7	9	11	9	12	9
1.6	9	5	9	5	17	11	6	7	9	10	12	8
1.7	6	5	8	4	21	11	7	7	9	12	9	8
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3.9	10	9	10	7		13	13	12	13			13
4.0		10		12								
4.1		10										
4.2		10										
4.3												
4.4												
4.5												
4.6												
4.7												
4.8												
4.9												
5.0												

Follow-up of table from previous page

depth	C169	C170	C171	C172	C173	C174	C175	C176	C177	C178	C179	C180	C181
0.1	0	0	0	0	0	0	0	0	0	3	0	0	0
0.2	3	1	2	1	0	0	0	2	0	3	0	1	1
0.3	4	2	2	3	1	1	2	3	2	4	2	4	3
0.4	3	3	4	3	2	4	3	4	4	5	3	3	3
0.5	4	5	5	3	4	4	3	4	3	4	4	3	2
0.6	5	5	5	4	3	4	3	6	5	6	2	4	4
0.7	6	4	5	3	4	4	4	5	4	7	3	4	6
0.8	6	5	5	3	4	4	5	6	4	9	2	6	7
0.9	7	5	6	3	7	6	5	8	6	12	4	5	6
1.0	7	8	5	4	6	7	6	7	8	15	4	6	12
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1.3	11	7	8	6	10	8	6	8	9	15	6	12	14
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3.1	13	16	15	21	20		34				15	30	
3.2	13	13	18	23	15		43				17	31	
3.3	16	14	19	22	24						21		
3.4	13	15	19	30	37						23		
3.5	14	13	21	30	30						30		
3.6	12	14	20	34	27						35		
3.7	12	12	21		30						40		
3.8	12	12	20										
3.9	12	13	19										
4.0													

Enclosure 2.2 DPL diagrams

DPL-5

Explanation to ramming diagrams
The diagrams show the resistance towards dynamic penetration (number of strokes per 10 cm), in relation to the depth below surface.

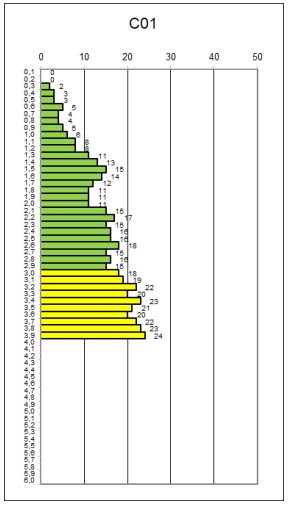
Case A The dynamic penetration test ends in a much greater depth than the foundation later on. That means that a profile of the foundation will meet no obstacle at this place. The required foundation depth will be calculated according to the parameters of that soil type.

Case B The dynamic penetration test ends much higher than the foundation later on. The soil resistance increases rapidly to a very high level.
That shows an obstacle at that place. A rammed profile cannot reach the necessary depth without special works like excavating or drilling through the obstacle.

Case C The dynamic penetration test ends higher than the foundation later on. The soil resistance increases continuously to a high level.
That shows a soil type becoming more and more compact to the depth. Thin profiles with thin walls cannot penetrate deeper than the penetration test. Compact profiles of thicker material can probably penetrate some decimeters deeper than the penetration test, and will end inside a very stable soil, capable of taking high bearing forces.

Legend of colouring

TOPSOIL	organic silty CLAY, dark-brown, consistency: soft	Grey
Layer **S1**	silty CLAY, brown or grey-brown, consistency: soft – stiff	Green
Layer **S2**	clayey sandy SILT, brown-grey, consistency: firm – very stiff	Yellow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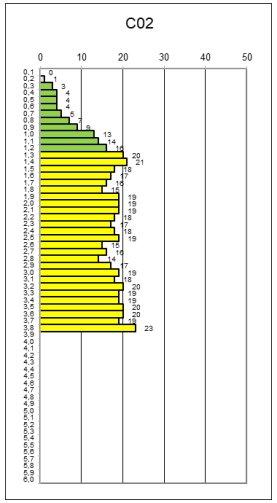
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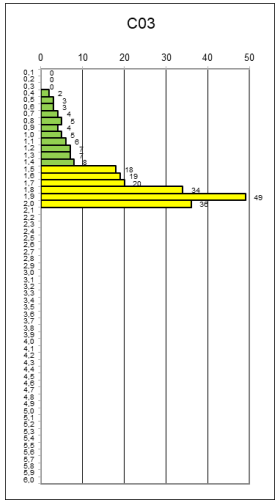
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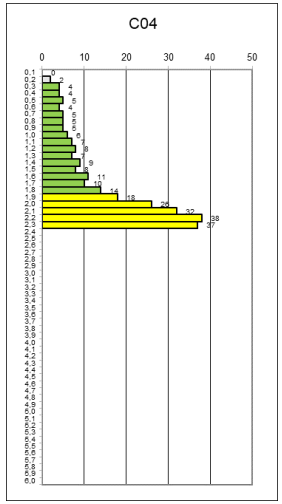
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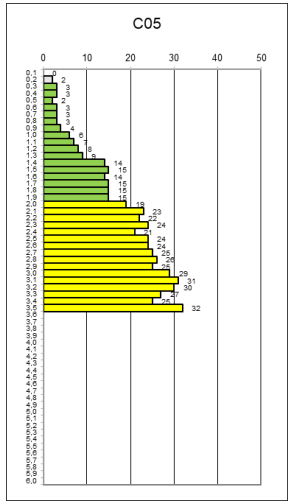
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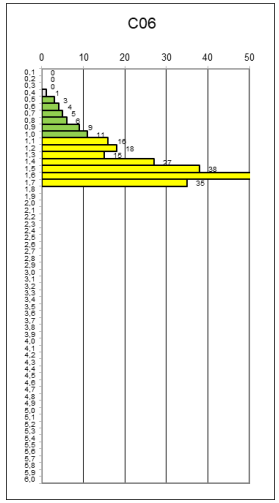
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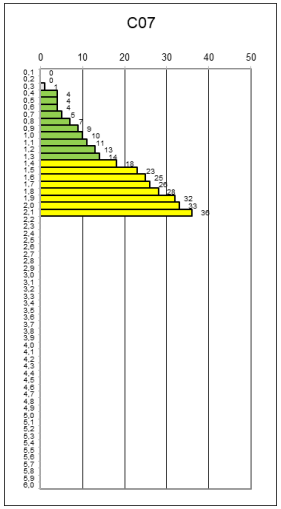
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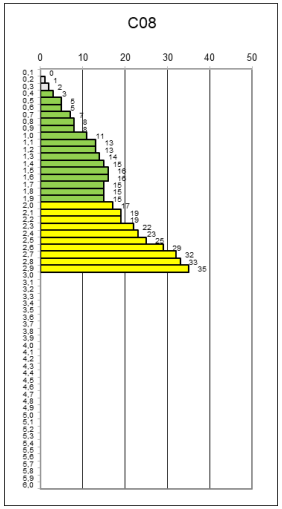
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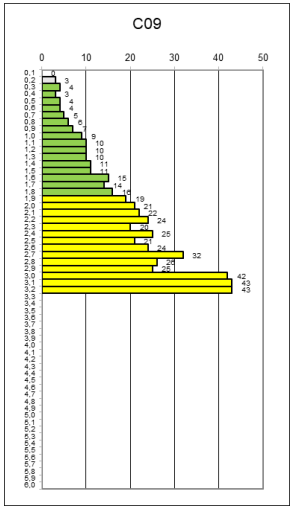
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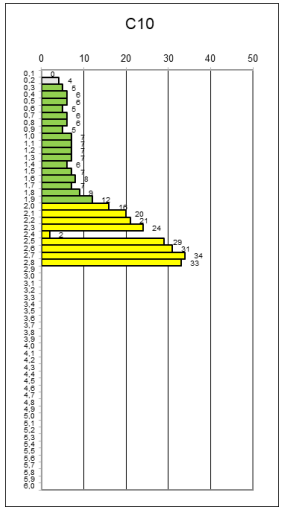
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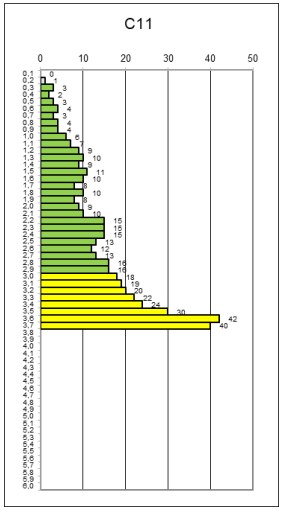
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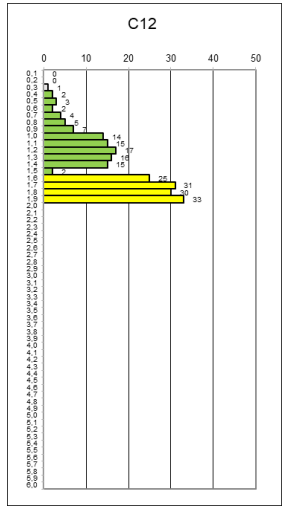
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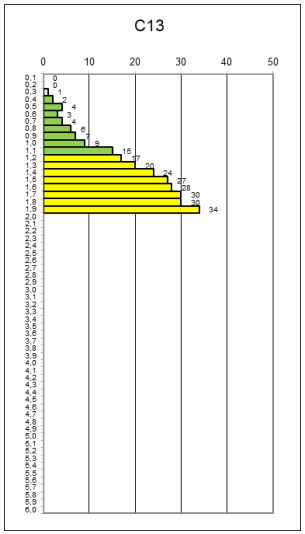
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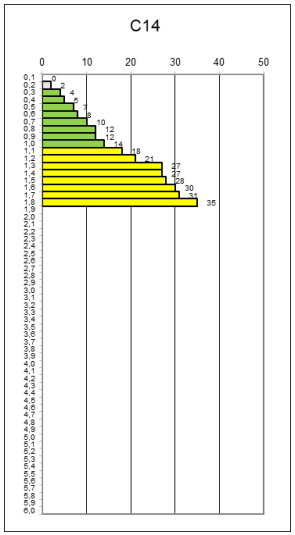
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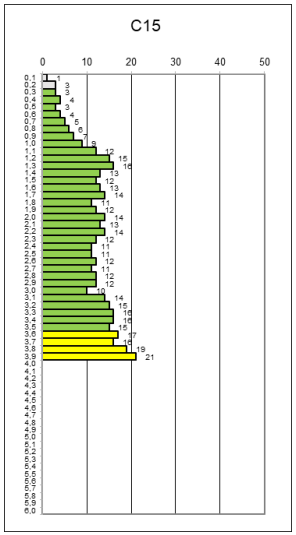
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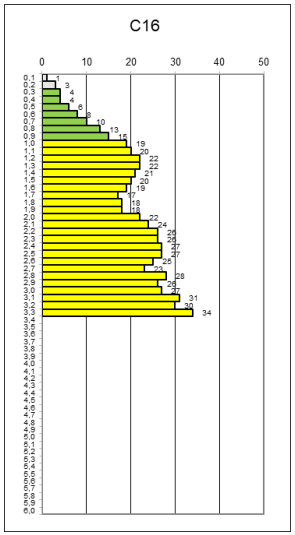
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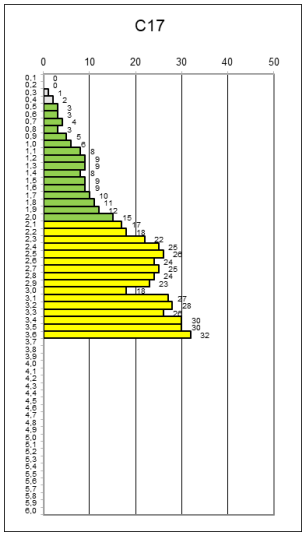
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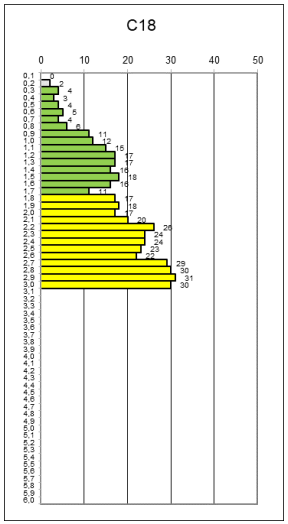
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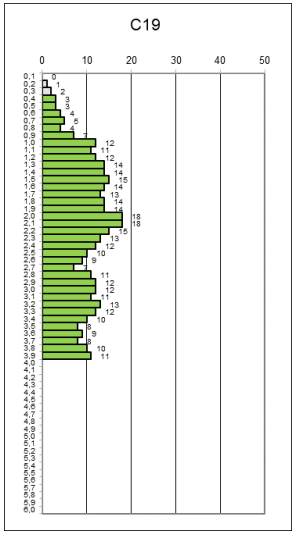
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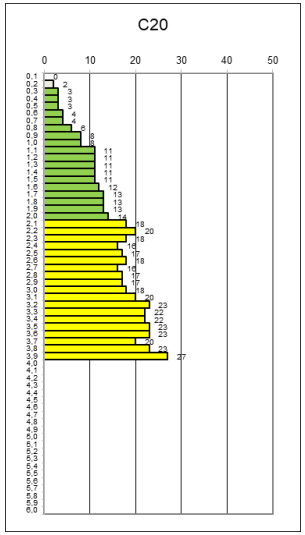
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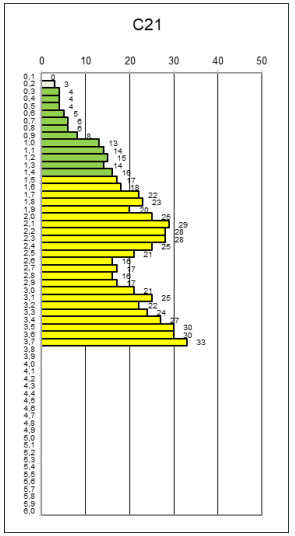
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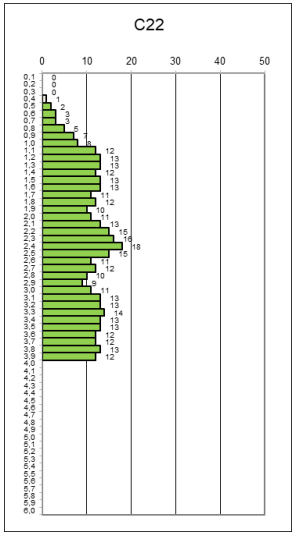
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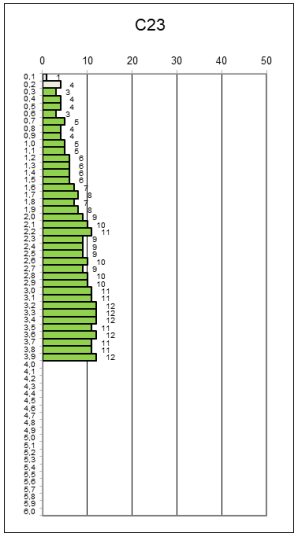
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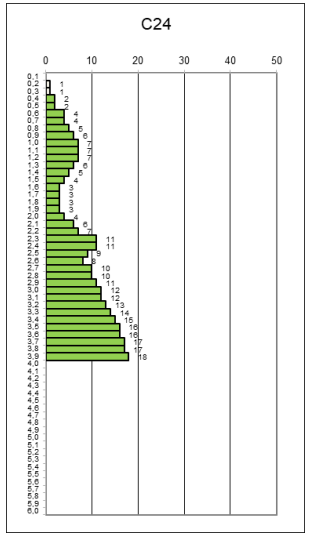
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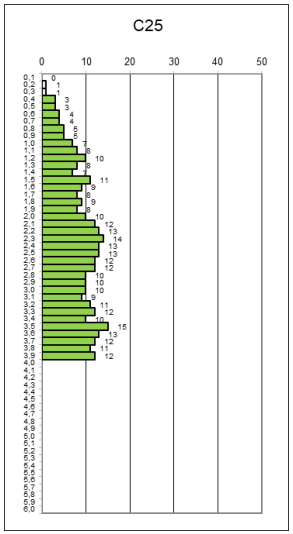
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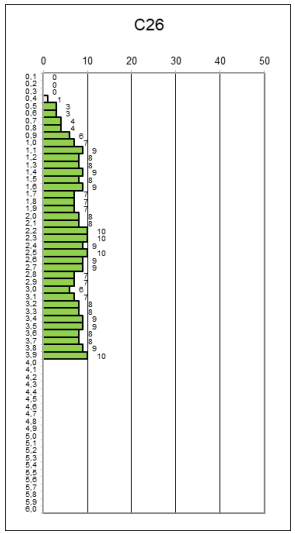
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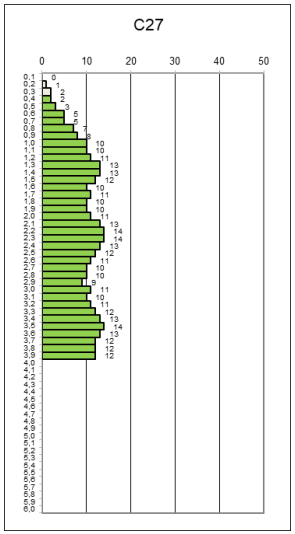
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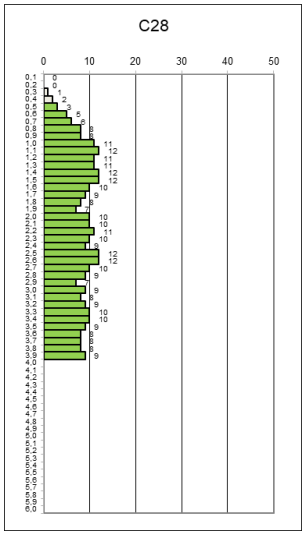
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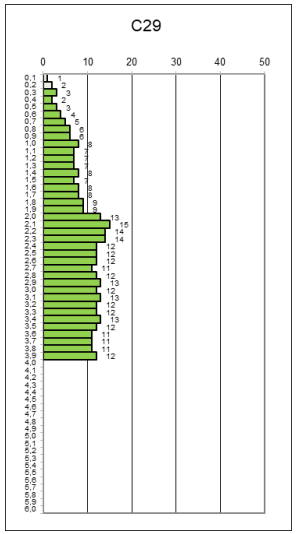
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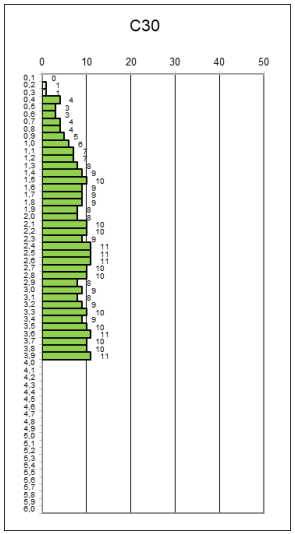
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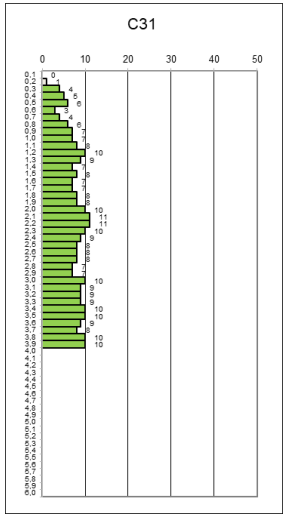
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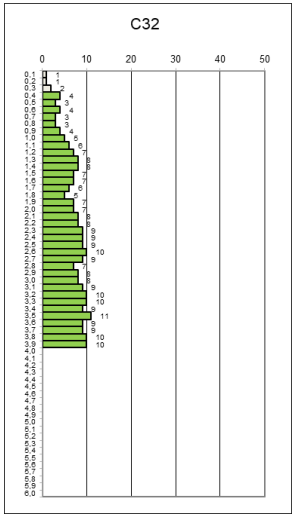
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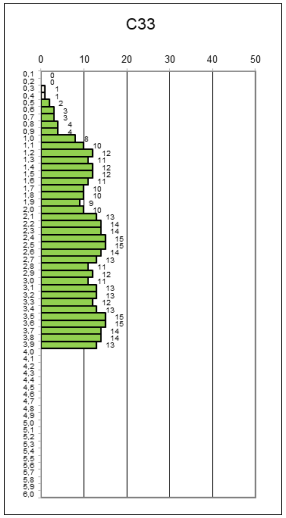
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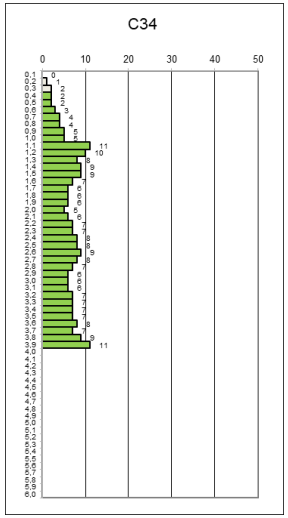
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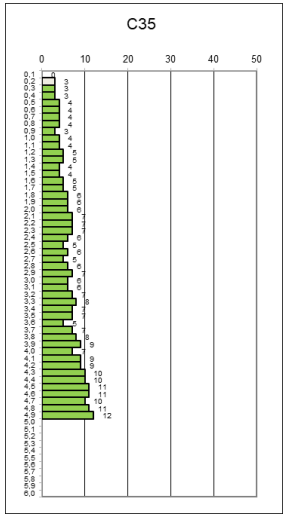
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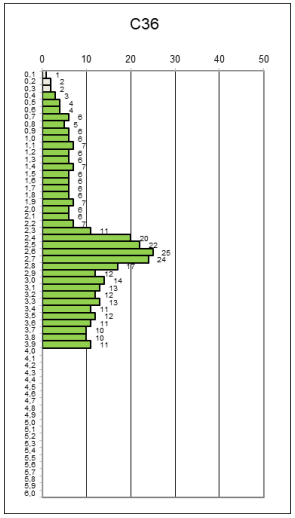
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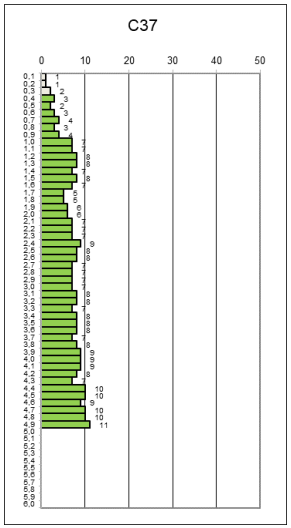
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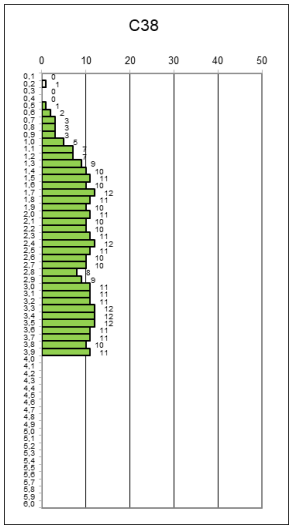
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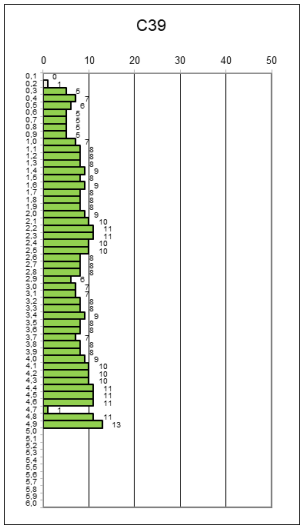
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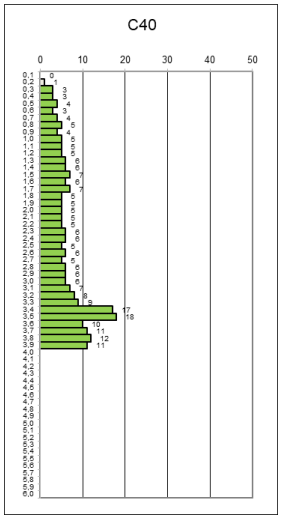
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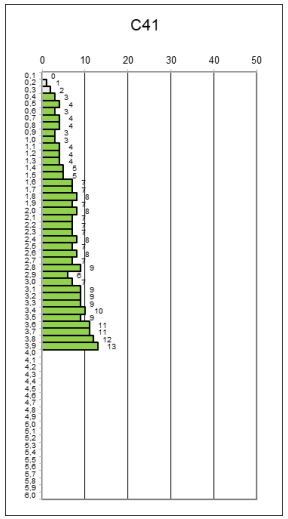
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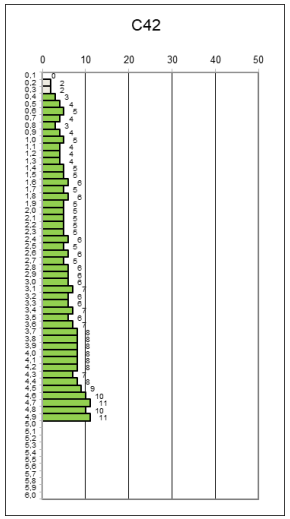
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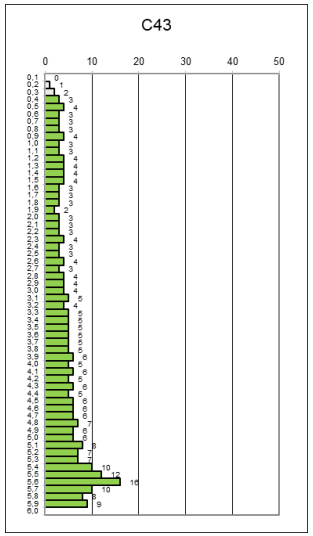
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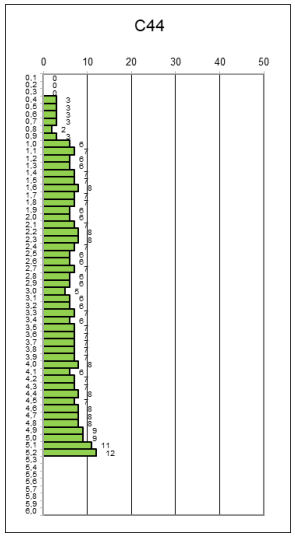
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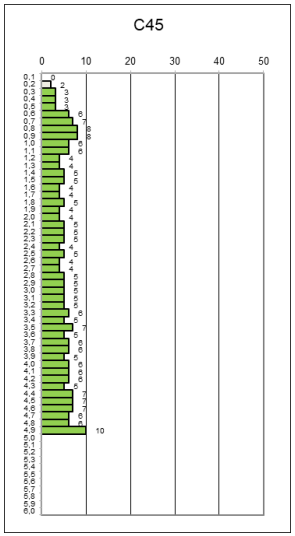
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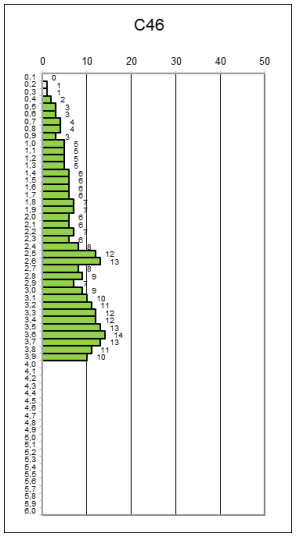
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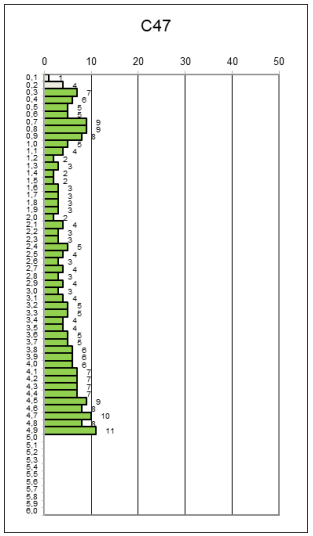
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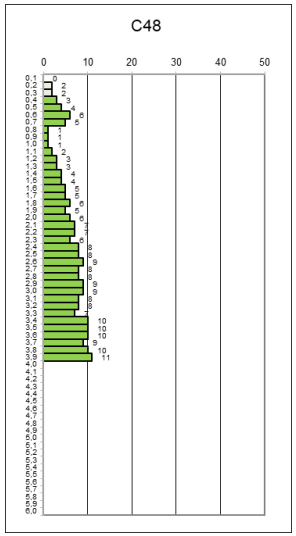
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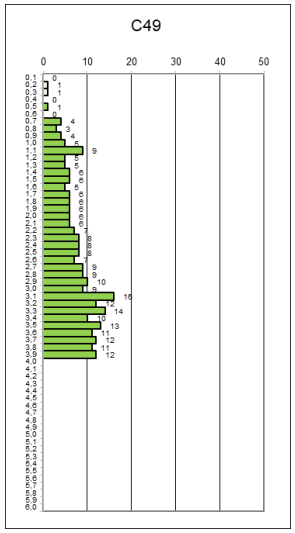
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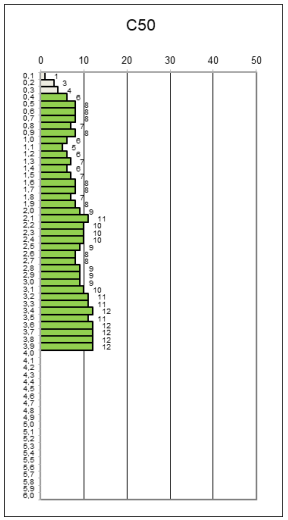
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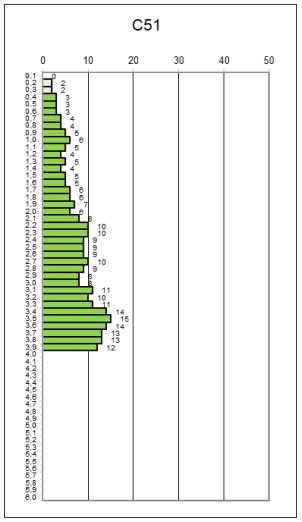
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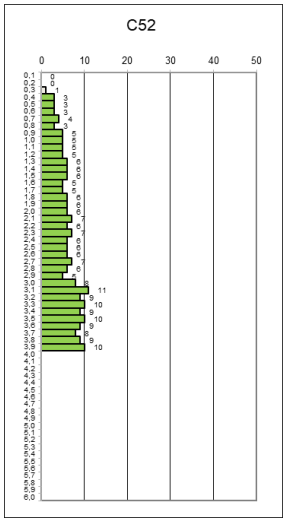
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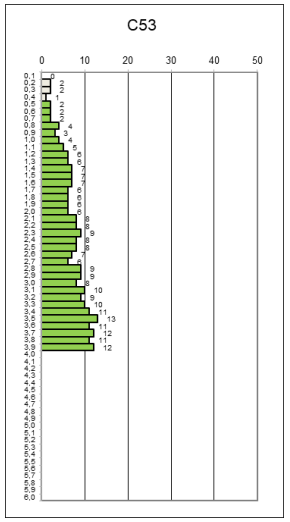
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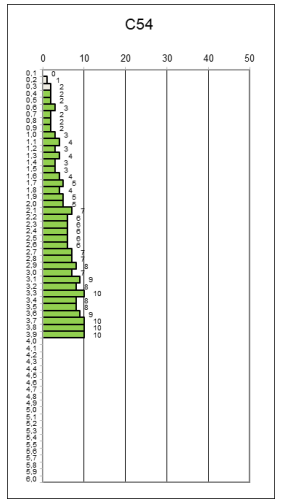
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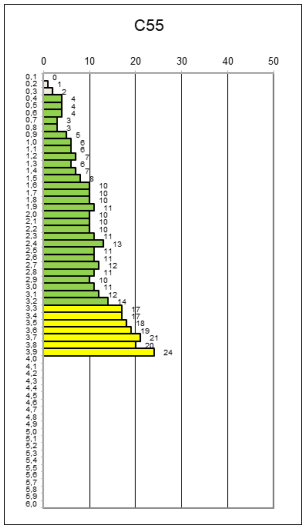
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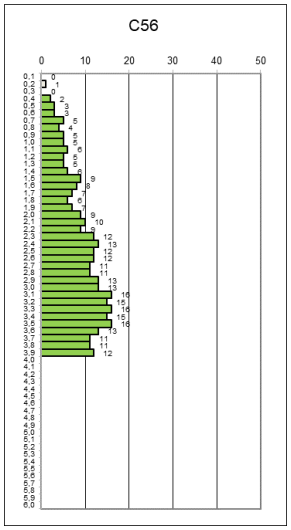
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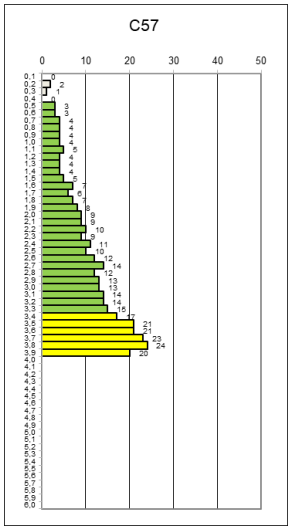
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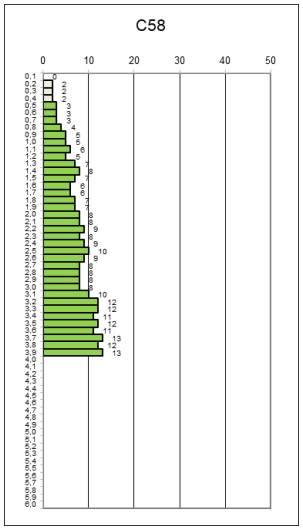
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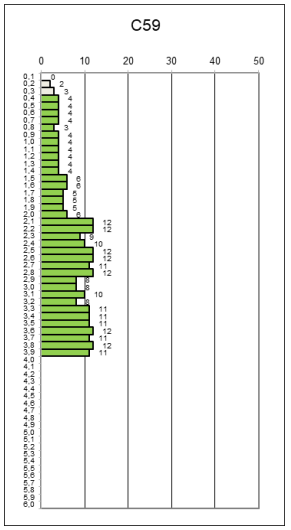
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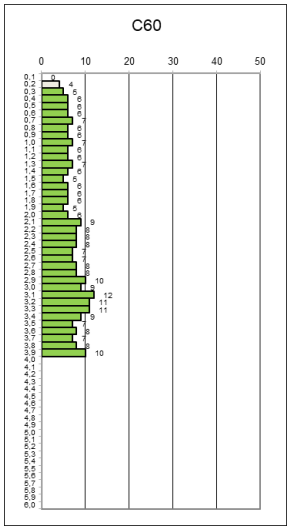
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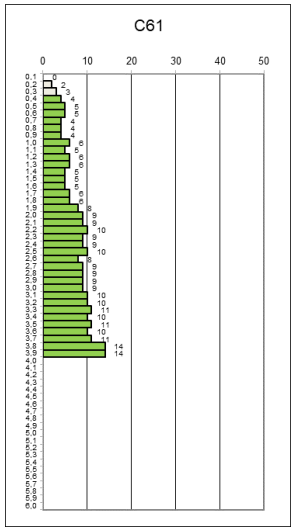
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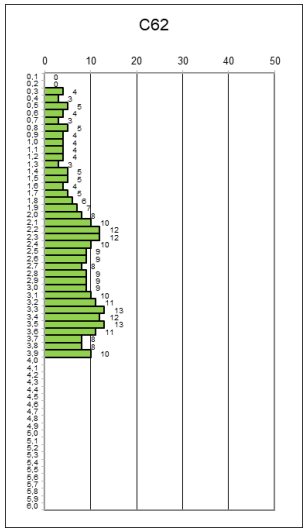
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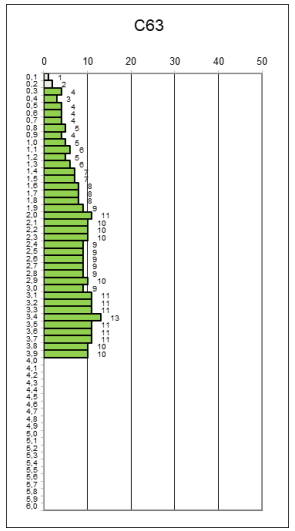
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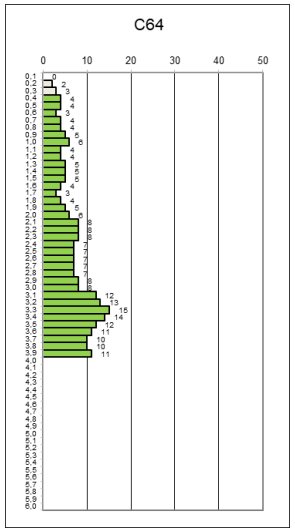
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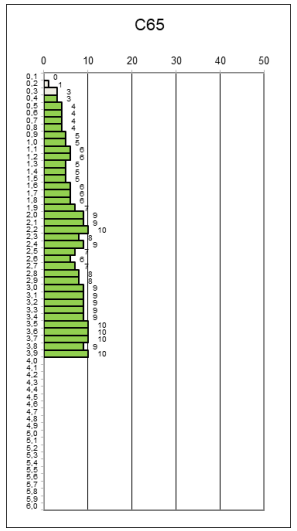
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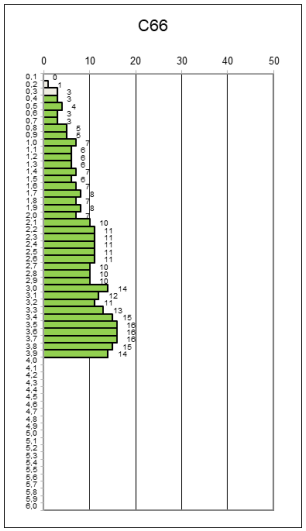
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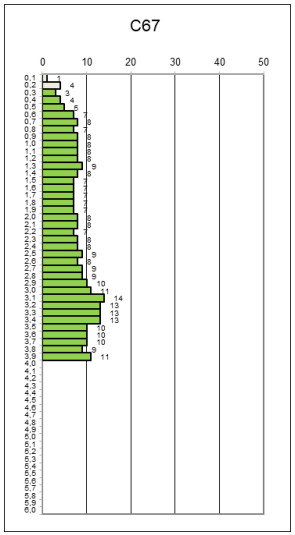
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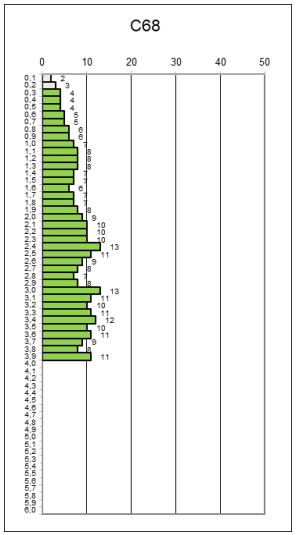
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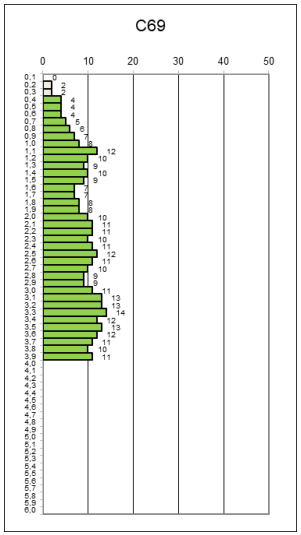
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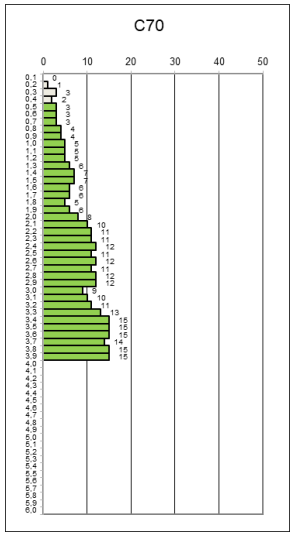
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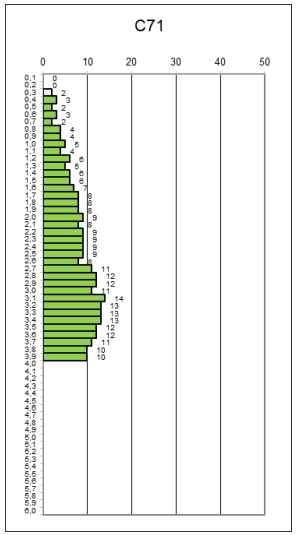
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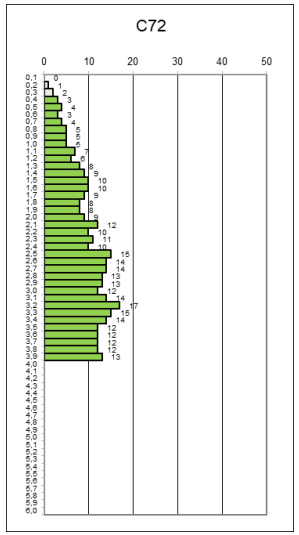
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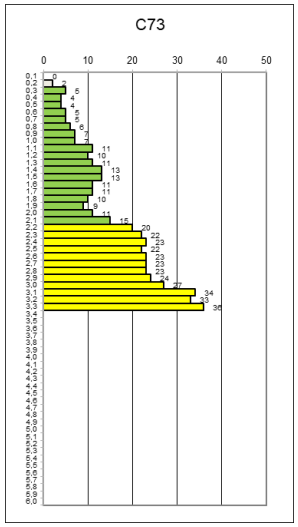
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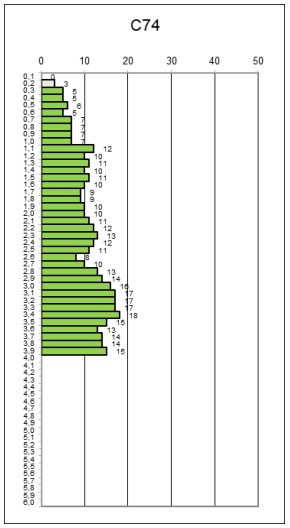
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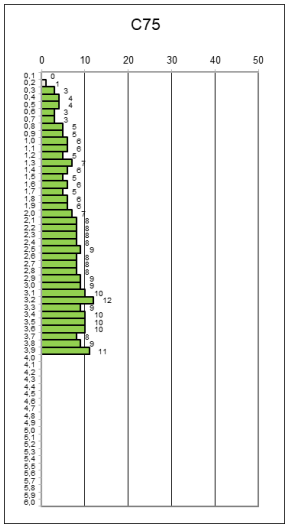
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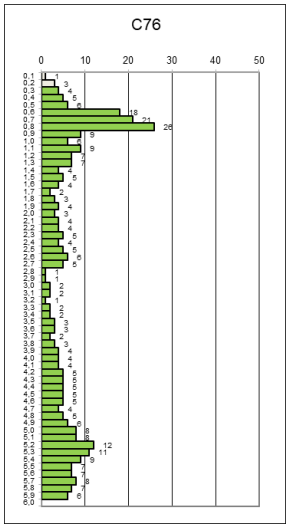
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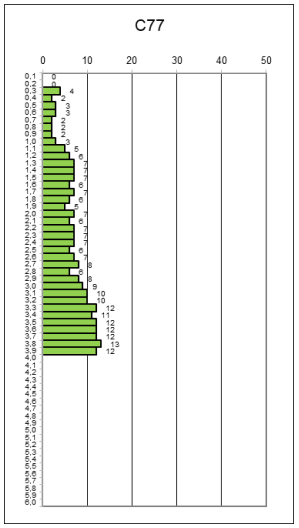
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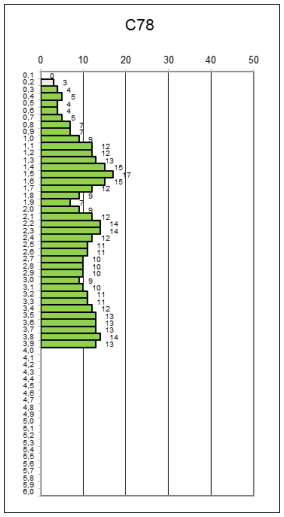
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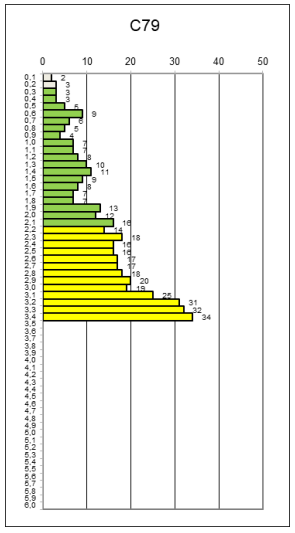
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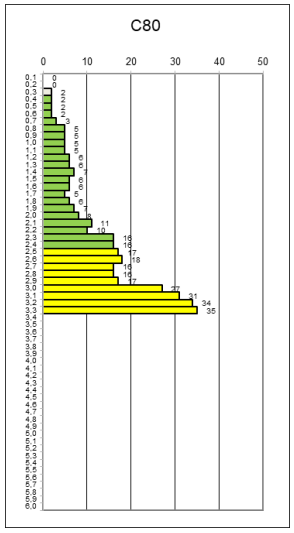
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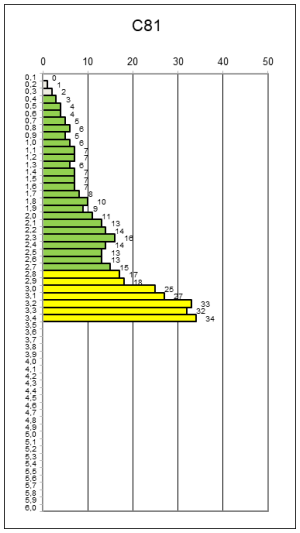
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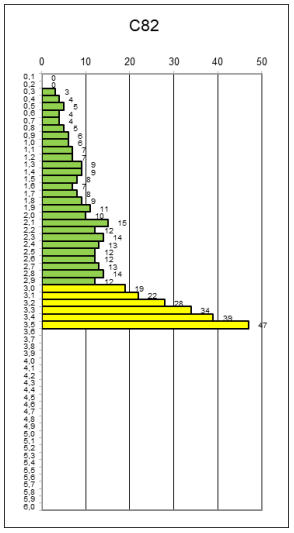
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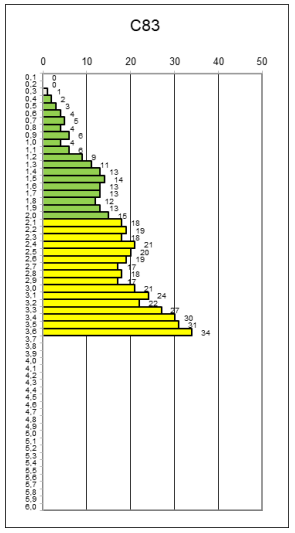
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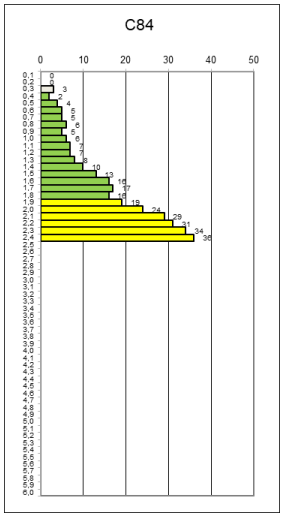
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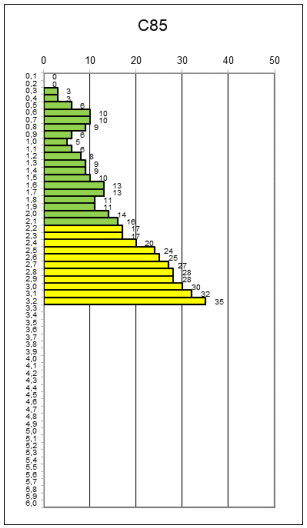
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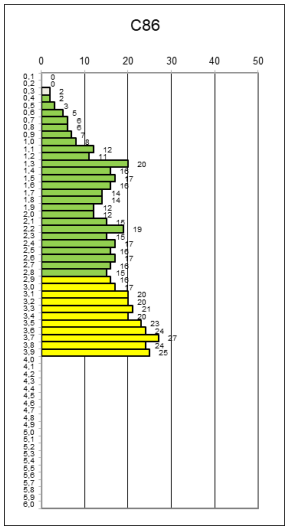
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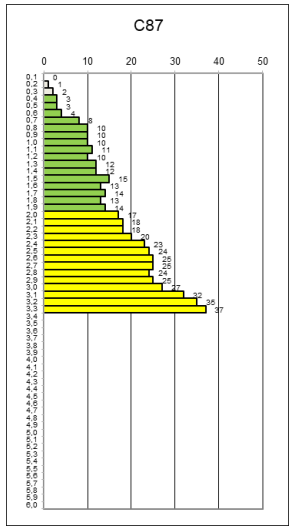
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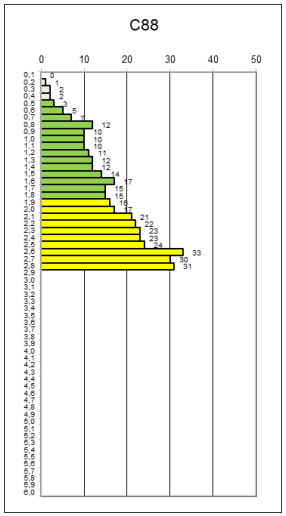
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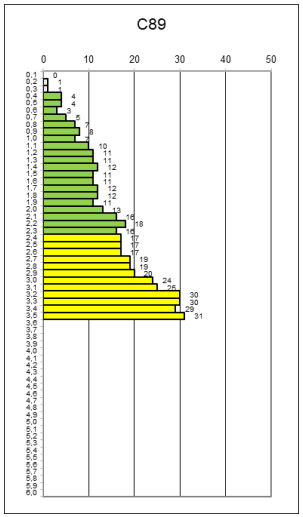
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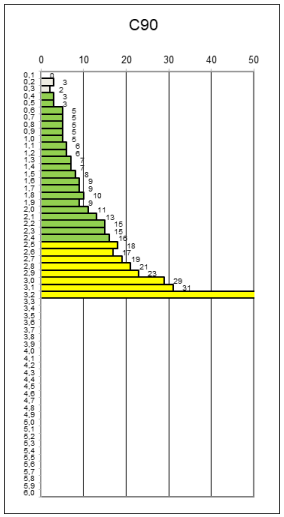
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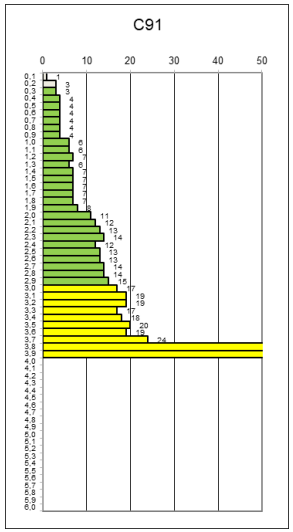
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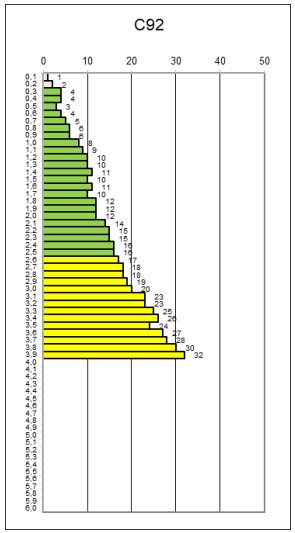
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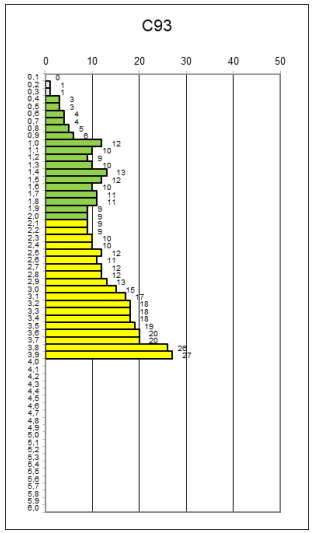
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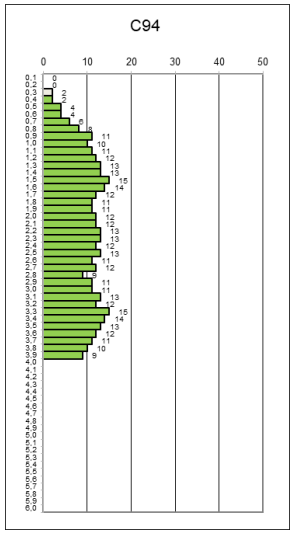
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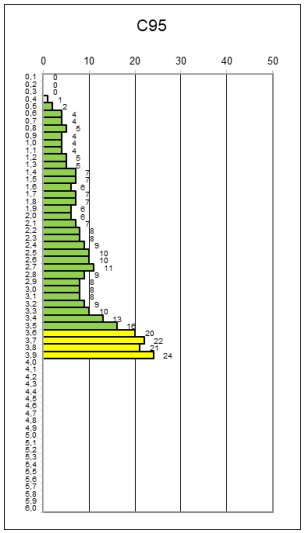
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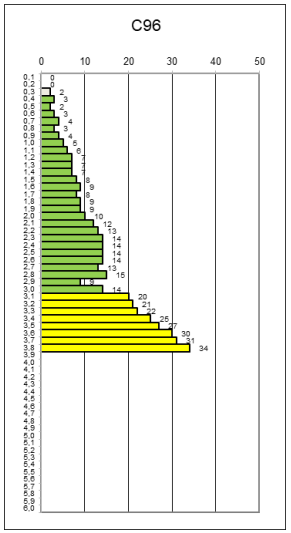
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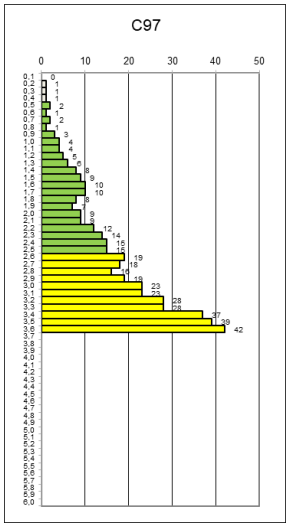
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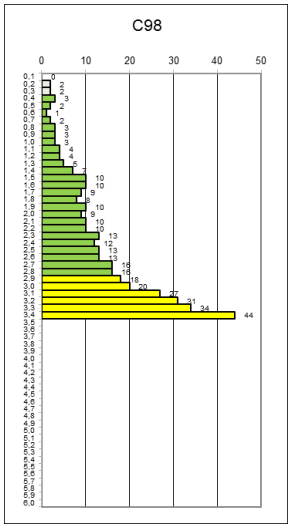
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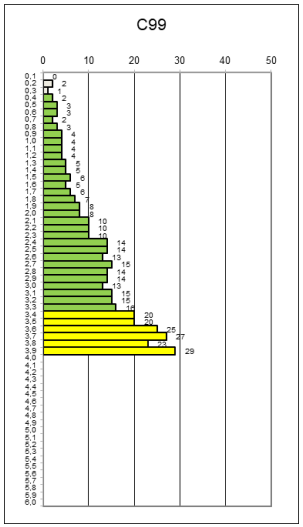
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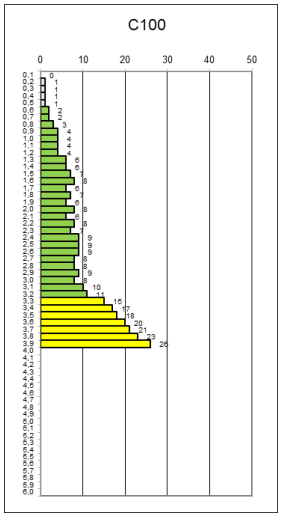
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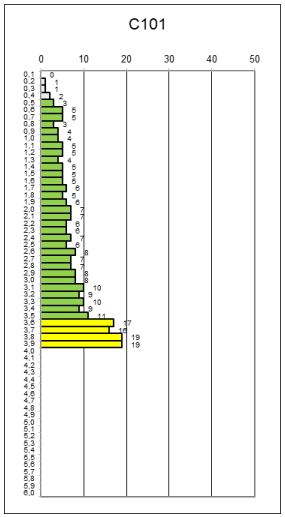
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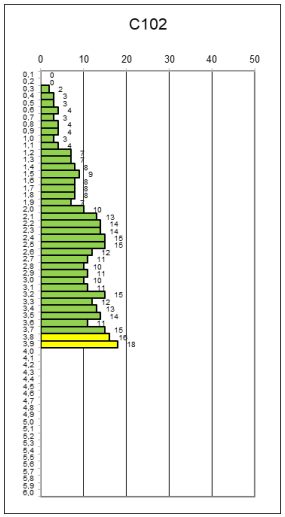
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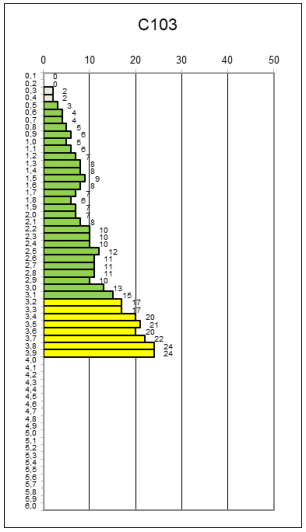
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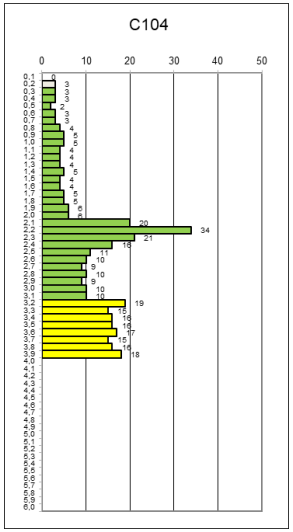
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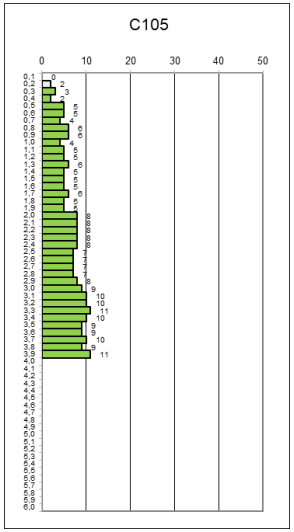
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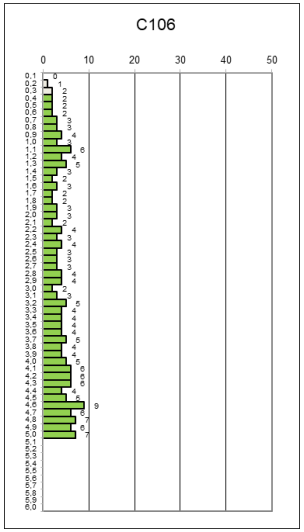
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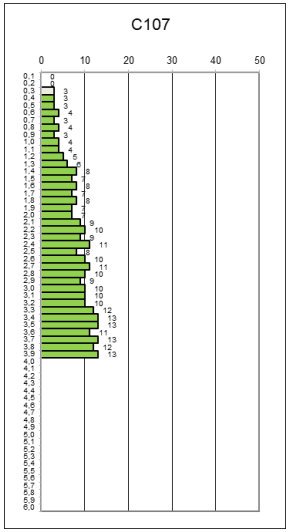
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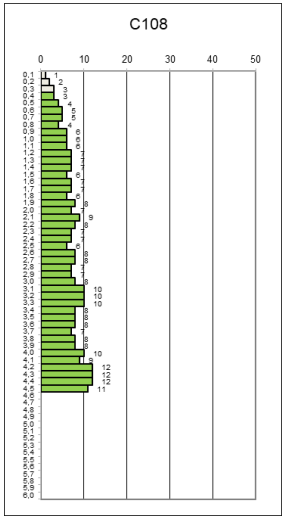
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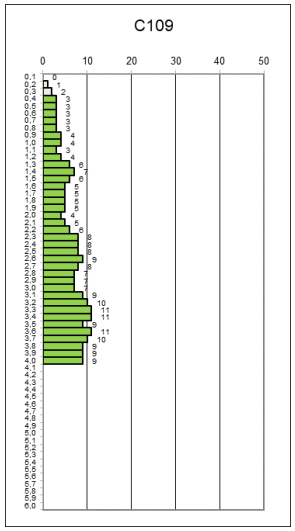
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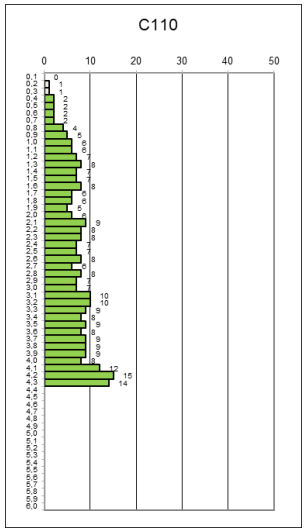
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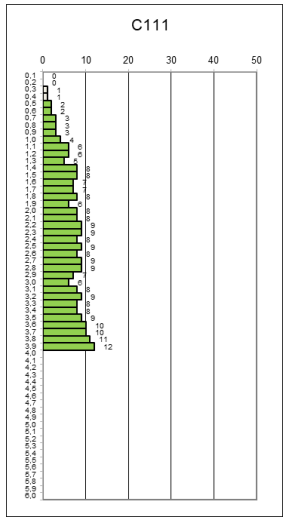
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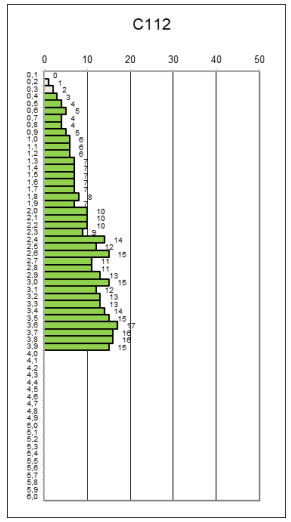
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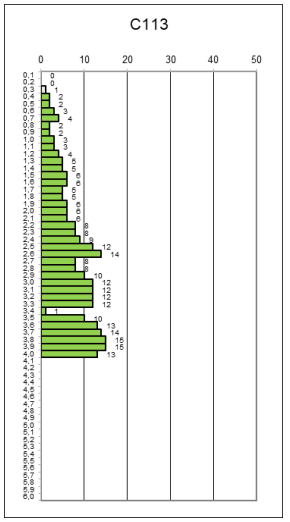
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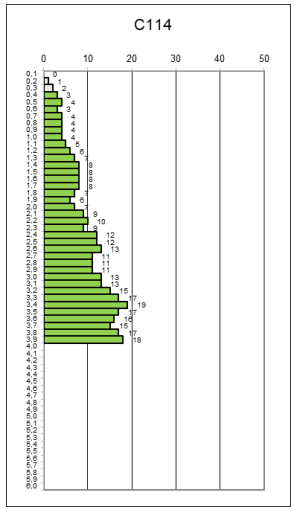
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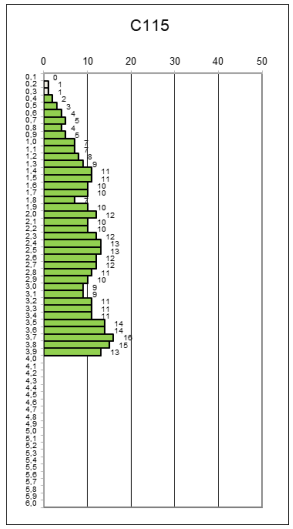
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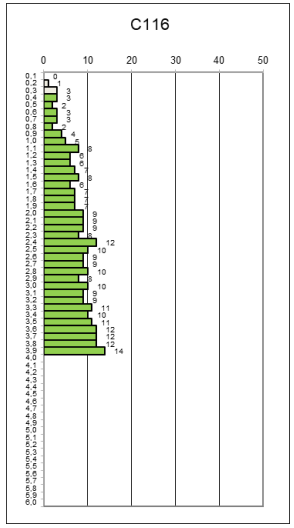
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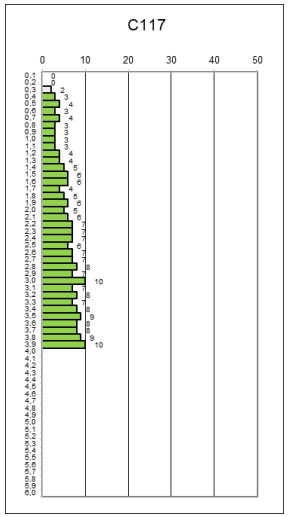
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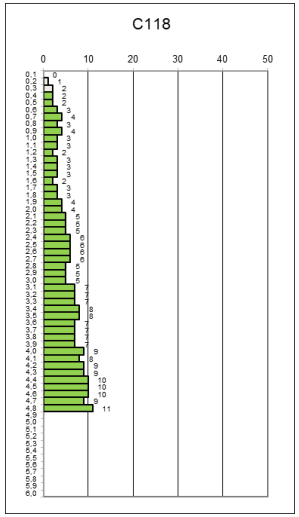
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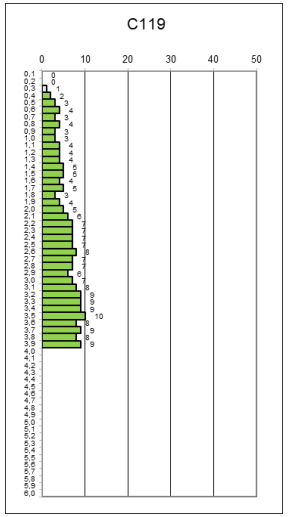
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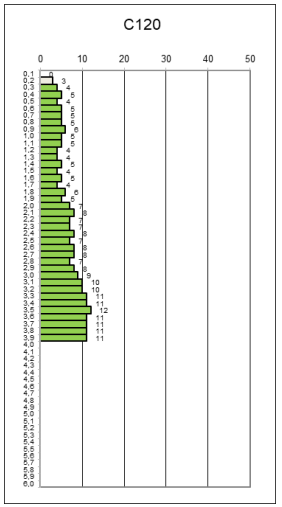
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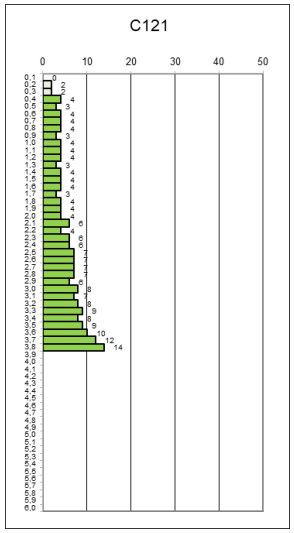
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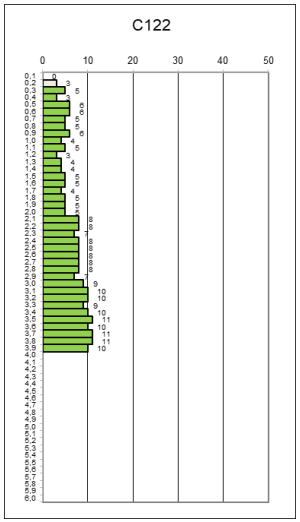
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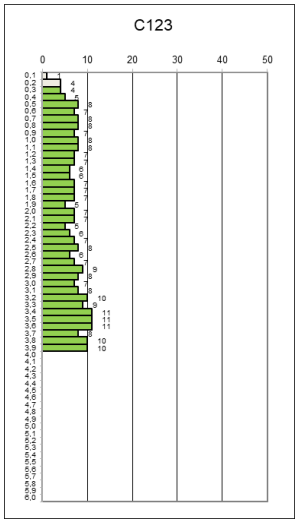
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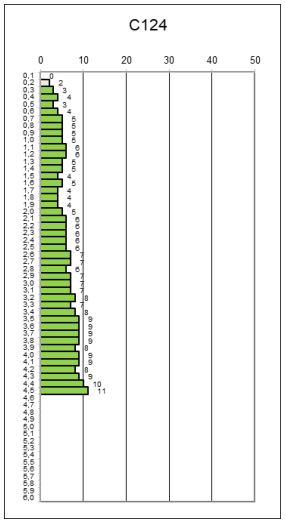
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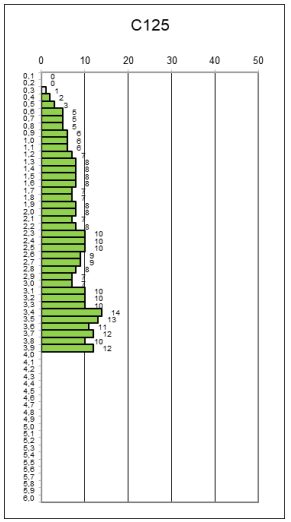
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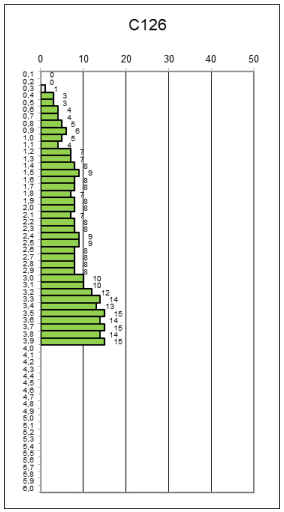
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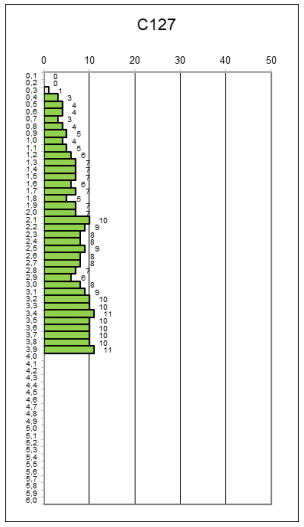
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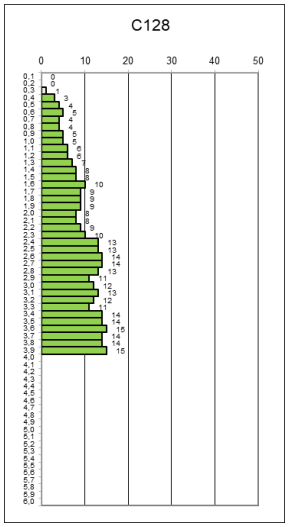
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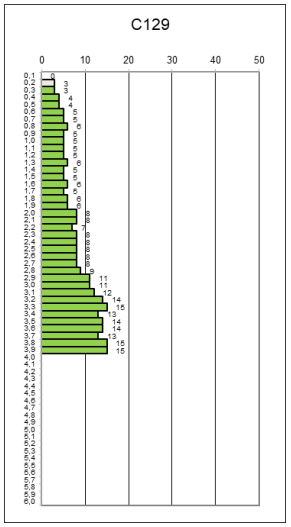
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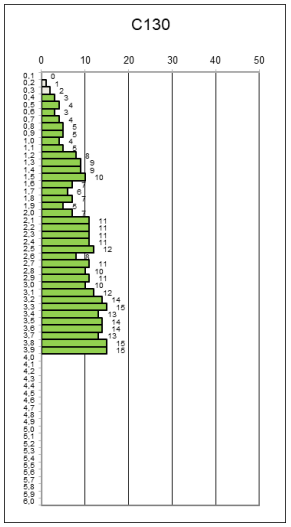
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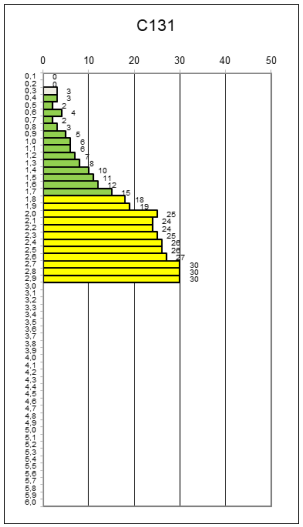
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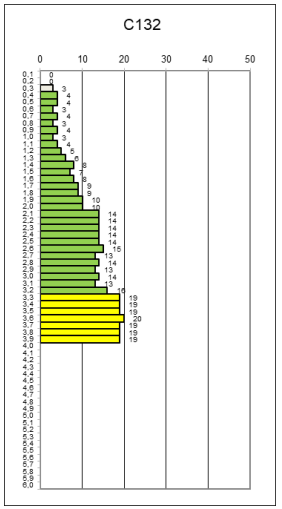
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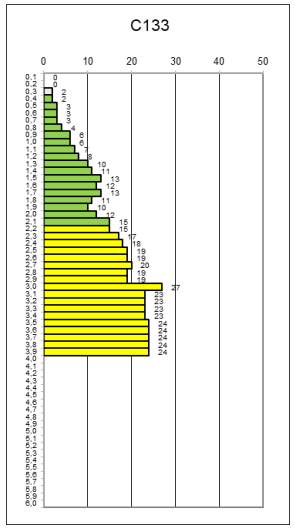
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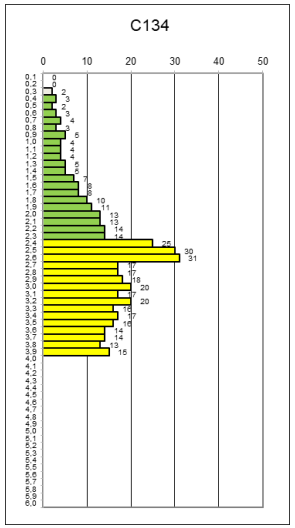
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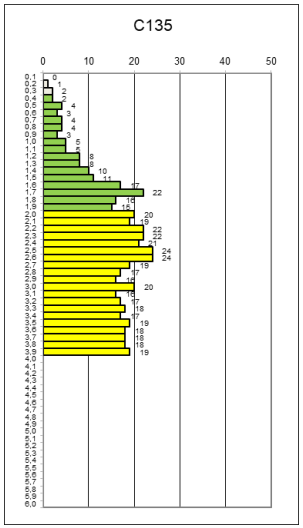
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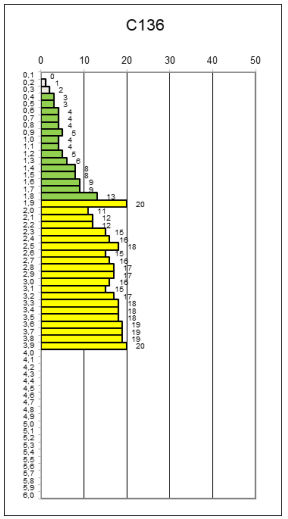
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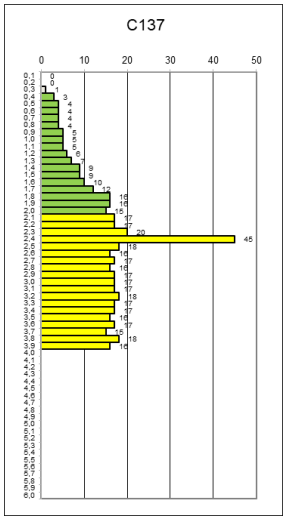
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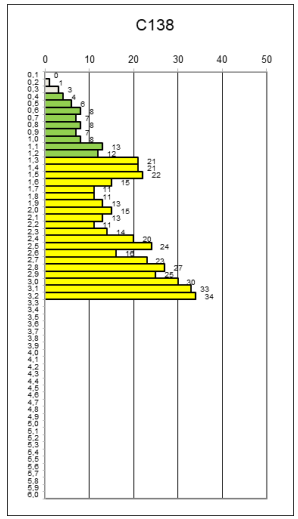
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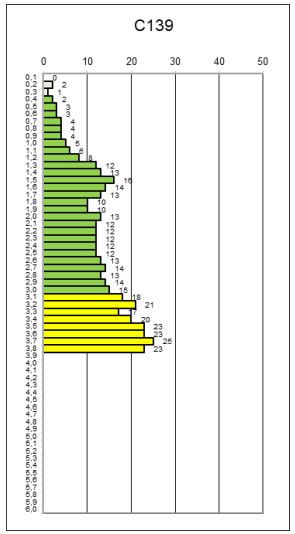
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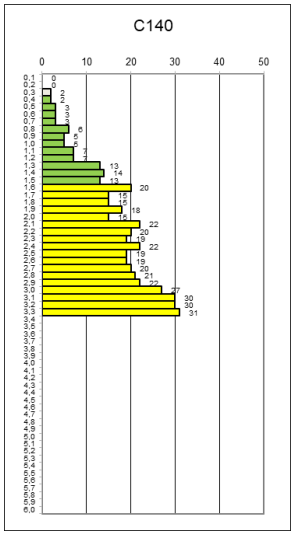
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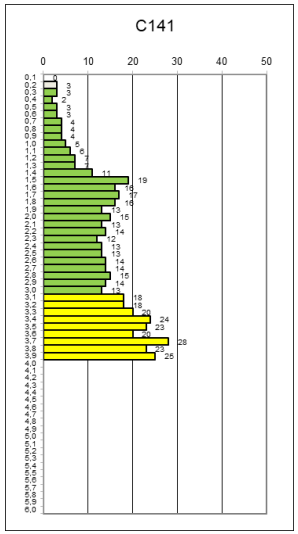
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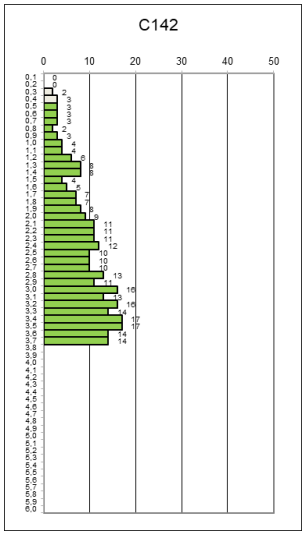
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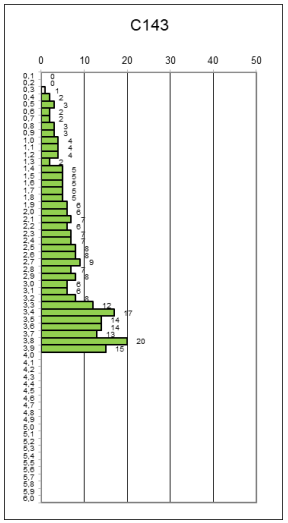
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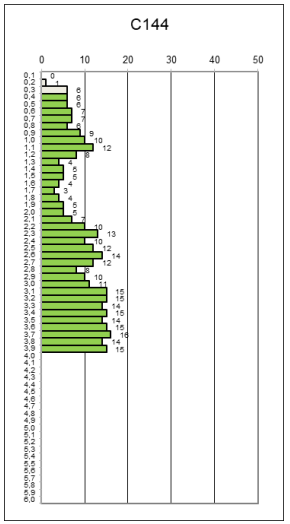
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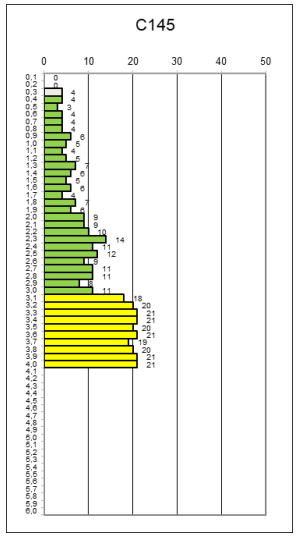
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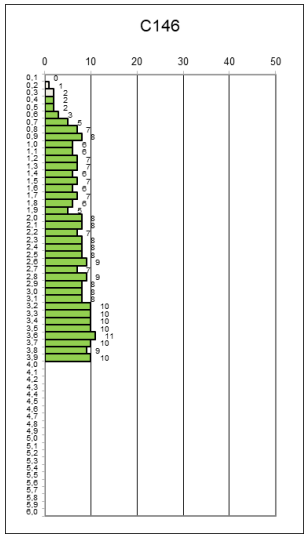
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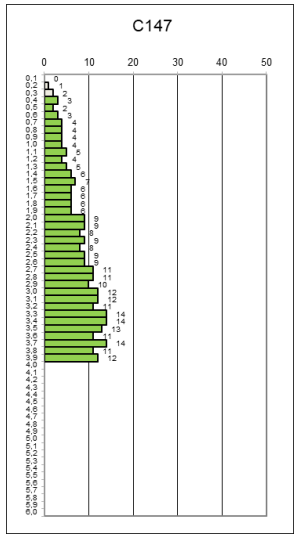
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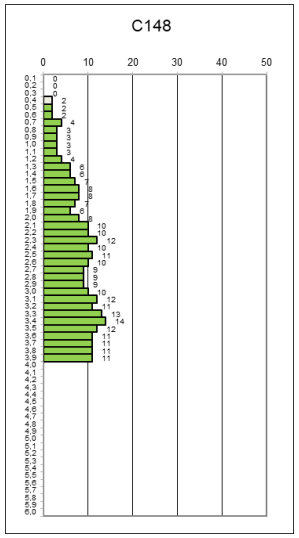
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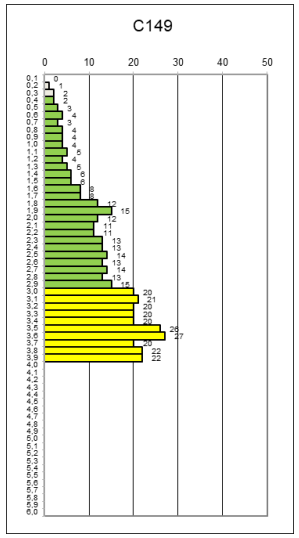
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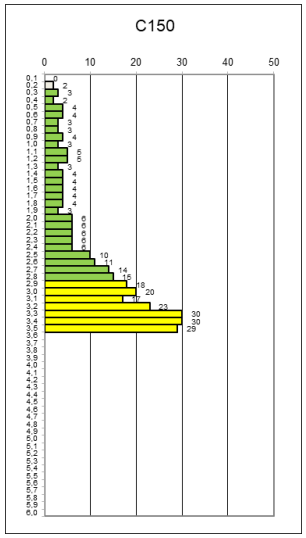
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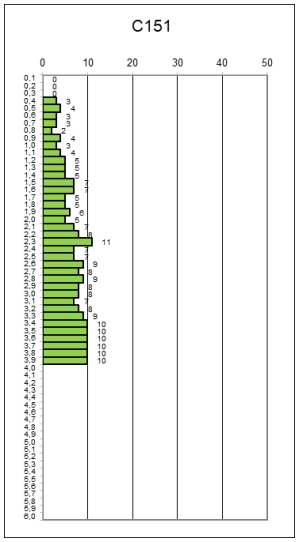
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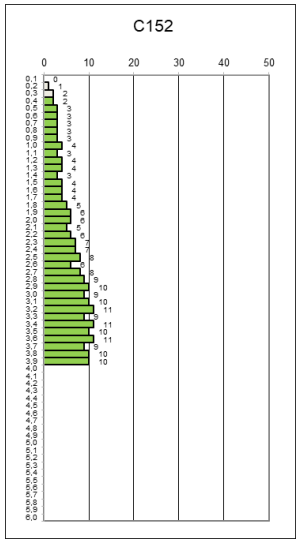
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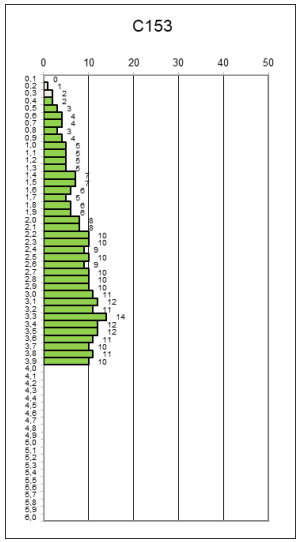
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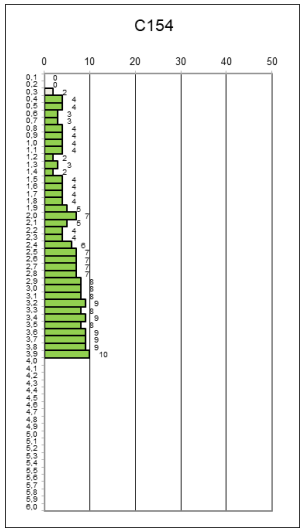
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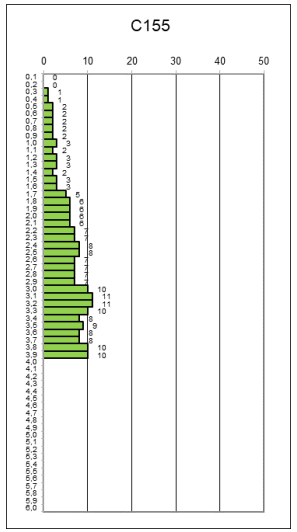
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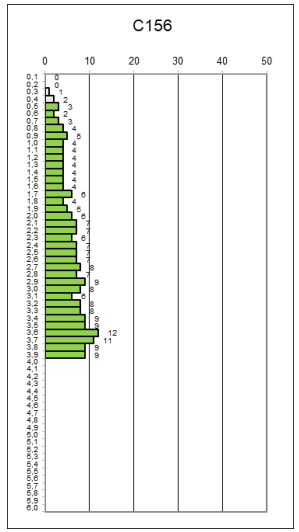
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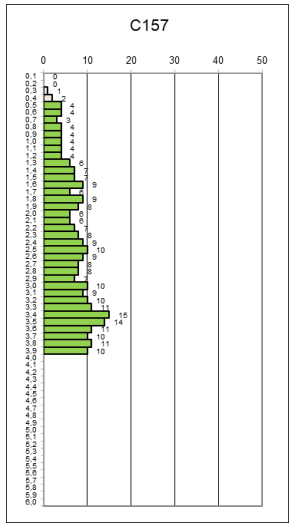
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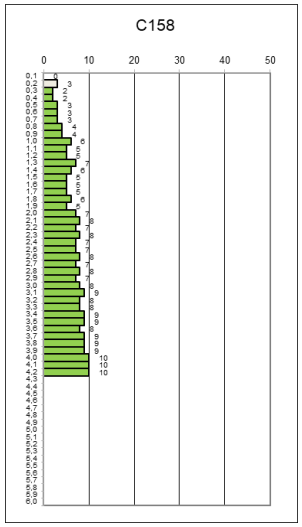
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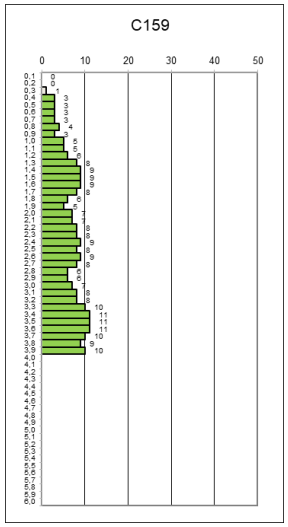
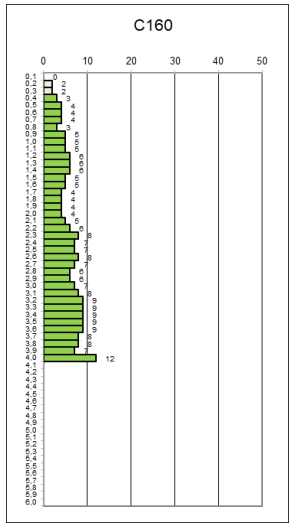

C159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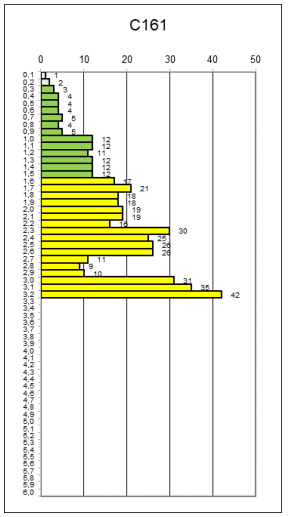
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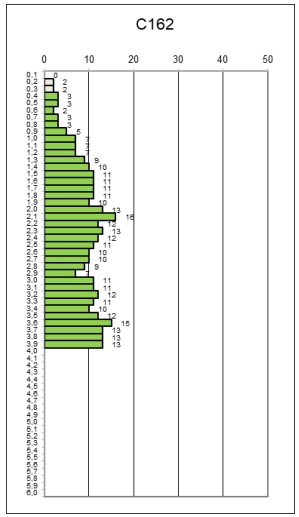
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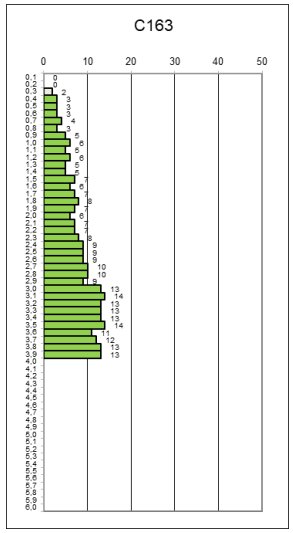
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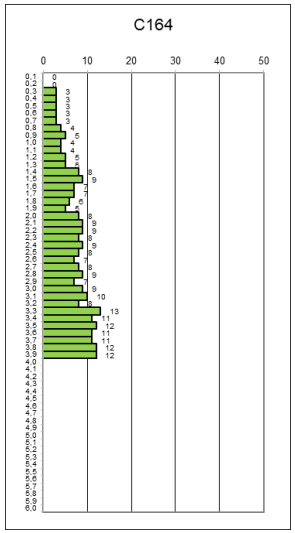
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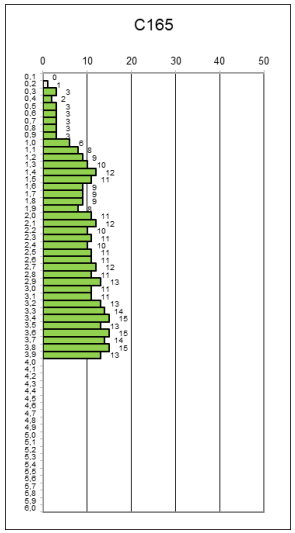
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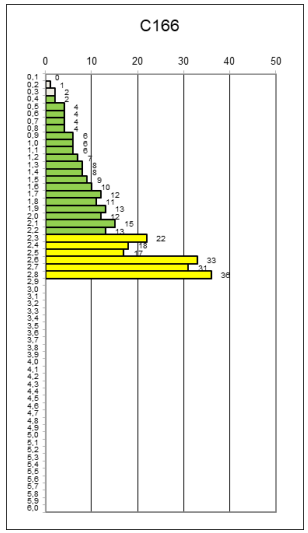
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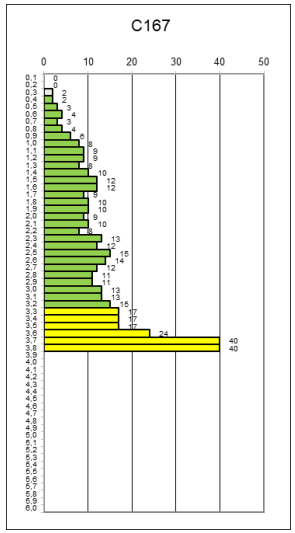
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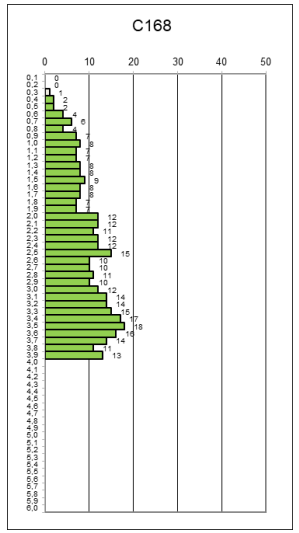
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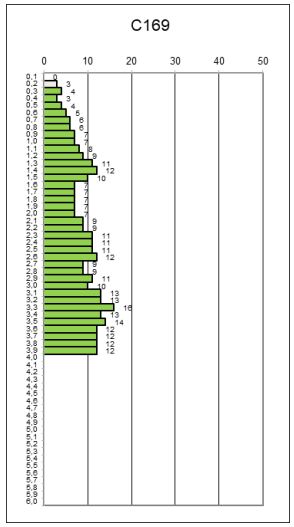
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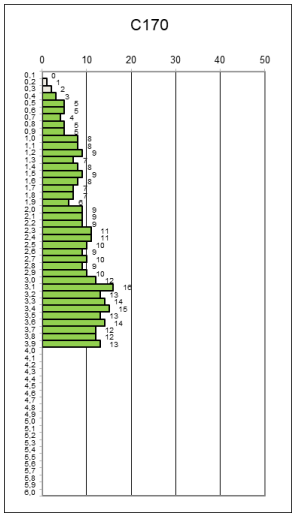
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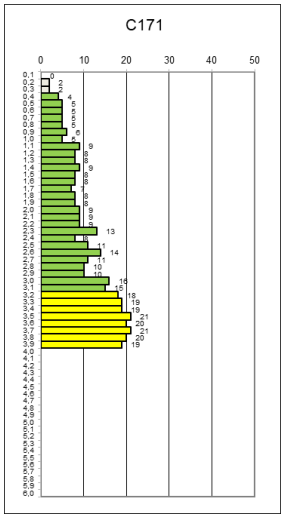
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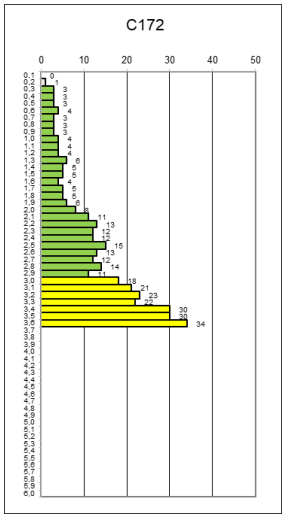
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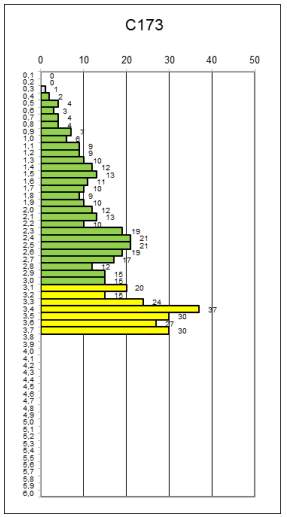
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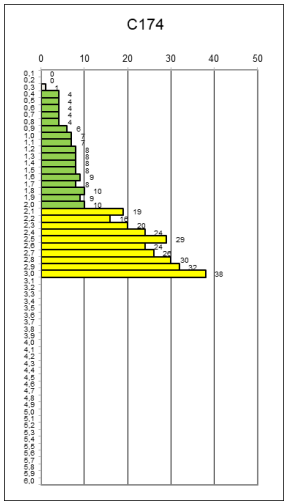
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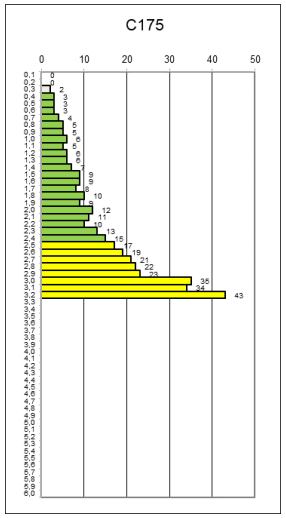
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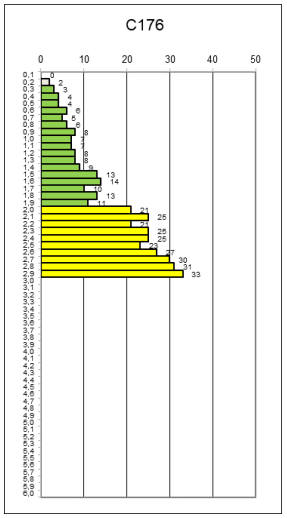
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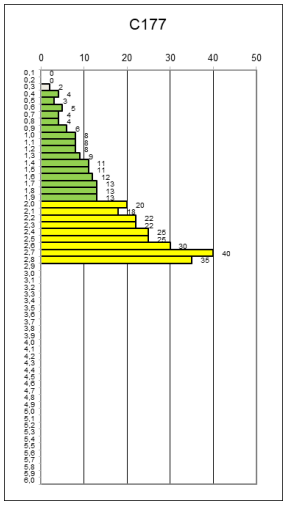
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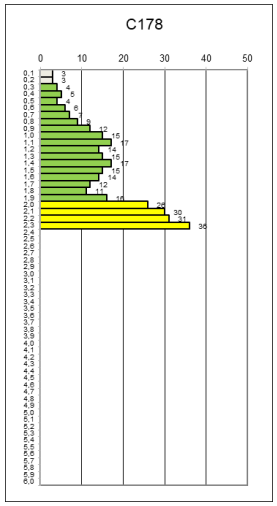
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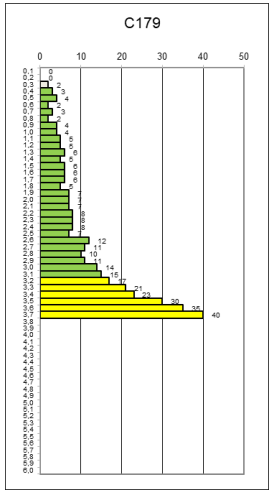
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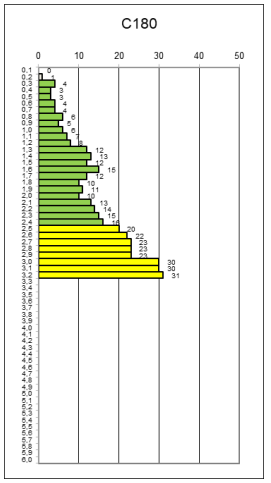
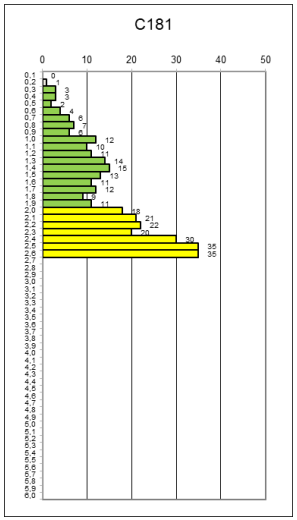
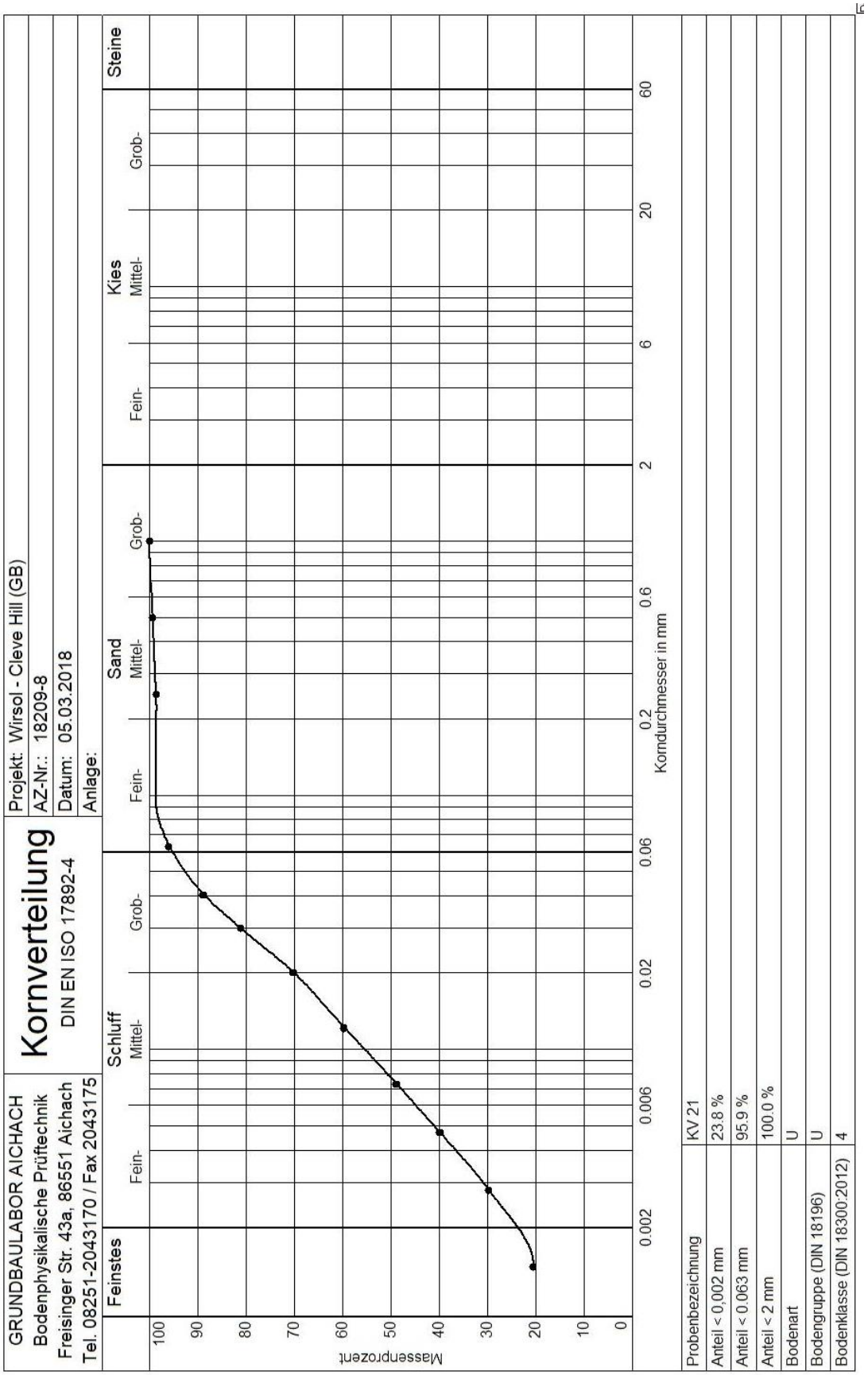

C180

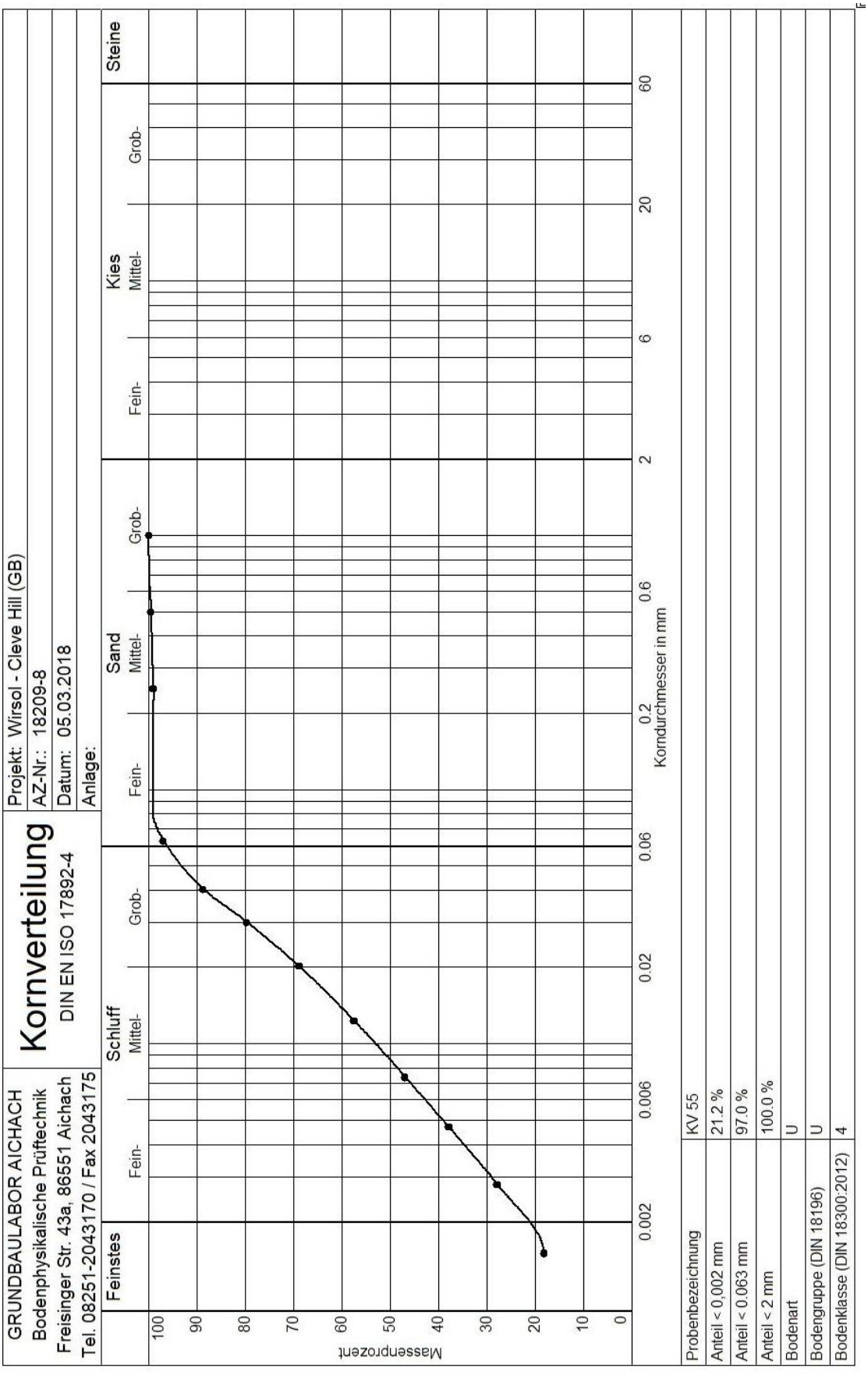

C181
0
10
20
30
40
50

Enclosure 2.3 Results of analysis of the particle size distribution at soil samples KV 21, KV55, KV 67, KV 77 and KV 85

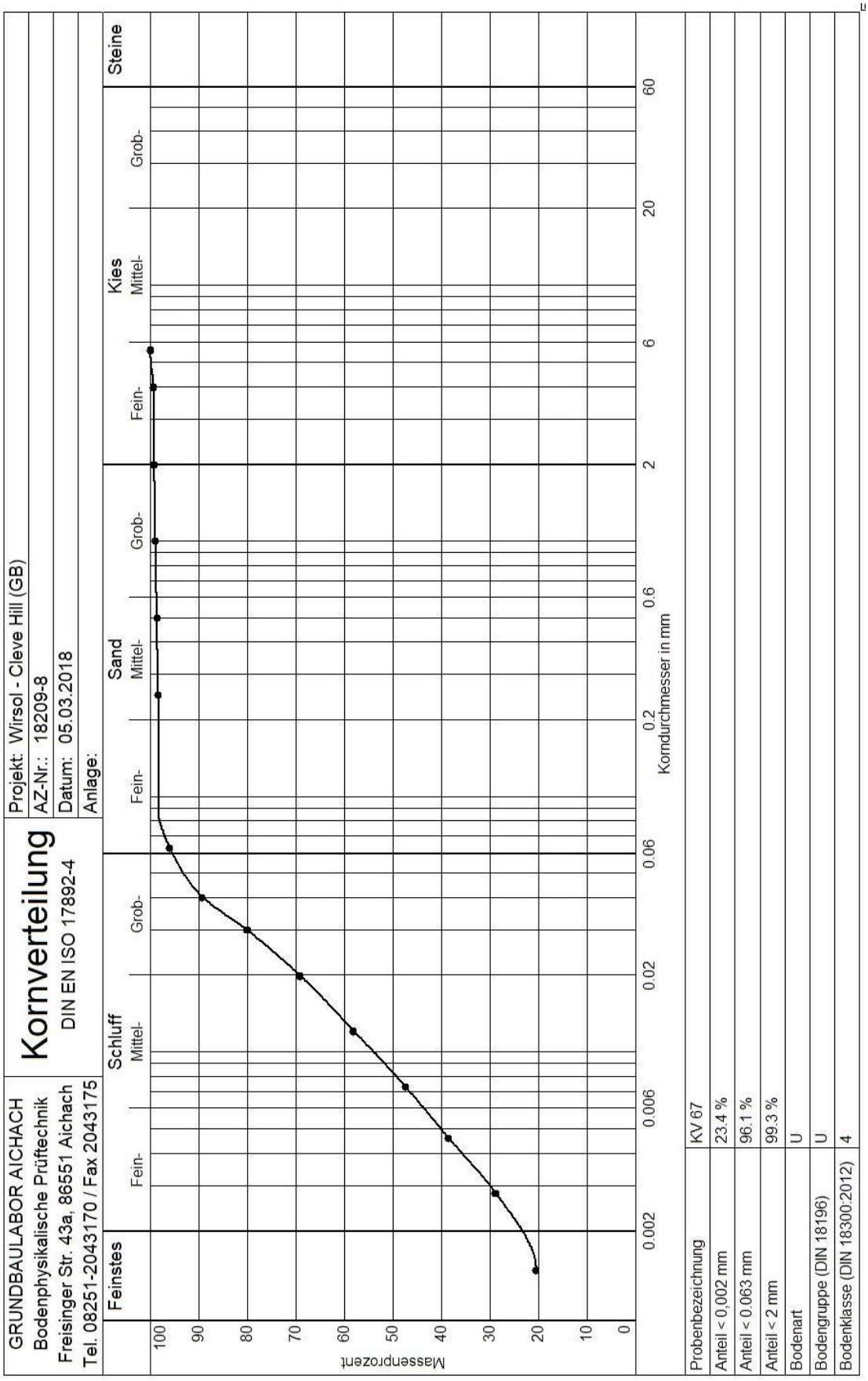
KV 21:



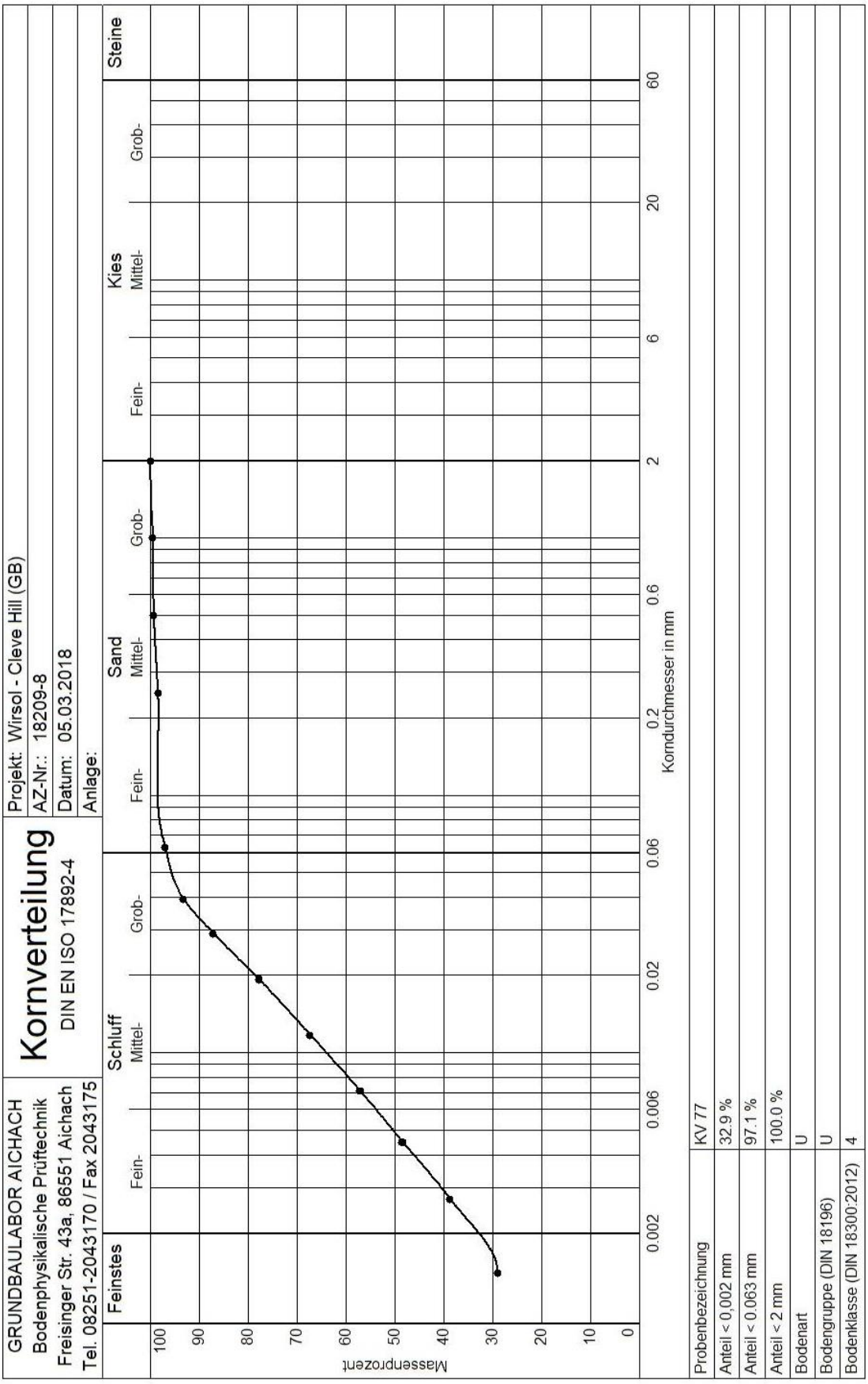
KV 55:


GRUNDBAULABOR AICHACH
Bodenphysikalische Prüftechnik
Freisinger Str. 43a, 86551 Aichach
Tel. 08251-2043170 / Fax 2043175
Kornverteilung
DIN EN ISO 17892-4
Projekt: Wirsol - Cleve Hill (GB)
AZ-Nr.: 18209-8
Datum: 05.03.2018
Anlage:
Feinstes
Schluff
Sand
Kies
Steine
Fein-
Mittel-
Grob-
Fein-
Mittel-
Grob-
Fein-
Mittel-
Grob-
Massenprozent
100
90
80
70
60
50
40
30
20
10
0
0.002
0.006
0.02
0.06
0.2
0.6
2
6
20
60
Korndurchmesser in mm
Probenbezeichnung KV 55
Anteil < 0,002 mm 21.2 %
Anteil < 0.063 mm 97.0 %
Anteil < 2 mm 100.0 %
Bodenart U
Bodengruppe (DIN 18196) U
Bodenklasse (DIN 18300:2012) 4

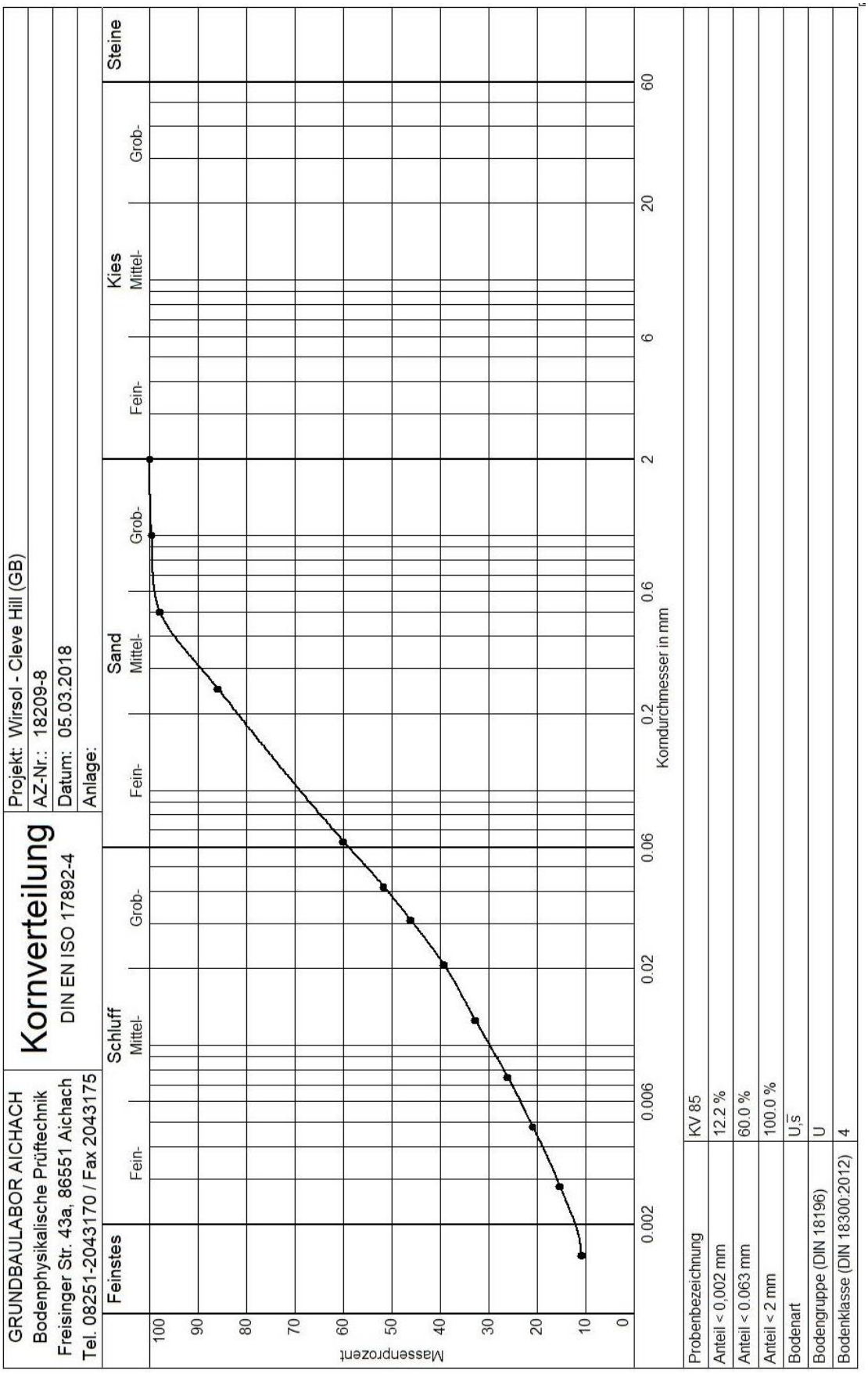
KV 67:


GRUNDBAULABOR AICHACH
Bodenphysikalische Prüftechnik
Freisinger Str. 43a, 86551 Aichach
Tel. 08251-2043170 / Fax 2043175
Korngrößenverteilung
DIN EN ISO 17892-4
Projekt: Wirsol - Cleve Hill (GB)
AZ-Nr.: 18209-8
Datum: 05.03.2018
Anlage:
Feinstes
Schluff
Sand
Kies
Steine
Fein-
Mittel-
Grob-
Fein-
Mittel-
Grob-
Fein-
Mittel-
Grob-
Massenprozent
Korndurchmesser in mm
0.002
0.006
0.02
0.06
0.2
0.6
2
6
20
60
Probenbezeichnung KV 67
Anteil < 0,002 mm 23.4 %
Anteil < 0.063 mm 96.1 %
Anteil < 2 mm 99.3 %
Bodenart U
Bodengruppe (DIN 18196) U
Bodenklasse (DIN 18300:2012) 4

KV 77:


GRUNDBAULABOR AICHACH
Bodenphysikalische Prüftechnik
Freisinger Str. 43a, 86551 Aichach
Tel. 08251-2043170 / Fax 2043175
Kornverteilung
DIN EN ISO 17892-4
Projekt: Wirsol - Cleve Hill (GB)
AZ-Nr.: 18209-8
Datum: 05.03.2018
Anlage:
Feinstes
Schluff
Sand
Kies
Steine
Fein-
Mittel-
Grob-
Fein-
Mittel-
Grob-
Fein-
Mittel-
Grob-
Massenprozent
Korndurchmesser in mm
0.002
0.006
0.02
0.06
0.2
0.6
2
6
20
60
Probenbezeichnung KV 77
Anteil < 0,002 mm 32.9 %
Anteil < 0.063 mm 97.1 %
Anteil < 2 mm 100.0 %
Bodenart U
Bodengruppe (DIN 18196) U
Bodenklasse (DIN 18300:2012) 4

KV 85:


GRUNDBAULABOR AICHACH
Bodenphysikalische Prüftechnik
Freisinger Str. 43a, 86551 Aichach
Tel. 08251-2043170 / Fax 2043175
Kornverteilung
DIN EN ISO 17892-4
Projekt: Wirsol - Cleve Hill (GB)
AZ-Nr.: 18209-8
Datum: 05.03.2018
Anlage:
Feinstes
Schluff
Sand
Kies
Steine
Fein-
Mittel-
Grob-
Fein-
Mittel-
Grob-
Fein-
Mittel-
Grob-
Massenprozent
Korndurchmesser in mm
0.002
0.006
0.02
0.06
0.2
0.6
2
6
20
60
Probenbezeichnung KV 85
Anteil < 0,002 mm 12.2 %
Anteil < 0.063 mm 60.0 %
Anteil < 2 mm 100.0 %
Bodenart U,s
Bodengruppe (DIN 18196) U
Bodenklasse (DIN 18300:2012) 4

Enclosure 3 Soil characteristics of the sounded layers and classification of suitability for rammed steel profiles

TOPSOIL (Organic silty CLAY, partially with some pebbles and sand)

Colour: dark-brown

In depths down to 0.2 m – 0.4 m (0.3 m on average)

Consistency: soft

Specific gravity γ cal.	Angle of friction φ cal.	Cohesion c' cal	Vertical stiffness Es v	Horizontal stiffness Es h	Skin friction (Breaking value)
kN/m³	°	kN/m²	MN/m²	MN/m²	MN/m²
15.0	17.5	1.0	8	6	0.010

Soil class 1 Winkler coefficient $k_{s\ hor}$ not applicable CBR 1 - 5

Layer **S1** (silty CLAY)

Colour: brown – grey-brown, partly with fine laminations and reddish mooted spots as well as lenses of grey fine sand

Beneath TOPSOIL, in depths from 0.2 to > 3.0 m, except, where layer **S2** follows

Consistency: soft – stiff

Specific gravity γ cal.	Specific gravity below the groundwater surface γ' cal.	Angle of friction φ cal.	Cohesion c' cal	Vertical stiffness Es v	Horizontal stiffness Es h	Skin friction (Breaking value)
kN/m³	kN/m³	°	kN/m²	MN/m²	MN/m²	MN/m²
19.0	9.0	17.5	2.5	12	10	0.0175

Soil class 3 Winkler coefficient $k_{s\ hor}$ 25 MN/m³ CBR 5 - 8

Layer **S2** (Clayey sandy SILT)

Colour: grey-brown

Only in some parts of the area, underneath layer **S1** (see enclosure 1.4),

in depths from 0.9 m to > 3.0 m

Consistency: firm – very stiff

Specific gravity γ cal.	Specific gravity below the groundwater surface γ' cal.	Angle of friction φ cal.	Cohesion c' cal	Vertical stiffness Es v	Horizontal stiffness Es h	Skin friction (Breaking value)
kN/m³	kN/m³	°	kN/m²	MN/m²	MN/m²	MN/m²
20.5	10.5	22.5	10,0	20	18	0.020

Soil class 4 Winkler coefficient $k_{s\ hor.}$ 30 MN/m³ CBR 10

Soil type	Cohesive soil (clay and silt)	Non-cohesive soil (sand and gravel)	Coarse-grained soil (gravel and stones)	Mixed soil with different grain sizes	Rock (weathered)	Rock (compact)	Artificially filled soil
Percentage of the area	Present on the entire field (layers **S1** and **S2**)	None	None	None	None	None	None
Possibility of ramming	Very good – good						
Ramming obstacles	No						
Drilling necessary	No						
Corrosivity towards zinc coated steel	See enclosure 5						
Ground water	From a depth of approximately 1.5 m, temporarily at ground level						
Slope	0° - 2 °, partly up to 8 °						
Resistance towards horizontal and vertical forces	Layer **S1** and **S2**: Hor.: medium Vert.: medium						
Traffic ability W: wheeled vehicle T: crawler-tracked vehicle	W: during rainy periods worse, during dry periods medium T: during rainy periods medium, during dry periods good*						
Vegetation	Arable land (partly harvested and or laying fallow or freshly cultivated and sown)						

Enclosure 4 Results of the geo-electric soil resistivity measurements

On 22/02/2018, 23/02/2018 and 04/03/2018 the Büro Boden und Wasser has conducted geo-electric soil resistivity tests at 19 locations together with moisture measurements of the ground. These locations (C07 (SR 1), C17 (SR 2), C19 (SR 3), C20 (SR 4), C24 (SR 5) , C28 (SR 6), C37 (SR 7), C43 (SR 8), C103 (SR 103), C106 (SR 106), C110 (SR 110), C121 (SR 121), C136 (SR 136), C143 (SR 143), C155 (SR 155) and C172 (SR 172)) are marked in the plan in enclosure 1.4.

These results should be used for the whole area where the solar plant will be constructed (red framed area in enclosure 1.4). The electrode spacing of 1 m, 2 m, 3 m, 4 m and 5 m gives the ground resistivity for the upper layer (down to 4 m below ground level). The results of the tests are shown in the following 19 tables.

Date: 22.02.2018

SR 1: C07	Average Humidity: 31.7 %	
Electrode Spacing (m) A	Ground Resistence (Ω) r	Resistivity (Ω*m) \rho
1	42,2	265,15
2	44,9	564,23
3	52,9	997,14
4	46,3	1163,65
5	55,5	1743,58

SR 2: C17	Average Humidity: 32.5 %	
Electrode Spacing (m) A	Ground Resistence (Ω) r	Resistivity (Ω*m) \rho
1	25,0	157,08
2	26,6	334,27
3	24,3	458,04
4	20,3	510,19
5	23,5	738,27

SR 3: C19	Average Humidity: 31.2 %	
Electrode Spacing (m) A	Ground Resistence (Ω) r	Resistivity (Ω*m) \rho
1	25,1	157,71
2	36,7	461,19
3	39,7	748,33
4	33,8	849,49
5	72,8	2287,08

SR 4: C20	Average Humidity: 46.6 %	
Electrode Spacing (m) A	Ground Resistence (Ω) r	Resistivity (Ω*m) \rho
1	38,4	241,27
2	40,4	507,68
3	44,2	833,15
4	35,8	899,75
5	29,5	926,77

Date: 23.02.2018

SR 5: C24	Average Humidity: 43.2 %	
Electrode Spacing (m) A	Ground Resistence (Ω) r	Resistivity (Ω*m) \rho
1	34,6	217,40
2	34,8	437,31
3	31,0	584,34
4	34,2	859,54
5	30,9	970,75

SR 6: C28	Average Humidity: 23.6 %	
Electrode Spacing (m) A	Ground Resistence (Ω) r	Resistivity (Ω*m) \rho
1	25,4	159,59
2	24,5	307,88
3	20,7	390,19
4	27,3	686,12
5	25,6	804,25

SR 7: C37	Average Humidity: 26.4 %	
Electrode Spacing (m) A	Ground Resistence (Ω) r	Resistivity (Ω*m) \rho
1	25,1	157,71
2	28,2	354,37
3	28,9	544,75
4	44,2	1110,87
5	36,2	1137,26

SR 8: C43	Average Humidity: 35.3	
Electrode Spacing (m) A	Ground Resistence (Ω) r	Resistivity (Ω*m) \rho
1	32,8	206,09
2	33,4	419,72
3	34,8	655,96
4	35,0	879,65
5	30,8	967,61

SR 9: C46	Average Humidity: 34.9 %	
Electrode Spacing (m) A	Ground Resistence (Ω) r	Resistivity (Ω*m) \rho
1	41	257,61
2	39,9	501,40
3	38,5	725,71
4	44,8	1125,95
5	42,4	1332,04

Date: 04.03.2018

SR C57	Average Humidity: 32.5 %	
Electrode Spacing (m) A	Ground Resistence (Ω) r	Resistivity (Ω*m) \rho
1	25,3	158,96
2	25,6	321,70
3	29,4	554,18
4	27,4	688,64
5	27,7	870,22

SR C103	Average Humidity: 30.7 %	
Electrode Spacing (m) A	Ground Resistence (Ω) r	Resistivity (Ω*m) \rho
1	40,1	251,96
2	34,8	437,31
3	34,8	655,96
4	41,4	1040,50
5	40	1256,64

SR C106	Average Humidity: 26.1 %	
Electrode Spacing (m) A	Ground Resistence (Ω) r	Resistivity (Ω*m) \rho
1	40,3	253,21
2	41,2	517,73
3	40,2	757,75
4	41,3	1037,98
5	45,5	1429,42

SR C110	Average Humidity: 47.9 %	
Electrode Spacing (m) A	Ground Resistence (Ω) r	Resistivity (Ω*m) \rho
1	26	163,36
2	28,6	359,40
3	25,8	486,32
4	31,8	799,22
5	31,3	983,32

SR C121	Average Humidity: 27.0 %	
Electrode Spacing (m) A	Ground Resistence (Ω) r	Resistivity (Ω*m) \rho
1	43,5	273,32
2	49,2	618,27
3	49,8	938,71
4	53,2	1337,06
5	54,5	1712,17

SR C136	Average Humidity: 30.9 %	
Electrode Spacing (m) A	Ground Resistence (Ω) r	Resistivity (Ω*m) \rho
1	45,7	287,14
2	54,7	687,38
3	47,6	897,24
4	48,3	1213,91
5	47,6	1495,40

SR C143	Average Humidity: 24.0 %	
Electrode Spacing (m) A	Ground Resistence (Ω) r	Resistivity (Ω*m) \rho
1	42,8	268,92
2	45,9	576,80
3	44,4	836,92
4	42,8	1075,68
5	49,1	1542,52

SR C155	Average Humidity: 24.7 %	
Electrode Spacing (m) A	Ground Resistence (Ω) r	Resistivity (Ω*m) \rho
1	41,5	260,75
2	42,4	532,81
3	46,8	882,16
4	52	1306,90
5	58,6	1840,97

SR C160	Average Humidity: 22.6 %	
Electrode Spacing (m) A	Ground Resistence (Ω) r	Resistivity (Ω*m) \rho
1	52,5	329,87
2	50,2	630,83
3	45	848,23
4	62,3	1565,77
5	70,7	2221,11

SR C173	Average Humidity: 32.1 %	
Electrode Spacing (m) A	Ground Resistence (Ω) r	Resistivity (Ω*m) \rho
1	49,6	311,65
2	51,5	647,17
3	48,1	906,66
4	52,2	1311,93
5	46,2	1451,42

SR C181	Average Humidity: 23.1 %	
Electrode Spacing (m) A	Ground Resistence (Ω) r	Resistivity (Ω*m) \rho
1	71,4	448,62
2	71,7	901,01
3	79	1489,11
4	69,8	1754,27
5	49,7	1561,37

Enclosure 5 Chemical analysis

Enclosure 5.1 Results of the chemical laboratory studies for corrosiveness towards steel according to DIN 50929 and for the corrosiveness towards concrete according to DIN 4030 at the soil samples PNCo 06, PNCo 50, PNCo 64, PNCo 72, PNCo 83 and PNCo 89

PNCo 06:

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Report

Wirsol, Cleve Hill (GB)
Az 18209-8

COA no.	CMU18-003552-2	Order_no	CMU-00848-18	Date	07.03.2018

Sample No.	**18-031453-01**
Date of receipt	27.02.2018
Designation	PNCo 06 vom 17.02.2018
Sample type	Soil
Sampling by	client
Sample container	1xBag
Number of containers	1
Start of analysis	27.02.2018
End of analysis	06.03.2018

Soil testing - concrete/steel corrosiveness

sample no			18-031453-01
designation			PNCo 06 vom 17.02.2018
Hydrochloric acid extract		AD	**28.02.2018**
Aqueous extract		AD	**28.02.2018**
Elutriatable substances	Gew%	OS	**76,8**
Water content	Gew%	OS	**29,0**
pH-value		OS	**8,0**
Acid capacity pH 4,3	mmol/kg	OS	**40,8**
Base capacity pH 7,0	mmol/kg	OS	**n.a.**
Sulfide (S) total	mg/kg	AD	**<1,00**
Degree of acidity by Baumann-Gully	ml/kg	AD	**39**

In the water extract C

sample no			18-031453-01
designation			PNCo 06 vom 17.02.2018
Chloride (Cl)	mmol/kg	AD	**0,12**
Sulfate (SO4)	mmol/kg	AD	**0,07**

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In the hydrochloric acid

sample no			18-031453-01
designation			PNCo 06 vom 17.02.2018
Sulphur (S)	mg/kg	AD	**200**
Sulfate (SO4) calc.	mg/kg	AD	**599**
Sulfate (SO4) calc.	mmol/kg	AD	**6,24**

In the water extract A

sample no			18-031453-01
designation			PNCo 06 vom 17.02.2018
Chloride (Cl)	mg/kg	AD	**<25,0**

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COA no.	**CMU18-003552-2**	Order_no	**CMU-00848-18**	Date	**07.03.2018**

18-031453-01
Acid- / Base capacity, pH 7,0: not analyzed

Abbreviations and Methods

Elutriable solids in soil	WES 1017	Umweltanalytik Oppin
Dry residue/ water content (soil)	DIN ISO 11465 (1996-12)[A]	Umweltanalytik Oppin
pH-value in solid	DIN ISO 10390 (2005-12)[A]	Umweltanalytik Oppin
Capacity of acid/base	H. Steinrath/DVGW	Umweltanalytik Oppin
Sulfide total (concrete- and steel aggressiveness)	DIN 4030-2 (2008-06)[A]	Umweltanalytik Oppin
Chloride and sulfate steel aggressivity	DIN 50929-3 mod. (1985-09)	Umweltanalytik Oppin
Sulfate (steel aggressiveness)	DIN 4030-2 mod. (2008-06)[A]	Umweltanalytik Oppin
Degree of acidity acc. to Baumann-Gully	DIN 4030-2 (2008-06)[A]	Umweltanalytik Oppin
Sulfate (SO4) in HCl extract B (concrete- and steel aggressiveness)	DIN 4030-2 mod. (2008-06)[A]	Umweltanalytik Oppin
Chloride (Cl) solvent in H2O extract A (concrete aggressivity)	DIN 4030-2 mod. (2008-06)[A]	Umweltanalytik Oppin
Hydrochloric acid extract (concrete aggressivity)	DIN 4030-2 (2008-06)[A]	Umweltanalytik Oppin
Aqueous extract	DIN 4030-2 (2008-06)[A]	Umweltanalytik Oppin

AD	Air dried
OS	Original substance

The report replaces the report CMU18-003552-1 dated 06.03.2018

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PNCo 50:

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Wirsol, Cleve Hill (GB)
Az 18209-8

COA no.	CMU18-003553-2	Order_no	CMU-00848-18	Date	07.03.2018

Sample No.	**18-031453-02**
Date of receipt	27.02.2018
Designation	PNCo 50 vom 18.02.2018
Sample type	Soil
Sampling by	client
Sample container	1xBag
Number of containers	1
Start of analysis	27.02.2018
End of analysis	06.03.2018

Soil testing - concrete/steel corrosiveness

sample no			18-031453-02
designation			PNCo 50 vom 18.02.2018
Hydrochloric acid extract		AD	**28.02.2018**
Aqueous extract		AD	**28.02.2018**
Elutriatable substances	Gew%	OS	**97,2**
Water content	Gew%	OS	**29,2**
pH-value		OS	**7,8**
Acid capacity pH 4,3	mmol/kg	OS	**72,9**
Base capacity pH 7,0	mmol/kg	OS	**n.a.**
Sulfide (S) total	mg/kg	AD	**<1,00**
Degree of acidity by Baumann-Gully	ml/kg	AD	**9**

In the water extract C

sample no			18-031453-02
designation			PNCo 50 vom 18.02.2018
Chloride (Cl)	mmol/kg	AD	**1,2**
Sulfate (SO4)	mmol/kg	AD	**1,3**

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COA no.	CMU18-003553-2	Order_no	CMU-00848-18	Date	07.03.2018

In the hydrochloric acid

sample no			18-031453-02
designation			PNCo 50 vom 18.02.2018
Sulphur (S)	mg/kg	AD	**290**
Sulfate (SO4) calc.	mg/kg	AD	**868**
Sulfate (SO4) calc.	mmol/kg	AD	**9,04**

In the water extract A

sample no			18-031453-02
designation			PNCo 50 vom 18.02.2018
Chloride (Cl)	mg/kg	AD	**28,0**

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COA no.	**CMU18-003553-2**	Order_no	**CMU-00848-18**	Date	**07.03.2018**

18-031453-02
Acid- / Base capacity, pH 7,0: not analyzed

Abbreviations and Methods

Elutriable solids in soil	WES 1017	Umweltanalytik Oppin
Dry residue/ water content (soil)	DIN ISO 11465 (1996-12)[A]	Umweltanalytik Oppin
pH-value in solid	DIN ISO 10390 (2005-12)[A]	Umweltanalytik Oppin
Capacity of acid/base	H. Steinrath/DVGW	Umweltanalytik Oppin
Sulfide total (concrete- and steel aggressiveness)	DIN 4030-2 (2008-06)[A]	Umweltanalytik Oppin
Chloride and sulfate steel aggressivity	DIN 50929-3 mod. (1985-09)	Umweltanalytik Oppin
Sulfate (steel aggressiveness)	DIN 4030-2 mod. (2008-06)[A]	Umweltanalytik Oppin
Degree of acidity acc. to Baumann-Gully	DIN 4030-2 (2008-06)[A]	Umweltanalytik Oppin
Sulfate (SO4) in HCl extract B (concrete- and steel aggressiveness)	DIN 4030-2 mod. (2008-06)[A]	Umweltanalytik Oppin
Chloride (Cl) solvent in H2O extract A (concrete aggressivity)	DIN 4030-2 mod. (2008-06)[A]	Umweltanalytik Oppin
Hydrochloric acid extract (concrete aggressivity)	DIN 4030-2 (2008-06)[A]	Umweltanalytik Oppin
Aqueous extract	DIN 4030-2 (2008-06)[A]	Umweltanalytik Oppin

AD	Air dried
OS	Original substance

The report replaces the report CMU18-003553-1 dated 06.03.2018

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PNCo 64:

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Report

Wirsol, Cleve Hill (GB)
Az 18209-8

COA no. **CMU18-003554-2** Order_no **CMU-00848-18** Date **07.03.2018**

Sample No.	**18-031453-03**
Date of receipt	27.02.2018
Designation	PNCo 64 vom 20.02.2018
Sample type	Soil
Sampling by	client
Sample container	1xBag
Number of containers	1
Start of analysis	27.02.2018
End of analysis	06.03.2018

Soil testing - concrete/steel corrosiveness

sample no			18-031453-03
designation			PNCo 64 vom 20.02.2018
Hydrochloric acid extract		AD	**28.02.2018**
Aqueous extract		AD	**28.02.2018**
Elutriatable substances	Gew%	OS	**97,9**
Water content	Gew%	OS	**27,6**
pH-value		OS	**9,2**
Acid capacity pH 4,3	mmol/kg	OS	**394**
Base capacity pH 7,0	mmol/kg	OS	**n.a.**
Sulfide (S) total	mg/kg	AD	**<1,00**
Degree of acidity by Baumann-Gully	ml/kg	AD	**3**

In the water extract C

sample no			18-031453-03
designation			PNCo 64 vom 20.02.2018
Chloride (Cl)	mmol/kg	AD	**0,82**
Sulfate (SO4)	mmol/kg	AD	**0,49**

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In the hydrochloric acid

sample no			18-031453-03
designation			PNCo 64 vom 20.02.2018
Sulphur (S)	mg/kg	AD	**160**
Sulfate (SO4) calc.	mg/kg	AD	**479**
Sulfate (SO4) calc.	mmol/kg	AD	**4,99**

In the water extract A

sample no			18-031453-03
designation			PNCo 64 vom 20.02.2018
Chloride (Cl)	mg/kg	AD	**<25,0**

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COA no.	**CMU18-003554-2**	Order_no	**CMU-00848-18**	Date	**07.03.2018**

18-031453-03
Acid- / Base capacity, pH 7,0: not analyzed

Abbreviations and Methods

Elutriable solids in soil	WES 1017	Umweltanalytik Oppin
Dry residue/ water content (soil)	DIN ISO 11465 (1996-12)[A]	Umweltanalytik Oppin
pH-value in solid	DIN ISO 10390 (2005-12)[A]	Umweltanalytik Oppin
Capacity of acid/base	H. Steinrath/DVGW	Umweltanalytik Oppin
Sulfide total (concrete- and steel aggressiveness)	DIN 4030-2 (2008-06)[A]	Umweltanalytik Oppin
Chloride and sulfate steel aggressivity	DIN 50929-3 mod. (1985-09)	Umweltanalytik Oppin
Sulfate (steel aggressiveness)	DIN 4030-2 mod. (2008-06)[A]	Umweltanalytik Oppin
Degree of acidity acc. to Baumann-Gully	DIN 4030-2 (2008-06)[A]	Umweltanalytik Oppin
Sulfate (SO4) in HCl extract B (concrete- and steel aggressiveness)	DIN 4030-2 mod. (2008-06)[A]	Umweltanalytik Oppin
Chloride (Cl) solvent in H2O extract A (concrete aggressivity)	DIN 4030-2 mod. (2008-06)[A]	Umweltanalytik Oppin
Hydrochloric acid extract (concrete aggressivity)	DIN 4030-2 (2008-06)[A]	Umweltanalytik Oppin
Aqueous extract	DIN 4030-2 (2008-06)[A]	Umweltanalytik Oppin

AD	Air dried
OS	Original substance

The report replaces the report CMU18-003554-1 dated 06.03.2018

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PNCo 72:

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Report

Wirsol, Cleve Hill (GB)
Az 18209-8

COA no.	**CMU18-003555-2**	Order_no	**CMU-00848-18**	Date	**07.03.2018**

Sample No.	**18-031453-04**
Date of receipt	27.02.2018
Designation	PNCo 72 vom 21.02.2018
Sample type	Soil
Sampling by	client
Sample container	1xBag
Number of containers	1
Start of analysis	27.02.2018
End of analysis	06.03.2018

Soil testing - concrete/steel corrosiveness

sample no			18-031453-04
designation			PNCo 72 vom 21.02.2018
Hydrochloric acid extract		AD	**28.02.2018**
Aqueous extract		AD	**28.02.2018**
Elutriatable substances	Gew%	OS	**99,0**
Water content	Gew%	OS	**27,5**
pH-value		OS	**8,9**
Acid capacity pH 4,3	mmol/kg	OS	**98,8**
Base capacity pH 7,0	mmol/kg	OS	**n.a.**
Sulfide (S) total	mg/kg	AD	**<1,00**
Degree of acidity by Baumann-Gully	ml/kg	AD	**10**

In the water extract C

sample no			18-031453-04
designation			PNCo 72 vom 21.02.2018
Chloride (Cl)	mmol/kg	AD	**0,17**
Sulfate (SO4)	mmol/kg	AD	**0,05**

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COA no.	**CMU18-003555-2**	Order_no	**CMU-00848-18**		Date	**07.03.2018**

In the hydrochloric acid

sample no			18-031453-04
designation			PNCo 72 vom 21.02.2018
Sulphur (S)	mg/kg	AD	**230**
Sulfate (SO4) calc.	mg/kg	AD	**689**
Sulfate (SO4) calc.	mmol/kg	AD	**7,17**

In the water extract A

sample no			18-031453-04
designation			PNCo 72 vom 21.02.2018
Chloride (Cl)	mg/kg	AD	**<25,0**

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COA no.	**CMU18-003555-2**	Order_no	**CMU-00848-18**	Date	**07.03.2018**

18-031453-04
Acid- / Base capacity, pH 7,0: not analyzed

Abbreviations and Methods

Elutriable solids in soil	WES 1017	Umweltanalytik Oppin
Dry residue/ water content (soil)	DIN ISO 11465 (1996-12)[A]	Umweltanalytik Oppin
pH-value in solid	DIN ISO 10390 (2005-12)[A]	Umweltanalytik Oppin
Capacity of acid/base	H. Steinrath/DVGW	Umweltanalytik Oppin
Sulfide total (concrete- and steel aggressiveness)	DIN 4030-2 (2008-06)[A]	Umweltanalytik Oppin
Chloride and sulfate steel aggressivity	DIN 50929-3 mod. (1985-09)	Umweltanalytik Oppin
Sulfate (steel aggressiveness)	DIN 4030-2 mod. (2008-06)[A]	Umweltanalytik Oppin
Degree of acidity acc. to Baumann-Gully	DIN 4030-2 (2008-06)[A]	Umweltanalytik Oppin
Sulfate (SO4) in HCl extract B (concrete- and steel aggressiveness)	DIN 4030-2 mod. (2008-06)[A]	Umweltanalytik Oppin
Chloride (Cl) solvent in H2O extract A (concrete aggressivity)	DIN 4030-2 mod. (2008-06)[A]	Umweltanalytik Oppin
Hydrochloric acid extract (concrete aggressivity)	DIN 4030-2 (2008-06)[A]	Umweltanalytik Oppin
Aqueous extract	DIN 4030-2 (2008-06)[A]	Umweltanalytik Oppin

AD	Air dried
OS	Original substance

The report replaces the report CMU18-003555-1 dated 06.03.2018

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PNCo 83:

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Report

Wirsol, Cleve Hill (GB)
Az 18209-8

COA no.	CMU18-003556-2	Order_no	CMU-00848-18	Date	07.03.2018

Sample No.	**18-031453-05**
Date of receipt	27.02.2018
Designation	PNCo 83 vom 21.02.2018
Sample type	Soil
Sampling by	client
Sample container	1xBag
Number of containers	1
Start of analysis	27.02.2018
End of analysis	06.03.2018

Soil testing - concrete/steel corrosiveness

sample no			18-031453-05
designation			PNCo 83 vom 21.02.2018
Hydrochloric acid extract		AD	**28.02.2018**
Aqueous extract		AD	**28.02.2018**
Elutriatable substances	Gew%	OS	**96,2**
Water content	Gew%	OS	**26,8**
pH-value		OS	**8,3**
Acid capacity pH 4,3	mmol/kg	OS	**43,0**
Base capacity pH 7,0	mmol/kg	OS	**n.a.**
Sulfide (S) total	mg/kg	AD	**<1,00**
Degree of acidity by Baumann-Gully	ml/kg	AD	**34**

In the water extract C

sample no			18-031453-05
designation			PNCo 83 vom 21.02.2018
Chloride (Cl)	mmol/kg	AD	**0,27**
Sulfate (SO4)	mmol/kg	AD	**0,13**

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COA no.	**CMU18-003556-2**	Order_no	**CMU-00848-18**	Date	**07.03.2018**

In the hydrochloric acid

sample no			18-031453-05
designation			PNCo 83 vom 21.02.2018
Sulphur (S)	mg/kg	AD	**190**
Sulfate (SO4) calc.	mg/kg	AD	**569**
Sulfate (SO4) calc.	mmol/kg	AD	**5,93**

In the water extract A

sample no			18-031453-05
designation			PNCo 83 vom 21.02.2018
Chloride (Cl)	mg/kg	AD	**<25,0**

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COA no.	**CMU18-003556-2**	Order_no	**CMU-00848-18**	Date	**07.03.2018**

18-031453-05
Acid- / Base capacity, pH 7,0: not analyzed

Abbreviations and Methods

Elutriable solids in soil	WES 1017	Umweltanalytik Oppin
Dry residue/ water content (soil)	DIN ISO 11465 (1996-12)[A]	Umweltanalytik Oppin
pH-value in solid	DIN ISO 10390 (2005-12)[A]	Umweltanalytik Oppin
Capacity of acid/base	H. Steinrath/DVGW	Umweltanalytik Oppin
Sulfide total (concrete- and steel aggressiveness)	DIN 4030-2 (2008-06)[A]	Umweltanalytik Oppin
Chloride and sulfate steel aggressivity	DIN 50929-3 mod. (1985-09)	Umweltanalytik Oppin
Sulfate (steel aggressiveness)	DIN 4030-2 mod. (2008-06)[A]	Umweltanalytik Oppin
Degree of acidity acc. to Baumann-Gully	DIN 4030-2 (2008-06)[A]	Umweltanalytik Oppin
Sulfate (SO4) in HCl extract B (concrete- and steel aggressiveness)	DIN 4030-2 mod. (2008-06)[A]	Umweltanalytik Oppin
Chloride (Cl) solvent in H2O extract A (concrete aggressivity)	DIN 4030-2 mod. (2008-06)[A]	Umweltanalytik Oppin
Hydrochloric acid extract (concrete aggressivity)	DIN 4030-2 (2008-06)[A]	Umweltanalytik Oppin
Aqueous extract	DIN 4030-2 (2008-06)[A]	Umweltanalytik Oppin

AD	Air dried
OS	Original substance

The report replaces the report CMU18-003556-1 dated 06.03.2018

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PNCo 89:

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Report

Wirsol, Cleve Hill (GB)
Az 18209-8

COA no.	**CMU18-003557-2**	Order_no	**CMU-00848-18**	Date	**07.03.2018**

Sample No.	**18-031453-06**
Date of receipt	27.02.2018
Designation	PNCo 89 vom 22.02.2018
Sample type	Soil
Sampling by	client
Sample container	1xBag
Number of containers	1
Start of analysis	27.02.2018
End of analysis	06.03.2018

Soil testing - concrete/steel corrosiveness

sample no			18-031453-06
designation			PNCo 89 vom 22.02.2018
Hydrochloric acid extract		AD	**28.02.2018**
Aqueous extract		AD	**28.02.2018**
Elutriatable substances	Gew%	OS	**96,6**
Water content	Gew%	OS	**32,1**
pH-value		OS	**8,5**
Acid capacity pH 4,3	mmol/kg	OS	**48,5**
Base capacity pH 7,0	mmol/kg	OS	**n.a.**
Sulfide (S) total	mg/kg	AD	**<1,00**
Degree of acidity by Baumann-Gully	ml/kg	AD	**18**

In the water extract C

sample no			18-031453-06
designation			PNCo 89 vom 22.02.2018
Chloride (Cl)	mmol/kg	AD	**0,44**
Sulfate (SO4)	mmol/kg	AD	**1,1**

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COA no.	**CMU18-003557-2**	Order_no	**CMU-00848-18**		Date	**07.03.2018**

In the hydrochloric acid

sample no			18-031453-06
designation			PNCo 89 vom 22.02.2018
Sulphur (S)	mg/kg	AD	**220**
Sulfate (SO4) calc.	mg/kg	AD	**659**
Sulfate (SO4) calc.	mmol/kg	AD	**6,86**

In the water extract A

sample no			18-031453-06
designation			PNCo 89 vom 22.02.2018
Chloride (Cl)	mg/kg	AD	**<25,0**

BERATUNG | ANALYTIK | PLANUNG

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COA no.	**CMU18-003557-2**	Order_no	**CMU-00848-18**	Date	**07.03.2018**

18-031453-06
Acid- / Base capacity, pH 7,0: not analyzed

Abbreviations and Methods

Elutriable solids in soil	WES 1017	Umweltanalytik Oppin
Dry residue/ water content (soil)	DIN ISO 11465 (1996-12)[A]	Umweltanalytik Oppin
pH-value in solid	DIN ISO 10390 (2005-12)[A]	Umweltanalytik Oppin
Capacity of acid/base	H. Steinrath/DVGW	Umweltanalytik Oppin
Sulfide total (concrete- and steel aggressiveness)	DIN 4030-2 (2008-06)[A]	Umweltanalytik Oppin
Chloride and sulfate steel aggressivity	DIN 50929-3 mod. (1985-09)	Umweltanalytik Oppin
Sulfate (steel aggressiveness)	DIN 4030-2 mod. (2008-06)[A]	Umweltanalytik Oppin
Degree of acidity acc. to Baumann-Gully	DIN 4030-2 (2008-06)[A]	Umweltanalytik Oppin
Sulfate (SO4) in HCl extract B (concrete- and steel aggressiveness)	DIN 4030-2 mod. (2008-06)[A]	Umweltanalytik Oppin
Chloride (Cl) solvent in H2O extract A (concrete aggressivity)	DIN 4030-2 mod. (2008-06)[A]	Umweltanalytik Oppin
Hydrochloric acid extract (concrete aggressivity)	DIN 4030-2 (2008-06)[A]	Umweltanalytik Oppin
Aqueous extract	DIN 4030-2 (2008-06)[A]	Umweltanalytik Oppin

AD	Air dried
OS	Original substance

The report replaces the report CMU18-003557-1 dated 06.03.2018

Dr. Nils Kunze
Diplom-Geologe
Senior Consultant

Enclosure 5.2 Evaluation for corrosiveness towards steel according to DIN 50929 and towards concrete according to DIN 4030 at the soil samples PNCo 06, PNCo 50, PNCo 64, PNCo 72, PNCo 83 and PNCo 89

Steel:

PNCo 06:

WESSLING

Anlage: Bewertung der Stahlaggressivität von Boden
nach **DIN 50929 Teil 3**: Korrosionswahrscheinlichkeit metallischer Werkstoffe
bei äußerer Korrosionsbelastung
(Rohrleitungen und Bauteile in Böden und Wässern)

Auswertung für Probennummer: **18-031453-01**

Merkmal und Messgröße	Einheit	**Analyse**	Bewertungszahl	
(1) Abschlämmbare Bestandteile (a) (nicht für Torf, Moor, Müll,Schlacke!)	Ma%	**76,8**	Z_1=	**-2**
(3) Wassergehalt	Ma%	**29**	Z_3=	**-1**
(4) pH-Wert		**8**	Z_4=	**0**
(5) Pufferkapazität (berechnet)	mmol/kg		Z_5=	**0**
Säurekapazität bis pH 4,3	mmol/kg	**40,8**		0
Basekapazität bis pH 7,0	mmol/kg	**n.a.**		0
(6) Sulfid (S^{2-})	mg/kg	**0,5**	Z_6=	**0**
(7) Neutralsalze (wässriger Auszug)	mmol/kg			
$c(Cl^-) + 2c(SO_4^{2-})$		0,26	Z_7=	**0**
mit Chlorid (Cl^-) im H_2O-Extr.	mmol/kg	**0,12**		
mit Sulfat (SO_4^{2-}) im H_2O-Extr.	mmol/kg	**0,07**		
(8) Sulfat (SO_4^{2-} im salzsauren Auszug)	mmol/kg	**6,24**	Z_8=	**-2**

Eingabe der Z-Werte aus vor-Ort- Betrachtungen/Messungen	Bewertungszahl	
(2) spezifischer Bodenwiderstand	Z_2=	
(9) Lage des Objektes zum Grundwasser	Z_9=	
Grundwasser nicht vorhanden = 0		
Grundwasser vorhanden = -1		
Grundwasser wechselt zeitlich = -2		
(10) Bodenhomogenität, horizontal	Z_{10}=	
(11) Bodenhomogenität, vertikal	Z_{11}=	
homogen, dann Z_{11}= 0		
inhomogen, Holz, Wurzeln, dann Z_{11} = -6		

Bewertungszahlsumme	B_0=	**-5**
Bewertungszahlsumme	B_1=	**-5**

Einschätzung/Beurteilung:

Der Boden ist in die Bodenklasse **II** einzuordnen, er ist **aggressiv.** (B_0= **-5**)

Die Korrosionswahrscheinlichkeit bei freier Korrosion von unlegierten und niedriglegierten Eisenwerkstoffen ist **mittel** bezüglich der Mulden- und Lochkorrosion und **gering** bezüglich der Flächenkorrosion. (B_1= **-5**)

Die o.g. Auswertung bezieht sich ausschließlich auf die o.g. Analysenwerte. Durch fehlende Vor-Ort-Werte ist eine Gesamteinschätzung nicht möglich !

WESSLING GmbH, Forstenrieder Straße 8-14, 82061 Neuried

München	06.03.2018	Dr. N. Kunze
Ort	Datum	Sachbearbeiter

English translation - The German version is valid for the correctness of the information!

WESSLING

Enclosure: Evaluation of the aggressiveness of soil towards steel

acc. to **DIN 50929 part 3**: corrosion probability of metallic materials under external corrosion impact.
(Pipes and building components in soils and waters)

Evaluation of sample number **18-031453-01**

Characteristics and measured value	unit	analysis	valuation number	
(1) elutriable components (a) (not for peat, moor, waste, slag!)	Ma%	**76,8**	Z_1=	**-2**
(3) Water content	Ma%	**29**	Z_3=	**-1**
(4) pH value		**8**	Z_4=	**0**
(5) Buffer capacity (calculated)	mmol/kg		Z_5=	**0**
Acid capacity up to pH 4,3	mmol/kg	**40,8**		0
Alcalic capacity up to pH 7,0	mmol/kg			0
(6) Sulphide (S^{2-})	mg/kg	**0,5**	Z_6=	**0**
(7) Neutral salts (watery extract)	mmol/kg			
$c(Cl^-) + 2c(SO_4^{2-})$		0,26	Z_7=	**0**
with chloride (Cl^-) in the H_2O extract	mmol/kg	**0,12**		
with sulphate (SO_4^{2-}) in the H_2O extract	mmol/kg	**0,07**		
(8) Sulphate (SO_4^{2-} in the hydrochloric acid extrac	mmol/kg	**6,24**	Z_8=	**-2**

Entry of the Z values of the observations/measurements on site	valuation number	
(2) specific soil resistance	Z_2=	
(9) Location of the object relative to the ground water	Z_9=	
Ground water not present = 0		
Ground water present = -1		
Ground water level varies with time = -2		
(10) Homogeneity of the soil, horizontally	Z_{10}=	
(11) Homogeneity of the soil, vertically	Z_{11}=	
homogeneous, then Z_{11}= 0		
inhomogeneous, wood, roots, then Z_{11} = -6		

Sum of valuation numbers	B_0=	**-5**
Sum of valuation numbers	B_1=	**-5**

Evaluation/assessment

The soil has soil class **II** and is **aggressive.** (B_0= **-5**)

The corrosion probability of free corrosion of unalloyed and low alloyed metallic materials is **middle** regarding piting corrosion and corrosion and **low** regarding surface corrosion

(B_1= **-5**)

The evaluation above is based exclusively on the above mentionned values. An overall evaluation is not possible due to the fact that the chemical engineer has not seen the situation on site!

Munich	06.03.2018	Dr. N. Kunze	Wessling GmbH, Forstenrieder Strasse 8-14 D-82061 Neuried
Place	Date	Person in charge	

PNCo 50:

WESSLING

Anlage: Bewertung der Stahlaggressivität von Boden
nach **DIN 50929 Teil 3**: Korrosionswahrscheinlichkeit metallischer Werkstoffe
bei äußerer Korrosionsbelastung
(Rohrleitungen und Bauteile in Böden und Wässern)

Auswertung für Probennummer: **18-031453-02**

Merkmal und Messgröße	Einheit	**Analyse**	Bewertungszahl	
(1) Abschlämmbare Bestandteile (a)	Ma%	**97,2**	Z_1=	**-4**
(nicht für Torf, Moor, Müll,Schlacke!)				
(3) Wassergehalt	Ma%	**29,2**	Z_3=	**-1**
(4) pH-Wert		**7,8**	Z_4=	**0**
(5) Pufferkapazität (berechnet)	mmol/kg		Z_5=	**0**
Säurekapazität bis pH 4,3	mmol/kg	**72,9**		0
Basekapazität bis pH 7,0	mmol/kg	**n.a.**		0
(6) Sulfid (S^{2-})	mg/kg	**0,5**	Z_6=	**0**
(7) Neutralsalze (wässriger Auszug)	mmol/kg			
$c(Cl^-) + 2c(SO_4^{2-})$		3,8	Z_7=	**-1**
mit Chlorid (Cl^-) im H_2O-Extr.	mmol/kg	**1,2**		
mit Sulfat (SO_4^{2-}) im H_2O-Extr.	mmol/kg	**1,3**		
(8) Sulfat (SO_4^{2-} im salzsauren Auszug)	mmol/kg	**9,04**	Z_8=	**-2**

Eingabe der Z-Werte aus vor-Ort- Betrachtungen/Messungen	Bewertungszahl	
(2) spezifischer Bodenwiderstand	Z_2=	
(9) Lage des Objektes zum Grundwasser	Z_9=	
Grundwasser nicht vorhanden = 0 Grundwasser vorhanden = -1 Grundwasser wechselt zeitlich = -2		
(10) Bodenhomogenität, horizontal	Z_{10}=	
(11) Bodenhomogenität, vertikal	Z_{11}=	
homogen, dann Z_{11}= 0 inhomogen, Holz, Wurzeln, dann Z_{11} = -6		

Bewertungszahlsumme	B_0=	**-8**
Bewertungszahlsumme	B_1=	**-8**

Einschätzung/Beurteilung:

Der Boden ist in die Bodenklasse **II** einzuordnen, er ist **aggressiv.** (B_0= **-8**)

Die Korrosionswahrscheinlichkeit bei freier Korrosion von unlegierten und niedriglegierten Eisenwerkstoffen ist **mittel** bezüglich der Mulden- und Lochkorrosion und **gering** bezüglich der Flächenkorrosion. (B_1= **-8**)

Die o.g. Auswertung bezieht sich ausschließlich auf die o.g. Analysenwerte. Durch fehlende Vor-Ort-Werte ist eine Gesamteinschätzung nicht möglich !

München	06.03.2018	Dr. N. Kunze	WESSLING GmbH, Forstenrieder Straße 8-14, 82061 Neuried
Ort	Datum	Sachbearbeiter	

English translation - The German version is valid for the correctness of the information!

WESSLING

Enclosure: Evaluation of the aggressiveness of soil towards steel

acc. to **DIN 50929 part 3**: corrosion probability of metallic materials under external corrosion impact.
(Pipes and building components in soils and waters)

Evaluation of sample number **18-031453-02**

Characteristics and measured value	unit	analysis	valuation number	
(1) elutriable components (a) (not for peat, moor, waste, slag!)	Ma%	**97,2**	Z_1=	**-4**
(3) Water content	Ma%	**29,2**	Z_3=	**-1**
(4) pH value		**7,8**	Z_4=	**0**
(5) Buffer capacity (calculated)	mmol/kg		Z_5=	**0**
Acid capacity up to pH 4,3	mmol/kg	**72,9**		0
Alcalic capacity up to pH 7,0	mmol/kg			0
(6) Sulphide (S^{2-})	mg/kg	**0,5**	Z_6=	**0**
(7) Neutral salts (watery extract)	mmol/kg			
$c(Cl^-) + 2c(SO_4^{2-})$		3,8	Z_7=	**-1**
with chloride (Cl^-) in the H_2O extract	mmol/kg	**1,2**		
with sulphate (SO_4^{2-}) in the H_2O extract	mmol/kg	**1,3**		
(8) Sulphate (SO_4^{2-} in the hydrochloric acid extrac	mmol/kg	**9,04**	Z_8=	**-2**

Entry of the Z values of the observations/measurements on site	valuation number	
(2) specific soil resistance	Z_2=	
(9) Location of the object relative to the ground water	Z_9=	
Ground water not present = 0		
Ground water present = -1		
Ground water level varies with time = -2		
(10) Homogeneity of the soil, horizontally	Z_{10}=	
(11) Homogeneity of the soil, vertically	Z_{11}=	
homogeneous, then Z_{11}= 0		
inhomogeneous, wood, roots, then Z_{11} = -6		

Sum of valuation numbers	B_0=	**-8**
Sum of valuation numbers	B_1=	**-8**

Evaluation/assessment

The soil has soil class **II** and is **aggressive.** (B_0= **-8**)

The corrosion probability of free corrosion of unalloyed and low alloyed metallic materials is **middle** regarding piting corrosion and corrosion and **low** regarding surface corrosion

(B_1= **-8**)

The evaluation above is based exclusively on the above mentionned values. An overall evaluation is not possible due to the fact that the chemical engineer has not seen the situation on site!

Munich	06.03.2018	Dr. N. Kunze	Wessling GmbH, Forstenrieder Strasse 8-14 D-82061 Neuried
Place	Date	Person in charge	

PNCo 64:

WESSLING

Anlage: Bewertung der Stahlaggressivität von Boden
nach **DIN 50929 Teil 3**: Korrosionswahrscheinlichkeit metallischer Werkstoffe
bei äußerer Korrosionsbelastung
(Rohrleitungen und Bauteile in Böden und Wässern)

Auswertung für Probennummer: **18-031453-03**

Merkmal und Messgröße	Einheit	**Analyse**	Bewertungszahl	
(1) Abschlämmbare Bestandteile (a)	Ma%	**97,9**	Z_1=	**-4**
(nicht für Torf, Moor, Müll,Schlacke!)				
(3) Wassergehalt	Ma%	**27,6**	Z_3=	**-1**
(4) pH-Wert		**9,2**	Z_4=	**2**
(5) Pufferkapazität (berechnet)	mmol/kg		Z_5=	**1**
Säurekapazität bis pH 4,3	mmol/kg	**394**		1
Basekapazität bis pH 7,0	mmol/kg	**n.a.**		0
(6) Sulfid (S^{2-})	mg/kg	**0,5**	Z_6=	**0**
(7) Neutralsalze (wässriger Auszug)	mmol/kg			
$c(Cl^-) + 2c(SO_4^{2-})$		1,8	Z_7=	**0**
mit Chlorid (Cl^-) im H_2O-Extr.	mmol/kg	**0,82**		
mit Sulfat (SO_4^{2-}) im H_2O-Extr.	mmol/kg	**0,49**		
(8) Sulfat (SO_4^{2-} im salzsauren Auszug)	mmol/kg	**4,99**	Z_8=	**-1**

Eingabe der Z-Werte aus vor-Ort- Betrachtungen/Messungen	Bewertungszahl	
(2) spezifischer Bodenwiderstand	Z_2=	
(9) Lage des Objektes zum Grundwasser	Z_9=	
Grundwasser nicht vorhanden = 0		
Grundwasser vorhanden = -1		
Grundwasser wechselt zeitlich = -2		
(10) Bodenhomogenität, horizontal	Z_{10}=	
(11) Bodenhomogenität, vertikal	Z_{11}=	
homogen, dann Z_{11}= 0		
inhomogen, Holz, Wurzeln, dann Z_{11} = -6		

Bewertungszahlsumme	B_0=	**-3**
Bewertungszahlsumme	B_1=	**-3**

Einschätzung/Beurteilung:

Der Boden ist in die Bodenklasse **I b** einzuordnen, er ist
schwach aggressiv. (B_0= **-3**)

Die Korrosionswahrscheinlichkeit bei freier Korrosion von unlegierten und niedriglegierten Eisenwerkstoffen ist **gering** bezüglich der Mulden- und Lochkorrosion und **sehr gering** bezüglich der Flächenkorrosion.
(B_1= **-3**)

Die o.g. Auswertung bezieht sich ausschließlich auf die o.g. Analysenwerte. Durch fehlende Vor-Ort-Werte ist eine Gesamteinschätzung nicht möglich !

WESSLING GmbH, Forstenrieder Straße 8-14, 82061 Neuried

München	06.03.2018	Dr. N. Kunze
Ort	Datum	Sachbearbeiter

English translation - The German version is valid for the correctness of the information!

WESSLING

Enclosure: Evaluation of the aggressiveness of soil towards steel

acc. to **DIN 50929 part 3**: corrosion probability of metallic materials under external corrosion impact.
(Pipes and building components in soils and waters)

Evaluation of sample number **18-031453-03**

Characteristics and measured value	unit	analysis	valuation number	
(1) elutriable components (a) (not for peat, moor, waste, slag!)	Ma%	**97,9**	Z_1=	**-4**
(3) Water content	Ma%	**27,6**	Z_3=	**-1**
(4) pH value		**9,2**	Z_4=	**2**
(5) Buffer capacity (calculated)	mmol/kg		Z_5=	**1**
Acid capacity up to pH 4,3	mmol/kg	**394**		1
Alcalic capacity up to pH 7,0	mmol/kg			0
(6) Sulphide (S^{2-})	mg/kg	**0,5**	Z_6=	**0**
(7) Neutral salts (watery extract)	mmol/kg			
$c(Cl^-) + 2c(SO_4^{2-})$		1,8	Z_7=	**0**
with chloride (Cl^-) in the H_2O extract	mmol/kg	**0,82**		
with sulphate (SO_4^{2-}) in the H_2O extract	mmol/kg	**0,49**		
(8) Sulphate (SO_4^{2-} in the hydrochloric acid extrac	mmol/kg	**4,66**	Z_8=	**-1**

Entry of the Z values of the observations/measurements on site	valuation number	
(2) specific soil resistance	Z_2=	
(9) Location of the object relative to the ground water	Z_9=	
Ground water not present = 0		
Ground water present = -1		
Ground water level varies with time = -2		
(10) Homogeneity of the soil, horizontally	Z_{10}=	
(11) Homogeneity of the soil, vertically	Z_{11}=	
homogeneous, then Z_{11}= 0		
inhomogeneous, wood, roots, then Z_{11} = -6		

Sum of valuation numbers	B_0=	**-3**
Sum of valuation numbers	B_1=	**-3**

Evaluation/assessment

The soil has soil class **I b** and is **lowly aggressive.** (B_0= **-3**)

The corrosion probability of free corrosion of unalloyed and low alloyed metallic materials is **low** regarding piting corrosion and corrosion and **very low** regarding surface corrosion

(B_1= **-3**)

The evaluation above is based exclusively on the above mentionned values. An overall evaluation is not possible due to the fact that the chemical engineer has not seen the situation on site!

Munich	06.03.2018	Dr. N. Kunze	Wessling GmbH, Forstenrieder Strasse 8-14 D-82061 Neuried
Place	Date	Person in charge	

PNCo 72:

WESSLING

Anlage: Bewertung der Stahlaggressivität von Boden
nach **DIN 50929 Teil 3**: Korrosionswahrscheinlichkeit metallischer Werkstoffe
bei äußerer Korrosionsbelastung
(Rohrleitungen und Bauteile in Böden und Wässern)

Auswertung für Probennummer: **18-031453-04**

Merkmal und Messgröße	Einheit	**Analyse**	Bewertungszahl	
(1) Abschlämmbare Bestandteile (a) (nicht für Torf, Moor, Müll,Schlacke!)	Ma%	**99**	Z_1=	**-4**
(3) Wassergehalt	Ma%	**27,5**	Z_3=	**-1**
(4) pH-Wert		**8,9**	Z_4=	**0**
(5) Pufferkapazität (berechnet)	mmol/kg		Z_5=	**0**
Säurekapazität bis pH 4,3	mmol/kg	**98,8**		0
Basekapazität bis pH 7,0	mmol/kg	**n.a.**		0
(6) Sulfid (S^{2-})	mg/kg	**0,5**	Z_6=	**0**
(7) Neutralsalze (wässriger Auszug)	mmol/kg			
$c(Cl^-) + 2c(SO_4^{2-})$		0,27	Z_7=	**0**
mit Chlorid (Cl^-) im H_2O-Extr.	mmol/kg	**0,17**		
mit Sulfat (SO_4^{2-}) im H_2O-Extr.	mmol/kg	**0,05**		
(8) Sulfat (SO_4^{2-} im salzsauren Auszug)	mmol/kg	**7,17**	Z_8=	**-2**

Eingabe der Z-Werte aus vor-Ort- Betrachtungen/Messungen	Bewertungszahl	
(2) spezifischer Bodenwiderstand	Z_2=	
(9) Lage des Objektes zum Grundwasser	Z_9=	
Grundwasser nicht vorhanden = 0 Grundwasser vorhanden = -1 Grundwasser wechselt zeitlich = -2		
(10) Bodenhomogenität, horizontal	Z_{10}=	
(11) Bodenhomogenität, vertikal	Z_{11}=	
homogen, dann Z_{11}= 0 inhomogen, Holz, Wurzeln, dann Z_{11} = -6		

Bewertungszahlsumme	B_0=	**-7**
Bewertungszahlsumme	B_1=	**-7**

Einschätzung/Beurteilung:

Der Boden ist in die Bodenklasse **II** einzuordnen, er ist **aggressiv.** (B_0= **-7**)

Die Korrosionswahrscheinlichkeit bei freier Korrosion von unlegierten und niedriglegierten Eisenwerkstoffen ist **mittel** bezüglich der Mulden- und Lochkorrosion und **gering** bezüglich der Flächenkorrosion. (B_1= **-7**)

Die o.g. Auswertung bezieht sich ausschließlich auf die o.g. Analysenwerte. Durch fehlende Vor-Ort-Werte ist eine Gesamteinschätzung nicht möglich !

WESSLING GmbH, Forstenrieder Straße 8-14, 82061 Neuried

München	06.03.2018	Dr. N. Kunze
Ort	Datum	Sachbearbeiter

English translation - The German version is valid for the correctness of the information!

WESSLING

Enclosure: Evaluation of the aggressiveness of soil towards steel

acc. to **DIN 50929 part 3**: corrosion probability of metallic materials under external corrosion impact.
(Pipes and building components in soils and waters)

Evaluation of sample number **18-031453-04**

Characteristics and measured value	unit	analysis	valuation number
(1) elutriable components (a) (not for peat, moor, waste, slag!)	Ma%	**99**	Z_1= **-4**
(3) Water content	Ma%	**27,5**	Z_3= **-1**
(4) pH value		**8,9**	Z_4= **0**
(5) Buffer capacity (calculated)	mmol/kg		Z_5= **0**
Acid capacity up to pH 4,3	mmol/kg	**98,8**	0
Alcalic capacity up to pH 7,0	mmol/kg		0
(6) Sulphide (S^{2-})	mg/kg	**0,5**	Z_6= **0**
(7) Neutral salts (watery extract)	mmol/kg		
$c(Cl^-) + 2c(SO_4^{2-})$		0,27	Z_7= **0**
with chloride (Cl^-) in the H_2O extract	mmol/kg	**0,17**	
with sulphate (SO_4^{2-}) in the H_2O extract	mmol/kg	**0,05**	
(8) Sulphate (SO_4^{2-} in the hydrochloric acid extrac	mmol/kg	**7,17**	Z_8= **-2**

Entry of the Z values of the observations/measurements on site	valuation number	
(2) specific soil resistance	Z_2=	
(9) Location of the object relative to the ground water	Z_9=	
Ground water not present = 0		
Ground water present = -1		
Ground water level varies with time = -2		
(10) Homogeneity of the soil, horizontally	Z_{10}=	
(11) Homogeneity of the soil, vertically	Z_{11}=	
homogeneous, then Z_{11}= 0		
inhomogeneous, wood, roots, then Z_{11} = -6		

Sum of valuation numbers	B_0=	**-7**
Sum of valuation numbers	B_1=	**-7**

Evaluation/assessment

The soil has soil class **II** and is **aggressive.** (B_0= **-7**)

The corrosion probability of free corrosion of unalloyed and low alloyed metallic materials is **middle** regarding piting corrosion and corrosion and **low** regarding surface corrosion
(B_1= **-7**)

The evaluation above is based exclusively on the above mentionned values. An overall evaluation is not possible due to the fact that the chemical engineer has not seen the situation on site!

Munich	06.03.2018	Dr. N. Kunze	Wessling GmbH, Forstenrieder Strasse 8-14 D-82061 Neuried
Place	Date	Person in charge	

PNCo 83:

WESSLING

Anlage: Bewertung der Stahlaggressivität von Boden
nach **DIN 50929 Teil 3**: Korrosionswahrscheinlichkeit metallischer Werkstoffe
bei äußerer Korrosionsbelastung
(Rohrleitungen und Bauteile in Böden und Wässern)

Auswertung für Probennummer: **18-031453-05**

Merkmal und Messgröße	Einheit	**Analyse**	Bewertungszahl	
(1) Abschlämmbare Bestandteile (a) (nicht für Torf, Moor, Müll,Schlacke!)	Ma%	**96,2**	Z_1=	**-4**
(3) Wassergehalt	Ma%	**26,8**	Z_3=	**-1**
(4) pH-Wert		**8,3**	Z_4=	**0**
(5) Pufferkapazität (berechnet)	mmol/kg		Z_5=	**0**
Säurekapazität bis pH 4,3	mmol/kg	**43**		0
Basekapazität bis pH 7,0	mmol/kg	**n.a.**		0
(6) Sulfid (S^{2-})	mg/kg	**0,5**	Z_6=	**0**
(7) Neutralsalze (wässriger Auszug)	mmol/kg			
$c(Cl^-) + 2c(SO_4^{2-})$		0,53	Z_7=	**0**
mit Chlorid (Cl^-) im H_2O-Extr.	mmol/kg	**0,27**		
mit Sulfat (SO_4^{2-}) im H_2O-Extr.	mmol/kg	**0,13**		
(8) Sulfat (SO_4^{2-} im salzsauren Auszug)	mmol/kg	**5,93**	Z_8=	**-2**

Eingabe der Z-Werte aus vor-Ort- Betrachtungen/Messungen	Bewertungszahl	
(2) spezifischer Bodenwiderstand	Z_2=	
(9) Lage des Objektes zum Grundwasser	Z_9=	
Grundwasser nicht vorhanden = 0 Grundwasser vorhanden = -1 Grundwasser wechselt zeitlich = -2		
(10) Bodenhomogenität, horizontal	Z_{10}=	
(11) Bodenhomogenität, vertikal	Z_{11}=	
homogen, dann Z_{11}= 0 inhomogen, Holz, Wurzeln, dann Z_{11} = -6		

Bewertungszahlsumme	B_0=	**-7**
Bewertungszahlsumme	B_1=	**-7**

Einschätzung/Beurteilung:

Der Boden ist in die Bodenklasse **II** einzuordnen, er ist **aggressiv.** (B_0= **-7**)

Die Korrosionswahrscheinlichkeit bei freier Korrosion von unlegierten und niedriglegierten Eisenwerkstoffen ist **mittel** bezüglich der Mulden- und Lochkorrosion und **gering** bezüglich der Flächenkorrosion. (B_1= **-7**)

Die o.g. Auswertung bezieht sich ausschließlich auf die o.g. Analysenwerte. Durch fehlende Vor-Ort-Werte ist eine Gesamteinschätzung nicht möglich !

WESSLING GmbH, Forstenrieder Straße 8-14, 82061 Neuried

München	06.03.2018	Dr. N. Kunze
Ort	Datum	Sachbearbeiter

English translation - The German version is valid for the correctness of the information!

WESSLING

Enclosure: Evaluation of the aggressiveness of soil towards steel

acc. to **DIN 50929 part 3**: corrosion probability of metallic materials under external corrosion impact.
(Pipes and building components in soils and waters)

Evaluation of sample number **18-031453-05**

Characteristics and measured value	unit	analysis	valuation number	
(1) elutriable components (a) (not for peat, moor, waste, slag!)	Ma%	**96,2**	Z_1=	**-4**
(3) Water content	Ma%	**26,8**	Z_3=	**-1**
(4) pH value		**8,3**	Z_4=	**0**
(5) Buffer capacity (calculated)	mmol/kg		Z_5=	**0**
Acid capacity up to pH 4,3	mmol/kg	**43**		0
Alcalic capacity up to pH 7,0	mmol/kg			0
(6) Sulphide (S^{2-})	mg/kg	**0,5**	Z_6=	**0**
(7) Neutral salts (watery extract)	mmol/kg			
$c(Cl^-) + 2c(SO_4^{2-})$		0,53	Z_7=	**0**
with chloride (Cl^-) in the H_2O extract	mmol/kg	**0,27**		
with sulphate (SO_4^{2-}) in the H_2O extract	mmol/kg	**0,13**		
(8) Sulphate (SO_4^{2-} in the hydrochloric acid extrac	mmol/kg	**5,93**	Z_8=	**-2**

Entry of the Z values of the observations/measurements on site	valuation number	
(2) specific soil resistance	Z_2=	
(9) Location of the object relative to the ground water	Z_9=	
Ground water not present = 0		
Ground water present = -1		
Ground water level varies with time = -2		
(10) Homogeneity of the soil, horizontally	Z_{10}=	
(11) Homogeneity of the soil, vertically	Z_{11}=	
homogeneous, then Z_{11}= 0		
inhomogeneous, wood, roots, then Z_{11} = -6		

Sum of valuation numbers	B_0=	**-7**
Sum of valuation numbers	B_1=	**-7**

Evaluation/assessment

The soil has soil class **II** and is **aggressive.** (B_0= **-7**)

The corrosion probability of free corrosion of unalloyed and low alloyed metallic materials is **middle** regarding piting corrosion and corrosion and **low** regarding surface corrosion
(B_1= **-7**)

The evaluation above is based exclusively on the above mentionned values. An overall evaluation is not possible due to the fact that the chemical engineer has not seen the situation on site!

Munich	06.03.2018	Dr. N. Kunze	Wessling GmbH, Forstenrieder Strasse 8-14 D-82061 Neuried
Place	Date	Person in charge	

PNCo 89:

WESSLING

Anlage: Bewertung der Stahlaggressivität von Boden

nach **DIN 50929 Teil 3**: Korrosionswahrscheinlichkeit metallischer Werkstoffe
bei äußerer Korrosionsbelastung
(Rohrleitungen und Bauteile in Böden und Wässern)

Auswertung für Probennummer: **18-031453-06**

Merkmal und Messgröße	Einheit	**Analyse**	Bewertungszahl	
(1) Abschlämmbare Bestandteile (a)	Ma%	**96,6**	Z_1=	**-4**
(nicht für Torf, Moor, Müll,Schlacke!)				
(3) Wassergehalt	Ma%	**32,1**	Z_3=	**-1**
(4) pH-Wert		**8,5**	Z_4=	**0**
(5) Pufferkapazität (berechnet)	mmol/kg		Z_5=	**0**
Säurekapazität bis pH 4,3	mmol/kg	**48,5**		0
Basekapazität bis pH 7,0	mmol/kg	**n.a.**		0
(6) Sulfid (S^{2-})	mg/kg	**0,5**	Z_6=	**0**
(7) Neutralsalze (wässriger Auszug)	mmol/kg			
$c(Cl^-) + 2c(SO_4^{2-})$		2,64	Z_7=	**0**
mit Chlorid (Cl^-) im H_2O-Extr.	mmol/kg	**0,44**		
mit Sulfat (SO_4^{2-}) im H_2O-Extr.	mmol/kg	**1,1**		
(8) Sulfat (SO_4^{2-} im salzsauren Auszug)	mmol/kg	**6,86**	Z_8=	**-2**

Eingabe der Z-Werte aus vor-Ort- Betrachtungen/Messungen	Bewertungszahl	
(2) spezifischer Bodenwiderstand	Z_2=	
(9) Lage des Objektes zum Grundwasser	Z_9=	
Grundwasser nicht vorhanden = 0 Grundwasser vorhanden = -1 Grundwasser wechselt zeitlich = -2		
(10) Bodenhomogenität, horizontal	Z_{10}=	
(11) Bodenhomogenität, vertikal	Z_{11}=	
homogen, dann Z_{11}= 0 inhomogen, Holz, Wurzeln, dann Z_{11} = -6		

Bewertungszahlsumme	B_0=	**-7**
Bewertungszahlsumme	B_1=	**-7**

Einschätzung/Beurteilung:

Der Boden ist in die Bodenklasse **II** einzuordnen, er ist **aggressiv.** (B_0= **-7**)

Die Korrosionswahrscheinlichkeit bei freier Korrosion von unlegierten und niedriglegierten Eisenwerkstoffen ist **mittel** bezüglich der Mulden- und Lochkorrosion und **gering** bezüglich der Flächenkorrosion. (B_1= **-7**)

Die o.g. Auswertung bezieht sich ausschließlich auf die o.g. Analysenwerte. Durch fehlende Vor-Ort-Werte ist eine Gesamteinschätzung nicht möglich !

WESSLING GmbH, Forstenrieder Straße 8-14, 82061 Neuried

München	06.03.2018	Dr. N. Kunze
Ort	Datum	Sachbearbeiter

English translation - The German version is valid for the correctness of the information!

WESSLING

Enclosure: Evaluation of the aggressiveness of soil towards steel

acc. to **DIN 50929 part 3**: corrosion probability of metallic materials under external corrosion impact.
(Pipes and building components in soils and waters)

Evaluation of sample number **18-031453-06**

Characteristics and measured value	unit	**analysis**	valuation number	
(1) elutriable components (a) (not for peat, moor, waste, slag!)	Ma%	**96,6**	Z_1=	**-4**
(3) Water content	Ma%	**32,1**	Z_3=	**-1**
(4) pH value		**8,5**	Z_4=	**0**
(5) Buffer capacity (calculated)	mmol/kg		Z_5=	**0**
Acid capacity up to pH 4,3	mmol/kg	**48,5**		0
Alcalic capacity up to pH 7,0	mmol/kg			0
(6) Sulphide (S^{2-})	mg/kg	**0,5**	Z_6=	**0**
(7) Neutral salts (watery extract)	mmol/kg			
$c(Cl^-) + 2c(SO_4^{2-})$		2,64	Z_7=	**0**
with chloride (Cl^-) in the H_2O extract	mmol/kg	**0,44**		
with sulphate (SO_4^{2-}) in the H_2O extract	mmol/kg	**1,1**		
(8) Sulphate (SO_4^{2-} in the hydrochloric acid extrac	mmol/kg	**6,86**	Z_8=	**-2**

Entry of the Z values of the observations/measurements on site	valuation number	
(2) specific soil resistance	Z_2=	
(9) Location of the object relative to the ground water	Z_9=	
Ground water not present = 0		
Ground water present = -1		
Ground water level varies with time = -2		
(10) Homogeneity of the soil, horizontally	Z_{10}=	
(11) Homogeneity of the soil, vertically	Z_{11}=	
homogeneous, then Z_{11}= 0		
inhomogeneous, wood, roots, then Z_{11} = -6		

Sum of valuation numbers	B_0=	**-7**
Sum of valuation numbers	B_1=	**-7**

Evaluation/assessment

The soil has soil class **II** and is **aggressive.** (B_0= **-7**)

The corrosion probability of free corrosion of unalloyed and low alloyed metallic materials is **middle** regarding piting corrosion and corrosion and **low** regarding surface corrosion

(B_1= **-7**)

The evaluation above is based exclusively on the above mentionned values. An overall evaluation is not possible due to the fact that the chemical engineer has not seen the situation on site!

Munich	06.03.2018	Dr. N. Kunze	Wessling GmbH, Forstenrieder Strasse 8-14 D-82061 Neuried
Place	Date	Person in charge	

Corrosiveness towards steel according to DIN 50929

The samples

PNCo 06, laboratory number 18-031453-01,

PNCo 50, laboratory number 18-031453-02,

PNCo 64, laboratory number 18-031453-03,

PNCo 72, laboratory number 18-031453-04,

PNCo 83, laboratory number 18-031453-05 and

PNCo 89, laboratory number 18-031453-06

are classified as aggressive towards iron/steel construction materials. Their corrosivity towards non-alloyed and low-alloyed iron construction material is medium for pit corrosion and low for surface corrosion.

For assessing the corrosion probability of zinc coated steel profiles only the surface corrosion is relevant which is only low in the above cases. Therefore the soil is not aggressive against zinc coated steel.

Only if large areas of the zinc layer on the steel profiles are severely damaged, a relatively fast corrosion due to electrochemically active local elements is to be expected. In case of small scratches of up to 5 mm corrosion is not to be expected, as the so called sacrificial anode effect will occur between the steel and the zinc layer. This protects the steel against deeper corrosion.

Avoid any metallic connection (inside and outside soil) between the zinc galvanized steel and other more noble metals in the soil on site. This is important especially for copper parts! Any such contact will increase the corrosivity against the galvanized steel to a level many times higher than otherwise. Such a connection to a more noble metal will form an electro-galvanic element (battery), where the less noble metal (zinc and steel) will be corroded until dissolution.

Concrete

PNCo 06:

WESSLING

Anhang C

Prüfungen und Beurteilung von Böden

DIN 4030-2:2008-06

Prüfbericht über die Prüfung und Beurteilung von betonangreifendem Boden		Probenahme und Bodenanalyse nach DIN 4030 Teil 2
1. Allgemeine Angaben		
Auftraggeber:	**Büro Boden und Wasser**	Auftrags-Nr.:
Bauvorhaben:	Wirsol, Cleve Hill (GB) Az 18209-8	Probe-Nr.: 18-031453-01
Art des Bodens:		Bezeichnung des Bodens:
Entnahmestellen:	PNCo 06 vom 17.02.2018	Entnahmetiefe: Entnahmemenge:
Entnahmezeit:		Entnahmedatum:
2. Erweiterte Angaben		
Beschreibung der Geländeverhältnisse am Entnahmeort: Ackerfläche Ortsrandlage		
Ort, Datum:		Probennehmer: Auftraggeber

Probeneingang			**Grenzwerte zur Beurteilung nach DIN 4030 Teil 1**	
Bestandteil	Prüfergebnis		schwach angreifend	stark angreifend
Säuregrad nach Baumann-Gully	**39**	**ml/kg**	> 200	-
Sulfat (SO_4^{2-})	**599**	**mg/kg**	2000 bis 5000	> 5000
Sulfid (S^{2-})	**<1**	**mg/kg**	- a)	-
Chlorid	**<25**	**mg/kg**	-	-

[a)] Bei Sulfidgehalten von > 100 mg S^{2-}/kg Boden ist eine gesonderte Beurteilung durch einen Fachmann erforderlich.

3. Beurteilung

Der Boden gilt als nicht betonangreifend.

WESSLING GmbH, Forstenrieder Straße 8-14, 82061 Neuried

München	06.03.2018	Dr. N. Kunze
Ort	Datum	Sachbearbeiter

English translation - The German version is valid for the correctness of the information!

WESSLING

Enclosure C

Evaluation and testing of soils — DIN 4030-2:2008-06

Test report on the testing and evaluation of soils aggressive towards concrete		Soil sampling and analysis according to DIN 4030 Part 2
1. General information		
Client:	**Boden und Wasser**	Order no.
Project:	Wirsol, Cleve Hill (GB) Az 18209-8	Sample no. 18-031453-01
Soil type:		Denomination of the soil type:
Sampling location:	PNCo 06 Co by 17.02.2018	Sampling depth: Sampling quantity:
Sampling time:		Sampling date:
2. Additional information		
Description of the soil conditions at the sampling location: Agricultural land, on the border of a city		
Place, date:		Sampling by: Boden und Wasser

Receipt of samples			**Limit values for the evaluation acc. To DIN 4030 Teil 1**	
Element	Test result		slightly aggressive	very aggressive
Acidity acc. To Baumann-Gully	**39**	**ml/kg**	> 200	-
Sulphate (SO_4^{2-})	**599**	**mg/kg**	2000 bis 5000	> 5000
Sulphide (S^{2-})	**<1**	**mg/kg**	- a)	-
Chloride	**<25**	**mg/kg**	-	-

a) In case of sulphide values of > 100 mg S^{2-}/kg of soil an additional evaluation by an expert is necessary.

3. Evaluation

The soil is considered **not** aggressive towards concrete

Munich	06.03.2018	Dr. N. Kunze
Place	Date	Person in charge

PNCo 50:

WESSLING

Anhang C

Prüfungen und Beurteilung von Böden

DIN 4030-2:2008-06

Prüfbericht über die Prüfung und Beurteilung von betonangreifendem Boden		Probenahme und Bodenanalyse nach DIN 4030 Teil 2
1. Allgemeine Angaben		
Auftraggeber:	**Büro Boden und Wasser**	Auftrags-Nr.:
Bauvorhaben:	Wirsol, Cleve Hill (GB) Az 18209-8	Probe-Nr.: 18-031453-02
Art des Bodens:		Bezeichnung des Bodens:
Entnahmestellen:	PNCo 50 vom 18.02.2018	Entnahmetiefe: Entnahmemenge:
Entnahmezeit:		Entnahmedatum:
2. Erweiterte Angaben		
Beschreibung der Geländeverhältnisse am Entnahmeort: Ackerfläche Ortsrandlage		
Ort, Datum:		Probennehmer: Auftraggeber

Probeneingang			**Grenzwerte zur Beurteilung nach DIN 4030 Teil 1**	
Bestandteil	Prüfergebnis		schwach angreifend	stark angreifend
Säuregrad nach Baumann-Gully	**9**	**ml/kg**	> 200	-
Sulfat (SO_4^{2-})	**868**	**mg/kg**	2000 bis 5000	> 5000
Sulfid (S^{2-})	**<1**	**mg/kg**	- a)	-
Chlorid	**28**	**mg/kg**	-	-

[a)] Bei Sulfidgehalten von > 100 mg S^{2-}/kg Boden ist eine gesonderte Beurteilung durch einen Fachmann erforderlich.

3. Beurteilung

Der Boden gilt als nicht betonangreifend.

München	06.03.2018	Dr. N. Kunze	WESSLING GmbH, Forstenrieder Straße 8-14, 82061 Neuried
Ort	Datum	Sachbearbeiter	

English translation - The German version is valid for the correctness of the information!

WESSLING

Enclosure C

Evaluation and testing of soils

DIN 4030-2:2008-06

Test report on the testing and evaluation of soils aggressive towards concrete		Soil sampling and analysis according to DIN 4030 Part 2
1. General information		
Client:	**Boden und Wasser**	Order no.
Project:	Wirsol, Cleve Hill (GB) Az 18209-8	Sample no. 18-031453-02
Soil type:		Denomination of the soil type:
Sampling location:	PNCo 50 Co by 18.02.2018	Sampling depth: Sampling quantity:
Sampling time:		Sampling date:
2. Additional information		
Description of the soil conditions at the sampling location: Agricultural land, on the border of a city		
Place, date:		Sampling by: Boden und Wasser

Receipt of samples			**Limit values for the evaluation acc. To DIN 4030 Teil 1**	
Element	Test result		slightly aggressive	very aggressive
Acidity acc. To Baumann-Gully	**9**	**ml/kg**	> 200	-
Sulphate (SO_4^{2-})	**868**	**mg/kg**	2000 bis 5000	> 5000
Sulphide (S^{2-})	**<1**	**mg/kg**	- a)	-
Chloride	**28**	**mg/kg**	-	-

[a)] In case of sulphide values of > 100 mg S^{2-}/kg of soil an additional evaluation by an expert is necessary.

3. Evaluation

The soil is considered not aggressive towards concrete

Munich	06.03.2018	Dr. N. Kunze
Place	Date	Person in charge

PNCo 64:

WESSLING

Anhang C

Prüfungen und Beurteilung von Böden

DIN 4030-2:2008-06

Prüfbericht über die Prüfung und Beurteilung von betonangreifendem Boden		Probenahme und Bodenanalyse nach DIN 4030 Teil 2
1. Allgemeine Angaben		
Auftraggeber:	**Büro Boden und Wasser**	Auftrags-Nr.:
Bauvorhaben:	Wirsol, Cleve Hill (GB) Az 18209-8	Probe-Nr.: 18-031453-03
Art des Bodens:		Bezeichnung des Bodens:
Entnahmestellen:	PNCo 64 vom 20.02.2018	Entnahmetiefe: Entnahmemenge:
Entnahmezeit:		Entnahmedatum:
2. Erweiterte Angaben		
Beschreibung der Geländeverhältnisse am Entnahmeort: Ackerfläche Ortsrandlage		
Ort, Datum:		Probennehmer: Auftraggeber

Probeneingang			**Grenzwerte zur Beurteilung nach DIN 4030 Teil 1**	
Bestandteil	Prüfergebnis		schwach angreifend	stark angreifend
Säuregrad nach Baumann-Gully	**3**	**ml/kg**	> 200	-
Sulfat (SO_4^{2-})	**479**	**mg/kg**	2000 bis 5000	> 5000
Sulfid (S^{2-})	**<1**	**mg/kg**	- a)	-
Chlorid	**<25**	**mg/kg**	-	-

[a)] Bei Sulfidgehalten von > 100 mg S^{2-}/kg Boden ist eine gesonderte Beurteilung durch einen Fachmann erforderlich.

3. Beurteilung

Der Boden gilt als nicht betonangreifend.

München	06.03.2018	Dr. N. Kunze	WESSLING GmbH, Forstenrieder Straße 8-14, 82061 Neuried
Ort	Datum	Sachbearbeiter	

English translation - The German version is valid for the correctness of the information!

WESSLING

Enclosure C

Evaluation and testing of soils

DIN 4030-2:2008-06

Test report on the testing and evaluation of soils aggressive towards concrete		Soil sampling and analysis according to DIN 4030 Part 2
1. General information		
Client:	**Boden und Wasser**	Order no.
Project:	Wirsol, Cleve Hill (GB) Az 18209-8	Sample no. 18-031453-03
Soil type:		Denomination of the soil type:
Sampling location:	PNCo 64 Co by 20.02.2018	Sampling depth: Sampling quantity:
Sampling time:		Sampling date:
2. Additional information		
Description of the soil conditions at the sampling location: Agricultural land, on the border of a city		
Place, date:		Sampling by: Boden und Wasser

Receipt of samples			**Limit values for the evaluation acc. To DIN 4030 Teil 1**	
Element	Test result		slightly aggressive	very aggressive
Acidity acc. To Baumann-Gully	**3**	**ml/kg**	> 200	-
Sulphate (SO_4^{2-})	**479**	**mg/kg**	2000 bis 5000	> 5000
Sulphide (S^{2-})	**<1**	**mg/kg**	- a)	-
Chloride	**<25**	**mg/kg**	-	-

[a)] In case of sulphide values of > 100 mg S^{2-}/kg of soil an additional evaluation by an expert is necessary.

3. Evaluation

The soil is considered not aggressive towards concrete

Munich	06.03.2018	Dr. N. Kunze
Place	Date	Person in charge

PNCo 72:

WESSLING

Anhang C

Prüfungen und Beurteilung von Böden

DIN 4030-2:2008-06

Prüfbericht über die Prüfung und Beurteilung von betonangreifendem Boden		Probenahme und Bodenanalyse nach DIN 4030 Teil 2
1. Allgemeine Angaben		
Auftraggeber:	**Büro Boden und Wasser**	Auftrags-Nr.:
Bauvorhaben:	Wirsol, Cleve Hill (GB) Az 18209-8	Probe-Nr.: 18-031453-04
Art des Bodens:		Bezeichnung des Bodens:
Entnahmestellen:	PNCo 72 vom 21.02.2018	Entnahmetiefe: Entnahmemenge:
Entnahmezeit:		Entnahmedatum:
2. Erweiterte Angaben		
Beschreibung der Geländeverhältnisse am Entnahmeort: Ackerfläche Ortsrandlage		
Ort, Datum:		Probennehmer: Auftraggeber

Probeneingang			**Grenzwerte zur Beurteilung nach DIN 4030 Teil 1**	
Bestandteil	Prüfergebnis		schwach angreifend	stark angreifend
Säuregrad nach Baumann-Gully	**10**	**ml/kg**	> 200	-
Sulfat (SO_4^{2-})	**689**	**mg/kg**	2000 bis 5000	> 5000
Sulfid (S^{2-})	**<1**	**mg/kg**	- a)	-
Chlorid	**<25**	**mg/kg**	-	-

[a)] Bei Sulfidgehalten von > 100 mg S^{2-}/kg Boden ist eine gesonderte Beurteilung durch einen Fachmann erforderlich.

3. Beurteilung

Der Boden gilt als **nicht** betonangreifend.

München	06.03.2018	Dr. N. Kunze	WESSLING GmbH, Forstenrieder Straße 8-14, 82061 Neuried
Ort	Datum	Sachbearbeiter	

English translation - The German version is valid for the correctness of the information!

WESSLING

Enclosure C

Evaluation and testing of soils DIN 4030-2:2008-06

Test report on the testing and evaluation of soils aggressive towards concrete		Soil sampling and analysis according to DIN 4030 Part 2
1. General information		
Client:	**Boden und Wasser**	Order no.
Project:	Wirsol, Cleve Hill (GB) Az 18209-8	Sample no. 18-031453-04
Soil type:		Denomination of the soil type:
Sampling location:	PNCo 72 Co by 21.02.2018	Sampling depth: Sampling quantity:
Sampling time:		Sampling date:
2. Additional information		
Description of the soil conditions at the sampling location: Agricultural land, on the border of a city		
Place, date:		Sampling by: Boden und Wasser

Receipt of samples			**Limit values for the evaluation acc. To DIN 4030 Teil 1**	
Element	Test result		slightly aggressive	very aggressive
Acidity acc. To Baumann-Gully	**10**	**ml/kg**	> 200	-
Sulphate (SO_4^{2-})	**689**	**mg/kg**	2000 bis 5000	> 5000
Sulphide (S^{2-})	**<1**	**mg/kg**	- a)	-
Chloride	**<25**	**mg/kg**	-	-

[a)] In case of sulphide values of > 100 mg S^{2-}/kg of soil an additional evaluation by an expert is necessary.

3. Evaluation

The soil is considered not aggressive towards concrete

Munich	06.03.2018	Dr. N. Kunze
Place	Date	Person in charge

PNCo 83:

WESSLING

Anhang C

Prüfungen und Beurteilung von Böden

DIN 4030-2:2008-06

Prüfbericht über die Prüfung und Beurteilung von betonangreifendem Boden		Probenahme und Bodenanalyse nach DIN 4030 Teil 2
1. Allgemeine Angaben		
Auftraggeber:	**Büro Boden und Wasser**	Auftrags-Nr.:
Bauvorhaben:	Wirsol, Cleve Hill (GB) Az 18209-8	Probe-Nr.: 18-031453-05
Art des Bodens:		Bezeichnung des Bodens:
Entnahmestellen:	PNCo 83 vom 21.02.2018	Entnahmetiefe: Entnahmemenge:
Entnahmezeit:		Entnahmedatum:
2. Erweiterte Angaben		
Beschreibung der Geländeverhältnisse am Entnahmeort: Ackerfläche Ortsrandlage		
Ort, Datum:		Probennehmer: Auftraggeber

Probeneingang			**Grenzwerte zur Beurteilung nach DIN 4030 Teil 1**	
Bestandteil	Prüfergebnis		schwach angreifend	stark angreifend
Säuregrad nach Baumann-Gully	**34**	**ml/kg**	> 200	-
Sulfat (SO_4^{2-})	**569**	**mg/kg**	2000 bis 5000	> 5000
Sulfid (S^{2-})	**<1**	**mg/kg**	- a)	-
Chlorid	**<25**	**mg/kg**	-	-

[a)] Bei Sulfidgehalten von > 100 mg S^{2-}/kg Boden ist eine gesonderte Beurteilung durch einen Fachmann erforderlich.

3. Beurteilung

Der Boden gilt als nicht betonangreifend.

München	06.03.2018	Dr. N. Kunze	WESSLING GmbH, Forstenrieder Straße 8-14, 82061 Neuried
Ort	Datum	Sachbearbeiter	

English translation - The German version is valid for the correctness of the information!

WESSLING

Enclosure C

Evaluation and testing of soils DIN 4030-2:2008-06

Test report on the testing and evaluation of soils aggressive towards concrete		Soil sampling and analysis according to DIN 4030 Part 2
1. General information		
Client:	**Boden und Wasser**	Order no.
Project:	Wirsol, Cleve Hill (GB) Az 18209-8	Sample no. 18-031453-05
Soil type:		Denomination of the soil type:
Sampling location:	PNCo 83 Co by 21.02.2018	Sampling depth: Sampling quantity:
Sampling time:		Sampling date:
2. Additional information		
Description of the soil conditions at the sampling location: Agricultural land, on the border of a city		
Place, date:		Sampling by: Boden und Wasser

Receipt of samples			**Limit values for the evaluation acc. To DIN 4030 Teil 1**	
Element	Test result		slightly aggressive	very aggressive
Acidity acc. To Baumann-Gully	**34**	**ml/kg**	> 200	-
Sulphate (SO_4^{2-})	**569**	**mg/kg**	2000 bis 5000	> 5000
Sulphide (S^{2-})	**<1**	**mg/kg**	- a)	-
Chloride	**<25**	**mg/kg**	-	-

[a)] In case of sulphide values of > 100 mg S^{2-}/kg of soil an additional evaluation by an expert is necessary.

3. Evaluation

The soil is considered not aggressive towards concrete

Munich	06.03.2018	Dr. N. Kunze
Place	Date	Person in charge

PNCo 89:

WESSLING

Anhang C

Prüfungen und Beurteilung von Böden

DIN 4030-2:2008-06

Prüfbericht über die Prüfung und Beurteilung von betonangreifendem Boden		Probenahme und Bodenanalyse nach DIN 4030 Teil 2
1. Allgemeine Angaben		
Auftraggeber:	**Büro Boden und Wasser**	Auftrags-Nr.:
Bauvorhaben:	Wirsol, Cleve Hill (GB) Az 18209-8	Probe-Nr.: 18-031453-06
Art des Bodens:		Bezeichnung des Bodens:
Entnahmestellen:	PNCo 89 vom 22.02.2018	Entnahmetiefe: Entnahmemenge:
Entnahmezeit:		Entnahmedatum:
2. Erweiterte Angaben		
Beschreibung der Geländeverhältnisse am Entnahmeort: Ackerfläche Ortsrandlage		
Ort, Datum:		Probennehmer: Auftraggeber

Probeneingang			**Grenzwerte zur Beurteilung nach DIN 4030 Teil 1**	
Bestandteil	Prüfergebnis		schwach angreifend	stark angreifend
Säuregrad nach Baumann-Gully	**18**	**ml/kg**	> 200	-
Sulfat (SO_4^{2-})	**659**	**mg/kg**	2000 bis 5000	> 5000
Sulfid (S^{2-})	**<1**	**mg/kg**	- a)	-
Chlorid	**<25**	**mg/kg**	-	-

[a)] Bei Sulfidgehalten von > 100 mg S^{2-}/kg Boden ist eine gesonderte Beurteilung durch einen Fachmann erforderlich.

3. Beurteilung

Der Boden gilt als nicht betonangreifend.

München	06.03.2018	Dr. N. Kunze	WESSLING GmbH, Forstenrieder Straße 8-14, 82061 Neuried
Ort	Datum	Sachbearbeiter	

English translation - The German version is valid for the correctness of the information!

WESSLING

Enclosure C

Evaluation and testing of soils DIN 4030-2:2008-06

Test report on the testing and evaluation of soils aggressive towards concrete		Soil sampling and analysis according to DIN 4030 Part 2
1. General information		
Client:	**Boden und Wasser**	Order no.
Project:	Wirsol, Cleve Hill (GB) Az 18209-8	Sample no. 18-031453-06
Soil type:		Denomination of the soil type:
Sampling location:	PNCo 89 by 22.02.2018	Sampling depth: Sampling quantity:
Sampling time:		Sampling date:
2. Additional information		
Description of the soil conditions at the sampling location: Agricultural land, on the border of a city		
Place, date:		Sampling by: Boden und Wasser

Receipt of samples			**Limit values for the evaluation acc. To DIN 4030 Teil 1**	
Element	Test result		slightly aggressive	very aggressive
Acidity acc. To Baumann-Gully	**18**	**ml/kg**	> 200	-
Sulphate (SO_4^{2-})	**659**	**mg/kg**	2000 bis 5000	> 5000
Sulphide (S^{2-})	**<1**	**mg/kg**	- a)	-
Chloride	**<25**	**mg/kg**	-	-

[a)] In case of sulphide values of > 100 mg S^{2-}/kg of soil an additional evaluation by an expert is necessary.

3. Evaluation

The soil is considered not aggressive towards concrete

Munich	06.03.2018	Dr. N. Kunze
Place	Date	Person in charge

Corrosiveness towards concrete according to DIN 4030

The samples

PNCo 06, laboratory number 18-031453-01,

PNCo 50, laboratory number 18-031453-02,

PNCo 64, laboratory number 18-031453-03,

PNCo 72, laboratory number 18-031453-04,

PNCo 83, laboratory number 18-031453-05 and

PNCo 89, laboratory number 18-031453-06

are classified as not aggressive towards concrete materials.

Enclosure 6 Determination of the necessary ramming-depths

Step 1 (Determination of the ramming depths using the calculation program acc. to ZTV-Lsw 88 and ZTV-Lsw 06):

For the solar plant Cleve Hill the ramming depth for four different areas must be determined. These are the non-marked, the orange marked, the brown marked and the green marked area (see enclosure 1.4).

In this first step, the ramming depth for every soil layer important for the foundation (in this case layer S1 silty clay and S2 clayey sandy silt according to enclosure 3) is determined for each different profile type (pile 1 and 2 for field Y and pile 1 (in and out) and piles 2,3 and 4 (in and out) for the fields A-X) using the calculation program acc. ZTV-Lsw 88 and ZTV-Lsw 06 as well as the soil characteristics of enclosure 3. At this point, the max. horizontal load and tilting moment of the static calculation are important for the calculation. The max. vertical load (pressure and traction) are not taken into account. For calculations acc. to ZTV-Lsw 88 and ZTV-Lsw 06, a safety factor of 1.4 for the ground characteristics has to be used if design values for the max. horizontal load and tilting moment are taken from the static calculation.

The calculations are based on the profile C 12x70x96x70x12. This profile has a surface of 0.47 m^2 per meter of length.

For the calculations, the bonding depth of the profile starts 0.3 m under the surface, since the soil above that depth is considered not to be consolidated enough.

The determinations of the necessary ramming depths are based on the two present soil layers. The following thicknesses are accepted for the calculation, broken down into the different areas.

Non-marked area:
Layer S1: Silty clay (from 0.30 m below surface)

Orange marked area:
Layer S1: Silty clay (0.30 to 1.0 m below surface)
Layer S2: Clayey sandy silt (from 1.0 m below surface)

Brown marked area:
Layer S1: Silty clay (0.30 to 2.0 m below surface)
Layer S2: Clayey sandy silt (from 2.0 m below surface)

Green marked area:
Layer S1: Silty clay (0.30 to 2.9 m below surface)

Layer S2: Clayey sandy silt (from 2.9 m below surface)

The calculation of the necessary ramming depth was based on the forces and moments acting on the steel profile from Greencells Group of 22/05/2018. The designation of the different profile types used here was taken from this information. The initial values are summarized in the following table A.

Table A: List of the loads important for the determination of the foundation depth Carrying capacity

Field	Pile	min $V_{d\ (traction)}$ [kN]	max $V_{d\ (pressure)}$ [kN]	max H_d [kN]	max M_d [kNm]
Fields A - X	Pile 1; out	6.51	9.77	2.58	0.23
	Pile 1; in	3.25	9.43	1.57	0.17
	Pile 2, 3, 4; out	2.05	9.83	1.24	0.25
	Pile 2, 3, 4; in	0.00	9.58	0.64	0.18
Field Y	Pile 1	5.76	6.74	1.38	0.21
	Pile 2	0.85	6.80	0.33	0.20

Determination of the necessary ramming depth necessary for “pile 1, out” for the fields A-X in layer S1 to bear the ***max. horizontal forces and moments*** using the calculation program acc. to ZTV-Lsw 88 and ZTV-Lsw 06 as well as the soil characteristics listed in enclosure 3 with a safety factor of 1.4:

Program: Gründung
Project: CleveHill20180525
Short : CleveHill_FieldA-X_Pile1_out_S1

Input data

Angle of slope beta	2.00	degrees
Angle of friction	17.50	degrees
Cohesion c	2.50	kN/m²
reduced to	1.25	kN/m²
Specific gravity gamma	9.00	kN/m³
Skin friction angle delta	8.75	degrees
Breadth of pole b	0..7	m
Safety eta	1.40	(-)
Affecting H-load H	2.58	kN
Affecting moment M	0.23	kNm
Initial depth	0.30	m

Results of the calculations

H * Eta	3.61	kN
M * Eta	0.32	kNm
Depth of the centre of motion t	1.331	m
Sliding surface angle theta	35.94	degrees
Guiding line a	1.752	m
Gap length L	2.164	m
Surface F	1.17	m²
Soil resistance Ephl	11.67	kN
Soil resistance stress eph	250.51	kN/m²
Equilibrium force Eph2	8.06	kN
delta t for SumH=0 dt	0.23	m
Necessary pole length l	**1.56**	**m**
Maximal pole moment Mpf	1.50	kNm
Mpf * eta	2.11	kNm
In a depth X0 =	0.74	m

The foundation depths in layer S1 and S2 for every different pile type (see table A) are calculated using the same method.

Step 2 (Determination of the ramming depths to bear the max. vertical loads):

In a second step, the ramming depths those are necessary for the profile to be able to bear the max. vertical loads (pressure and traction forces) are determined.
When the foundation is carried out in loose soils, the max. vertical loads are transmitted to the ground almost exclusively over the skin friction. Multiplying the pile length (ramming depth) with the skin friction of the soil and the surface per meter of length of the used profile, the max. vertical load the pile is able to bear - when applied exclusively over the skin friction - can be determined.

In the following table, the results from steps 1 and 2 are summarized.

Table B: Summary of the ramming depths [in m from the surface of the area] necessary for the posts to bear the maximum *horizontal* forces and tilting moments, and the ramming depths necessary for the posts to bear the maximum *vertical* forces

Field	Pile	Layer	Calculated ramming depth [m] necessary for the horizontal load and tilting moment, if the foundation only reaches 1 soil layer Safety = 1.4	Calculated ramming depth [m] necessary to take on the vertical loads, if the foundation only reaches 1 soil layer Safety pressure ≥ 1.2 Safety traction ≥ 1.3
Fields A - X	Pile 1; out	S1	1.56	1.43
		S2	0.87	1.25
	Pile 1; in	S1	1.29	1.38
		S2	0.70	1.20
	Pile 2, 3, 4; out	S1	1.20	1.43
		S2	0.67	1.25
	Pile 2, 3, 4; in	S1	0.95	1.40
		S2	0.53	1.22
Field Y	Pile 1	S1	1.31	0.98
		S2	0.69	0.86
	Pile 2	S1	0.87	0.99
		S2	0.48	0.87

Step 3 (Correlation between the necessary ramming depths and the thicknesses of the layers, determining of the total depths):

Now, the ramming depths determined for each layer are correlated in order to get the combined ramming depth for the soil in the orange marked area.

This correlation is carried out - separately - for the ramming depth in column 4 in table B, determined using the max. horizontal forces and moments, and the one in column 5 in table B, determined using the max. vertical loads.

The combined max. ramming depths that results from this correlation is decisive for the recommendation given on the final ramming depth.

The following table C shows the exemplary correlation of the ramming depths determined for the max. horizontal forces and moments (see table B, column 4) with the thickness of the different layers for the “pile 1, out” for the fields A-X and the resulting final ramming depth in the orange marked area.

Table C: Correlation between the necessary ramming depths to bear the maximum *horizontal* forces and tilting moments and the thicknesses of the layers, determining of the total depth

Orange-marked area, fields A-X, pile 1, out

Horizontal forces and tilting moments **Orange-marked area,** **Fields A-X** **Pile 1, out**	Determined ramming depth [m]	Proportional thickness of cover layer to determined ramming depth cover layer [%]	Proportional ramming depth cover layer [m]	Remainder of cover layer transfer to underlying layer [%]	Remainder of cover layer transfer to underlying layer [m]	Share of total ramming depth [m]
Layer S1 thickness [m] 1.00	1.56	64.10	**1.00**	35.90		**1.00**
Layer S2 thickness [m] > 1.00	0.87			35.90	0.31	**0.31**
Total ramming depth to bear the maximum horizontal forces and tilting moments [m]						**1.31**

Step 4 (determination of the recommended ramming depth):

After steps 1 - 3 the recommended ramming depths are determined. In this recommendation, the highest final ramming depth is taken into account. the recommended ramming depths can additionally include a safety factor freely chosen by the geologist. This safety factor is determined using the experience of "Boden und Wasser" as well as the assessment of the long term stability of the sounded soil layers.

Due to our experience with coastal soil types we recommend a minimal foundation depth of 1.40 m in any case, even if shorter foundation depths are the result of the calculation.
For the project Cleve Hill, the following ramming depths are recommended (table D.1 and D.2):

Table D.1: Summary of the calculated and recommended final ramming depths [in m starting from the surface of the area] necessary for the posts to bear the max. *horizontal* forces and tilting moments, and the max. *vertical* forces
Non-marked, brown marked and green marked area

Field	Pile	Calculated ramming depths nec. for the horizontal forces and moments [m from surface]	Calculated ramming depths nec. for the vertical loads [m from surface]	Recommen-ded final ramming depth [m from surface]	Safety factor on the recommended final ramming depth for bearing the vertical pressure and traction forces [-]	
					pressure	traction
Fields A-X	Pile 1; out	1.56	1.43	**1.56**	> 1.3	> 1.9
	Pile 1; in	1.29	1.38	**1.40**	1.2	> 3.4
	Pile 2, 3, 4; out	1.20	1.43	**1.43**	1.2	> 5.7
	Pile 2, 3, 4; in	0.95	1.40	**1.40**	1.2	No traction
Field Y	Pile 1	1.31	0.98	**1.40**	> 1.5	> 1.8
	Pile 2	0.87	0.99	**1.40**	> 1.4	> 11

Table D.2: Summary of the calculated and recommended final ramming depths [in m starting from the surface of the area] necessary for the posts to bear the max. *horizontal* forces and tilting moments, and the max. *vertical* forces

Orange marked area

Field	Pile	Calculated ramming depths nec. for the horizontal forces and moments [m from surface]	Calculated ramming depths nec. for the vertical loads [m from surface]	Recommen-ded final ramming depth [m from surface]	Safety factor on the recommended final ramming depth for bearing the vertical pressure and traction forces [-]	
					pressure	traction
Fields A-X	Pile 1; out	1.31	1.37	**1.40**	1.2	> 1.7
	Pile 1; in	1.16	1.33	**1.40**	1.2	> 3.4
	Pile 2, 3, 4; out	1.11	1.38	**1.40**	1.2	> 5.7
	Pile 2, 3, 4; in	0.95	1.35	**1.40**	1.2	No traction
Field Y	Pile 1	1.16	0.98	**1.40**	> 1.4	> 1.7
	Pile 2	0.87	0.99	**1.40**	> 1.4	> 11

The recommended ramming depths in tables D.1 and D.2 are sufficient for the steel profiles to bear the maximum ***horizontal*** loads and moments (see also calculation results above). These depths are also sufficient to bear the ***vertical loads*** from the static calculation (see safety factors indicated in tables D.1 and D.2, column 6). One very important factor for this is a sufficient time difference between the ramming process and the application of this load on the profile. It can be assumed that the time span between the ramming of the steel profiles and the installation of the solar modules is in any case sufficient in order for the profile to be able to bear the entire load (see also chapter 5.3).

It is very important not to ram the profiles deeper than the recommended ramming depths and then pull it on the right length. This can subsequently lead to settlements of the ramming profile and hence of the framework.

For the recommendation of this ramming depth, influences like ground frost, fluctuating groundwater levels,… have been taken into account.