

## **APPENDIX C – EXPLORATORY HOLE RECORDS**

Project Name: Ruabon Business Park -  
Phase I & II

Client: Beech Developments

Date: 22/06/2023

Location: Ruabon

Contractor: Harvey Plant

Project No. : 2949

Crew Name: Thomas Plant

Equipment: JCB 3CX

Location Number  
SA01Location Type  
TP

Level

Logged By  
RPScale  
1:25Page Number  
Sheet 1 of 1

| Well | Water Strikes | Sample and In Situ Testing |         |         | Depth (m) | Level (m) | Legend | Stratum Description                                                                                                                                                                                      |   |
|------|---------------|----------------------------|---------|---------|-----------|-----------|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|      |               | Depth (m)                  | Type    | Results |           |           |        |                                                                                                                                                                                                          |   |
|      |               | 0.25                       | ES      |         | 0.20      |           |        | Dark brown slightly sandy very gravelly CLAY. Gravel is fine to medium angular to subangular of sandstone and brick.<br>(MADE GROUND)                                                                    |   |
|      |               | 0.50                       | ES      |         |           |           |        | Very loose dark blackish brown clayey sandy angular to subangular fine to coarse GRAVEL of sandstone, concrete, clinker and brick with low cobble content. Cobbles are angular concrete<br>(MADE GROUND) |   |
|      |               | 1.00<br>1.00               | B<br>ES |         |           |           |        |                                                                                                                                                                                                          | 1 |
|      |               | 1.75                       | D       |         |           |           |        |                                                                                                                                                                                                          |   |
|      |               | 2.00                       | ES      |         | 2.10      |           |        |                                                                                                                                                                                                          | 2 |
|      |               | 2.50                       | B       |         |           |           |        | Firm dark brown slightly sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded of sandstone.<br>(GLACIAL TILL)                                                                             |   |
|      |               | 3.00                       | D       |         |           |           |        |                                                                                                                                                                                                          | 3 |
|      |               |                            |         |         | 3.25      |           |        | End of Borehole at 3.250m                                                                                                                                                                                |   |
|      |               |                            |         |         |           |           |        |                                                                                                                                                                                                          | 4 |
|      |               |                            |         |         |           |           |        |                                                                                                                                                                                                          | 5 |

## Dimensions

## Trench Support and Comment

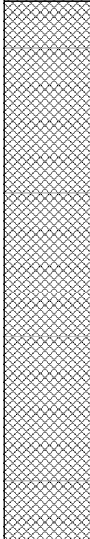
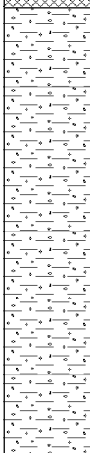
## Pumping Data

| Pit Length | Pit Width | Pit Stability | Shoring Used | Remarks | Date | Rate | Remarks |
|------------|-----------|---------------|--------------|---------|------|------|---------|
| 2.10       | 1.25      | Unstable      | None         |         |      |      |         |

## Remarks

No groundwater encountered. Soakaway test completed at 1.00m bgl.

|                                                   |                     |                            |                 |                    |                             |
|---------------------------------------------------|---------------------|----------------------------|-----------------|--------------------|-----------------------------|
| Project Name: Ruabon Business Park - Phase I & II |                     | Client: Beech Developments |                 | Date: 22/06/2023   |                             |
| Location: Ruabon                                  |                     | Contractor: Harvey Plant   |                 |                    |                             |
| Project No. : 2949                                |                     | Crew Name: Thomas Plant    |                 | Equipment: JCB 3CX |                             |
| Location Number<br>SA02                           | Location Type<br>TP | Level                      | Logged By<br>RP | Scale<br>1:25      | Page Number<br>Sheet 1 of 1 |

| Well                                                                               | Water Strikes | Sample and In Situ Testing                                                          |        |         | Depth (m) | Level (m) | Legend                                                                            | Stratum Description                                                                                                                                                                                         |                                                                                    |                                                                                                                              |   |
|------------------------------------------------------------------------------------|---------------|-------------------------------------------------------------------------------------|--------|---------|-----------|-----------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|---|
|                                                                                    |               | Depth (m)                                                                           | Type   | Results |           |           |                                                                                   |                                                                                                                                                                                                             |                                                                                    |                                                                                                                              |   |
|  |               | 0.20                                                                                | ES     |         | 0.20      |           |  | Dark brown slightly sandy very gravelly CLAY. Gravel is fine to medium angular to subangular of sandstone. (MADE GROUND)                                                                                    | 1                                                                                  |                                                                                                                              |   |
|                                                                                    |               | 0.50                                                                                | ES     |         |           |           |                                                                                   |                                                                                                                                                                                                             |                                                                                    |                                                                                                                              |   |
|                                                                                    |               | 0.75<br>0.75                                                                        | B<br>D |         |           |           |                                                                                   |                                                                                                                                                                                                             |                                                                                    |                                                                                                                              |   |
|                                                                                    |               | 1.00                                                                                | ES     |         |           |           |                                                                                   |                                                                                                                                                                                                             |                                                                                    |                                                                                                                              |   |
|                                                                                    |               | 1.50                                                                                | D      |         |           |           |  | Very loose dark blackish brown clayey sandy angular to subangular fine to coarse GRAVEL of sandstone, concrete, clinker, coal and brick with low cobble content. Cobbles are angular concrete (MADE GROUND) | 2                                                                                  |                                                                                                                              |   |
|                                                                                    |               | 2.00                                                                                | ES     |         | 2.00      |           |                                                                                   |                                                                                                                                                                                                             |                                                                                    |                                                                                                                              |   |
|                                                                                    |               | 2.20                                                                                | D      |         |           |           |                                                                                   |                                                                                                                                                                                                             |                                                                                    |                                                                                                                              |   |
|                                                                                    |               | 2.50                                                                                | D      |         |           |           |                                                                                   |                                                                                                                                                                                                             |                                                                                    |                                                                                                                              |   |
|                                                                                    |               |  |        | 3.25    | B         |           |                                                                                   |                                                                                                                                                                                                             |  | Firm dark brown slightly sandy gravelly CLAY. Gravel is fine to coarse subangular to subrounded of sandstone. (GLACIAL TILL) | 3 |
|                                                                                    |               |                                                                                     |        |         |           |           | 3.50                                                                              |                                                                                                                                                                                                             |                                                                                    |                                                                                                                              |   |
|                                                                                    |               | End of Borehole at 3.500m                                                           |        |         |           |           |                                                                                   |                                                                                                                                                                                                             | 4                                                                                  |                                                                                                                              |   |
|                                                                                    |               |                                                                                     |        |         |           |           |                                                                                   |                                                                                                                                                                                                             | 5                                                                                  |                                                                                                                              |   |

| Dimensions |           | Trench Support and Comment |              |         | Pumping Data |      |         |
|------------|-----------|----------------------------|--------------|---------|--------------|------|---------|
| Pit Length | Pit Width | Pit Stability              | Shoring Used | Remarks | Date         | Rate | Remarks |
| 2.00       | 1.25      | Unstable                   | None         |         |              |      |         |

|                                                                                     |  |  |  |  |  |                                                                                  |  |
|-------------------------------------------------------------------------------------|--|--|--|--|--|----------------------------------------------------------------------------------|--|
| <b>Remarks</b><br>No groundwater encountered. Soakaway test completed at 1.00m bgl. |  |  |  |  |  | GroundSolve Ltd<br>Unit 1 Well House Barns<br>Chester Road<br>Bretton<br>CH4 0DH |  |
|-------------------------------------------------------------------------------------|--|--|--|--|--|----------------------------------------------------------------------------------|--|

|                                                   |                     |                            |                 |                    |                             |
|---------------------------------------------------|---------------------|----------------------------|-----------------|--------------------|-----------------------------|
| Project Name: Ruabon Business Park - Phase I & II |                     | Client: Beech Developments |                 | Date: 22/06/2023   |                             |
| Location: Ruabon                                  |                     | Contractor: Harvey Plant   |                 |                    |                             |
| Project No. : 2949                                |                     | Crew Name: Thomas Plant    |                 | Equipment: JCB 3CX |                             |
| Location Number<br>SA03                           | Location Type<br>TP | Level                      | Logged By<br>RP | Scale<br>1:25      | Page Number<br>Sheet 1 of 1 |

| Well | Water Strikes | Sample and In Situ Testing |         |         | Depth (m) | Level (m) | Legend | Stratum Description                                                                                                                                                                                                                      |   |
|------|---------------|----------------------------|---------|---------|-----------|-----------|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|      |               | Depth (m)                  | Type    | Results |           |           |        |                                                                                                                                                                                                                                          |   |
|      |               | 0.20                       | ES      |         | 0.25      |           |        | Dark brown slightly sandy very gravelly CLAY. Gravel is fine to medium angular to subangular of sandstone. (MADE GROUND)                                                                                                                 |   |
|      |               | 0.50                       | ES      |         |           |           |        | Very loose dark brown slightly clayey slightly sandy angular to subangular fine to coarse gravel of sandstone, concrete, brick, clinker and coal medium cobble content. Cobbles are angular of concrete, brick and clinker (MADE GROUND) |   |
|      |               | 1.00<br>1.00               | B<br>ES |         |           |           |        |                                                                                                                                                                                                                                          | 1 |
|      |               | 2.00                       | ES      |         |           |           |        |                                                                                                                                                                                                                                          | 2 |
|      |               | 2.85                       | B       |         | 3.00      |           |        | Firm brown sandy very gravelly CLAY. Gravel is angular to subangular fine to coarse of sandstone, concrete and brick. (MADE GROUND)                                                                                                      | 3 |
|      |               |                            |         |         | 3.50      |           |        | End of Borehole at 3.500m                                                                                                                                                                                                                | 4 |
|      |               |                            |         |         |           |           |        |                                                                                                                                                                                                                                          | 5 |

| Dimensions |           | Trench Support and Comment |              |         | Pumping Data |      |         |
|------------|-----------|----------------------------|--------------|---------|--------------|------|---------|
| Pit Length | Pit Width | Pit Stability              | Shoring Used | Remarks | Date         | Rate | Remarks |
| 2.00       | 1.40      | Unstable                   | None         |         |              |      |         |

|                                                                                     |  |  |  |  |  |                                                                                  |  |
|-------------------------------------------------------------------------------------|--|--|--|--|--|----------------------------------------------------------------------------------|--|
| <b>Remarks</b><br>No groundwater encountered. Soakaway test completed at 1.00m bgl. |  |  |  |  |  | GroundSolve Ltd<br>Unit 1 Well House Barns<br>Chester Road<br>Bretton<br>CH4 0DH |  |
|-------------------------------------------------------------------------------------|--|--|--|--|--|----------------------------------------------------------------------------------|--|



|                                                   |                     |                            |                 |                  |                             |
|---------------------------------------------------|---------------------|----------------------------|-----------------|------------------|-----------------------------|
| Project Name: Ruabon Business Park - Phase I & II |                     | Client: Beech Developments |                 | Date: 09/09/2020 |                             |
| Location: Ruabon                                  |                     | Contractor: Harvey Plant   |                 |                  |                             |
| Project No. : 2949                                |                     | Crew Name:                 |                 | Equipment:       |                             |
| Location Number<br>TP1                            | Location Type<br>TP | Level                      | Logged By<br>SF | Scale<br>1:25    | Page Number<br>Sheet 1 of 1 |

| Well | Water Strikes | Sample and In Situ Testing |      |         | Depth (m) | Level (m) | Legend | Stratum Description                                                                                                                                                                        |   |
|------|---------------|----------------------------|------|---------|-----------|-----------|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|      |               | Depth (m)                  | Type | Results |           |           |        |                                                                                                                                                                                            |   |
|      |               |                            |      |         | 0.12      |           |        | Grass over dark brown slightly gravelly SAND. Gravel is fine to medium sub-angular of brick and mudstone (MADE GROUND)                                                                     |   |
|      |               |                            |      |         | 0.40      |           |        | Very stiff orangish brown slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular to angular of mudstone and coal (MADE GROUND)                                                 |   |
|      |               |                            |      |         | 1.10      |           |        | Very dense dark grey slightly sandy clayey fine to coarse sub-angular to angular GRAVEL of mudstone with high cobble content, Cobbles are sub-angular to angular of mudstone (MADE GROUND) | 1 |
|      |               |                            |      |         |           |           |        | End of Borehole at 1.100m                                                                                                                                                                  | 2 |
|      |               |                            |      |         |           |           |        |                                                                                                                                                                                            | 3 |
|      |               |                            |      |         |           |           |        |                                                                                                                                                                                            | 4 |
|      |               |                            |      |         |           |           |        |                                                                                                                                                                                            | 5 |

| Dimensions |           | Trench Support and Comment |              |         | Pumping Data |      |         |
|------------|-----------|----------------------------|--------------|---------|--------------|------|---------|
| Pit Length | Pit Width | Pit Stability              | Shoring Used | Remarks | Date         | Rate | Remarks |
| 1.20       | 0.70      | Unstable                   | None         |         |              |      |         |

|                                              |                                                                                  |
|----------------------------------------------|----------------------------------------------------------------------------------|
| <b>Remarks</b><br>No groundwater encountered | GroundSolve Ltd<br>Unit 1 Well House Barns<br>Chester Road<br>Bretton<br>CH4 0DH |
|----------------------------------------------|----------------------------------------------------------------------------------|



|                                                   |                     |                            |                 |                  |                             |
|---------------------------------------------------|---------------------|----------------------------|-----------------|------------------|-----------------------------|
| Project Name: Ruabon Business Park - Phase I & II |                     | Client: Beech Developments |                 | Date: 09/09/2020 |                             |
| Location: Ruabon                                  |                     | Contractor: Harvey Plant   |                 |                  |                             |
| Project No. : 2949                                |                     | Crew Name:                 |                 | Equipment:       |                             |
| Location Number<br>TP2                            | Location Type<br>TP | Level                      | Logged By<br>SF | Scale<br>1:25    | Page Number<br>Sheet 1 of 1 |

| Well | Water Strikes | Sample and In Situ Testing |      |         | Depth (m) | Level (m) | Legend | Stratum Description                                                                                                                                                                 |   |
|------|---------------|----------------------------|------|---------|-----------|-----------|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|      |               | Depth (m)                  | Type | Results |           |           |        |                                                                                                                                                                                     |   |
|      |               |                            |      |         | 0.30      |           |        | Grass over dark brown slightly gravelly SAND. Gravel is fine to medium sub-angular of brick and mudstone (MADE GROUND)                                                              |   |
|      |               |                            |      |         |           |           |        | Loose orangish brown sandy fine to coarse sub-angular to angular GRAVEL of mudstone and burnt shale (MADE GROUND)                                                                   | 1 |
|      |               |                            |      |         | 2.10      |           |        |                                                                                                                                                                                     |   |
|      |               |                            |      |         | 2.30      |           |        | Soft black sandy gravelly CLAY. Gravel is fine to coarse sub-angular to angular of mudstone, burnt shale and brick. Occasional sub-angular cobbles of mudstone noted. (MADE GROUND) | 2 |
|      |               |                            |      |         |           |           |        | End of Borehole at 2.300m                                                                                                                                                           |   |
|      |               |                            |      |         |           |           |        |                                                                                                                                                                                     | 3 |
|      |               |                            |      |         |           |           |        |                                                                                                                                                                                     | 4 |
|      |               |                            |      |         |           |           |        |                                                                                                                                                                                     | 5 |

| Dimensions |           | Trench Support and Comment |              |         | Pumping Data |      |         |
|------------|-----------|----------------------------|--------------|---------|--------------|------|---------|
| Pit Length | Pit Width | Pit Stability              | Shoring Used | Remarks | Date         | Rate | Remarks |
| 1.25       | 0.70      | Unstable                   | None         |         |              |      |         |

|                                              |                                                                                  |
|----------------------------------------------|----------------------------------------------------------------------------------|
| <b>Remarks</b><br>No groundwater encountered | GroundSolve Ltd<br>Unit 1 Well House Barns<br>Chester Road<br>Bretton<br>CH4 0DH |
|----------------------------------------------|----------------------------------------------------------------------------------|

Project Name: Ruabon Business Park -  
Phase I & II

Client: Beech Developments

Date: 09/09/2020

Location: Ruabon

Contractor: Harvey Plant

Project No. : 2949

Crew Name:

Equipment:

Location Number  
TP3Location Type  
TP

Level

Logged By  
SFScale  
1:25Page Number  
Sheet 1 of 1

| Well | Water<br>Strikes | Sample and In Situ Testing |      |         | Depth<br>(m) | Level<br>(m) | Legend | Stratum Description                                                                                                                                                                                                                                                                                     |   |
|------|------------------|----------------------------|------|---------|--------------|--------------|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|      |                  | Depth (m)                  | Type | Results |              |              |        |                                                                                                                                                                                                                                                                                                         |   |
|      |                  |                            |      |         | 0.15         |              |        | Grass over dark brown slightly gravelly SAND. Gravel is fine to medium sub-angular of brick and mudstone (MADE GROUND)<br>Loose dark grey sandy fine to coarse sub-angular to angular GRAVEL of mudstone and burnt shale. Occasional sub-rounded to sub-angular cobbles of mudstone noted (MADE GROUND) | 1 |
|      |                  |                            |      |         | 1.80         |              |        |                                                                                                                                                                                                                                                                                                         |   |
|      |                  |                            |      |         | 2.00         |              |        | Very dense dark grey slightly sandy clayey fine to coarse sub-angular to angular GRAVEL of mudstone with high cobble content, Cobbles are sub-angular to angular of mudstone (MADE GROUND)<br>End of Borehole at 2.000m                                                                                 | 2 |
|      |                  |                            |      |         |              |              |        |                                                                                                                                                                                                                                                                                                         | 3 |
|      |                  |                            |      |         |              |              |        |                                                                                                                                                                                                                                                                                                         | 4 |
|      |                  |                            |      |         |              |              |        |                                                                                                                                                                                                                                                                                                         | 5 |

## Dimensions

## Trench Support and Comment

## Pumping Data

| Pit Length | Pit Width | Pit Stability | Shoring Used | Remarks | Date | Rate | Remarks |
|------------|-----------|---------------|--------------|---------|------|------|---------|
| 1.30       | 0.70      | Stable        | None         |         |      |      |         |

## Remarks

No groundwater encountered

|                                                   |                     |                            |                 |                  |                             |
|---------------------------------------------------|---------------------|----------------------------|-----------------|------------------|-----------------------------|
| Project Name: Ruabon Business Park - Phase I & II |                     | Client: Beech Developments |                 | Date: 09/09/2020 |                             |
| Location: Ruabon                                  |                     | Contractor: Harvey Plant   |                 |                  |                             |
| Project No. : 2949                                |                     | Crew Name:                 |                 | Equipment:       |                             |
| Location Number<br>TP4                            | Location Type<br>TP | Level                      | Logged By<br>SF | Scale<br>1:25    | Page Number<br>Sheet 1 of 1 |

| Well | Water Strikes | Sample and In Situ Testing |      |         | Depth (m) | Level (m) | Legend | Stratum Description                                                                                                                                                                              |   |
|------|---------------|----------------------------|------|---------|-----------|-----------|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|      |               | Depth (m)                  | Type | Results |           |           |        |                                                                                                                                                                                                  |   |
|      |               |                            |      |         |           |           |        | Dense light grey slightly sandy fine to coarse sub-angular to angular GRAVEL of mudstone with high cobble/boulder content. Cobbles/boulders are sub-angular to angular of mudstone (MADE GROUND) |   |
|      |               |                            |      |         |           |           |        | At 0.70m becomes loose                                                                                                                                                                           | 1 |
|      |               |                            |      |         |           |           |        | At 1.20m becomes very dense                                                                                                                                                                      |   |
|      |               |                            |      |         | 1.70      |           |        |                                                                                                                                                                                                  |   |
|      |               |                            |      |         | 1.90      |           |        | Firm black sandy gravelly CLAY. Gravel is fine to coarse sub-angular to angular of mudstone, burnt shale and brick. Occasional sub-angular cobbles of mudstone noted. (MADE GROUND)              | 2 |
|      |               |                            |      |         |           |           |        | End of Borehole at 1.900m                                                                                                                                                                        |   |
|      |               |                            |      |         |           |           |        |                                                                                                                                                                                                  | 3 |
|      |               |                            |      |         |           |           |        |                                                                                                                                                                                                  | 4 |
|      |               |                            |      |         |           |           |        |                                                                                                                                                                                                  | 5 |

| Dimensions |           | Trench Support and Comment |              |         | Pumping Data |      |         |
|------------|-----------|----------------------------|--------------|---------|--------------|------|---------|
| Pit Length | Pit Width | Pit Stability              | Shoring Used | Remarks | Date         | Rate | Remarks |
| 1.20       | 0.70      | Stable                     | None         |         |              |      |         |

|                                              |                                                                                  |
|----------------------------------------------|----------------------------------------------------------------------------------|
| <b>Remarks</b><br>No groundwater encountered | GroundSolve Ltd<br>Unit 1 Well House Barns<br>Chester Road<br>Bretton<br>CH4 0DH |
|----------------------------------------------|----------------------------------------------------------------------------------|

Project Name: Ruabon Business Park -  
Phase I & II

Client: Beech Developments

Date: 20/06/2023

Location: Ruabon

Contractor: Harvey Plant

Project No. : 2949

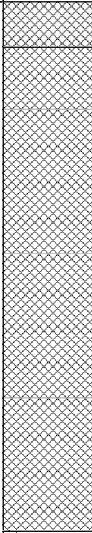
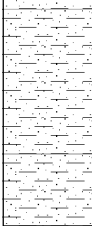
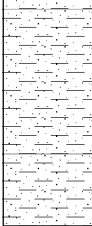
Crew Name: Thomas Plant

Equipment: JCB 3CX

Location Number  
TT01Location Type  
TP

Level

Logged By  
RPScale  
1:25Page Number  
Sheet 1 of 1

| Well                                                                               | Water<br>Strikes | Sample and In Situ Testing |         |         | Depth<br>(m) | Level<br>(m) | Legend                                                                             | Stratum Description                                                                                                                                                                                                                                                                                                                                     |   |
|------------------------------------------------------------------------------------|------------------|----------------------------|---------|---------|--------------|--------------|------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|                                                                                    |                  | Depth (m)                  | Type    | Results |              |              |                                                                                    |                                                                                                                                                                                                                                                                                                                                                         |   |
|  |                  | 0.25                       | ES      |         | 0.15         |              |   | Dark brown slightly sandy very gravelly CLAY. Gravel is fine to medium angular to subangular of sandstone and brick.<br>(MADE GROUND)<br>Very loose dark blackish brown clayey sandy angular to subangular fine to coarse GRAVEL of sandstone, concrete, clinker, coal and brick with low cobble content. Cobbles are angular concrete<br>(MADE GROUND) | 1 |
|                                                                                    |                  | 0.50                       | ES      |         |              |              |                                                                                    |                                                                                                                                                                                                                                                                                                                                                         |   |
|                                                                                    |                  | 0.95<br>1.00               | B<br>ES |         |              |              |                                                                                    |                                                                                                                                                                                                                                                                                                                                                         |   |
|                                                                                    |                  | 1.50                       | D       |         |              |              |                                                                                    |                                                                                                                                                                                                                                                                                                                                                         |   |
|                                                                                    |                  |                            |         |         | 1.75         |              |                                                                                    |                                                                                                                                                                                                                                                                                                                                                         |   |
|  |                  |                            |         |         | 2.50         |              |  | Soft dark brown sandy slightly gravelly CLAY. Gravel is fine to medium subangular to subrounded of sandstone<br>(GLACIAL TILL)<br><i>Large metal column support present</i>                                                                                                                                                                             | 2 |
|                                                                                    |                  | 2.75                       | B       |         |              |              |                                                                                    |                                                                                                                                                                                                                                                                                                                                                         |   |
|                                                                                    |                  |                            |         |         |              |              |                                                                                    | End of Borehole at 2.500m                                                                                                                                                                                                                                                                                                                               | 3 |
|                                                                                    |                  |                            |         |         |              |              |                                                                                    |                                                                                                                                                                                                                                                                                                                                                         |   |
|                                                                                    |                  |                            |         |         |              |              |                                                                                    |                                                                                                                                                                                                                                                                                                                                                         |   |
|                                                                                    |                  |                            |         |         |              |              |                                                                                    |                                                                                                                                                                                                                                                                                                                                                         |   |
|                                                                                    |                  |                            |         |         |              |              |                                                                                    |                                                                                                                                                                                                                                                                                                                                                         |   |
|                                                                                    |                  |                            |         |         |              |              |                                                                                    |                                                                                                                                                                                                                                                                                                                                                         | 4 |
|                                                                                    |                  |                            |         |         |              |              |                                                                                    |                                                                                                                                                                                                                                                                                                                                                         |   |
|                                                                                    |                  |                            |         |         |              |              |                                                                                    |                                                                                                                                                                                                                                                                                                                                                         |   |
|                                                                                    |                  |                            |         |         |              |              |                                                                                    |                                                                                                                                                                                                                                                                                                                                                         |   |
|                                                                                    |                  |                            |         |         |              |              |                                                                                    |                                                                                                                                                                                                                                                                                                                                                         |   |
|                                                                                    |                  |                            |         |         |              |              |                                                                                    |                                                                                                                                                                                                                                                                                                                                                         | 5 |
|                                                                                    |                  |                            |         |         |              |              |                                                                                    |                                                                                                                                                                                                                                                                                                                                                         |   |
|                                                                                    |                  |                            |         |         |              |              |                                                                                    |                                                                                                                                                                                                                                                                                                                                                         |   |
|                                                                                    |                  |                            |         |         |              |              |                                                                                    |                                                                                                                                                                                                                                                                                                                                                         |   |
|                                                                                    |                  |                            |         |         |              |              |                                                                                    |                                                                                                                                                                                                                                                                                                                                                         |   |

## Dimensions

## Trench Support and Comment

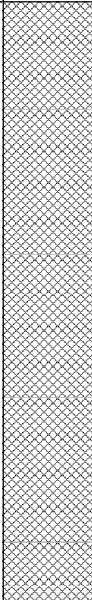
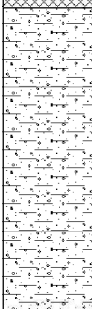
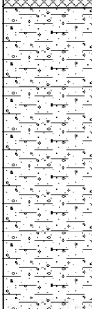
## Pumping Data

| Pit Length | Pit Width | Pit Stability | Shoring Used | Remarks | Date | Rate | Remarks |
|------------|-----------|---------------|--------------|---------|------|------|---------|
| 4.00       | 2.00      | Unstable      | None         |         |      |      |         |

## Remarks

No groundwater encountered. Large metal column support present at 1.75m bgl.

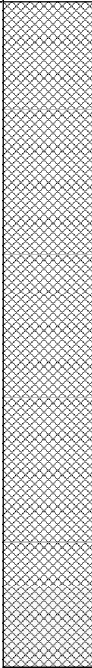
|                                                   |                     |                            |                 |                    |                             |
|---------------------------------------------------|---------------------|----------------------------|-----------------|--------------------|-----------------------------|
| Project Name: Ruabon Business Park - Phase I & II |                     | Client: Beech Developments |                 | Date: 20/06/2023   |                             |
| Location: Ruabon                                  |                     | Contractor: Harvey Plant   |                 |                    |                             |
| Project No. : 2949                                |                     | Crew Name: Thomas Plant    |                 | Equipment: JCB 3CX |                             |
| Location Number<br>TT02                           | Location Type<br>TP | Level                      | Logged By<br>RP | Scale<br>1:25      | Page Number<br>Sheet 1 of 1 |

| Well                                                                               | Water Strikes | Sample and In Situ Testing |      |         | Depth (m) | Level (m) | Legend                                                                             | Stratum Description                                                                                                                                   |   |
|------------------------------------------------------------------------------------|---------------|----------------------------|------|---------|-----------|-----------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|                                                                                    |               | Depth (m)                  | Type | Results |           |           |                                                                                    |                                                                                                                                                       |   |
|  |               | 0.25                       | ES   |         | 2.00      |           |   | Very loose dark blackish brown clayey sandy angular to subangular fine to coarse GRAVEL of sandstone, concrete, clinker, coal and brick (MADE GROUND) | 1 |
|                                                                                    |               | 0.50                       | ES   |         |           |           |                                                                                    |                                                                                                                                                       |   |
|                                                                                    |               | 0.70                       | D    |         |           |           |                                                                                    |                                                                                                                                                       |   |
|                                                                                    |               | 1.00                       | ES   |         |           |           |                                                                                    |                                                                                                                                                       |   |
|                                                                                    |               | 1.50                       | B    |         |           |           |                                                                                    |                                                                                                                                                       |   |
|  |               |                            |      |         | 3.00      |           |  | Horizontal metal beams present<br>Soft dark brown sandy gravelly CLAY. Gravel is fine to medium subangular to subrounded of sandstone (GLACIAL TILL)  | 2 |
|                                                                                    |               |                            |      |         |           |           |                                                                                    |                                                                                                                                                       |   |
|                                                                                    |               |                            |      |         |           |           |                                                                                    | End of Borehole at 3.000m                                                                                                                             | 3 |
|                                                                                    |               |                            |      |         |           |           |                                                                                    |                                                                                                                                                       |   |
|                                                                                    |               |                            |      |         |           |           |                                                                                    |                                                                                                                                                       |   |
|                                                                                    |               | 3.50                       | B    |         |           |           |                                                                                    |                                                                                                                                                       | 4 |
|                                                                                    |               |                            |      |         |           |           |                                                                                    |                                                                                                                                                       |   |
|                                                                                    |               |                            |      |         |           |           |                                                                                    |                                                                                                                                                       | 5 |
|                                                                                    |               |                            |      |         |           |           |                                                                                    |                                                                                                                                                       |   |

| Dimensions |           | Trench Support and Comment |              |         | Pumping Data |      |         |
|------------|-----------|----------------------------|--------------|---------|--------------|------|---------|
| Pit Length | Pit Width | Pit Stability              | Shoring Used | Remarks | Date         | Rate | Remarks |
| 4.30       | 2.00      | Unstable                   | None         |         |              |      |         |

|                                                                          |  |  |  |  |  |                                                                                  |  |
|--------------------------------------------------------------------------|--|--|--|--|--|----------------------------------------------------------------------------------|--|
| Remarks                                                                  |  |  |  |  |  | GroundSolve Ltd<br>Unit 1 Well House Barns<br>Chester Road<br>Bretton<br>CH4 0DH |  |
| No groundwater encountered. Horizontal metal beams present at 2.00m bgl. |  |  |  |  |  |                                                                                  |  |

|                                                   |                     |                            |                 |                    |                             |
|---------------------------------------------------|---------------------|----------------------------|-----------------|--------------------|-----------------------------|
| Project Name: Ruabon Business Park - Phase I & II |                     | Client: Beech Developments |                 | Date: 20/06/2023   |                             |
| Location: Ruabon                                  |                     | Contractor: Harvey Plant   |                 |                    |                             |
| Project No. : 2949                                |                     | Crew Name: Thomas Plant    |                 | Equipment: JCB 3CX |                             |
| Location Number<br>TT03                           | Location Type<br>TP | Level                      | Logged By<br>RP | Scale<br>1:25      | Page Number<br>Sheet 1 of 1 |

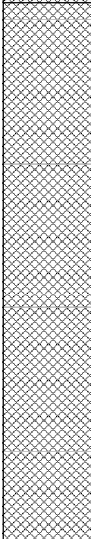
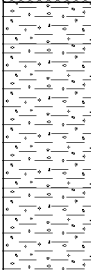
| Well                                                                               | Water Strikes                                                                       | Sample and In Situ Testing |         |         | Depth (m) | Level (m) | Legend                                                                              | Stratum Description                                                                                                                                                                                         |   |
|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------------------|---------|---------|-----------|-----------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|                                                                                    |                                                                                     | Depth (m)                  | Type    | Results |           |           |                                                                                     |                                                                                                                                                                                                             |   |
|  |  | 0.25                       | ES      |         |           |           |   | Very loose dark blackish brown clayey sandy angular to subangular fine to coarse GRAVEL of sandstone, concrete, clinker, coal and brick with low cobble content. Cobbles are angular concrete (MADE GROUND) | 1 |
|                                                                                    |                                                                                     | 0.50                       | ES      |         |           |           |                                                                                     |                                                                                                                                                                                                             |   |
|                                                                                    |                                                                                     | 1.00<br>1.00               | B<br>ES |         |           |           |                                                                                     |                                                                                                                                                                                                             |   |
|                                                                                    |                                                                                     |                            |         |         | 2.20      |           |                                                                                     | Soft dark brown sandy gravelly CLAY. Gravel is fine to coarse angular to subangular of sandstone, metal and concrete (MADE GROUND)                                                                          | 2 |
|                                                                                    |                                                                                     |                            |         |         |           |           |                                                                                     |                                                                                                                                                                                                             |   |
|                                                                                    |                                                                                     | 3.00                       | B       |         | 3.00      |           |  | <u>Metal sheets and concrete slab covering a void</u><br>End of Borehole at 3.000m                                                                                                                          | 3 |
|                                                                                    |                                                                                     |                            |         |         |           |           |                                                                                     |                                                                                                                                                                                                             |   |
|                                                                                    |                                                                                     |                            |         |         |           |           |                                                                                     |                                                                                                                                                                                                             | 4 |
|                                                                                    |                                                                                     |                            |         |         |           |           |                                                                                     |                                                                                                                                                                                                             | 5 |

| Dimensions |           | Trench Support and Comment |              |         | Pumping Data |      |         |
|------------|-----------|----------------------------|--------------|---------|--------------|------|---------|
| Pit Length | Pit Width | Pit Stability              | Shoring Used | Remarks | Date         | Rate | Remarks |
| 6.50       | 2.20      | Unstable                   | None         |         |              |      |         |

|                                                                                                                                                                                     |  |  |  |  |  |                                                                                  |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|----------------------------------------------------------------------------------|--|
| <b>Remarks</b><br>Groundwater encountered at 2.50m bgl. Horizontal metal sheets and concrete blocks present at base of pit. Appears to be covering a void, possibly the mine shaft. |  |  |  |  |  | GroundSolve Ltd<br>Unit 1 Well House Barns<br>Chester Road<br>Bretton<br>CH4 0DH |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|----------------------------------------------------------------------------------|--|



|                                                   |                     |                            |                 |                    |                             |
|---------------------------------------------------|---------------------|----------------------------|-----------------|--------------------|-----------------------------|
| Project Name: Ruabon Business Park - Phase I & II |                     | Client: Beech Developments |                 | Date: 21/06/2023   |                             |
| Location: Ruabon                                  |                     | Contractor: Harvey Plant   |                 |                    |                             |
| Project No. : 2949                                |                     | Crew Name: Thomas Plant    |                 | Equipment: JCB 3CX |                             |
| Location Number<br>TT04                           | Location Type<br>TP | Level                      | Logged By<br>RP | Scale<br>1:25      | Page Number<br>Sheet 1 of 1 |

| Well                                                                               | Water Strikes | Sample and In Situ Testing |         |         | Depth (m) | Level (m) | Legend                                                                              | Stratum Description                                                                                                                                                                                                                 |   |
|------------------------------------------------------------------------------------|---------------|----------------------------|---------|---------|-----------|-----------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|                                                                                    |               | Depth (m)                  | Type    | Results |           |           |                                                                                     |                                                                                                                                                                                                                                     |   |
|  |               | 0.30                       | ES      |         | 0.30      |           |    | Dark brown slightly sandy very gravelly CLAY. Gravel is fine to medium angular to subangular of sandstone (MADE GROUND)                                                                                                             |   |
|                                                                                    |               | 1.00<br>1.00               | B<br>ES |         |           |           |   | Very loose dark blackish brown clayey sandy angular to subangular fine to coarse GRAVEL of sandstone, concrete, clinker, coal and brick with low cobble content. Cobbles are angular concrete. Wooden stakes present. (MADE GROUND) | 1 |
|                                                                                    |               | 1.50                       | D       |         |           |           |                                                                                     |                                                                                                                                                                                                                                     |   |
|                                                                                    |               | 2.10                       | ES      |         |           |           |                                                                                     | <u>Horizontal timber beam</u>                                                                                                                                                                                                       | 2 |
|                                                                                    |               | 2.75                       | B       |         | 2.60      |           |  | Firm dark brown slightly sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded of sandstone. (GLACIAL TILL)                                                                                                           | 3 |
|                                                                                    |               | 3.75                       | B       |         | 3.50      |           |                                                                                     | End of Borehole at 3.500m                                                                                                                                                                                                           | 4 |
|                                                                                    |               |                            |         |         |           |           |                                                                                     |                                                                                                                                                                                                                                     | 5 |

| Dimensions |           | Trench Support and Comment |              |         | Pumping Data |      |         |
|------------|-----------|----------------------------|--------------|---------|--------------|------|---------|
| Pit Length | Pit Width | Pit Stability              | Shoring Used | Remarks | Date         | Rate | Remarks |
| 4.00       | 2.00      | Unstable                   | None         |         |              |      |         |

|                                                                                          |  |  |  |  |  |                                                                                  |  |
|------------------------------------------------------------------------------------------|--|--|--|--|--|----------------------------------------------------------------------------------|--|
| <b>Remarks</b><br>No groundwater encountered. Horizontal timber beam noted at 2.10m bgl. |  |  |  |  |  | GroundSolve Ltd<br>Unit 1 Well House Barns<br>Chester Road<br>Bretton<br>CH4 0DH |  |
|------------------------------------------------------------------------------------------|--|--|--|--|--|----------------------------------------------------------------------------------|--|

Project Name: Ruabon Business Park -  
Phase I & II

Client: Beech Developments

Date: 21/06/2023

Location: Ruabon

Contractor: Harvey Plant

Project No. : 2949

Crew Name: Thomas Plant

Equipment: JCB 3CX

Location Number  
TT05Location Type  
TP

Level

Logged By  
RPScale  
1:25Page Number  
Sheet 1 of 1

| Well | Water<br>Strikes | Sample and In Situ Testing |      |         | Depth<br>(m) | Level<br>(m) | Legend | Stratum Description                                                                                                                                 |   |
|------|------------------|----------------------------|------|---------|--------------|--------------|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------|---|
|      |                  | Depth (m)                  | Type | Results |              |              |        |                                                                                                                                                     |   |
|      |                  | 0.25                       | ES   |         | 0.15         |              |        | Dark brown slightly sandy very gravelly CLAY. Gravel is fine to medium angular to subangular of sandstone and brick.<br>(MADE GROUND)               |   |
|      |                  | 0.50                       | ES   |         |              |              |        | Very loose blackish brown clayey sandy angular to subangular fine to coarse GRAVEL of sandstone, concrete, clinker, coal and brick<br>(MADE GROUND) |   |
|      |                  | 0.90                       | D    |         |              |              |        |                                                                                                                                                     | 1 |
|      |                  | 1.00                       | ES   |         |              |              |        |                                                                                                                                                     |   |
|      |                  | 1.50                       | B    |         |              |              |        |                                                                                                                                                     |   |
|      |                  | 2.00                       | D    |         | 2.00         |              |        | Firm brown slightly sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded of sandstone.<br>(GLACIAL TILL)                             | 2 |
|      |                  | 2.00                       | ES   |         |              |              |        |                                                                                                                                                     |   |
|      |                  | 3.00                       | B    |         |              |              |        |                                                                                                                                                     | 3 |
|      |                  |                            |      |         | 3.50         |              |        | End of Borehole at 3.500m                                                                                                                           | 4 |
|      |                  |                            |      |         |              |              |        |                                                                                                                                                     | 5 |

## Dimensions

## Trench Support and Comment

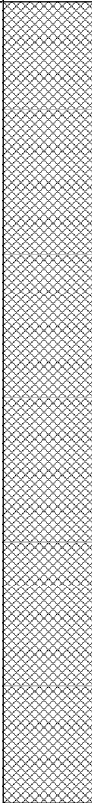
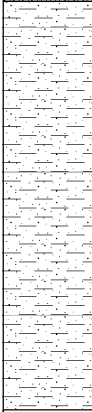
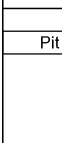
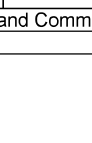
## Pumping Data

| Pit Length | Pit Width | Pit Stability | Shoring Used | Remarks | Date | Rate | Remarks |
|------------|-----------|---------------|--------------|---------|------|------|---------|
| 3.50       | 1.50      | Unstable      | None         |         |      |      |         |

## Remarks

No groundwater encountered.

|                                                   |                     |                            |                 |                    |                             |
|---------------------------------------------------|---------------------|----------------------------|-----------------|--------------------|-----------------------------|
| Project Name: Ruabon Business Park - Phase I & II |                     | Client: Beech Developments |                 | Date: 21/06/2023   |                             |
| Location: Ruabon                                  |                     | Contractor: Harvey Plant   |                 |                    |                             |
| Project No. : 2949                                |                     | Crew Name: Thomas Plant    |                 | Equipment: JCB 3CX |                             |
| Location Number<br>TT06                           | Location Type<br>TP | Level                      | Logged By<br>RP | Scale<br>1:25      | Page Number<br>Sheet 1 of 1 |

| Well                                                                                | Water Strikes | Sample and In Situ Testing |      |         | Depth (m) | Level (m) | Legend                                                                              | Stratum Description                                                                                                                     |   |
|-------------------------------------------------------------------------------------|---------------|----------------------------|------|---------|-----------|-----------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|---|
|                                                                                     |               | Depth (m)                  | Type | Results |           |           |                                                                                     |                                                                                                                                         |   |
|   |               | 0.25                       | ES   |         |           |           |   | Loose dark brown clayey sandy angular to subangular fine to coarse GRAVEL of sandstone, concrete, clinker, coal and brick (MADE GROUND) | 1 |
|                                                                                     |               | 0.40                       | ES   |         |           |           |                                                                                     |                                                                                                                                         |   |
|                                                                                     |               | 0.60                       | D    |         |           |           |                                                                                     |                                                                                                                                         |   |
|                                                                                     |               | 1.00                       | ES   |         |           |           |                                                                                     |                                                                                                                                         |   |
|                                                                                     |               | 1.50                       | B    |         |           |           |                                                                                     |                                                                                                                                         |   |
|                                                                                     |               | 2.00                       | ES   |         |           |           |                                                                                     |                                                                                                                                         |   |
|                                                                                     |               | 2.25                       | D    |         |           |           |                                                                                     |                                                                                                                                         |   |
|  |               |                            |      |         | 2.65      |           |  | Soft dark brown sandy slightly gravelly CLAY. Gravel is fine to medium subangular to subrounded of sandstone (GLACIAL TILL)             | 3 |
|                                                                                     |               | 3.50                       | B    |         |           |           |                                                                                     |                                                                                                                                         |   |
|  |               |                            |      |         | 4.00      |           |  | End of Borehole at 4.000m                                                                                                               | 4 |
|                                                                                     |               |                            |      |         |           |           |                                                                                     |                                                                                                                                         |   |
|  |               |                            |      |         |           |           |  |                                                                                                                                         | 5 |
|                                                                                     |               |                            |      |         |           |           |                                                                                     |                                                                                                                                         |   |

| Dimensions |           | Trench Support and Comment |              |         | Pumping Data |      |         |
|------------|-----------|----------------------------|--------------|---------|--------------|------|---------|
| Pit Length | Pit Width | Pit Stability              | Shoring Used | Remarks | Date         | Rate | Remarks |
| 3.50       | 1.50      | Unstable                   | None         |         |              |      |         |

|                                               |  |  |  |  |  |                                                                                  |  |
|-----------------------------------------------|--|--|--|--|--|----------------------------------------------------------------------------------|--|
| <b>Remarks</b><br>No groundwater encountered. |  |  |  |  |  | GroundSolve Ltd<br>Unit 1 Well House Barns<br>Chester Road<br>Bretton<br>CH4 0DH |  |
|-----------------------------------------------|--|--|--|--|--|----------------------------------------------------------------------------------|--|

|                                                   |                     |                            |                 |                    |                             |
|---------------------------------------------------|---------------------|----------------------------|-----------------|--------------------|-----------------------------|
| Project Name: Ruabon Business Park - Phase I & II |                     | Client: Beech Developments |                 | Date: 21/06/2023   |                             |
| Location: Ruabon                                  |                     | Contractor: Harvey Plant   |                 |                    |                             |
| Project No. : 2949                                |                     | Crew Name: Thomas Plant    |                 | Equipment: JCB 3CX |                             |
| Location Number<br>TT07                           | Location Type<br>TP | Level                      | Logged By<br>RP | Scale<br>1:25      | Page Number<br>Sheet 1 of 1 |

| Well                                                                               | Water Strikes | Sample and In Situ Testing |      |         | Depth (m) | Level (m) | Legend                                                                            | Stratum Description                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|------------------------------------------------------------------------------------|---------------|----------------------------|------|---------|-----------|-----------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                    |               | Depth (m)                  | Type | Results |           |           |                                                                                   |                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|  |               | 0.25                       | ES   |         | 0.20      |           |  | Dark brown slightly sandy very gravelly CLAY. Gravel is fine to medium angular to subangular of sandstone (MADE GROUND) | <div><div></div><div>1</div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div> |

| Dimensions |           | Trench Support and Comment |              |         | Pumping Data |      |         |
|------------|-----------|----------------------------|--------------|---------|--------------|------|---------|
| Pit Length | Pit Width | Pit Stability              | Shoring Used | Remarks | Date         | Rate | Remarks |
| 3.50       | 1.25      | Unstable                   | None         |         |              |      |         |

|                                               |  |  |  |  |  |                                                                                  |  |
|-----------------------------------------------|--|--|--|--|--|----------------------------------------------------------------------------------|--|
| <b>Remarks</b><br>No groundwater encountered. |  |  |  |  |  | GroundSolve Ltd<br>Unit 1 Well House Barns<br>Chester Road<br>Bretton<br>CH4 0DH |  |
|-----------------------------------------------|--|--|--|--|--|----------------------------------------------------------------------------------|--|

Project Name: Ruabon Business Park - Phase I & II

Client: Beech Developments

Date: 23/06/2023

Location: Ruabon

Contractor: Harvey Plant

Project No. : 2949

Crew Name: Regional Drilling

Drilling Equipment: Dando Terrier

Borehole Number  
WS01

Hole Type  
WLS

Level

Logged By  
RP

Scale  
1:25

Page Number  
Sheet 1 of 1

| Well                                                                               | Water Strikes | Sample and In Situ Testing |           |                             | Depth (m) | Level (m) | Legend | Stratum Description                                                                                                                                                                         |   |
|------------------------------------------------------------------------------------|---------------|----------------------------|-----------|-----------------------------|-----------|-----------|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|                                                                                    |               | Depth (m)                  | Type      | Results                     |           |           |        |                                                                                                                                                                                             |   |
|  |               | 0.25                       | ES        |                             |           |           |        | Dense dark blackish brown slightly clayey very sandy fine to medium GRAVEL of sandstone, brick, ash, clinker and concrete (MADE GROUND)                                                     | 1 |
|                                                                                    |               | 0.50                       | ES        |                             |           |           |        |                                                                                                                                                                                             |   |
|                                                                                    |               | 0.75                       | D         |                             |           |           |        |                                                                                                                                                                                             |   |
|                                                                                    |               | 1.00<br>1.00               | ES<br>SPT | N=31 (3,3/3,7,11,10)        |           |           |        |                                                                                                                                                                                             |   |
|                                                                                    |               | 1.50                       | D         |                             | 1.75      |           |        | Firm dark brown sandy slightly gravelly CLAY. Gravel is fine to medium subangular to subrounded of sandstone (GLACIAL TILL - WEATHERED)                                                     | 2 |
|                                                                                    |               | 2.00                       | SPT       | N=12 (2,2/2,3,3,4)          | 2.50      |           |        |                                                                                                                                                                                             |   |
|                                                                                    |               | 3.00                       | SPT       | N=36 (5,9/6,7,11,12)        |           |           |        | Stiff greyish brown sandy slightly gravelly CLAY. Gravel is fine to medium subangular to subrounded of sandstone. (GLACIAL TILL)<br><i>Grey fine to medium angular to subangular gravel</i> | 3 |
|                                                                                    |               | 3.50                       | D         |                             |           |           |        |                                                                                                                                                                                             |   |
|                                                                                    |               | 4.00                       | SPT       | 50 (25 for 5mm/50 for 10mm) | 4.00      |           |        | End of Borehole at 4.000m                                                                                                                                                                   | 4 |
|                                                                                    |               |                            |           |                             |           |           |        |                                                                                                                                                                                             |   |

| Hole Diameter |          | Casing Diameter |          | Chiselling |            |          |      | Inclination and Orientation |            |             |             |
|---------------|----------|-----------------|----------|------------|------------|----------|------|-----------------------------|------------|-------------|-------------|
| Depth Base    | Diameter | Depth Base      | Diameter | Depth Top  | Depth Base | Duration | Tool | Depth Top                   | Depth Base | Inclination | Orientation |
| 1.00          | 100      |                 |          |            |            |          |      |                             |            |             |             |
| 2.00          | 92       |                 |          |            |            |          |      |                             |            |             |             |
| 3.00          | 79       |                 |          |            |            |          |      |                             |            |             |             |
| 4.00          | 70       |                 |          |            |            |          |      |                             |            |             |             |

**Remarks**  
Terminated due to SPT refusal. No groundwater encountered.

GroundSolve Ltd  
Unit 1 Well House Barns  
Chester Road  
Bretton  
CH4 0DH

Page Number  
Sheet 1 of 1

GroundSolve Ltd  
Unit 1 Well House Barns  
Chester Road  
Bretton  
CH4 0DH

Project Name: Ruabon Business Park -  
Phase I & II

Client: Beech Developments

Date: 23/06/2023

Location: Ruabon

Contractor: Harvey Plant

Project No. : 2949

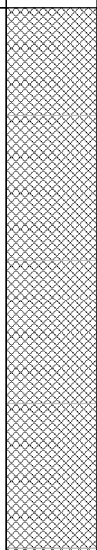
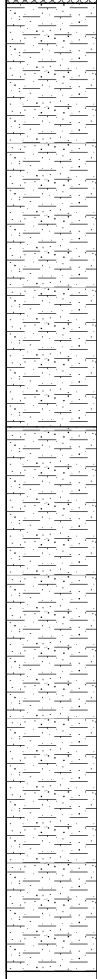
Crew Name: Regional Drilling

Drilling Equipment: Dando Terrier

Borehole Number  
WS03Hole Type  
WLS

Level

Logged By  
RPScale  
1:25Page Number  
Sheet 1 of 1

| Well                                                                               | Water Strikes                                                                      | Sample and In Situ Testing |      |                     | Depth (m) | Level (m) | Legend                                                                             | Stratum Description                                                                                                                                     |   |
|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|----------------------------|------|---------------------|-----------|-----------|------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|                                                                                    |                                                                                    | Depth (m)                  | Type | Results             |           |           |                                                                                    |                                                                                                                                                         |   |
|  |  | 0.25                       | ES   |                     |           |           |   | Medium dense dark brown slightly clayey sandy angular to subangular fine to coarse gravel of sandstone, concrete, brick, clinker and coal (MADE GROUND) | 1 |
|                                                                                    |                                                                                    | 0.50                       | ES   |                     |           |           |                                                                                    |                                                                                                                                                         |   |
|                                                                                    |                                                                                    | 0.60                       | D    |                     |           |           |                                                                                    |                                                                                                                                                         |   |
|                                                                                    |                                                                                    | 1.00                       | ES   |                     |           |           |  | Firm dark brownish black sandy slightly gravelly CLAY. Gravel is fine to medium subangular to subrounded of sandstone (GLACIAL TILL - WEATHERED)        | 2 |
|                                                                                    |                                                                                    | 1.00                       | SPT  | N=15 (3,4/3,4,4,4)  |           |           |                                                                                    |                                                                                                                                                         |   |
|                                                                                    |                                                                                    |                            |      |                     | 1.80      |           |                                                                                    |                                                                                                                                                         |   |
|                                                                                    |                                                                                    | 2.00                       | SPT  | N=10 (1,1/2,2,2,4)  |           |           |                                                                                    |                                                                                                                                                         |   |
|                                                                                    |                                                                                    | 2.50                       | D    |                     |           |           |                                                                                    |                                                                                                                                                         |   |
|                                                                                    |                                                                                    | 3.00                       | SPT  | N=13 (2,2/2,3,3,5)  |           |           |                                                                                    |                                                                                                                                                         |   |
|                                                                                    |                                                                                    |                            |      |                     | 3.20      |           |                                                                                    |                                                                                                                                                         |   |
|                                                                                    |                                                                                    | 4.00                       | SPT  | N=23 (4,5/4,5,7,7)  |           |           |                                                                                    | Stiff brown sandy slightly gravelly CLAY. Gravel is fine to medium subangular to subrounded of sandstone (GLACIAL TILL)                                 | 4 |
|                                                                                    |                                                                                    | 4.20                       | D    |                     |           |           |                                                                                    |                                                                                                                                                         |   |
|                                                                                    |                                                                                    | 4.50                       | D    |                     |           |           |                                                                                    |                                                                                                                                                         |   |
|                                                                                    |                                                                                    | 5.00                       | SPT  | N=29 (2,3/5,5,7,12) | 5.00      |           |                                                                                    | End of Borehole at 5.000m                                                                                                                               | 5 |

| Hole Diameter |          | Casing Diameter |          | Chiselling |            |          |      | Inclination and Orientation |            |             |             |
|---------------|----------|-----------------|----------|------------|------------|----------|------|-----------------------------|------------|-------------|-------------|
| Depth Base    | Diameter | Depth Base      | Diameter | Depth Top  | Depth Base | Duration | Tool | Depth Top                   | Depth Base | Inclination | Orientation |
| 1.00          | 100      |                 |          |            |            |          |      |                             |            |             |             |
| 2.00          | 92       |                 |          |            |            |          |      |                             |            |             |             |
| 3.00          | 79       |                 |          |            |            |          |      |                             |            |             |             |
| 4.00          | 70       |                 |          |            |            |          |      |                             |            |             |             |
| 5.00          | 64       |                 |          |            |            |          |      |                             |            |             |             |

## Remarks

Groundwater encountered at 2.00m bgl.



Date: 23/06/2023

Contractor: Harvey Plant

### Drilling Equipment: Dando Terrier

Page Number  
Sheet 1 of 1

GroundSolve Ltd  
Unit 1 Well House Barns  
Chester Road  
Bretton  
CH4 0DH



Page Number  
Sheet 1 of 1

|                                                            |                                                                                  |
|------------------------------------------------------------|----------------------------------------------------------------------------------|
| Remarks                                                    | GroundSolve Ltd<br>Unit 1 Well House Barns<br>Chester Road<br>Bretton<br>CH4 0DH |
| Terminated due to SPT refusal. No groundwater encountered. |                                                                                  |

Date: 09/09/2020

Contractor: Harvey Plant

Drilling Equipment: Dando Terrier

Page Number  
Sheet 1 of 2

GroundSolve Ltd  
Unit 1 Well House Barns  
Chester Road  
Bretton  
CH4 0DH

Project Name: Ruabon Business Park -  
Phase I & II

Client: Beech Developments

Date: 09/09/2020

Location: Ruabon

Contractor: Harvey Plant

Project No. : 2949

Crew Name: Regional Drilling

Drilling Equipment: Dando Terrier

Borehole Number  
WS1Hole Type  
WLS

Level

Logged By  
ABScale  
1:25Page Number  
Sheet 2 of 2

| Well                  | Water Strikes | Sample and In Situ Testing |          |                         | Depth (m)  | Level (m) | Legend | Stratum Description                                           |                           |                                                                                  |             |
|-----------------------|---------------|----------------------------|----------|-------------------------|------------|-----------|--------|---------------------------------------------------------------|---------------------------|----------------------------------------------------------------------------------|-------------|
|                       |               | Depth (m)                  | Type     | Results                 |            |           |        |                                                               |                           |                                                                                  |             |
|                       |               | 5.00                       | SPT      | N=50 (0,0/50 for 297mm) | 5.42       |           |        | Very Stiff light greyish brown very sandy CLAY (GLACIAL TILL) |                           |                                                                                  |             |
|                       |               |                            |          |                         |            |           |        |                                                               | End of Borehole at 5.420m |                                                                                  |             |
|                       |               |                            |          |                         |            |           |        |                                                               | 6                         |                                                                                  |             |
|                       |               |                            |          |                         |            |           |        |                                                               | 7                         |                                                                                  |             |
|                       |               |                            |          |                         |            |           |        |                                                               | 8                         |                                                                                  |             |
|                       |               |                            |          |                         |            |           |        |                                                               | 9                         |                                                                                  |             |
|                       |               |                            |          |                         |            |           |        |                                                               | 10                        |                                                                                  |             |
| Hole Diameter         |               | Casing Diameter            |          | Chiselling              |            |           |        | Inclination and Orientation                                   |                           |                                                                                  |             |
| Depth Base            | Diameter      | Depth Base                 | Diameter | Depth Top               | Depth Base | Duration  | Tool   | Depth Top                                                     | Depth Base                | Inclination                                                                      | Orientation |
|                       |               |                            |          |                         |            |           |        |                                                               |                           |                                                                                  |             |
| Remarks               |               |                            |          |                         |            |           |        |                                                               |                           | GroundSolve Ltd<br>Unit 1 Well House Barns<br>Chester Road<br>Bretton<br>CH4 0DH |             |
| Water strike at 1.00m |               |                            |          |                         |            |           |        |                                                               |                           |                                                                                  |             |

Project Name: Ruabon Business Park -  
Phase I & II

Client: Beech Developments

Date: 09/09/2020

Location: Ruabon

Contractor: Harvey Plant

Project No. : 2949

Crew Name: Regional Drilling

Drilling Equipment: Dando Terrier

Borehole Number  
WS10Hole Type  
WLS

Level

Logged By  
ABScale  
1:25Page Number  
Sheet 1 of 1

| Well                  | Water Strikes | Sample and In Situ Testing |          |                       | Depth (m)  | Level (m) | Legend | Stratum Description                                                                                                             |            |                                                                                  |             |
|-----------------------|---------------|----------------------------|----------|-----------------------|------------|-----------|--------|---------------------------------------------------------------------------------------------------------------------------------|------------|----------------------------------------------------------------------------------|-------------|
|                       |               | Depth (m)                  | Type     | Results               |            |           |        |                                                                                                                                 |            |                                                                                  |             |
|                       |               | 1.00                       | SPT      | N=37 (0,0/0,0,0,37)   | 1.70       |           |        | Grass over dense dark brown sandy gravelly SILT. Gravel is fine to medium sub-angular of brick and mudstone (MADE GROUND)       | 1          |                                                                                  |             |
|                       |               | 2.00                       | SPT      | N=42 (0,0/0,0,0,42)   |            |           |        | Very stiff dark grey sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mudstone (GLACIAL TILL) | 2          |                                                                                  |             |
|                       |               | 3.00                       | SPT      | N=39 (0,0/0,0,0,39)   | 3.00       |           |        | Very stiff grey slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of sandstone (GLACIAL TILL)           | 3          |                                                                                  |             |
|                       |               | 3.60                       | SPT      | 50 (0,0/50 for 120mm) | 3.72       |           |        | End of Borehole at 3.720m                                                                                                       | 4          |                                                                                  |             |
|                       |               |                            |          |                       |            |           |        |                                                                                                                                 | 5          |                                                                                  |             |
| Hole Diameter         |               | Casing Diameter            |          | Chiselling            |            |           |        | Inclination and Orientation                                                                                                     |            |                                                                                  |             |
| Depth Base            | Diameter      | Depth Base                 | Diameter | Depth Top             | Depth Base | Duration  | Tool   | Depth Top                                                                                                                       | Depth Base | Inclination                                                                      | Orientation |
|                       |               |                            |          |                       |            |           |        |                                                                                                                                 |            |                                                                                  |             |
| Remarks               |               |                            |          |                       |            |           |        |                                                                                                                                 |            | GroundSolve Ltd<br>Unit 1 Well House Barns<br>Chester Road<br>Bretton<br>CH4 0DH |             |
| Water strike at 1.70m |               |                            |          |                       |            |           |        |                                                                                                                                 |            |                                                                                  |             |

Project Name: Ruabon Business Park -  
Phase I & II

Client: Beech Developments

Date: 09/09/2020

Location: Ruabon

Contractor: Harvey Plant

Project No. : 2949

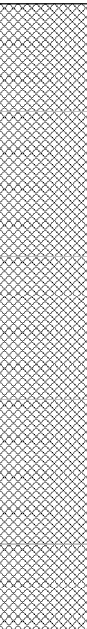
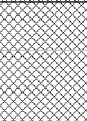
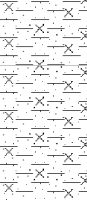
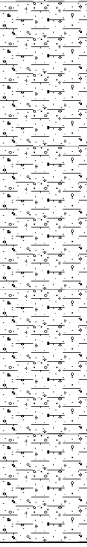
Crew Name: Regional Drilling

Drilling Equipment: Dando Terrier

Borehole Number  
WS2Hole Type  
WLS

Level

Logged By  
TGScale  
1:25Page Number  
Sheet 1 of 2

| Well                                                                               | Water Strikes                                                                      | Sample and In Situ Testing |          |                     | Depth (m)  | Level (m) | Legend                                                                              | Stratum Description                                                                                                  |            |                                                                                  |             |
|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|----------------------------|----------|---------------------|------------|-----------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|------------|----------------------------------------------------------------------------------|-------------|
|                                                                                    |                                                                                    | Depth (m)                  | Type     | Results             |            |           |                                                                                     |                                                                                                                      |            |                                                                                  |             |
|  |  | 1.00                       | SPT      | N=10 (0,0/0,0,0,10) | 2.10       |           |   | Medium dense black sandy angular to subangular fine to coarse GRAVEL of mudstone and burnt shale (MADE GROUND)       | 1          |                                                                                  |             |
|                                                                                    |                                                                                    | 2.00                       | SPT      | N=10 (0,0/0,0,0,10) |            |           |  | Firm black slightly sandy gravelly CLAY. Gravel is angular to subangular fine to coarse of burnt shale (MADE GROUND) | 2          |                                                                                  |             |
|                                                                                    |                                                                                    | 3.00                       | SPT      | N=12 (0,0/0,0,0,12) | 2.50       |           |  | Firm grey silty sandy CLAY (GLACIAL TILL - WEATHERED)                                                                | 3          |                                                                                  |             |
|                                                                                    |                                                                                    | 4.00                       | SPT      | N=27 (0,0/0,0,0,27) | 3.20       |           |  | Stiff brown sandy gravelly CLAY (GLACIAL TILL)                                                                       | 4          |                                                                                  |             |
|                                                                                    |                                                                                    | 5.00                       | SPT      | N=23 (0,0/0,0,0,23) |            |           |                                                                                     |                                                                                                                      |            | 5                                                                                |             |
| Hole Diameter                                                                      |                                                                                    | Casing Diameter            |          | Chiselling          |            |           |                                                                                     | Inclination and Orientation                                                                                          |            |                                                                                  |             |
| Depth Base                                                                         | Diameter                                                                           | Depth Base                 | Diameter | Depth Top           | Depth Base | Duration  | Tool                                                                                | Depth Top                                                                                                            | Depth Base | Inclination                                                                      | Orientation |
|                                                                                    |                                                                                    |                            |          |                     |            |           |                                                                                     |                                                                                                                      |            |                                                                                  |             |
| Remarks                                                                            |                                                                                    |                            |          |                     |            |           |                                                                                     |                                                                                                                      |            | GroundSolve Ltd<br>Unit 1 Well House Barns<br>Chester Road<br>Bretton<br>CH4 0DH |             |
| Water strike at 2.00m                                                              |                                                                                    |                            |          |                     |            |           |                                                                                     |                                                                                                                      |            |                                                                                  |             |

|                                                   |                  |                              |                 |                                   |                             |
|---------------------------------------------------|------------------|------------------------------|-----------------|-----------------------------------|-----------------------------|
| Project Name: Ruabon Business Park - Phase I & II |                  | Client: Beech Developments   |                 | Date: 09/09/2020                  |                             |
| Location: Ruabon                                  |                  | Contractor: Harvey Plant     |                 |                                   |                             |
| Project No. : 2949                                |                  | Crew Name: Regional Drilling |                 | Drilling Equipment: Dando Terrier |                             |
| Borehole Number<br>WS2                            | Hole Type<br>WLS | Level                        | Logged By<br>TG | Scale<br>1:25                     | Page Number<br>Sheet 2 of 2 |

| Well | Water Strikes | Sample and In Situ Testing |      |         | Depth (m) | Level (m) | Legend | Stratum Description                            |    |
|------|---------------|----------------------------|------|---------|-----------|-----------|--------|------------------------------------------------|----|
|      |               | Depth (m)                  | Type | Results |           |           |        |                                                |    |
|      |               |                            |      |         | 5.45      |           |        | Stiff brown sandy gravelly CLAY (GLACIAL TILL) |    |
|      |               |                            |      |         |           |           |        | End of Borehole at 5.450m                      |    |
|      |               |                            |      |         |           |           |        |                                                | 6  |
|      |               |                            |      |         |           |           |        |                                                | 7  |
|      |               |                            |      |         |           |           |        |                                                | 8  |
|      |               |                            |      |         |           |           |        |                                                | 9  |
|      |               |                            |      |         |           |           |        |                                                | 10 |

| Hole Diameter |          | Casing Diameter |          | Chiselling |            |          |      | Inclination and Orientation |            |             |             |
|---------------|----------|-----------------|----------|------------|------------|----------|------|-----------------------------|------------|-------------|-------------|
| Depth Base    | Diameter | Depth Base      | Diameter | Depth Top  | Depth Base | Duration | Tool | Depth Top                   | Depth Base | Inclination | Orientation |
|               |          |                 |          |            |            |          |      |                             |            |             |             |

|                                         |  |  |  |  |  |  |  |  |  |                                                                                  |
|-----------------------------------------|--|--|--|--|--|--|--|--|--|----------------------------------------------------------------------------------|
| <b>Remarks</b><br>Water strike at 2.00m |  |  |  |  |  |  |  |  |  | GroundSolve Ltd<br>Unit 1 Well House Barns<br>Chester Road<br>Bretton<br>CH4 0DH |
|-----------------------------------------|--|--|--|--|--|--|--|--|--|----------------------------------------------------------------------------------|

Project Name: Ruabon Business Park -  
Phase I & II

Client: Beech Developments

Date: 09/09/2020

Location: Ruabon

Contractor: Harvey Plant

Project No. : 2949

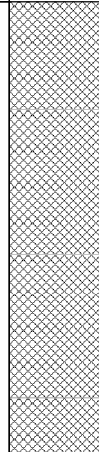
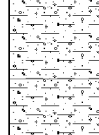
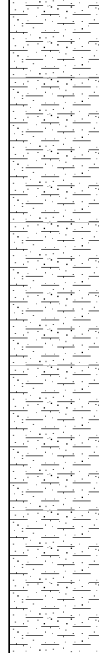
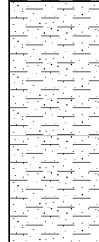
Crew Name: Regional Drilling

Drilling Equipment: Dando Terrier

Borehole Number  
WS3Hole Type  
WLS

Level

Logged By  
ABScale  
1:25Page Number  
Sheet 1 of 2

| Well                                                                               | Water Strikes                                                                     | Sample and In Situ Testing         |          |                     | Depth (m)  | Level (m) | Legend                                                                              | Stratum Description                                                                                                                 |                                                                                                                 |                                                                                  |             |
|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------|----------|---------------------|------------|-----------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|-------------|
|                                                                                    |                                                                                   | Depth (m)                          | Type     | Results             |            |           |                                                                                     |                                                                                                                                     |                                                                                                                 |                                                                                  |             |
|  |  | 1.00                               | SPT      | N=13 (0,0/0,0,0,13) | 1.50       |           |    | Grass over medium dense dark brown slightly gravelly SAND. Gravel is fine to medium sub-angular of brick and mudstone (MADE GROUND) | 1                                                                                                               |                                                                                  |             |
|                                                                                    |                                                                                   | 2.00                               | SPT      | N=14 (0,0/0,0,0,14) |            |           | 2.00                                                                                |                                                    | Very stiff black sandy gravelly CLAY. Gravel is angular to subangular fine to coarse of mudstone (GLACIAL TILL) | 2                                                                                |             |
|                                                                                    |                                                                                   | 3.00                               | SPT      | N=25 (0,0/0,0,0,25) | 4.20       |           |  | Firm greyish brown sandy CLAY (GLACIAL TILL)                                                                                        | 3                                                                                                               |                                                                                  |             |
|                                                                                    |                                                                                   | <i>At 3.00m becomes very stiff</i> |          |                     |            |           |                                                                                     |                                                                                                                                     |                                                                                                                 |                                                                                  |             |
|                                                                                    |                                                                                   | 4.00                               | SPT      | N=39 (0,0/0,0,0,39) |            |           |                                                                                     |                                                                                                                                     |                                                                                                                 |                                                                                  |             |
|                                                                                    |                                                                                   | 5.00                               | SPT      | N=31 (0,0/0,0,0,31) |            |           |  | Very stiff dark brown slightly sandy gravelly CLAY. Gravel is angular to subrounded fine to coarse of mudstone (GLACIAL TILL)       | 5                                                                                                               |                                                                                  |             |
| Hole Diameter                                                                      |                                                                                   | Casing Diameter                    |          | Chiselling          |            |           |                                                                                     | Inclination and Orientation                                                                                                         |                                                                                                                 |                                                                                  |             |
| Depth Base                                                                         | Diameter                                                                          | Depth Base                         | Diameter | Depth Top           | Depth Base | Duration  | Tool                                                                                | Depth Top                                                                                                                           | Depth Base                                                                                                      | Inclination                                                                      | Orientation |
|                                                                                    |                                                                                   |                                    |          |                     |            |           |                                                                                     |                                                                                                                                     |                                                                                                                 |                                                                                  |             |
| Remarks                                                                            |                                                                                   |                                    |          |                     |            |           |                                                                                     |                                                                                                                                     |                                                                                                                 | GroundSolve Ltd<br>Unit 1 Well House Barns<br>Chester Road<br>Bretton<br>CH4 0DH |             |
| Water strike at 1.50m                                                              |                                                                                   |                                    |          |                     |            |           |                                                                                     |                                                                                                                                     |                                                                                                                 |                                                                                  |             |

|                                                   |                  |                              |                 |                                   |                             |
|---------------------------------------------------|------------------|------------------------------|-----------------|-----------------------------------|-----------------------------|
| Project Name: Ruabon Business Park - Phase I & II |                  | Client: Beech Developments   |                 | Date: 09/09/2020                  |                             |
| Location: Ruabon                                  |                  | Contractor: Harvey Plant     |                 |                                   |                             |
| Project No. : 2949                                |                  | Crew Name: Regional Drilling |                 | Drilling Equipment: Dando Terrier |                             |
| Borehole Number<br>WS3                            | Hole Type<br>WLS | Level                        | Logged By<br>AB | Scale<br>1:25                     | Page Number<br>Sheet 2 of 2 |

| Well | Water Strikes | Sample and In Situ Testing |      |         | Depth (m) | Level (m) | Legend | Stratum Description                                                                                                           |    |
|------|---------------|----------------------------|------|---------|-----------|-----------|--------|-------------------------------------------------------------------------------------------------------------------------------|----|
|      |               | Depth (m)                  | Type | Results |           |           |        |                                                                                                                               |    |
|      |               |                            |      |         | 5.45      |           |        | Very stiff dark brown slightly sandy gravelly CLAY. Gravel is angular to subrounded fine to coarse of mudstone (GLACIAL TILL) |    |
|      |               |                            |      |         |           |           |        | End of Borehole at 5.450m                                                                                                     |    |
|      |               |                            |      |         |           |           |        |                                                                                                                               | 6  |
|      |               |                            |      |         |           |           |        |                                                                                                                               | 7  |
|      |               |                            |      |         |           |           |        |                                                                                                                               | 8  |
|      |               |                            |      |         |           |           |        |                                                                                                                               | 9  |
|      |               |                            |      |         |           |           |        |                                                                                                                               | 10 |

| Hole Diameter |          | Casing Diameter |          | Chiselling |            |          |      | Inclination and Orientation |            |             |             |
|---------------|----------|-----------------|----------|------------|------------|----------|------|-----------------------------|------------|-------------|-------------|
| Depth Base    | Diameter | Depth Base      | Diameter | Depth Top  | Depth Base | Duration | Tool | Depth Top                   | Depth Base | Inclination | Orientation |
|               |          |                 |          |            |            |          |      |                             |            |             |             |

|                                         |  |  |  |  |  |  |  |  |  |                                                                                  |
|-----------------------------------------|--|--|--|--|--|--|--|--|--|----------------------------------------------------------------------------------|
| <b>Remarks</b><br>Water strike at 1.50m |  |  |  |  |  |  |  |  |  | GroundSolve Ltd<br>Unit 1 Well House Barns<br>Chester Road<br>Bretton<br>CH4 0DH |
|-----------------------------------------|--|--|--|--|--|--|--|--|--|----------------------------------------------------------------------------------|



Project Name: Ruabon Business Park -  
Phase I & II

Client: Beech Developments

Date: 09/09/2020

Location: Ruabon

Contractor: Harvey Plant

Project No. : 2949

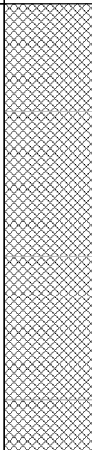
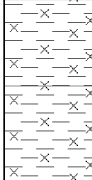
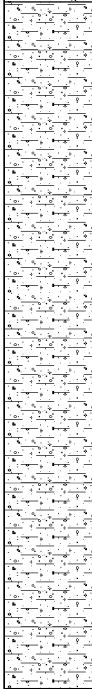
Crew Name: Regional Drilling

Drilling Equipment: Dando Terrier

Borehole Number  
WS4Hole Type  
WLS

Level

Logged By  
TGScale  
1:25Page Number  
Sheet 1 of 1

| Well                                                                               | Water Strikes                                                                     | Sample and In Situ Testing |          |                         | Depth (m)  | Level (m) | Legend                                                                              | Stratum Description                                                                                                           |            |                                                                                  |             |
|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|----------------------------|----------|-------------------------|------------|-----------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|------------|----------------------------------------------------------------------------------|-------------|
|                                                                                    |                                                                                   | Depth (m)                  | Type     | Results                 |            |           |                                                                                     |                                                                                                                               |            |                                                                                  |             |
|  |  | 1.00                       | SPT      | N=8 (0,0/0,0,0,8)       | 1.50       |           |    | Loose reddish brown to light brown sandy angular to subangular fine to coarse GRAVEL of mudstoneand burnt shale (MADE GROUND) | 1          |                                                                                  |             |
|                                                                                    |                                                                                   | 2.00                       | SPT      | N=8 (0,0/0,0,0,8)       |            |           |   | Firm black to grey silty CLAY (GLACIAL TILL - WEATHERED)                                                                      | 2          |                                                                                  |             |
|                                                                                    |                                                                                   | 3.00                       | SPT      | N=6 (0,0/0,0,0,6)       | 2.10       |           |  | Soft greyish brown sandy gravelly CLAY. Gravel is subrounded to rounded fine to coarse of sandstone (GLACIAL TILL)            | 3          |                                                                                  |             |
|                                                                                    |                                                                                   | 4.00                       | SPT      | N=50 (0,0/50 for 292mm) |            |           | <i>At 4.00m becomes very stiff</i>                                                  | 4                                                                                                                             |            |                                                                                  |             |
|                                                                                    |                                                                                   |                            |          |                         | 4.37       |           |                                                                                     | End of Borehole at 4.370m                                                                                                     | 5          |                                                                                  |             |
| Hole Diameter                                                                      |                                                                                   | Casing Diameter            |          | Chiselling              |            |           |                                                                                     | Inclination and Orientation                                                                                                   |            |                                                                                  |             |
| Depth Base                                                                         | Diameter                                                                          | Depth Base                 | Diameter | Depth Top               | Depth Base | Duration  | Tool                                                                                | Depth Top                                                                                                                     | Depth Base | Inclination                                                                      | Orientation |
|                                                                                    |                                                                                   |                            |          |                         |            |           |                                                                                     |                                                                                                                               |            |                                                                                  |             |
| Remarks                                                                            |                                                                                   |                            |          |                         |            |           |                                                                                     |                                                                                                                               |            | GroundSolve Ltd<br>Unit 1 Well House Barns<br>Chester Road<br>Bretton<br>CH4 0DH |             |
| Water strike at 1.50m                                                              |                                                                                   |                            |          |                         |            |           |                                                                                     |                                                                                                                               |            |                                                                                  |             |

Project Name: Ruabon Business Park -  
Phase I & II

Client: Beech Developments

Date: 09/09/2020

Location: Ruabon

Contractor: Harvey Plant

Project No. : 2949

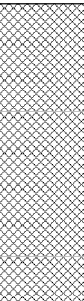
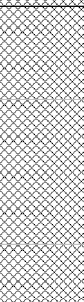
Crew Name: Regional Drilling

Drilling Equipment: Dando Terrier

Borehole Number  
WS5Hole Type  
WLS

Level

Logged By  
ABScale  
1:25Page Number  
Sheet 1 of 2

| Well                  | Water Strikes                                                                     | Sample and In Situ Testing |          |                     | Depth (m)  | Level (m) | Legend                                                                              | Stratum Description                                                                                                 |                                               |                                                                                  |             |
|-----------------------|-----------------------------------------------------------------------------------|----------------------------|----------|---------------------|------------|-----------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|----------------------------------------------------------------------------------|-------------|
|                       |                                                                                   | Depth (m)                  | Type     | Results             |            |           |                                                                                     |                                                                                                                     |                                               |                                                                                  |             |
|                       |  | 1.00                       | SPT      | N=31 (0,0/0,0,0,31) | 1.00       |           |    | Grass over dark brown sandy gravelly SILT. Gravel is fine to medium sub-angular of brick and mudstone (MADE GROUND) | 1                                             |                                                                                  |             |
|                       |                                                                                   | 2.00                       | SPT      | N=3 (0,0/0,0,0,3)   | 2.00       |           |    | Very stiff black sandy gravelly CLAY. Gravel is angular to subangular fine to coarse of mudstone (MADE GROUND)      | 2                                             |                                                                                  |             |
|                       |                                                                                   | 3.00                       | SPT      | N=14 (0,0/0,0,0,14) |            |           |   | Soft greyish brown sandy CLAY (GLACIAL TILL - WEATHERED)                                                            | 3                                             |                                                                                  |             |
|                       |                                                                                   | 4.00                       | SPT      | N=40 (0,0/0,0,0,40) | 4.00       |           |  | At 3.00m becomes firm                                                                                               | 4                                             |                                                                                  |             |
|                       |                                                                                   |                            |          |                     |            |           |                                                                                     |                                  | Stiff greyish brown sandy CLAY (GLACIAL TILL) | 5                                                                                |             |
| Hole Diameter         |                                                                                   | Casing Diameter            |          | Chiselling          |            |           |                                                                                     | Inclination and Orientation                                                                                         |                                               |                                                                                  |             |
| Depth Base            | Diameter                                                                          | Depth Base                 | Diameter | Depth Top           | Depth Base | Duration  | Tool                                                                                | Depth Top                                                                                                           | Depth Base                                    | Inclination                                                                      | Orientation |
|                       |                                                                                   |                            |          |                     |            |           |                                                                                     |                                                                                                                     |                                               |                                                                                  |             |
| Remarks               |                                                                                   |                            |          |                     |            |           |                                                                                     |                                                                                                                     |                                               | GroundSolve Ltd<br>Unit 1 Well House Barns<br>Chester Road<br>Bretton<br>CH4 0DH |             |
| Water strike at 1.00m |                                                                                   |                            |          |                     |            |           |                                                                                     |                                                                                                                     |                                               |                                                                                  |             |



Date: 09/09/2020

Contractor: Harvey Plant

### Drilling Equipment: Dando Terrier

Page Number  
Sheet 2 of 2[illegible]

GroundSolve Ltd  
Unit 1 Well House Barns  
Chester Road  
Bretton  
CH4 0DH

Project Name: Ruabon Business Park -  
Phase I & II

Client: Beech Developments

Date: 09/09/2020

Location: Ruabon

Contractor: Harvey Plant

Project No. : 2949

Crew Name: Regional Drilling

Drilling Equipment: Dando Terrier

Borehole Number  
WS6Hole Type  
WLS

Level

Logged By  
TGScale  
1:25Page Number  
Sheet 1 of 1

| Well                  | Water Strikes | Sample and In Situ Testing |          |                         | Depth (m)  | Level (m) | Legend                                     | Stratum Description                                                                                             |                           |                                                                                  |             |
|-----------------------|---------------|----------------------------|----------|-------------------------|------------|-----------|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------|---------------------------|----------------------------------------------------------------------------------|-------------|
|                       |               | Depth (m)                  | Type     | Results                 |            |           |                                            |                                                                                                                 |                           |                                                                                  |             |
|                       |               | 1.00                       | SPT      | N=14 (0,0/0,0,0,14)     | 1.90       |           |                                            | Medium dense black sandy6 angular to subangular fine to coarse GRAVEL of mudstone and burnt shale (MADE GROUND) | 1                         |                                                                                  |             |
|                       |               | 2.00                       | SPT      | N=7 (0,0/0,0,0,7)       |            |           |                                            | Firm to stiff brown silty sandy CLAY (GLACIAL TILL - WEATHERED)                                                 | 2                         |                                                                                  |             |
|                       |               | 3.00                       | SPT      | N=30 (0,0/0,0,0,30)     | 3.00       |           | No Recovery - Possibly sand (GLACIAL TILL) | 3                                                                                                               |                           |                                                                                  |             |
|                       |               | 4.00                       | SPT      | N=50 (0,0/50 for 296mm) | 4.41       |           |                                            |                                                                                                                 | 4                         |                                                                                  |             |
|                       |               |                            |          |                         |            |           |                                            |                                                                                                                 | End of Borehole at 4.410m | 5                                                                                |             |
| Hole Diameter         |               | Casing Diameter            |          | Chiselling              |            |           |                                            | Inclination and Orientation                                                                                     |                           |                                                                                  |             |
| Depth Base            | Diameter      | Depth Base                 | Diameter | Depth Top               | Depth Base | Duration  | Tool                                       | Depth Top                                                                                                       | Depth Base                | Inclination                                                                      | Orientation |
|                       |               |                            |          |                         |            |           |                                            |                                                                                                                 |                           |                                                                                  |             |
| Remarks               |               |                            |          |                         |            |           |                                            |                                                                                                                 |                           | GroundSolve Ltd<br>Unit 1 Well House Barns<br>Chester Road<br>Bretton<br>CH4 0DH |             |
| Water strike at 1.80m |               |                            |          |                         |            |           |                                            |                                                                                                                 |                           |                                                                                  |             |

Project Name: Ruabon Business Park -  
Phase I & II

Client: Beech Developments

Date: 09/09/2020

Location: Ruabon

Contractor: Harvey Plant

Project No. : 2949

Crew Name: Regional Drilling

Drilling Equipment: Dando Terrier

Borehole Number  
WS7Hole Type  
WLS

Level

Logged By  
ABScale  
1:25Page Number  
Sheet 1 of 2

| Well                  | Water Strikes | Sample and In Situ Testing |          |                     | Depth (m)  | Level (m) | Legend                                                                                                                           | Stratum Description         |            |                                                                                 |             |
|-----------------------|---------------|----------------------------|----------|---------------------|------------|-----------|----------------------------------------------------------------------------------------------------------------------------------|-----------------------------|------------|---------------------------------------------------------------------------------|-------------|
|                       |               | Depth (m)                  | Type     | Results             |            |           |                                                                                                                                  |                             |            |                                                                                 |             |
|                       |               | 1.00                       | SPT      | N=33 (0,0/0,0,0,33) | 1.50       |           | Grass over dense dark brown sandy gravelly SILT. Gravel is fine to medium sub-angular of brick and mudstone (MADE GROUND)        | 1                           |            |                                                                                 |             |
|                       |               | 2.00                       | SPT      | N=3 (0,0/0,0,0,3)   |            |           | Very soft grey sandy slightly gravelly CLAY. Gravel is fine to coarse of mudstone (GLACIAL TILL - WEATHERED)                     | 2                           |            |                                                                                 |             |
|                       |               | 3.00                       | SPT      | N=24 (0,0/0,0,0,24) | 3.00       |           | Very stiff grey very sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of sandstone (GLACIAL TILL) | 3                           |            |                                                                                 |             |
|                       |               | 4.00                       | SPT      | N=26 (0,0/0,0,0,26) |            |           |                                                                                                                                  | 4                           |            |                                                                                 |             |
|                       |               |                            |          |                     |            |           |                                                                                                                                  | 5                           |            |                                                                                 |             |
| Hole Diameter         |               | Casing Diameter            |          | Chiselling          |            |           |                                                                                                                                  | Inclination and Orientation |            |                                                                                 |             |
| Depth Base            | Diameter      | Depth Base                 | Diameter | Depth Top           | Depth Base | Duration  | Tool                                                                                                                             | Depth Top                   | Depth Base | Inclination                                                                     | Orientation |
|                       |               |                            |          |                     |            |           |                                                                                                                                  |                             |            |                                                                                 |             |
| Remarks               |               |                            |          |                     |            |           |                                                                                                                                  |                             |            | GroundSolve Ltd<br>Unit 1 Well House Barn<br>Chester Road<br>Bretton<br>CH4 0DH |             |
| Water strike at 1.50m |               |                            |          |                     |            |           |                                                                                                                                  |                             |            |                                                                                 |             |

|                                                   |                  |                              |                 |                                   |                             |
|---------------------------------------------------|------------------|------------------------------|-----------------|-----------------------------------|-----------------------------|
| Project Name: Ruabon Business Park - Phase I & II |                  | Client: Beech Developments   |                 | Date: 09/09/2020                  |                             |
| Location: Ruabon                                  |                  | Contractor: Harvey Plant     |                 |                                   |                             |
| Project No. : 2949                                |                  | Crew Name: Regional Drilling |                 | Drilling Equipment: Dando Terrier |                             |
| Borehole Number<br>WS7                            | Hole Type<br>WLS | Level                        | Logged By<br>AB | Scale<br>1:25                     | Page Number<br>Sheet 2 of 2 |

| Well | Water Strikes | Sample and In Situ Testing |      |                         | Depth (m) | Level (m) | Legend | Stratum Description                                                                                                              |    |
|------|---------------|----------------------------|------|-------------------------|-----------|-----------|--------|----------------------------------------------------------------------------------------------------------------------------------|----|
|      |               | Depth (m)                  | Type | Results                 |           |           |        |                                                                                                                                  |    |
|      |               | 5.00                       | SPT  | N=50 (0,0/50 for 291mm) | 5.36      |           |        | Very stiff grey very sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of sandstone (GLACIAL TILL) |    |
|      |               |                            |      |                         |           |           |        | End of Borehole at 5.360m                                                                                                        |    |
|      |               |                            |      |                         |           |           |        |                                                                                                                                  | 6  |
|      |               |                            |      |                         |           |           |        |                                                                                                                                  | 7  |
|      |               |                            |      |                         |           |           |        |                                                                                                                                  | 8  |
|      |               |                            |      |                         |           |           |        |                                                                                                                                  | 9  |
|      |               |                            |      |                         |           |           |        |                                                                                                                                  | 10 |

| Hole Diameter |          | Casing Diameter |          | Chiselling |            |          |      | Inclination and Orientation |            |             |             |
|---------------|----------|-----------------|----------|------------|------------|----------|------|-----------------------------|------------|-------------|-------------|
| Depth Base    | Diameter | Depth Base      | Diameter | Depth Top  | Depth Base | Duration | Tool | Depth Top                   | Depth Base | Inclination | Orientation |
|               |          |                 |          |            |            |          |      |                             |            |             |             |

|                                         |  |  |  |  |  |  |  |  |  |                                                                                  |
|-----------------------------------------|--|--|--|--|--|--|--|--|--|----------------------------------------------------------------------------------|
| <b>Remarks</b><br>Water strike at 1.50m |  |  |  |  |  |  |  |  |  | GroundSolve Ltd<br>Unit 1 Well House Barns<br>Chester Road<br>Bretton<br>CH4 0DH |
|-----------------------------------------|--|--|--|--|--|--|--|--|--|----------------------------------------------------------------------------------|

Project Name: Ruabon Business Park -  
Phase I & II

Client: Beech Developments

Date: 09/09/2020

Location: Ruabon

Contractor: Harvey Plant

Project No. : 2949

Crew Name: Regional Drilling

Drilling Equipment: Dando Terrier

Borehole Number  
WS8Hole Type  
WLS

Level

Logged By  
TGScale  
1:25Page Number  
Sheet 1 of 2

| Well                       | Water Strikes | Sample and In Situ Testing |          |                     | Depth (m)  | Level (m) | Legend | Stratum Description                                                                                            |            |                                                                                  |             |
|----------------------------|---------------|----------------------------|----------|---------------------|------------|-----------|--------|----------------------------------------------------------------------------------------------------------------|------------|----------------------------------------------------------------------------------|-------------|
|                            |               | Depth (m)                  | Type     | Results             |            |           |        |                                                                                                                |            |                                                                                  |             |
|                            |               | 1.00                       | SPT      | N=34 (0,0/0,0,0,34) | 1.00       |           |        | Medium dense black sandy angular to subangular fine to coarse GRAVEL of mudstone and burnt shale (MADE GROUND) | 1          |                                                                                  |             |
|                            |               |                            |          |                     | 1.50       |           |        | Dense black SILT (MADE GROUND)                                                                                 |            |                                                                                  |             |
|                            |               |                            |          |                     |            |           |        | Firm black slightly sandy CLAY (MADE GROUND)                                                                   |            |                                                                                  |             |
|                            |               | 2.00                       | SPT      | N=10 (0,0/0,0,0,10) | 2.00       |           |        | Stiff to very stiff greyish brown sandy gravelly CLAY (GLACIAL TILL)                                           | 2          |                                                                                  |             |
|                            |               |                            |          |                     |            |           |        |                                                                                                                |            |                                                                                  |             |
|                            |               | 3.00                       | SPT      | N=30 (0,0/0,0,0,30) |            |           |        |                                                                                                                | 3          |                                                                                  |             |
|                            |               |                            |          |                     |            |           |        |                                                                                                                |            |                                                                                  |             |
|                            |               | 4.00                       | SPT      | N=24 (0,0/0,0,0,24) |            |           |        |                                                                                                                | 4          |                                                                                  |             |
|                            |               |                            |          |                     |            |           |        |                                                                                                                |            |                                                                                  |             |
|                            |               | 5.00                       | SPT      | N=34 (0,0/0,0,0,34) |            |           |        |                                                                                                                | 5          |                                                                                  |             |
| Hole Diameter              |               | Casing Diameter            |          | Chiselling          |            |           |        | Inclination and Orientation                                                                                    |            |                                                                                  |             |
| Depth Base                 | Diameter      | Depth Base                 | Diameter | Depth Top           | Depth Base | Duration  | Tool   | Depth Top                                                                                                      | Depth Base | Inclination                                                                      | Orientation |
|                            |               |                            |          |                     |            |           |        |                                                                                                                |            |                                                                                  |             |
| Remarks                    |               |                            |          |                     |            |           |        |                                                                                                                |            | GroundSolve Ltd<br>Unit 1 Well House Barns<br>Chester Road<br>Bretton<br>CH4 0DH |             |
| No groundwater encountered |               |                            |          |                     |            |           |        |                                                                                                                |            |                                                                                  |             |

|                                                   |                  |                              |                 |                                   |                             |
|---------------------------------------------------|------------------|------------------------------|-----------------|-----------------------------------|-----------------------------|
| Project Name: Ruabon Business Park - Phase I & II |                  | Client: Beech Developments   |                 | Date: 09/09/2020                  |                             |
| Location: Ruabon                                  |                  | Contractor: Harvey Plant     |                 |                                   |                             |
| Project No. : 2949                                |                  | Crew Name: Regional Drilling |                 | Drilling Equipment: Dando Terrier |                             |
| Borehole Number<br>WS8                            | Hole Type<br>WLS | Level                        | Logged By<br>TG | Scale<br>1:25                     | Page Number<br>Sheet 2 of 2 |

| Well | Water Strikes | Sample and In Situ Testing |      |         | Depth (m) | Level (m) | Legend | Stratum Description                                                  |    |
|------|---------------|----------------------------|------|---------|-----------|-----------|--------|----------------------------------------------------------------------|----|
|      |               | Depth (m)                  | Type | Results |           |           |        |                                                                      |    |
|      |               |                            |      |         | 5.45      |           |        | Stiff to very stiff greyish brown sandy gravelly CLAY (GLACIAL TILL) |    |
|      |               |                            |      |         |           |           |        | End of Borehole at 5.450m                                            |    |
|      |               |                            |      |         |           |           |        |                                                                      | 6  |
|      |               |                            |      |         |           |           |        |                                                                      | 7  |
|      |               |                            |      |         |           |           |        |                                                                      | 8  |
|      |               |                            |      |         |           |           |        |                                                                      | 9  |
|      |               |                            |      |         |           |           |        |                                                                      | 10 |

| Hole Diameter |          | Casing Diameter |          | Chiselling |            |          |      | Inclination and Orientation |            |             |             |
|---------------|----------|-----------------|----------|------------|------------|----------|------|-----------------------------|------------|-------------|-------------|
| Depth Base    | Diameter | Depth Base      | Diameter | Depth Top  | Depth Base | Duration | Tool | Depth Top                   | Depth Base | Inclination | Orientation |
|               |          |                 |          |            |            |          |      |                             |            |             |             |

|                                              |  |  |  |  |  |  |  |  |  |                                                                                  |
|----------------------------------------------|--|--|--|--|--|--|--|--|--|----------------------------------------------------------------------------------|
| <b>Remarks</b><br>No groundwater encountered |  |  |  |  |  |  |  |  |  | GroundSolve Ltd<br>Unit 1 Well House Barns<br>Chester Road<br>Bretton<br>CH4 0DH |
|----------------------------------------------|--|--|--|--|--|--|--|--|--|----------------------------------------------------------------------------------|



Project Name: Ruabon Business Park -  
Phase I & II

Client: Beech Developments

Date: 09/09/2020

Location: Ruabon

Contractor: Harvey Plant

Project No. : 2949

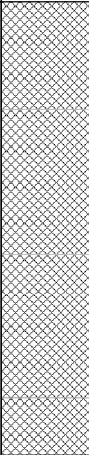
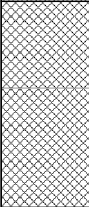
Crew Name: Regional Drilling

Drilling Equipment: Dando Terrier

Borehole Number  
WS9Hole Type  
WLS

Level

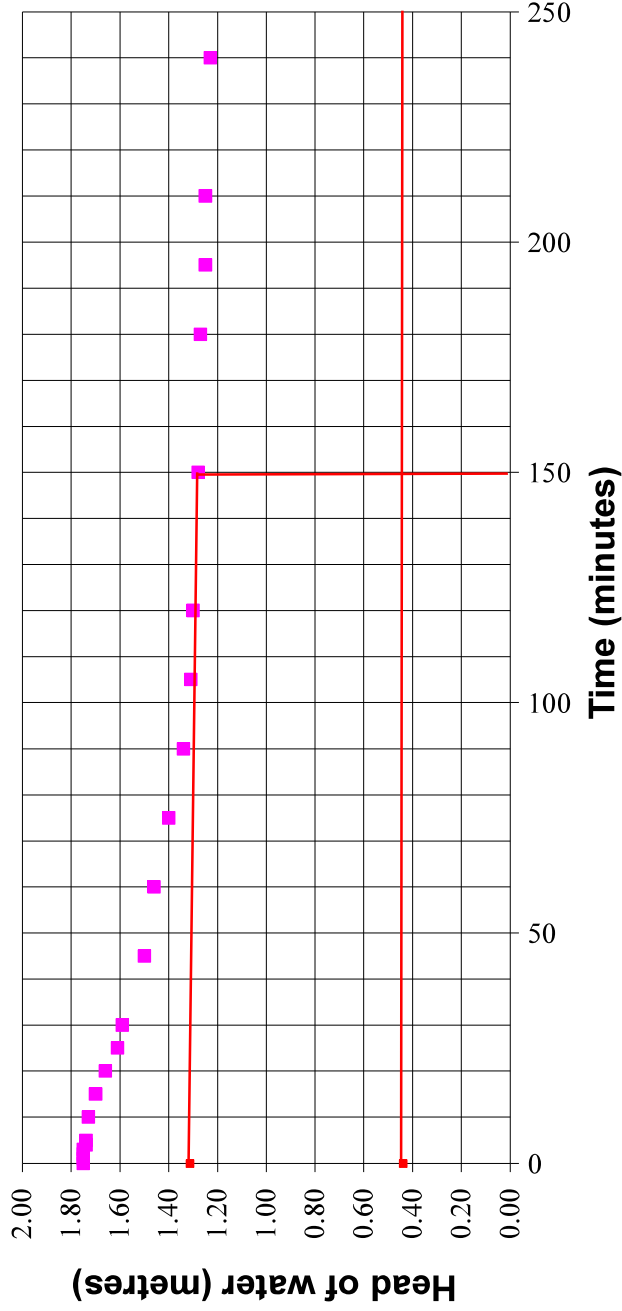
Logged By  
ABScale  
1:25Page Number  
Sheet 1 of 1

| Well                                                                               | Water Strikes                                                                     | Sample and In Situ Testing |          |                      | Depth (m)  | Level (m) | Legend                                                                             | Stratum Description                                                                                                 |            |                                                                                  |             |
|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|----------------------------|----------|----------------------|------------|-----------|------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|------------|----------------------------------------------------------------------------------|-------------|
|                                                                                    |                                                                                   | Depth (m)                  | Type     | Results              |            |           |                                                                                    |                                                                                                                     |            |                                                                                  |             |
|  |  | 1.00                       | SPT      | N=26 (0,0/0,0,0,26)  | 1.50       |           |   | Grass over dark brown sandy gravelly SILT. Gravel is fine to medium sub-angular of brick and mudstone (MADE GROUND) | 1          |                                                                                  |             |
|                                                                                    |                                                                                   | 2.00                       | SPT      | 50 (0,0/50 for 30mm) |            |           |  | Very dense black asphalt (MADE GROUND)                                                                              | 2          |                                                                                  |             |
|                                                                                    |                                                                                   |                            |          |                      |            |           | End of Borehole at 2.180m                                                          |                                                                                                                     |            |                                                                                  |             |
|                                                                                    |                                                                                   |                            |          |                      | 2.18       |           |                                                                                    |                                                                                                                     | 3          |                                                                                  |             |
|                                                                                    |                                                                                   |                            |          |                      |            |           |                                                                                    |                                                                                                                     | 4          |                                                                                  |             |
|                                                                                    |                                                                                   |                            |          |                      |            |           |                                                                                    |                                                                                                                     | 5          |                                                                                  |             |
| Hole Diameter                                                                      |                                                                                   | Casing Diameter            |          | Chiselling           |            |           |                                                                                    | Inclination and Orientation                                                                                         |            |                                                                                  |             |
| Depth Base                                                                         | Diameter                                                                          | Depth Base                 | Diameter | Depth Top            | Depth Base | Duration  | Tool                                                                               | Depth Top                                                                                                           | Depth Base | Inclination                                                                      | Orientation |
|                                                                                    |                                                                                   |                            |          |                      |            |           |                                                                                    |                                                                                                                     |            |                                                                                  |             |
| Remarks                                                                            |                                                                                   |                            |          |                      |            |           |                                                                                    |                                                                                                                     |            | GroundSolve Ltd<br>Unit 1 Well House Barns<br>Chester Road<br>Bretton<br>CH4 0DH |             |
| Water strike at 1.50m. Terminated on obstruction.                                  |                                                                                   |                            |          |                      |            |           |                                                                                    |                                                                                                                     |            |                                                                                  |             |

## **APPENDIX D – INFILTRATION TEST RESULTS**

2949. Ruabon Business Park  
SA01 Test 1

| Time<br>(Mins) | Depth of<br>Water | Head of<br>Water |
|----------------|-------------------|------------------|
| 0              | 1.50              | 1.75             |
| 1              | 1.50              | 1.75             |
| 2              | 1.50              | 1.75             |
| 3              | 1.50              | 1.75             |
| 4              | 1.51              | 1.74             |
| 5              | 1.51              | 1.74             |
| 10             | 1.52              | 1.73             |
| 15             | 1.55              | 1.70             |
| 20             | 1.59              | 1.66             |
| 25             | 1.64              | 1.61             |
| 30             | 1.66              | 1.59             |
| 45             | 1.75              | 1.50             |
| 60             | 1.79              | 1.46             |
| 75             | 1.85              | 1.40             |
| 90             | 1.91              | 1.34             |
| 105            | 1.94              | 1.31             |
| 120            | 1.95              | 1.30             |
| 150            | 1.97              | 1.28             |
| 180            | 1.98              | 1.27             |
| 195            | 2.00              | 1.25             |
| 210            | 2.00              | 1.25             |
| 240            | 2.02              | 1.23             |
|                |                   |                  |
|                |                   |                  |
|                |                   |                  |
|                |                   |                  |
|                |                   |                  |

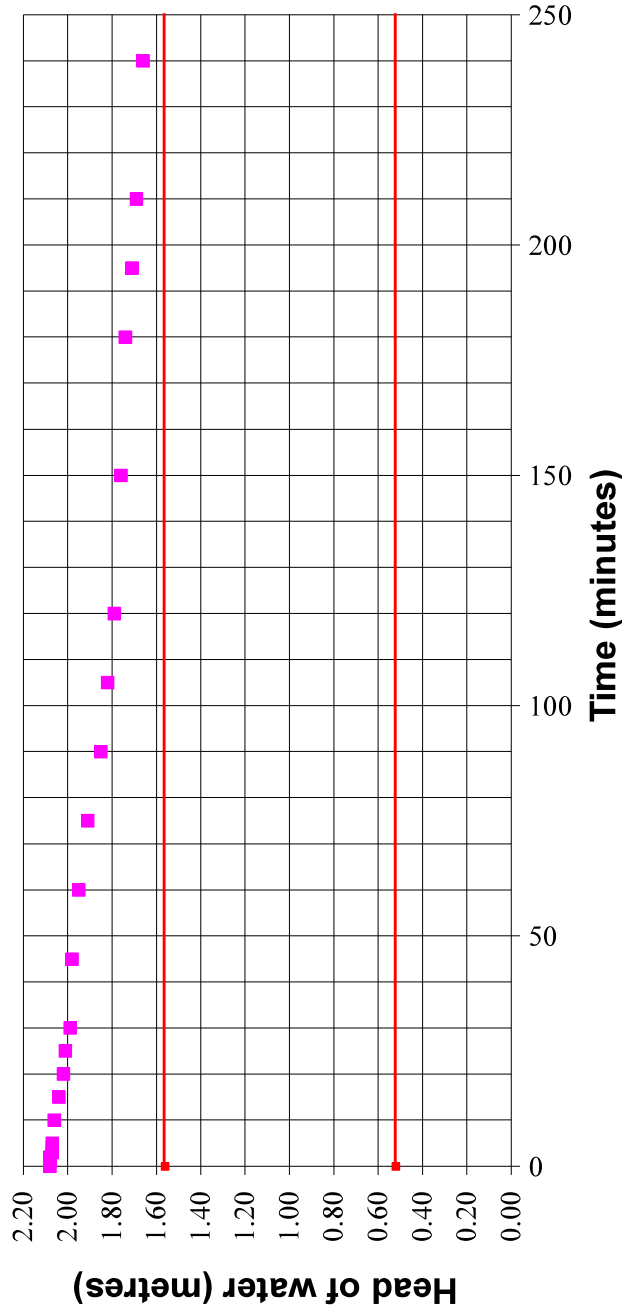


| Depth<br>(m) | Length<br>(m) | Width<br>(m) | Head at 75% Vol<br>(m) | Head at 25% Vol<br>(m) | Water depth $h(t=0)$<br>(m) | Effective Area<br>Ap50 m <sup>2</sup> | Vp75-Vp25<br>Volume of water m <sup>3</sup> | Adjustment Factor * | t75<br>(mins) | t25<br>(mins) | Infiltration<br>rate m/s |
|--------------|---------------|--------------|------------------------|------------------------|-----------------------------|---------------------------------------|---------------------------------------------|---------------------|---------------|---------------|--------------------------|
| 3.25         | 2.10          | 1.00         | 1.313                  | 0.44                   | 1.75                        | 7.525                                 | 2.481                                       | 0.30                | 105           |               | N/A                      |

\* with gravel filter adjustment factor = 0.30, with no filter = 1.0

Note: The test failed to reach the 25% head

2949. Ruabon Business Park  
**SA02 Test 1**



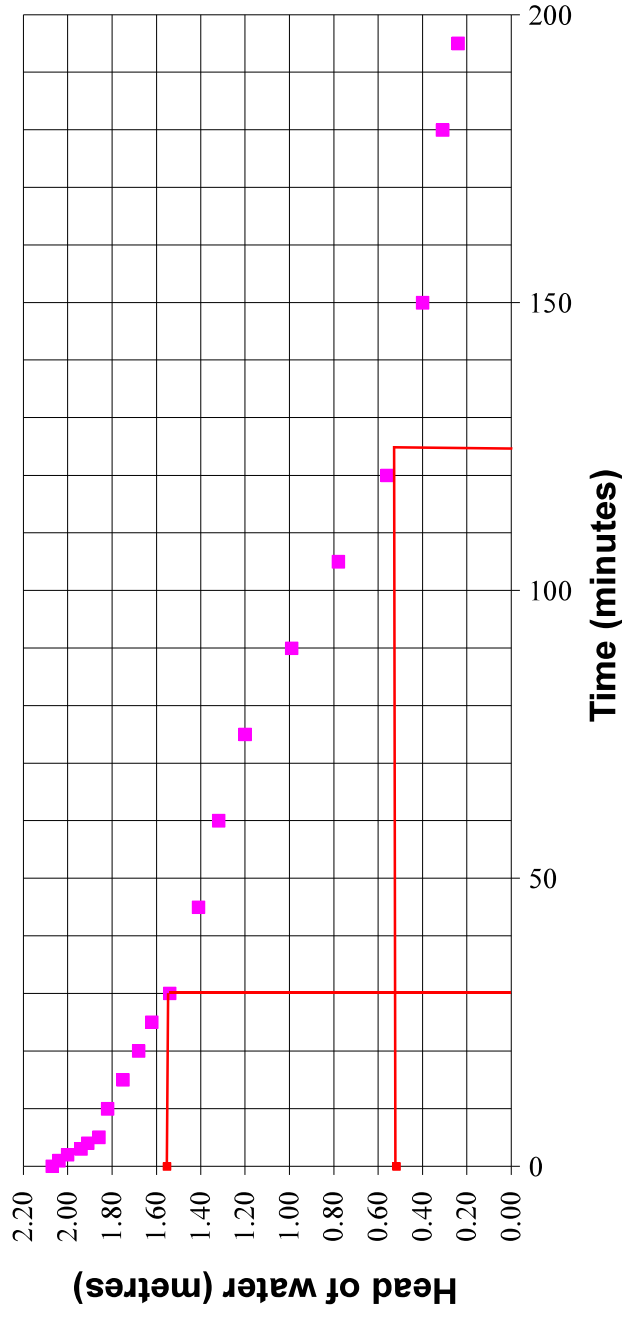
| Time (Mins) | Depth of Water | Head of Water |
|-------------|----------------|---------------|
| 0           | 1.42           | 2.08          |
| 1           | 1.42           | 2.08          |
| 2           | 1.42           | 2.08          |
| 3           | 1.43           | 2.07          |
| 4           | 1.43           | 2.07          |
| 5           | 1.43           | 2.07          |
| 10          | 1.44           | 2.06          |
| 15          | 1.46           | 2.04          |
| 20          | 1.48           | 2.02          |
| 25          | 1.49           | 2.01          |
| 30          | 1.51           | 1.99          |
| 45          | 1.52           | 1.98          |
| 60          | 1.55           | 1.95          |
| 75          | 1.59           | 1.91          |
| 90          | 1.65           | 1.85          |
| 105         | 1.68           | 1.82          |
| 120         | 1.71           | 1.79          |
| 150         | 1.74           | 1.76          |
| 180         | 1.76           | 1.74          |
| 195         | 1.79           | 1.71          |
| 210         | 1.81           | 1.69          |
| 240         | 1.84           | 1.66          |
|             |                |               |
|             |                |               |
|             |                |               |
|             |                |               |
|             |                |               |
|             |                |               |

| Depth (m) | Length (m) | Width (m) | Head at 75% Vol (m) | Head at 25% Vol (m) | Water depth( $t=0$ ) (m) | Effective Area $A_{p50}$ m <sup>2</sup> | $V_{p75}-V_{p25}$ Volume of water m <sup>3</sup> | Adjustment Factor * | $t_{75}$ (mins) | $t_{25}$ (mins) | Infiltration rate m/s |
|-----------|------------|-----------|---------------------|---------------------|--------------------------|-----------------------------------------|--------------------------------------------------|---------------------|-----------------|-----------------|-----------------------|
| 3.50      | 2.00       | 1.00      | 1.560               | 0.52                | 2.08                     | 8.240                                   | 2.808                                            | 0.30                |                 |                 | N/A                   |

\* with gravel filter adjustment factor = 0.30, with no filter = 1.0

Note: The test failed to reach the 25% & 75% head

2949. Ruabon Business Park  
SA03 Test 1



| Time (Mins) | Depth of Water | Head of Water |
|-------------|----------------|---------------|
| 0           | 1.43           | 2.07          |
| 1           | 1.46           | 2.04          |
| 2           | 1.50           | 2.00          |
| 3           | 1.56           | 1.94          |
| 4           | 1.59           | 1.91          |
| 5           | 1.64           | 1.86          |
| 10          | 1.68           | 1.82          |
| 15          | 1.75           | 1.75          |
| 20          | 1.82           | 1.68          |
| 25          | 1.88           | 1.62          |
| 30          | 1.96           | 1.54          |
| 45          | 2.09           | 1.41          |
| 60          | 2.18           | 1.32          |
| 75          | 2.30           | 1.20          |
| 90          | 2.51           | 0.99          |
| 105         | 2.72           | 0.78          |
| 120         | 2.94           | 0.56          |
| 150         | 3.10           | 0.40          |
| 180         | 3.19           | 0.31          |
| 195         | 3.26           | 0.24          |
|             |                |               |
|             |                |               |
|             |                |               |
|             |                |               |
|             |                |               |
|             |                |               |
|             |                |               |
|             |                |               |

| Depth (m) | Length (m) | Width (m) | Head at 75% Vol (m) | Head at 25% Vol (m) | Water depth( $t=0$ ) (m) | Effective Area $A_{p50}$ m <sup>2</sup> | $V_{p75}-V_{p25}$ Volume of water m <sup>3</sup> | Adjustment Factor * | $t_{75}$ (mins) | $t_{25}$ (mins) | Infiltration rate m/s |
|-----------|------------|-----------|---------------------|---------------------|--------------------------|-----------------------------------------|--------------------------------------------------|---------------------|-----------------|-----------------|-----------------------|
| 3.50      | 2.00       | 1.10      | 1.553               | 0.52                | 2.07                     | 8.617                                   | 2.270                                            | 0.30                | 30              | 125             | 4.622E-05             |

\* with gravel filter adjustment factor = 0.30, with no filter = 1.0

2949. Ruabon Business Park  
SA03 Test 2

2949. Ruabon Business Park  
SA03 Test 3

## **APPENDIX E – SUMMARY OF GAS AND GROUNDWATER MONITORING**



| GROUNDWATER AND GROUND GAS MONITORING |          |              |                         |                       |                     |                      |                             |                              |                        |                            |                     |                         |                            |                         |                            |                        |          |           |     |            |            |
|---------------------------------------|----------|--------------|-------------------------|-----------------------|---------------------|----------------------|-----------------------------|------------------------------|------------------------|----------------------------|---------------------|-------------------------|----------------------------|-------------------------|----------------------------|------------------------|----------|-----------|-----|------------|------------|
| No: 2949                              |          |              |                         |                       |                     |                      |                             |                              |                        | Site: Ruabon Business Park |                     |                         |                            |                         |                            |                        |          |           |     |            |            |
| Location                              | Date     | Monitored by | Well Details            |                       | Groundwater         |                      | Gas                         |                              |                        |                            |                     |                         |                            |                         |                            |                        | Weather  |           |     |            |            |
|                                       |          |              | Standpipe diameter (mm) | Depth to Base (m bgl) | Water Depth (m bgl) | Reduced Level (m OD) | Atmospheric Pressure (mbar) | Atmospheric Pressure Comment | Relative Pressure (mb) | Flow - Peak (l/h)          | Flow - Steady (l/h) | CH <sub>4</sub> (% v/v) | GSV CH <sub>4</sub> (l/hr) | CO <sub>2</sub> (% v/v) | GSV CO <sub>2</sub> (l/hr) | O <sub>2</sub> (% v/v) | CO (ppm) | H2S (ppm) | VOC | Serial No. | Conditions |
| WS01                                  | 27/07/23 | RP           | 50                      | 1.50                  | Dry                 |                      | 1002                        | Falling                      | 0.00                   | 0.1                        | 0.1                 | 0.3                     | 0.0003                     | 3.2                     | 0.0032                     | 19.1                   | 0.0      | 0.0       | 0.0 |            |            |
|                                       | 09/08/23 | RP           | 50                      | 1.50                  | Dry                 |                      | 998                         | Rising                       | 0.10                   | 0.1                        | 0.1                 | 0.2                     | 0.0002                     | 3.1                     | 0.0031                     | 19.5                   | 0.0      | 0.0       | 0.0 |            |            |
|                                       | 22/08/23 | RP           | 50                      | 1.50                  | Dry                 |                      | 1005                        | Rising                       | 0.10                   | 0.1                        | 0.1                 | 0.3                     | 0.0003                     | 3.6                     | 0.0036                     | 19.4                   | 0.0      | 0.0       | 0.0 |            |            |
|                                       | 07/09/23 | RP           | 50                      | 1.50                  | Dry                 |                      | 1000                        | Rising                       | 0.10                   | 0.1                        | 0.1                 | 0.2                     | 0.0002                     | 3.1                     | 0.0031                     | 19.2                   | 0.0      | 0.0       | 0.0 |            |            |
|                                       |          |              |                         |                       |                     |                      |                             |                              |                        |                            |                     |                         |                            |                         |                            |                        |          |           |     |            |            |
| WS02                                  | 27/07/23 | RP           | 50                      | 1.00                  | Dry                 |                      | 1002                        | Falling                      | 0.10                   | 0.1                        | 0.1                 | 0.1                     | 0.0001                     | 2.5                     | 0.0025                     | 17.6                   | 0.0      | 0.0       | 0.0 |            |            |
|                                       | 09/08/23 | RP           | 50                      | 1.00                  | Dry                 |                      | 998                         | Rising                       | 0.00                   | 0.1                        | 0.1                 | 0.1                     | 0.0001                     | 2.1                     | 0.0021                     | 17.1                   | 0.0      | 0.0       | 0.0 |            |            |
|                                       | 22/08/23 | RP           | 50                      | 1.00                  | Dry                 |                      | 1005                        | Rising                       | 0.10                   | 0.1                        | 0.1                 | 0.0                     | 0.0000                     | 2.4                     | 0.0024                     | 16.8                   | 0.0      | 0.0       | 0.0 |            |            |
|                                       | 07/09/23 | RP           | 50                      | 1.00                  | Dry                 |                      | 1000                        | Rising                       | 0.00                   | 0.0                        | 0.0                 | 0.0                     | 0.0000                     | 2.4                     | 0.0000                     | 17.3                   | 0.0      | 0.0       | 0.0 |            |            |
|                                       |          |              |                         |                       |                     |                      |                             |                              |                        |                            |                     |                         |                            |                         |                            |                        |          |           |     |            |            |
| WS03                                  | 27/07/23 | RP           | 50                      | 2.00                  | 1.80                |                      | 1002                        | Falling                      | 0.00                   | 0.1                        | 0.1                 | 0.1                     | 0.0001                     | 1.9                     | 0.0019                     | 17.3                   | 0.0      | 0.0       | 0.0 |            |            |
|                                       | 09/08/23 | RP           | 50                      | 2.00                  | 1.97                |                      | 998                         | Rising                       | 0.00                   | 0.1                        | 0.1                 | 0.1                     | 0.0001                     | 1.9                     | 0.0019                     | 17.5                   | 0.0      | 0.0       | 0.0 |            |            |
|                                       | 22/08/23 | RP           | 50                      | 1.98                  | 1.82                |                      | 1005                        | Rising                       | 0.00                   | 0.1                        | 0.1                 | 0.1                     | 0.0001                     | 1.4                     | 0.0014                     | 17.1                   | 0.0      | 0.0       | 0.0 |            |            |
|                                       | 07/09/23 | RP           | 50                      |                       |                     |                      | 1000                        | Rising                       | 0.00                   | 0.0                        | 0.0                 | 0.1                     | 0.0000                     | 1.6                     | 0.0000                     | 17.3                   | 0.0      | 0.0       | 0.0 |            |            |
|                                       |          |              |                         |                       |                     |                      |                             |                              |                        |                            |                     |                         |                            |                         |                            |                        |          |           |     |            |            |
| WS04                                  | 27/07/23 | RP           | 50                      | 1.00                  | Dry                 |                      | 1002                        | Falling                      | 0.00                   | 0.1                        | 0.1                 | 0.1                     | 0.0001                     | 2.1                     | 0.0021                     | 16.1                   | 0.0      | 0.0       | 0.0 |            |            |
|                                       | 09/08/23 | RP           | 50                      | 1.00                  | Dry                 |                      | 998                         | Rising                       | 0.10                   | 0.1                        | 0.1                 | 0.2                     | 0.0002                     | 1.8                     | 0.0018                     | 15.7                   | 0.0      | 0.0       | 0.0 |            |            |
|                                       | 22/08/23 | RP           | 50                      | 1.00                  | Dry                 |                      | 1005                        | Rising                       | 0.00                   | 0.1                        | 0.1                 | 0.2                     | 0.0002                     | 2.3                     | 0.0023                     | 16.9                   | 0.0      | 0.0       | 0.0 |            |            |
|                                       | 07/09/23 | RP           | 50                      | 1.00                  | Dry                 |                      | 1000                        | Rising                       | 0.10                   | 0.1                        | 0.1                 | 0.2                     | 0.0002                     | 2.2                     | 0.0022                     | 15.9                   | 0.0      | 0.0       | 0.0 |            |            |
|                                       |          |              |                         |                       |                     |                      |                             |                              |                        |                            |                     |                         |                            |                         |                            |                        |          |           |     |            |            |
| WS05                                  | 27/07/23 | RP           | 50                      | 3.00                  | 2.93                |                      | 1002                        | Falling                      | 0.00                   | 0.1                        | 0.1                 | 0.2                     | 0.0002                     | 2.0                     | 0.0020                     | 18.4                   | 0.0      | 0.0       | 0.0 |            |            |
|                                       | 09/08/23 | RP           | 50                      | 2.95                  | 2.75                |                      | 998                         | Rising                       | 0.00                   | 0.1                        | 0.1                 | 0.2                     | 0.0002                     | 2.1                     | 0.0021                     | 18.0                   | 0.0      | 0.0       | 0.0 |            |            |
|                                       | 22/08/23 | RP           | 50                      | 2.94                  | 2.91                |                      | 1005                        | Rising                       | 0.10                   | 0.1                        | 0.1                 | 0.2                     | 0.0002                     | 1.6                     | 0.0016                     | 18.3                   | 0.0      | 0.0       | 0.0 |            |            |
|                                       | 07/09/23 | RP           | 51                      | 2.94                  | 2.88                |                      | 1000                        | Rising                       | 0.10                   | 0.1                        | 0.1                 | 0.2                     | 0.0002                     | 1.8                     | 0.0018                     | 18.0                   | 0.0      | 0.0       | 0.0 |            |            |
|                                       |          |              |                         |                       |                     |                      |                             |                              |                        |                            |                     |                         |                            |                         |                            |                        |          |           |     |            |            |

**NOTES:**  
 NM = Not Measured.  
 (x) = Peak value recorded.  
 [grey] = Below detection limit.

$$GSV \text{ (l/hr)} = \frac{[\text{gas concentration (\%v/v)}] \times [\text{gas well flow rate (l/hr)}]}{100}$$

## **APPENDIX F – CHEMICAL TEST RESULTS**



## Certificate of Analysis

**Certificate Number** 23-16015

**Issued:** 19-Jul-23

**Client** GroundSolve Limited  
Unit 1  
Well House Barns  
Bretton  
Flintshire  
FAO Adam Fenwick  
CH4 0DH

**Our Reference** 23-16015

**Client Reference** 2936

**Order No** (not supplied)

**Contract Title** Ruabon Business Park

**Description** 5 Soil samples.

**Date Received** 05-Jul-23

**Date Started** 05-Jul-23

**Date Completed** 19-Jul-23

**Test Procedures** Identified by prefix DETSn (details on request).

**Notes** Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

**Approved By**

Kirk Bridgewood  
General Manager



2139

# Summary of Chemical Analysis

## Soil Samples

Our Ref 23-16015

Client Ref 2936

Contract Title Ruabon Business Park

| Lab No        | 2197983    | 2197984    | 2197985    | 2197986    | 2197987    |
|---------------|------------|------------|------------|------------|------------|
| Sample ID     | WS01       | WS03       | WS03       | WS05       | WS05       |
| Depth         | 1.00       | 0.50       | 1.00       | 0.50       | 1.00       |
| Other ID      |            |            |            |            |            |
| Sample Type   | SOIL       | SOIL       | SOIL       | SOIL       | SOIL       |
| Sampling Date | 23/06/2023 | 23/06/2023 | 23/06/2023 | 23/06/2023 | 23/06/2023 |
| Sampling Time | n/s        | n/s        | n/s        | n/s        | n/s        |

| Test                                  | Method      | LOD  | Units |        |        |      |        |      |
|---------------------------------------|-------------|------|-------|--------|--------|------|--------|------|
| <b>Metals</b>                         |             |      |       |        |        |      |        |      |
| Arsenic                               | DETSC 2301# | 0.2  | mg/kg | 25     | 15     |      | 8.0    |      |
| Boron, Water Soluble (2.5:1)          | DETSC 2311# | 0.2  | mg/kg | 0.8    | 1.0    |      | < 0.2  |      |
| Cadmium                               | DETSC 2301# | 0.1  | mg/kg | 0.2    | < 0.1  |      | < 0.1  |      |
| Chromium                              | DETSC 2301# | 0.15 | mg/kg | 7.2    | 12     |      | 5.4    |      |
| Chromium III                          | DETSC 2301* | 0.15 | mg/kg | 7.2    | 12     |      | 5.4    |      |
| Chromium, Hexavalent                  | DETSC 2204* | 1    | mg/kg | < 1.0  | < 1.0  |      | < 1.0  |      |
| Copper                                | DETSC 2301# | 0.2  | mg/kg | 30     | 36     |      | 13     |      |
| Lead                                  | DETSC 2301# | 0.3  | mg/kg | 21     | 22     |      | 0.9    |      |
| Mercury                               | DETSC 2325# | 0.05 | mg/kg | 0.05   | < 0.05 |      | < 0.05 |      |
| Nickel                                | DETSC 2301# | 1    | mg/kg | 34     | 23     |      | 6.8    |      |
| Selenium                              | DETSC 2301# | 0.5  | mg/kg | 1.5    | 0.6    |      | < 0.5  |      |
| Zinc                                  | DETSC 2301# | 1    | mg/kg | 72     | 33     |      | 6.0    |      |
| <b>Inorganics</b>                     |             |      |       |        |        |      |        |      |
| pH                                    | DETSC 2008# |      | pH    | 4.8    | 5.5    | 5.1  | 8.1    | 8.2  |
| Cyanide, Total                        | DETSC 2130# | 0.1  | mg/kg | 0.3    | 0.2    |      | < 0.1  |      |
| Organic matter                        | DETSC 2002# | 0.1  | %     | 0.8    | 0.2    |      | 0.6    |      |
| Sulphate Aqueous Extract as SO4 (2:1) | DETSC 2076# | 10   | mg/l  | 90     | 47     | 45   | 37     | 130  |
| Sulphide                              | DETSC 2024* | 10   | mg/kg | 20     | 24     |      | 20     |      |
| Sulphur (free)                        | DETSC 3049# | 0.75 | mg/kg | 17     | 2.4    |      | 2.3    |      |
| Sulphur as S, Total                   | DETSC 2320  | 0.01 | %     | 0.18   | 0.10   | 0.13 |        | 0.03 |
| Sulphate as SO4, Total                | DETSC 2321# | 0.01 | %     | 0.19   | 0.16   | 0.08 |        | 0.03 |
| <b>Petroleum Hydrocarbons</b>         |             |      |       |        |        |      |        |      |
| Aliphatic C5-C6                       | DETSC 3321* | 0.01 | mg/kg | < 0.01 | < 0.01 |      | < 0.01 |      |
| Aliphatic C6-C8                       | DETSC 3321* | 0.01 | mg/kg | < 0.01 | < 0.01 |      | < 0.01 |      |
| Aliphatic C8-C10                      | DETSC 3321* | 0.01 | mg/kg | < 0.01 | < 0.01 |      | < 0.01 |      |
| Aliphatic C10-C12                     | DETSC 3072# | 1.5  | mg/kg | < 1.5  | < 1.5  |      | < 1.5  |      |
| Aliphatic C12-C16                     | DETSC 3072# | 1.2  | mg/kg | < 1.2  | < 1.2  |      | < 1.2  |      |
| Aliphatic C16-C21                     | DETSC 3072# | 1.5  | mg/kg | < 1.5  | < 1.5  |      | < 1.5  |      |
| Aliphatic C21-C35                     | DETSC 3072# | 3.4  | mg/kg | < 3.4  | < 3.4  |      | < 3.4  |      |
| Aliphatic C35-C40                     | DETSC 3072* | 3.4  | mg/kg | < 3.4  | < 3.4  |      | < 3.4  |      |
| Aliphatic C5-C35                      | DETSC 3072* | 10   | mg/kg | < 10   | < 10   |      | < 10   |      |
| Aromatic C5-C7                        | DETSC 3321* | 0.01 | mg/kg | < 0.01 | < 0.01 |      | < 0.01 |      |
| Aromatic C7-C8                        | DETSC 3321* | 0.01 | mg/kg | < 0.01 | < 0.01 |      | < 0.01 |      |
| Aromatic C8-C10                       | DETSC 3321* | 0.01 | mg/kg | < 0.01 | < 0.01 |      | < 0.01 |      |
| Aromatic C10-C12                      | DETSC 3072# | 0.9  | mg/kg | < 0.9  | < 0.9  |      | < 0.9  |      |
| Aromatic C12-C16                      | DETSC 3072# | 0.5  | mg/kg | < 0.5  | < 0.5  |      | < 0.5  |      |
| Aromatic C16-C21                      | DETSC 3072# | 0.6  | mg/kg | < 0.6  | < 0.6  |      | < 0.6  |      |
| Aromatic C21-C35                      | DETSC 3072# | 1.4  | mg/kg | < 1.4  | < 1.4  |      | < 1.4  |      |
| Aromatic C35-C40                      | DETSC 3072* | 1.4  | mg/kg | < 1.4  | < 1.4  |      | < 1.4  |      |
| Aromatic C5-C35                       | DETSC 3072* | 10   | mg/kg | < 10   | < 10   |      | < 10   |      |
| TPH Ali/Aro Total C5-C35              | DETSC 3072* | 10   | mg/kg | < 10   | < 10   |      | < 10   |      |

## Summary of Chemical Analysis

### Soil Samples

Our Ref 23-16015

Client Ref 2936

Contract Title Ruabon Business Park

| Lab No        | 2197983    | 2197984    | 2197985    | 2197986    | 2197987    |
|---------------|------------|------------|------------|------------|------------|
| Sample ID     | WS01       | WS03       | WS03       | WS05       | WS05       |
| Depth         | 1.00       | 0.50       | 1.00       | 0.50       | 1.00       |
| Other ID      |            |            |            |            |            |
| Sample Type   | SOIL       | SOIL       | SOIL       | SOIL       | SOIL       |
| Sampling Date | 23/06/2023 | 23/06/2023 | 23/06/2023 | 23/06/2023 | 23/06/2023 |
| Sampling Time | n/s        | n/s        | n/s        | n/s        | n/s        |

| Test                    | Method      | LOD  | Units |        |        |  |        |  |
|-------------------------|-------------|------|-------|--------|--------|--|--------|--|
| <b>PAHs</b>             |             |      |       |        |        |  |        |  |
| Naphthalene             | DETSC 3303# | 0.03 | mg/kg | 0.29   | < 0.03 |  | < 0.03 |  |
| Acenaphthylene          | DETSC 3303# | 0.03 | mg/kg | < 0.03 | < 0.03 |  | < 0.03 |  |
| Acenaphthene            | DETSC 3303# | 0.03 | mg/kg | < 0.03 | < 0.03 |  | < 0.03 |  |
| Fluorene                | DETSC 3303  | 0.03 | mg/kg | < 0.03 | < 0.03 |  | < 0.03 |  |
| Phenanthrene            | DETSC 3303# | 0.03 | mg/kg | 0.13   | < 0.03 |  | < 0.03 |  |
| Anthracene              | DETSC 3303  | 0.03 | mg/kg | < 0.03 | < 0.03 |  | < 0.03 |  |
| Fluoranthene            | DETSC 3303# | 0.03 | mg/kg | < 0.03 | < 0.03 |  | < 0.03 |  |
| Pyrene                  | DETSC 3303# | 0.03 | mg/kg | < 0.03 | < 0.03 |  | < 0.03 |  |
| Benzo(a)anthracene      | DETSC 3303# | 0.03 | mg/kg | < 0.03 | < 0.03 |  | < 0.03 |  |
| Chrysene                | DETSC 3303  | 0.03 | mg/kg | < 0.03 | < 0.03 |  | < 0.03 |  |
| Benzo(b)fluoranthene    | DETSC 3303# | 0.03 | mg/kg | < 0.03 | < 0.03 |  | < 0.03 |  |
| Benzo(k)fluoranthene    | DETSC 3303# | 0.03 | mg/kg | < 0.03 | < 0.03 |  | < 0.03 |  |
| Benzo(a)pyrene          | DETSC 3303# | 0.03 | mg/kg | < 0.03 | < 0.03 |  | < 0.03 |  |
| Indeno(1,2,3-c,d)pyrene | DETSC 3303# | 0.03 | mg/kg | < 0.03 | < 0.03 |  | < 0.03 |  |
| Dibenzo(a,h)anthracene  | DETSC 3303# | 0.03 | mg/kg | < 0.03 | < 0.03 |  | < 0.03 |  |
| Benzo(g,h,i)perylene    | DETSC 3303# | 0.03 | mg/kg | < 0.03 | < 0.03 |  | < 0.03 |  |
| PAH - USEPA 16, Total   | DETSC 3303  | 0.1  | mg/kg | 0.42   | < 0.10 |  | < 0.10 |  |
| <b>Phenols</b>          |             |      |       |        |        |  |        |  |
| Phenol - Monohydric     | DETSC 2130# | 0.3  | mg/kg | 6.7    | 0.8    |  | < 0.3  |  |

## Summary of Asbestos Analysis Soil Samples

*Our Ref* 23-16015

*Client Ref* 2936

*Contract Title* Ruabon Business Park

| Lab No  | Sample ID | Material Type | Result | Comment* | Analyst     |
|---------|-----------|---------------|--------|----------|-------------|
| 2197983 | WS01 1.00 | SOIL          | NAD    | none     | Barry Kelly |
| 2197984 | WS03 0.50 | SOIL          | NAD    | none     | Barry Kelly |
| 2197986 | WS05 0.50 | SOIL          | NAD    | none     | Barry Kelly |

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: \* - not included in laboratory scope of accreditation.

## Information in Support of the Analytical Results

Our Ref 23-16015  
 Client Ref 2936  
 Contract Ruabon Business Park

### Containers Received & Deviating Samples

|         |                |              |                     |                                                                                 | Inappropriate container for tests |
|---------|----------------|--------------|---------------------|---------------------------------------------------------------------------------|-----------------------------------|
| Lab No  | Sample ID      | Date Sampled | Containers Received | Holding time exceeded for tests                                                 |                                   |
| 2197983 | WS01 1.00 SOIL | 23/06/23     | GJ 250ml, GJ 60ml   | Sulphur (free) (7 days), Total Sulphur ICP (7 days), pH + Conductivity (7 days) |                                   |
| 2197984 | WS03 0.50 SOIL | 23/06/23     | GJ 250ml, GJ 60ml   | Sulphur (free) (7 days), Total Sulphur ICP (7 days), pH + Conductivity (7 days) |                                   |
| 2197985 | WS03 1.00 SOIL | 23/06/23     | GJ 250ml, GJ 60ml   | Total Sulphur ICP (7 days), pH + Conductivity (7 days)                          |                                   |
| 2197986 | WS05 0.50 SOIL | 23/06/23     | GJ 250ml, GJ 60ml   | Sulphur (free) (7 days), pH + Conductivity (7 days)                             |                                   |
| 2197987 | WS05 1.00 SOIL | 23/06/23     | GJ 250ml, GJ 60ml   | Total Sulphur ICP (7 days), pH + Conductivity (7 days)                          |                                   |

Key: G-Glass J-Jar

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

### Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

### Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report



## Certificate of Analysis

**Certificate Number** 20-17753

23-Sep-20

**Client** GroundSolve Limited  
Unit 1  
Well House Barns  
Bretton  
Flintshire  
FAO Adam Fenwick  
CH4 0DH

**Our Reference** 20-17753

**Client Reference** 2387

**Order No** (not supplied)

**Contract Title** Wynnstay

**Description** 12 Soil samples.

**Date Received** 15-Sep-20

**Date Started** 15-Sep-20

**Date Completed** 23-Sep-20

**Test Procedures** Identified by prefix DETSn (details on request).

**Notes** Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

**Approved By**

Adam Fenwick  
Contracts Manager



2139





## Summary of Chemical Analysis

### Soil Samples

Our Ref 20-17753

Client Ref 2387

Contract Title Wynnstay

| Lab No        | 1726746    | 1726747    | 1726748    | 1726749    | 1726901    | 1726902    | 1726903    | 1726904    | 1726905    | 1726906    | 1726907    | 1726908    |
|---------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Sample ID     | TP02       | TP04       | TP06       | TP10       | WS02       | WS04       | TP01       | TP01       | TP02       | TP05       | TP07       | TP08       |
| Depth         | 2.10       | 0.50       | 1.00       | 0.50       | 3.50       | 2.00       | 2.00       | 0.50       | 0.50       | 0.50       | 0.50       | 0.50       |
| Other ID      |            |            |            |            |            |            |            |            |            |            |            |            |
| Sample Type   | D          | ES         | ES         | ES         | D          | D          | D          | ES         | ES         | ES         | ES         | ES         |
| Sampling Date | 08/09/2020 | 08/09/2020 | 08/09/2020 | 08/09/2020 | 08/09/2020 | 08/09/2020 | 08/09/2020 | 08/09/2020 | 08/09/2020 | 08/09/2020 | 08/09/2020 | 08/09/2020 |
| Sampling Time | n/s        | n/s        | n/s        | n/s        | n/s        | n/s        | n/s        | n/s        | n/s        | n/s        | n/s        | n/s        |

| Test                            | Method      | LOD  | Units |
|---------------------------------|-------------|------|-------|
| <b>Metals</b>                   |             |      |       |
| Magnesium Aqueous Extract       | DETSC 2076* | 10   | mg/l  |
| <b>Inorganics</b>               |             |      |       |
| pH                              | DETSC 2008# |      | pH    |
| Chloride Aqueous Extract        | DETSC 2055  | 1    | mg/l  |
| Nitrate Aqueous Extract as NO3  | DETSC 2055  | 1    | mg/l  |
| Sulphate Aqueous Extract as SO4 | DETSC 2076# | 10   | mg/l  |
| Sulphur as S, Total             | DETSC 2320  | 0.01 | %     |
| Sulphate as SO4, Total          | DETSC 2321# | 0.01 | %     |

## Information in Support of the Analytical Results

Our Ref 20-17753  
Client Ref 2387  
Contract Wynnstay

### Containers Received & Deviating Samples

| Lab No  | Sample ID      | Date Sampled | Containers Received         | Holding time exceeded for tests | Inappropriate container for tests |
|---------|----------------|--------------|-----------------------------|---------------------------------|-----------------------------------|
| 1726746 | TP02 2.10 SOIL | 08/09/20     | PT 1L                       |                                 |                                   |
| 1726747 | TP04 0.50 SOIL | 08/09/20     | GJ 250ml, GJ 60ml x2, PT 1L |                                 |                                   |
| 1726748 | TP06 1.00 SOIL | 08/09/20     | GJ 250ml, GJ 60ml x2, PT 1L |                                 |                                   |
| 1726749 | TP10 0.50 SOIL | 08/09/20     | GJ 250ml, GJ 60ml x2, PT 1L |                                 |                                   |
| 1726901 | WS02 3.50 SOIL | 08/09/20     | PT 1L                       |                                 |                                   |
| 1726902 | WS04 2.00 SOIL | 08/09/20     | PT 1L                       |                                 |                                   |
| 1726903 | TP01 2.00 SOIL | 08/09/20     | PT 1L                       |                                 |                                   |
| 1726904 | TP01 0.50 SOIL | 08/09/20     | GJ 250ml, GJ 60ml x2, PT 1L |                                 |                                   |
| 1726905 | TP02 0.50 SOIL | 08/09/20     | GJ 250ml, GJ 60ml x2, PT 1L |                                 |                                   |
| 1726906 | TP05 0.50 SOIL | 08/09/20     | GJ 250ml, GJ 60ml x2, PT 1L |                                 |                                   |
| 1726907 | TP07 0.50 SOIL | 08/09/20     | GJ 250ml, GJ 60ml x2, PT 1L |                                 |                                   |
| 1726908 | TP08 0.50 SOIL | 08/09/20     | GJ 250ml, GJ 60ml x2, PT 1L |                                 |                                   |

Key: P-Plastic T-Tub G-Glass J-Jar

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

### Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

### Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report



## Certificate of Analysis

*Certificate Number* 20-17753-1

06-Oct-20

*Client* GroundSolve Limited  
Unit 1  
Well House Barns  
Bretton  
Flintshire  
FAO Adam Fenwick  
CH4 ODH

*Our Reference* 20-17753-1

*Client Reference* 2387

*Order No* (not supplied)

*Contract Title* Wynnstay

*Description* 12 Soil samples.

*Date Received* 15-Sep-20

*Date Started* 15-Sep-20

*Date Completed* 06-Oct-20

*Test Procedures* Identified by prefix DETSn (details on request).

*Notes* **This report supersedes 20-17753, extra testing added**

Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

*Approved By*

Adam Fenwick  
Contracts Manager



# Summary of Chemical Analysis

## Soil Samples

Our Ref 20-17753-1

Client Ref 2387

Contract Title Wynnstay

| Lab No        | 1726746    | 1726747    | 1726748    | 1726749    | 1726901    | 1726902    |
|---------------|------------|------------|------------|------------|------------|------------|
| Sample ID     | TP02       | TP04       | TP06       | TP10       | WS02       | WS04       |
| Depth         | 2.10       | 0.50       | 1.00       | 0.50       | 3.50       | 2.00       |
| Other ID      |            |            |            |            |            |            |
| Sample Type   | D          | ES         | ES         | ES         | D          | D          |
| Sampling Date | 08/09/2020 | 08/09/2020 | 08/09/2020 | 08/09/2020 | 08/09/2020 | 08/09/2020 |
| Sampling Time | n/s        | n/s        | n/s        | n/s        | n/s        | n/s        |

| Test                            | Method      | LOD  | Units |      |         |        |        |     |     |
|---------------------------------|-------------|------|-------|------|---------|--------|--------|-----|-----|
| <b>Metals</b>                   |             |      |       |      |         |        |        |     |     |
| Arsenic                         | DETSC 2301# | 0.2  | mg/kg |      | 16      | 2.8    | 14     |     |     |
| Boron, Water Soluble            | DETSC 2311# | 0.2  | mg/kg |      | 0.4     | 0.5    | 0.5    |     |     |
| Cadmium                         | DETSC 2301# | 0.1  | mg/kg |      | 0.3     | < 0.1  | 0.5    |     |     |
| Chromium                        | DETSC 2301# | 0.15 | mg/kg |      | 15      | 16     | 10     |     |     |
| Chromium III                    | DETSC 2301* | 0.15 | mg/kg |      | 15      | 16     | 10     |     |     |
| Chromium, Hexavalent            | DETSC 2204* | 1    | mg/kg |      | < 1.0   | < 1.0  | < 1.0  |     |     |
| Copper                          | DETSC 2301# | 0.2  | mg/kg |      | 45      | 24     | 31     |     |     |
| Lead                            | DETSC 2301# | 0.3  | mg/kg |      | 49      | 15     | 30     |     |     |
| Magnesium Aqueous Extract       | DETSC 2076* | 10   | mg/l  |      | < 10    | < 10   | < 10   |     |     |
| Mercury                         | DETSC 2325# | 0.05 | mg/kg |      | 0.10    | < 0.05 | < 0.05 |     |     |
| Nickel                          | DETSC 2301# | 1    | mg/kg |      | 32      | 56     | 62     |     |     |
| Selenium                        | DETSC 2301# | 0.5  | mg/kg |      | 2.2     | < 0.5  | 3.3    |     |     |
| Zinc                            | DETSC 2301# | 1    | mg/kg |      | 91      | 59     | 92     |     |     |
| <b>Inorganics</b>               |             |      |       |      |         |        |        |     |     |
| pH                              | DETSC 2008# |      | pH    | 7.8  | 6.7     | 7.6    | 7.6    | 7.7 | 7.6 |
| Cyanide, Total                  | DETSC 2130# | 0.1  | mg/kg |      | 0.1     | < 0.1  | < 0.1  |     |     |
| Organic matter                  | DETSC 2002# | 0.1  | %     |      | 1.8     | 2.0    | 0.6    |     |     |
| Chloride Aqueous Extract        | DETSC 2055  | 1    | mg/l  |      | < 10.00 | 4.3    | 2.2    |     |     |
| Nitrate Aqueous Extract as NO3  | DETSC 2055  | 1    | mg/l  |      | 5.3     | < 1.0  | < 1.0  |     |     |
| Sulphate Aqueous Extract as SO4 | DETSC 2076# | 10   | mg/l  | 1700 | 89      | 110    | 110    | 94  | 100 |
| Sulphide                        | DETSC 2024* | 10   | mg/kg |      | 24      | 52     | < 10   |     |     |
| Sulphur (free)                  | DETSC 3049# | 0.75 | mg/kg |      | 13      | 5.0    | < 0.75 |     |     |
| Sulphur as S, Total             | DETSC 2320  | 0.01 | %     |      | 0.08    | 0.04   | 0.12   |     |     |
| Sulphate as SO4, Total          | DETSC 2321# | 0.01 | %     |      | 0.11    | 0.05   | 0.25   |     |     |
| <b>Petroleum Hydrocarbons</b>   |             |      |       |      |         |        |        |     |     |
| Aliphatic C5-C6                 | DETSC 3321* | 0.01 | mg/kg |      | < 0.01  | < 0.01 | < 0.01 |     |     |
| Aliphatic C6-C8                 | DETSC 3321* | 0.01 | mg/kg |      | < 0.01  | < 0.01 | < 0.01 |     |     |
| Aliphatic C8-C10                | DETSC 3321* | 0.01 | mg/kg |      | < 0.01  | < 0.01 | < 0.01 |     |     |
| Aliphatic C10-C12               | DETSC 3072# | 1.5  | mg/kg |      | < 1.5   | < 1.5  | < 1.5  |     |     |
| Aliphatic C12-C16               | DETSC 3072# | 1.2  | mg/kg |      | < 1.2   | < 1.2  | < 1.2  |     |     |
| Aliphatic C16-C21               | DETSC 3072# | 1.5  | mg/kg |      | < 1.5   | < 1.5  | < 1.5  |     |     |
| Aliphatic C21-C35               | DETSC 3072# | 3.4  | mg/kg |      | < 3.4   | < 3.4  | < 3.4  |     |     |
| Aliphatic C35-C40               | DETSC 3072* | 3.4  | mg/kg |      | < 3.4   | < 3.4  | < 3.4  |     |     |
| Aliphatic C5-C35                | DETSC 3072* | 10   | mg/kg |      | < 10    | < 10   | < 10   |     |     |
| Aromatic C5-C7                  | DETSC 3321* | 0.01 | mg/kg |      | < 0.01  | < 0.01 | < 0.01 |     |     |
| Aromatic C7-C8                  | DETSC 3321* | 0.01 | mg/kg |      | < 0.01  | < 0.01 | < 0.01 |     |     |
| Aromatic C8-C10                 | DETSC 3321* | 0.01 | mg/kg |      | < 0.01  | < 0.01 | < 0.01 |     |     |
| Aromatic C10-C12                | DETSC 3072# | 0.9  | mg/kg |      | < 0.9   | < 0.9  | < 0.9  |     |     |
| Aromatic C12-C16                | DETSC 3072# | 0.5  | mg/kg |      | < 0.5   | < 0.5  | < 0.5  |     |     |
| Aromatic C16-C21                | DETSC 3072# | 0.6  | mg/kg |      | < 0.6   | < 0.6  | < 0.6  |     |     |
| Aromatic C21-C35                | DETSC 3072# | 1.4  | mg/kg |      | < 1.4   | < 1.4  | < 1.4  |     |     |
| Aromatic C35-C40                | DETSC 3072* | 1.4  | mg/kg |      | < 1.4   | < 1.4  | < 1.4  |     |     |



# Summary of Chemical Analysis

## Soil Samples

Our Ref 20-17753-1

Client Ref 2387

Contract Title Wynnstay

| Lab No        | 1726746    | 1726747    | 1726748    | 1726749    | 1726901    | 1726902    |
|---------------|------------|------------|------------|------------|------------|------------|
| Sample ID     | TP02       | TP04       | TP06       | TP10       | WS02       | WS04       |
| Depth         | 2.10       | 0.50       | 1.00       | 0.50       | 3.50       | 2.00       |
| Other ID      |            |            |            |            |            |            |
| Sample Type   | D          | ES         | ES         | ES         | D          | D          |
| Sampling Date | 08/09/2020 | 08/09/2020 | 08/09/2020 | 08/09/2020 | 08/09/2020 | 08/09/2020 |
| Sampling Time | n/s        | n/s        | n/s        | n/s        | n/s        | n/s        |

| Test                    | Method      | LOD  | Units |  |        |        |        |  |  |
|-------------------------|-------------|------|-------|--|--------|--------|--------|--|--|
| Aromatic C5-C35         | DETSC 3072* | 10   | mg/kg |  | < 10   | < 10   | < 10   |  |  |
| TPH Ali/Aro Total       | DETSC 3072* | 10   | mg/kg |  | < 10   | < 10   | < 10   |  |  |
| <b>PAHs</b>             |             |      |       |  |        |        |        |  |  |
| Naphthalene             | DETSC 3303# | 0.03 | mg/kg |  | < 0.03 | < 0.03 | < 0.03 |  |  |
| Acenaphthylene          | DETSC 3303# | 0.03 | mg/kg |  | < 0.03 | < 0.03 | < 0.03 |  |  |
| Acenaphthene            | DETSC 3303# | 0.03 | mg/kg |  | < 0.03 | < 0.03 | < 0.03 |  |  |
| Fluorene                | DETSC 3303  | 0.03 | mg/kg |  | < 0.03 | < 0.03 | < 0.03 |  |  |
| Phenanthrene            | DETSC 3303# | 0.03 | mg/kg |  | < 0.03 | < 0.03 | < 0.03 |  |  |
| Anthracene              | DETSC 3303  | 0.03 | mg/kg |  | < 0.03 | < 0.03 | < 0.03 |  |  |
| Fluoranthene            | DETSC 3303# | 0.03 | mg/kg |  | < 0.03 | < 0.03 | < 0.03 |  |  |
| Pyrene                  | DETSC 3303# | 0.03 | mg/kg |  | < 0.03 | < 0.03 | < 0.03 |  |  |
| Benzo(a)anthracene      | DETSC 3303# | 0.03 | mg/kg |  | < 0.03 | < 0.03 | < 0.03 |  |  |
| Chrysene                | DETSC 3303  | 0.03 | mg/kg |  | < 0.03 | < 0.03 | < 0.03 |  |  |
| Benzo(b)fluoranthene    | DETSC 3303# | 0.03 | mg/kg |  | < 0.03 | < 0.03 | < 0.03 |  |  |
| Benzo(k)fluoranthene    | DETSC 3303# | 0.03 | mg/kg |  | < 0.03 | < 0.03 | < 0.03 |  |  |
| Benzo(a)pyrene          | DETSC 3303# | 0.03 | mg/kg |  | < 0.03 | < 0.03 | < 0.03 |  |  |
| Indeno(1,2,3-c,d)pyrene | DETSC 3303# | 0.03 | mg/kg |  | < 0.03 | < 0.03 | < 0.03 |  |  |
| Dibenzo(a,h)anthracene  | DETSC 3303# | 0.03 | mg/kg |  | < 0.03 | < 0.03 | < 0.03 |  |  |
| Benzo(g,h,i)perylene    | DETSC 3303# | 0.03 | mg/kg |  | < 0.03 | < 0.03 | < 0.03 |  |  |
| PAH - USEPA 16, Total   | DETSC 3303  | 0.1  | mg/kg |  | < 0.10 | < 0.10 | < 0.10 |  |  |
| <b>Phenols</b>          |             |      |       |  |        |        |        |  |  |
| Phenol - Monohydric     | DETSC 2130# | 0.3  | mg/kg |  | 1.7    | < 0.3  | < 0.3  |  |  |

# Summary of Chemical Analysis Soil Samples

Our Ref 20-17753-1

Client Ref 2387

Contract Title Wynnstay

| Lab No        | 1726903    | 1726904    | 1726905    | 1726906    | 1726907    | 1726908    |
|---------------|------------|------------|------------|------------|------------|------------|
| Sample ID     | TP01       | TP01       | TP02       | TP05       | TP07       | TP08       |
| Depth         | 2.00       | 0.50       | 0.50       | 0.50       | 0.50       | 0.50       |
| Other ID      |            |            |            |            |            |            |
| Sample Type   | D          | ES         | ES         | ES         | ES         | ES         |
| Sampling Date | 08/09/2020 | 08/09/2020 | 08/09/2020 | 08/09/2020 | 08/09/2020 | 08/09/2020 |
| Sampling Time | n/s        | n/s        | n/s        | n/s        | n/s        | n/s        |

| Test                            | Method      | LOD  | Units |     |        |        |        |        |        |
|---------------------------------|-------------|------|-------|-----|--------|--------|--------|--------|--------|
| <b>Metals</b>                   |             |      |       |     |        |        |        |        |        |
| Arsenic                         | DETSC 2301# | 0.2  | mg/kg |     | 9.0    | 57     | 10     | 15     | 20     |
| Boron, Water Soluble            | DETSC 2311# | 0.2  | mg/kg |     | 0.3    | 0.8    | 0.5    | 0.7    | 0.5    |
| Cadmium                         | DETSC 2301# | 0.1  | mg/kg |     | 0.3    | < 0.1  | 0.3    | 0.7    | 0.4    |
| Chromium                        | DETSC 2301# | 0.15 | mg/kg |     | 15     | 29     | 11     | 15     | 17     |
| Chromium III                    | DETSC 2301* | 0.15 | mg/kg |     | 15     | 29     | 11     | 15     | 17     |
| Chromium, Hexavalent            | DETSC 2204* | 1    | mg/kg |     | < 1.0  | < 1.0  | < 1.0  | < 1.0  | < 1.0  |
| Copper                          | DETSC 2301# | 0.2  | mg/kg |     | 27     | 60     | 49     | 43     | 53     |
| Lead                            | DETSC 2301# | 0.3  | mg/kg |     | 72     | 68     | 24     | 69     | 36     |
| Magnesium Aqueous Extract       | DETSC 2076* | 10   | mg/l  |     | < 10   | < 10   | < 10   | < 10   | < 10   |
| Mercury                         | DETSC 2325# | 0.05 | mg/kg |     | < 0.05 | < 0.05 | < 0.05 | 0.12   | 0.18   |
| Nickel                          | DETSC 2301# | 1    | mg/kg |     | 27     | 37     | 30     | 31     | 33     |
| Selenium                        | DETSC 2301# | 0.5  | mg/kg |     | < 0.5  | < 0.5  | 1.6    | 1.0    | 1.6    |
| Zinc                            | DETSC 2301# | 1    | mg/kg |     | 79     | 71     | 83     | 220    | 91     |
| <b>Inorganics</b>               |             |      |       |     |        |        |        |        |        |
| pH                              | DETSC 2008# |      | pH    | 5.4 | 8.0    | 6.6    | 6.3    | 7.0    | 7.1    |
| Cyanide, Total                  | DETSC 2130# | 0.1  | mg/kg |     | < 0.1  | < 0.1  | < 0.1  | < 0.1  | < 0.1  |
| Organic matter                  | DETSC 2002# | 0.1  | %     |     | 0.8    | 0.6    | 5.7    | 7.4    | 5.1    |
| Chloride Aqueous Extract        | DETSC 2055  | 1    | mg/l  |     | 21     | 2.7    | 2.8    | 9.1    | 3.5    |
| Nitrate Aqueous Extract as NO3  | DETSC 2055  | 1    | mg/l  |     | 1.4    | < 1.0  | 2.9    | 7.6    | 1.3    |
| Sulphate Aqueous Extract as SO4 | DETSC 2076# | 10   | mg/l  | 110 | 55     | 17     | 15     | 30     | 18     |
| Sulphide                        | DETSC 2024* | 10   | mg/kg |     | < 10   | < 10   | < 10   | 60     | 16     |
| Sulphur (free)                  | DETSC 3049# | 0.75 | mg/kg |     | < 0.75 | < 0.75 | < 0.75 | 5.3    | 1.9    |
| Sulphur as S, Total             | DETSC 2320  | 0.01 | %     |     | 0.05   | 0.06   | 0.06   | 0.07   | 0.19   |
| Sulphate as SO4, Total          | DETSC 2321# | 0.01 | %     |     | 0.04   | 0.12   | 0.06   | 0.09   | 0.28   |
| <b>Petroleum Hydrocarbons</b>   |             |      |       |     |        |        |        |        |        |
| Aliphatic C5-C6                 | DETSC 3321* | 0.01 | mg/kg |     | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Aliphatic C6-C8                 | DETSC 3321* | 0.01 | mg/kg |     | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Aliphatic C8-C10                | DETSC 3321* | 0.01 | mg/kg |     | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Aliphatic C10-C12               | DETSC 3072# | 1.5  | mg/kg |     | < 1.5  | < 1.5  | < 1.5  | < 1.5  | < 1.5  |
| Aliphatic C12-C16               | DETSC 3072# | 1.2  | mg/kg |     | < 1.2  | < 1.2  | < 1.2  | < 1.2  | < 1.2  |
| Aliphatic C16-C21               | DETSC 3072# | 1.5  | mg/kg |     | < 1.5  | < 1.5  | < 1.5  | < 1.5  | < 1.5  |
| Aliphatic C21-C35               | DETSC 3072# | 3.4  | mg/kg |     | < 3.4  | < 3.4  | < 3.4  | < 3.4  | < 3.4  |
| Aliphatic C35-C40               | DETSC 3072* | 3.4  | mg/kg |     | < 3.4  | < 3.4  | < 3.4  | < 3.4  | < 3.4  |
| Aliphatic C5-C35                | DETSC 3072* | 10   | mg/kg |     | < 10   | < 10   | < 10   | < 10   | < 10   |
| Aromatic C5-C7                  | DETSC 3321* | 0.01 | mg/kg |     | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Aromatic C7-C8                  | DETSC 3321* | 0.01 | mg/kg |     | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Aromatic C8-C10                 | DETSC 3321* | 0.01 | mg/kg |     | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Aromatic C10-C12                | DETSC 3072# | 0.9  | mg/kg |     | < 0.9  | < 0.9  | < 0.9  | < 0.9  | < 0.9  |
| Aromatic C12-C16                | DETSC 3072# | 0.5  | mg/kg |     | < 0.5  | < 0.5  | < 0.5  | < 0.5  | < 0.5  |
| Aromatic C16-C21                | DETSC 3072# | 0.6  | mg/kg |     | < 0.6  | < 0.6  | < 0.6  | < 0.6  | < 0.6  |
| Aromatic C21-C35                | DETSC 3072# | 1.4  | mg/kg |     | < 1.4  | < 1.4  | < 1.4  | < 1.4  | < 1.4  |
| Aromatic C35-C40                | DETSC 3072* | 1.4  | mg/kg |     | < 1.4  | < 1.4  | < 1.4  | < 1.4  | < 1.4  |

# Summary of Chemical Analysis

## Soil Samples

Our Ref 20-17753-1

Client Ref 2387

Contract Title Wynnstay

| Lab No        | 1726903    | 1726904    | 1726905    | 1726906    | 1726907    | 1726908    |
|---------------|------------|------------|------------|------------|------------|------------|
| Sample ID     | TP01       | TP01       | TP02       | TP05       | TP07       | TP08       |
| Depth         | 2.00       | 0.50       | 0.50       | 0.50       | 0.50       | 0.50       |
| Other ID      |            |            |            |            |            |            |
| Sample Type   | D          | ES         | ES         | ES         | ES         | ES         |
| Sampling Date | 08/09/2020 | 08/09/2020 | 08/09/2020 | 08/09/2020 | 08/09/2020 | 08/09/2020 |
| Sampling Time | n/s        | n/s        | n/s        | n/s        | n/s        | n/s        |

| Test                    | Method      | LOD  | Units |  |        |        |        |        |        |
|-------------------------|-------------|------|-------|--|--------|--------|--------|--------|--------|
| Aromatic C5-C35         | DETSC 3072* | 10   | mg/kg |  | < 10   | < 10   | < 10   | < 10   | < 10   |
| TPH Ali/Aro Total       | DETSC 3072* | 10   | mg/kg |  | < 10   | < 10   | < 10   | < 10   | < 10   |
| <b>PAHs</b>             |             |      |       |  |        |        |        |        |        |
| Naphthalene             | DETSC 3303# | 0.03 | mg/kg |  | < 0.03 | < 0.03 | < 0.03 | 0.05   | < 0.03 |
| Acenaphthylene          | DETSC 3303# | 0.03 | mg/kg |  | < 0.03 | < 0.03 | < 0.03 | < 0.03 | < 0.03 |
| Acenaphthene            | DETSC 3303# | 0.03 | mg/kg |  | < 0.03 | < 0.03 | < 0.03 | < 0.03 | < 0.03 |
| Fluorene                | DETSC 3303  | 0.03 | mg/kg |  | < 0.03 | < 0.03 | < 0.03 | < 0.03 | < 0.03 |
| Phenanthrene            | DETSC 3303# | 0.03 | mg/kg |  | < 0.03 | < 0.03 | < 0.03 | 0.44   | < 0.03 |
| Anthracene              | DETSC 3303  | 0.03 | mg/kg |  | < 0.03 | < 0.03 | < 0.03 | 0.09   | 0.04   |
| Fluoranthene            | DETSC 3303# | 0.03 | mg/kg |  | < 0.03 | < 0.03 | < 0.03 | 1.1    | < 0.03 |
| Pyrene                  | DETSC 3303# | 0.03 | mg/kg |  | < 0.03 | < 0.03 | < 0.03 | 0.96   | < 0.03 |
| Benzo(a)anthracene      | DETSC 3303# | 0.03 | mg/kg |  | < 0.03 | < 0.03 | < 0.03 | 0.34   | < 0.03 |
| Chrysene                | DETSC 3303  | 0.03 | mg/kg |  | < 0.03 | < 0.03 | < 0.03 | 0.39   | < 0.03 |
| Benzo(b)fluoranthene    | DETSC 3303# | 0.03 | mg/kg |  | < 0.03 | < 0.03 | < 0.03 | 0.35   | < 0.03 |
| Benzo(k)fluoranthene    | DETSC 3303# | 0.03 | mg/kg |  | < 0.03 | < 0.03 | < 0.03 | 0.14   | < 0.03 |
| Benzo(a)pyrene          | DETSC 3303# | 0.03 | mg/kg |  | < 0.03 | < 0.03 | < 0.03 | 0.27   | < 0.03 |
| Indeno(1,2,3-c,d)pyrene | DETSC 3303# | 0.03 | mg/kg |  | < 0.03 | < 0.03 | < 0.03 | 0.12   | < 0.03 |
| Dibenzo(a,h)anthracene  | DETSC 3303# | 0.03 | mg/kg |  | < 0.03 | < 0.03 | < 0.03 | < 0.03 | < 0.03 |
| Benzo(g,h,i)perylene    | DETSC 3303# | 0.03 | mg/kg |  | < 0.03 | < 0.03 | < 0.03 | 0.13   | < 0.03 |
| PAH - USEPA 16, Total   | DETSC 3303  | 0.1  | mg/kg |  | < 0.10 | < 0.10 | < 0.10 | 4.4    | < 0.10 |
| <b>Phenols</b>          |             |      |       |  |        |        |        |        |        |
| Phenol - Monohydric     | DETSC 2130# | 0.3  | mg/kg |  | < 0.3  | < 0.3  | < 0.3  | 0.4    | 0.3    |

## Summary of Asbestos Analysis Soil Samples

*Our Ref* 20-17753-1

*Client Ref* 2387

*Contract Title* Wynnstay

| Lab No  | Sample ID | Material Type | Result | Comment* | Analyst         |
|---------|-----------|---------------|--------|----------|-----------------|
| 1726747 | TP04 0.50 | SOIL          | NAD    | none     | Joanne Luscombe |
| 1726748 | TP06 1.00 | SOIL          | NAD    | none     | Joanne Luscombe |
| 1726749 | TP10 0.50 | SOIL          | NAD    | none     | Joanne Luscombe |
| 1726904 | TP01 0.50 | SOIL          | NAD    | none     | Joanne Luscombe |
| 1726905 | TP02 0.50 | SOIL          | NAD    | none     | Joanne Luscombe |
| 1726906 | TP05 0.50 | SOIL          | NAD    | none     | Joanne Luscombe |
| 1726907 | TP07 0.50 | SOIL          | NAD    | none     | Joanne Luscombe |
| 1726908 | TP08 0.50 | SOIL          | NAD    | none     | Joanne Luscombe |

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: \* - not included in laboratory scope of accreditation.



## Information in Support of the Analytical Results

Our Ref 20-17753-1  
 Client Ref 2387  
 Contract Wynnstay

### Containers Received & Deviating Samples

| Lab No  | Sample ID      | Date Sampled | Containers Received         | Hold time exceeded for tests | Inappropriate container for tests |
|---------|----------------|--------------|-----------------------------|------------------------------|-----------------------------------|
| 1726746 | TP02 2.10 SOIL | 08/09/20     | PT 1L                       |                              |                                   |
| 1726747 | TP04 0.50 SOIL | 08/09/20     | GJ 250ml, GJ 60ml x2, PT 1L |                              |                                   |
| 1726748 | TP06 1.00 SOIL | 08/09/20     | GJ 250ml, GJ 60ml x2, PT 1L |                              |                                   |
| 1726749 | TP10 0.50 SOIL | 08/09/20     | GJ 250ml, GJ 60ml x2, PT 1L |                              |                                   |
| 1726901 | WS02 3.50 SOIL | 08/09/20     | PT 1L                       |                              |                                   |
| 1726902 | WS04 2.00 SOIL | 08/09/20     | PT 1L                       |                              |                                   |
| 1726903 | TP01 2.00 SOIL | 08/09/20     | PT 1L                       |                              |                                   |
| 1726904 | TP01 0.50 SOIL | 08/09/20     | GJ 250ml, GJ 60ml x2, PT 1L |                              |                                   |
| 1726905 | TP02 0.50 SOIL | 08/09/20     | GJ 250ml, GJ 60ml x2, PT 1L |                              |                                   |
| 1726906 | TP05 0.50 SOIL | 08/09/20     | GJ 250ml, GJ 60ml x2, PT 1L |                              |                                   |
| 1726907 | TP07 0.50 SOIL | 08/09/20     | GJ 250ml, GJ 60ml x2, PT 1L |                              |                                   |
| 1726908 | TP08 0.50 SOIL | 08/09/20     | GJ 250ml, GJ 60ml x2, PT 1L |                              |                                   |

Key: P-Plastic T-Tub G-Glass J-Jar

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

### Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

### Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report

## **APPENDIX G – GEOTECHNICAL TEST RESULTS**

# Certificate of Accreditation



## Geotechnics Limited

Testing Laboratory No. 1365

**Is accredited in accordance with International Standard ISO/IEC 17025:2017  
– General Requirements for the competence of testing and calibration  
laboratories.**

This accreditation demonstrates technical competence for a defined scope specified in the schedule to this certificate, and the operation of a management system (refer joint ISO-ILAC-IAF Communiqué dated April 2017). The schedule to this certificate is an essential accreditation document and from time to time may be revised and reissued.

The most recent issue of the schedule of accreditation, which bears the same accreditation number as this certificate, is available from [www.ukas.com](http://www.ukas.com).

This accreditation is subject to continuing conformity with United Kingdom Accreditation Service requirements.

A handwritten signature in black ink, reading "Matt Gantley", is positioned above a horizontal line.

**Matt Gantley**, *Chief Executive Officer*  
United Kingdom Accreditation Service

Initial Accreditation: 1 September 1993  
Certificate Issued: 9 December 2019



Scan QR Code to  
verify

# Schedule of Accreditation

issued by

## United Kingdom Accreditation Service

2 Pine Trees, Chertsey Lane, Staines-Upon-Thames, Middlesex TW18 3HR

|                                                                                                                                                         |                                                                                                                              |                                                                                                                                                                                                                                                                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p><b>1365</b></p> <p>Accredited to<br/><b>ISO/IEC 17025:2017</b></p> | <p align="center"><b>Geotechnics Limited</b></p> <p align="center"><b>Issue No: 021    Issue date: 14 September 2020</b></p> |                                                                                                                                                                                                                                                                   |
|                                                                                                                                                         | <p><b>The Geotechnical Centre</b><br/>203 Torrington Avenue<br/>Tile Hill<br/>Coventry<br/>CV4 9AP</p>                       | <p><b>Contact: Mr Stephane Schiano</b><br/><b>Tel: +44 (0)24 7662 9024</b><br/><b>E-Mail: <a href="mailto:sschiano@geotechnics.co.uk">sschiano@geotechnics.co.uk</a></b><br/><b>Website: <a href="http://www.geotechnics.co.uk">www.geotechnics.co.uk</a></b></p> |
|                                                                                                                                                         | <p align="center"><b>Testing performed at the above address only</b></p>                                                     |                                                                                                                                                                                                                                                                   |

### DETAIL OF ACCREDITATION

| Materials/Products tested                                              | Type of test/Properties measured/Range of measurement        | Standard specifications/ Equipment/Techniques used                                            |
|------------------------------------------------------------------------|--------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| AGGREGATES                                                             | Particle size distribution<br>- sieving method               | BS EN 933-1:2012                                                                              |
|                                                                        | Water content                                                | BS EN 1097-5:2008                                                                             |
| ROCK                                                                   | Point load strength and anisotropy indices                   | ISRM Commission on Testing Methods. Suggested Method for Determining Point Load Strength 1985 |
|                                                                        | Water content – method 1                                     | International Society for Rock Mechanics – suggested methods, Part 1 Test 1: 1981             |
| GEOTECHNICAL INVESTIGATION and TESTING<br>- Laboratory testing of soil | Water content                                                | BS EN ISO 17892-1:2014                                                                        |
|                                                                        | Bulk density<br>- linear measurement method                  | BS EN ISO 17892-2:2014                                                                        |
|                                                                        | Determination of particle density – fluid pycnometer method, | BS EN ISO 17892-3:2015                                                                        |
|                                                                        | Determination of particle size distribution - Sieving method | BS EN ISO 17892-4:2016                                                                        |
|                                                                        | Determination of particle size distribution - Pipette method | BS EN ISO 17892-4:2016                                                                        |
|                                                                        | Incremental loading odometer test                            | BS EN ISO 17892-5:2017                                                                        |
|                                                                        | Unconsolidated undrained triaxial test                       | BS EN ISO 17892-8:2018                                                                        |
|                                                                        | Direct shear (small shearbox)                                | BS EN ISO 17892-10:2018                                                                       |
|                                                                        | Determination of liquid limit (fall cone method)             | BS EN ISO 17892-12:2018                                                                       |



1365  
Accredited to  
ISO/IEC 17025:2017

**Schedule of Accreditation**  
issued by  
**United Kingdom Accreditation Service**  
2 Pine Trees, Chertsey Lane, Staines-Upon-Thames, Middlesex TW18 3HR

**Geotechnics Limited**

**Issue No: 021    Issue date: 14 September 2020**

**Testing performed at main address only**

| Materials/Products tested                                                                                                                 | Type of test/Properties measured/Range of measurement             | Standard specifications/ Equipment/Techniques used |
|-------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|----------------------------------------------------|
| <b>GEOTECHNICAL INVESTIGATION and TESTING</b><br>- Laboratory testing of soil (cont'd)<br><br><b>SOILS for civil engineering purposes</b> | Determination of liquid limit (one-point fall cone method)        | BS EN ISO 17892-12:2018                            |
|                                                                                                                                           | Determination of plastic limit                                    | BS EN ISO 17892-12:2018                            |
|                                                                                                                                           | Determination of plasticity index                                 | BS EN ISO 17892-12:2018                            |
|                                                                                                                                           | Moisture content<br>- oven drying method                          | BS 1377-2:1990                                     |
|                                                                                                                                           | Saturation moisture content of chalk                              | BS 1377-2:1990                                     |
|                                                                                                                                           | Liquid limit<br>- cone penetrometer                               | BS 1377-2:1990                                     |
|                                                                                                                                           | Liquid limit<br>- cone penetrometer<br>- one point                | BS 1377-2:1990                                     |
|                                                                                                                                           | Plastic limit                                                     | BS 1377-2:1990                                     |
|                                                                                                                                           | Plasticity index                                                  | BS 1377-2:1990                                     |
|                                                                                                                                           | Linear shrinkage                                                  | BS 1377-2:1990                                     |
|                                                                                                                                           | Density<br>- linear measurement                                   | BS 1377-2:1990                                     |
|                                                                                                                                           | Particle density<br>- gas jar                                     | BS 1377-2:1990                                     |
|                                                                                                                                           | Particle density<br>- small pycnometer                            | BS 1377-2:1990                                     |
|                                                                                                                                           | Particle density<br>- large pycnometer                            | BS 1377-2:1990                                     |
|                                                                                                                                           | Particle size distribution<br>- wet sieving                       | BS 1377-2:1990                                     |
|                                                                                                                                           | Particle size distribution<br>- dry sieving                       | BS 1377-2:1990                                     |
|                                                                                                                                           | Particle size distribution<br>- sedimentation<br>- pipette method | BS 1377-2:1990                                     |
|                                                                                                                                           | Sulphate content of soil and ground water gravimetric method      | BS 1377-3:1990 (withdrawn)                         |



1365

Accredited to  
ISO/IEC 17025:2017

## Schedule of Accreditation

issued by

### United Kingdom Accreditation Service

2 Pine Trees, Chertsey Lane, Staines-Upon-Thames, Middlesex TW18 3HR

### Geotechnics Limited

Issue No: 021 Issue date: 14 September 2020

Testing performed at main address only

| Materials/Products tested                                                   | Type of test/Properties measured/Range of measurement                                                               | Standard specifications/ Equipment/Techniques used |
|-----------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| SOILS for civil engineering purposes (cont'd)                               | pH value                                                                                                            | BS 1377-3:1990 (withdrawn)                         |
|                                                                             | California Bearing Ratio (CBR)                                                                                      | BS 1377-4:1990                                     |
|                                                                             | Dry density/moisture content relationship (vibrating hammer)                                                        | BS 1377-4:1990                                     |
|                                                                             | Maximum and minimum dry densities for granular soils                                                                | BS 1377-4:1990                                     |
|                                                                             | Moisture condition value (MCV)                                                                                      | BS 1377-4:1990                                     |
|                                                                             | MCV/moisture content relation                                                                                       | BS 1377-4:1990                                     |
|                                                                             | Chalk crushing value                                                                                                | BS 1377-4:1990                                     |
|                                                                             | One-dimensional consolidation properties                                                                            | BS 1377-5:1990                                     |
|                                                                             | Shear strength - small shear box                                                                                    | BS1377-7:1990                                      |
|                                                                             | Residual strength<br>- small ring shear apparatus                                                                   | BS1377-7:1990                                      |
|                                                                             | Unconfined compressive strength<br>- load frame method                                                              | BS 1377-7:1990                                     |
|                                                                             | Undrained shear strength<br>- triaxial compression without measurement of pore pressure                             | BS 1377-7:1990                                     |
|                                                                             | Undrained shear strength<br>- triaxial compression with multistage loading and without measurement of pore pressure | BS 1377-7:1990                                     |
| Hydraulically bound and stabilized materials for civil engineering purposes | Initial consumption of lime                                                                                         | BS 1924-2:2018                                     |
|                                                                             | California Bearing Ratio / immediate bearing index                                                                  | BS EN 13286-47:2012                                |
|                                                                             | Moisture content<br>- oven drying method (definitive)                                                               | BS EN 17892-1:2014                                 |
|                                                                             | Plastic limit                                                                                                       | BS 1924-2:2018                                     |
|                                                                             | Liquid limit                                                                                                        | BS 1924-2:2018                                     |
|                                                                             | Plasticity index                                                                                                    | BS 1924-2:2018                                     |



1365  
Accredited to  
ISO/IEC 17025:2017

**Schedule of Accreditation**  
issued by  
**United Kingdom Accreditation Service**  
2 Pine Trees, Chertsey Lane, Staines-Upon-Thames, Middlesex TW18 3HR

**Geotechnics Limited**

**Issue No:** 021    **Issue date:** 14 September 2020

Testing performed at main address only

| Materials/Products tested                                                   | Type of test/Properties measured/Range of measurement                            | Standard specifications/ Equipment/Techniques used |
|-----------------------------------------------------------------------------|----------------------------------------------------------------------------------|----------------------------------------------------|
| Hydraulically bound and stabilized Materials for civil engineering purposes | Dry density/moisture content relationship (2.5 kg rammer)                        | BS 1924-2:2018 and BS EN 13826-2:2010              |
|                                                                             | Dry density/moisture content relationship (4.5 kg rammer)                        | BS 1924-2:2018 and BS EN 13826-2:2010              |
|                                                                             | Dry density/moisture content relationship (vibrating hammer - subsidiary method) | BS 1924-2:2018 and BS EN 13826-4:2003              |
|                                                                             | Moisture condition value (MCV)                                                   | BS EN 13826-46:2003                                |
| END                                                                         |                                                                                  |                                                    |

## Classification and Strength

| Symbol                | C - Clay<br>(0 - containing organic matter)<br>Plasticity | M - Silt<br>L - Low<br>I - Intermediate<br>H - High<br>V - Very High<br>E - Extremely High |
|-----------------------|-----------------------------------------------------------|--------------------------------------------------------------------------------------------|
| $I_p$                 | Plasticity Index                                          |                                                                                            |
| %                     | % retained on 425 $\mu$ m sieve, shown under $I_p$ value  |                                                                                            |
| $w_L$                 | Liquid Limit                                              |                                                                                            |
| $w_p$                 | Plastic Limit                                             |                                                                                            |
| NP                    | Non-Plastic                                               |                                                                                            |
| NAT                   | Sample tested in natural state                            |                                                                                            |
| w                     | Water Content                                             |                                                                                            |
| $\rho_d$              | Particle Density                                          |                                                                                            |
| Test                  | <b>Quick undrained triaxial tests</b>                     |                                                                                            |
|                       | SS                                                        | Single stage - 102mm diameter.                                                             |
|                       | S3                                                        | Single stage - set of 3<br>38mm diameter.                                                  |
|                       | MS                                                        | Multistage - 102mm diameter.                                                               |
|                       | D                                                         | Drained Test                                                                               |
|                       | HV                                                        | Hand Vane                                                                                  |
|                       | PP                                                        | Pocket Penetrometer ( $\text{kg}/\text{cm}^2$ )                                            |
|                       | NST                                                       | Not suitable for test                                                                      |
| $\gamma_b$            | Bulk Density                                              |                                                                                            |
| $\sigma_3$            | Triaxial Cell Pressure                                    |                                                                                            |
| $\sigma_1 - \sigma_3$ | Deviator Stress                                           |                                                                                            |
| ##                    | Excessive Strain                                          |                                                                                            |
| $c_u$                 | Undrained Cohesion                                        |                                                                                            |
| c                     | Cohesion Intercept                                        |                                                                                            |
| $\phi$                | Angle of Shearing Resistance                              |                                                                                            |
| Linear Shrink         | Linear Shrinkage                                          |                                                                                            |
| Stab add-             | Stabiliser which is added                                 |                                                                                            |

## Consolidation

|           |                                           |
|-----------|-------------------------------------------|
| $m_v$     | Coefficient of Volume Compressibility     |
| $c_{v50}$ | Coefficient of Consolidation - Log t      |
| $c_{v90}$ | Coefficient of Consolidation - $\sqrt{t}$ |

## Rock

|    |                      |
|----|----------------------|
| UF | Unacceptable Failure |
|----|----------------------|

## Chemical Analysis

|                 |                                                                                                                                |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------|
| Acid Soluble    | Total sulphate in specimen, expressed as $\text{SO}_3$ %, value in brackets expressed as $\text{SO}_4$ %                       |
| Water Soluble   | Soluble sulphate in 2:1 water : soil extract, expressed as $\text{SO}_3$ g/l, value in brackets expressed as $\text{SO}_4$ g/l |
| In Water        | Sulphate content of groundwater, expressed as $\text{SO}_3$ g/l, value in brackets expressed as $\text{SO}_4$ g/l              |
| pH              | pH value                                                                                                                       |
| Organic content | Organic content expressed as a percentage of dry weight                                                                        |
| Chloride        | Chloride Ion content expressed as a percentage of dry weight                                                                   |

## MCV, Compaction, CBR

|     |                                                   |
|-----|---------------------------------------------------|
| MCV | Moisture Condition Value at natural water content |
| MCC | Moisture Condition Calibration                    |
| CCV | Chalk Crushing Value                              |

### Compaction

|                                     |              |   |                                                        |
|-------------------------------------|--------------|---|--------------------------------------------------------|
| Type                                | 2.5          | = | 2.5 kg Rammer                                          |
|                                     | 4.5          | = | 4.5 kg Rammer                                          |
|                                     | V            | = | Vibrating Hammer                                       |
| $\gamma_b$                          | Bulk Density |   |                                                        |
| $\gamma_d$                          | Dry Density  |   |                                                        |
| <b>CBR California Bearing Ratio</b> |              |   |                                                        |
| Type                                | 2.5          | = | Test on Specimen<br>Recompacted using<br>2.5 kg Rammer |
|                                     | 4.5          | = | As above but using<br>4.5 kg Rammer                    |
|                                     | V            | = | As above but using<br>Vibrating Hammer                 |
|                                     | M            | = | Test on open drive mould<br>specimen cut in field      |
|                                     | S            | = | Soaked Specimen                                        |

|        |                        |
|--------|------------------------|
| Top    | CBR at top of mould    |
| Bottom | CBR at bottom of mould |
| ND     | None Detected          |

\* In the Sample Description denotes a laboratory only description



# Laboratory Test Certificate

Form REP008 Rev 3

|                           |                                                                                                                             |                                  |                 |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------|----------------------------------|-----------------|
| <b>Issued To</b>          | Tyler Goodrick<br>Groundsolve Ltd<br>Unit 1 Charter Court, Well House Barns<br>Chester Road, Bretton<br>Flintshire, CH4 0DH | <b>Date of issue</b>             | 25/09/2020      |
|                           |                                                                                                                             | <b>Issue No.</b>                 | 1               |
|                           |                                                                                                                             | <b>Client Ref. No.</b>           | 2387/WNY/TG     |
|                           |                                                                                                                             | <b>Samples / Material Source</b> |                 |
| <b>Testing Start Date</b> | 14/09/2020                                                                                                                  | <b>Samples Recv'd</b>            | 14/09/2020      |
| <b>Testing Complete</b>   | 25/09/2020                                                                                                                  | <b>Sample State</b>              | As received     |
| <b>Comments</b>           |                                                                                                                             | <b>Sampled by</b>                | Groundsolve Ltd |
| <b>Project No</b>         | PC207961                                                                                                                    |                                  |                 |
| <b>Project Name</b>       | 2387 - WYNNSTAY, RUABON                                                                                                     |                                  |                 |

## Summary of Tests

| Standard                                 | Test Description                                                     | Test Quantity | UKAS |
|------------------------------------------|----------------------------------------------------------------------|---------------|------|
| BS EN ISO 17892-1:2014                   | Water Content                                                        | 5             | Yes  |
| BS EN ISO 17892-12:2018<br>Cl. 5.3 & 5.5 | Liquid Limit and Plastic Limit (4 Points Method)                     | 5             | Yes  |
| BS EN ISO 17892-4:2016<br>Cl. 5.2        | Particle Size Distribution by Sieving Method                         | 10            | Yes  |
| BS 1377-4:1990<br>Cl. 3.3                | 2.5 kg Rammer Dry Density/Moisture Content Relationship (Compaction) | 3             | Yes  |
|                                          |                                                                      |               |      |
|                                          |                                                                      |               |      |
|                                          |                                                                      |               |      |
|                                          |                                                                      |               |      |
|                                          |                                                                      |               |      |
|                                          |                                                                      |               |      |
|                                          |                                                                      |               |      |
|                                          |                                                                      |               |      |
|                                          |                                                                      |               |      |
|                                          |                                                                      |               |      |
|                                          |                                                                      |               |      |
|                                          |                                                                      |               |      |
|                                          |                                                                      |               |      |
|                                          |                                                                      |               |      |
|                                          |                                                                      |               |      |
|                                          |                                                                      |               |      |

Note: Any descriptions, opinions or interpretations are outside the scope of UKAS accreditation.  
The results within this report relate only to the samples tested and received from the client.



Test Results checked and approved for issue.  
Signed for and on behalf of Geotechnics Limited

*Schiano*

Stephane Schiano (Laboratory Testing Manager)

**GEOTECHNICS**  
geotechnical and geoenvironmental specialists

203 Torrington Avenue, Tile Hill,  
Coventry, CV4 9UT

### LABORATORY RESULTS - Atterberg Limit

**Project** 2387 - WYNNSTAY, RUABON

**Project No:** PC207961

| Sample |                                   |      |               |                                                                                  | Results                                                                                             |               |                        |             |        |                     |                     |                     |
|--------|-----------------------------------|------|---------------|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|---------------|------------------------|-------------|--------|---------------------|---------------------|---------------------|
| Hole   | Depth<br>(Specimen<br>Depth)<br>m | Type | Sample<br>Ref | Description                                                                      | Test Type                                                                                           | Point Data    |                        | Sym-<br>bol | p<br>% | >425<br>sieve<br>µm | w <sub>L</sub><br>% | w <sub>p</sub><br>% |
|        |                                   |      |               |                                                                                  |                                                                                                     | Cone<br>Pene. | Water<br>%<br>(Factor) |             |        |                     |                     |                     |
| TP01   | 1.50<br>(1.50)                    | D    | C48351        | Dark grey slightly sandy organic slightly<br>gravelly CLAY.                      | Fall Cone 4pt with<br>increasing water content,<br>cone type: 80g/30,<br>washed over 425um<br>sieve |               |                        | CI          | 20     | 20%                 | 35                  | 15                  |
| TP04   | 2.00<br>(2.00)                    | D    | C48352        | Dark grey slightly sandy organic slightly<br>gravelly CLAY.                      | Fall Cone 4pt with<br>increasing water content,<br>cone type: 80g/30,<br>washed over 425um<br>sieve |               |                        | CL          | 16     | 8%                  | 33                  | 17                  |
| WS03   | 3.00<br>(3.00)                    | D    | C48353        | Brown occasionally light grey slightly<br>sandy slightly gravelly CLAY.          | Fall Cone 4pt with<br>increasing water content,<br>cone type: 80g/30,<br>washed over 425um<br>sieve |               |                        | CL          | 13     | 37%                 | 26                  | 13                  |
| WS05   | 2.00<br>(2.00)                    | D    | C48354        | Grey slightly sandy slightly gravelly<br>slightly organic CLAY.                  | Fall Cone 4pt with<br>increasing water content,<br>cone type: 80g/30,<br>washed over 425um<br>sieve |               |                        | CI          | 17     | 17%                 | 36                  | 19                  |
| WS08   | 1.50<br>(1.50)                    | D    | C48355        | Greenish brown occasionally light grey<br>slightly sandy slightly gravelly CLAY. | Fall Cone 4pt with<br>increasing water content,<br>cone type: 80g/30,<br>washed over 425um<br>sieve |               |                        | CL          | 17     | 17%                 | 32                  | 15                  |
|        |                                   |      |               |                                                                                  |                                                                                                     |               |                        |             |        |                     |                     |                     |

Remarks





geotechnical and geoenvironmental specialists

## LABORATORY RESULTS - Classification and Strength

**Project** 2387 - WYNNSTAY, RUABON

**Project No:** PC207961

| Sample |                                   |      |               |                                                                               | Classification |                          |            |            |                       | Strength |                                                                |                                 |                                            |                            |                                |
|--------|-----------------------------------|------|---------------|-------------------------------------------------------------------------------|----------------|--------------------------|------------|------------|-----------------------|----------|----------------------------------------------------------------|---------------------------------|--------------------------------------------|----------------------------|--------------------------------|
| Hole   | Depth<br>(Specimen<br>Depth)<br>m | Type | Sample<br>Ref | Description                                                                   | Symbol         | $I_p$<br>( $>425$ )<br>% | $w_L$<br>% | $w_p$<br>% | $w$<br>( $p_d$ )<br>% | Test     | $\gamma_b$<br>( $\gamma_d$ ) <sup>3</sup><br>Mg/m <sup>3</sup> | $\sigma_3$<br>kN/m <sup>2</sup> | $\sigma_1 - \sigma_3$<br>kN/m <sup>2</sup> | $c_u$<br>kN/m <sup>2</sup> | $c_{Avg}$<br>kN/m <sup>2</sup> |
| TP01   | 1.50<br>(1.50)                    | D    | C48351        | Dark grey slightly sandy organic slightly gravelly CLAY.                      | CI             | 20<br>(20%)              | 35         | 15         | 24.1                  |          |                                                                |                                 |                                            |                            |                                |
| TP04   | 2.00<br>(2.00)                    | D    | C48352        | Dark grey slightly sandy organic slightly gravelly CLAY.                      | CL             | 16<br>(8%)               | 33         | 17         | 23.4                  |          |                                                                |                                 |                                            |                            |                                |
| WS03   | 3.00<br>(3.00)                    | D    | C48353        | Brown occasionally light grey slightly sandy slightly gravelly CLAY.          | CL             | 13<br>(37%)              | 26         | 13         | 14.2                  |          |                                                                |                                 |                                            |                            |                                |
| WS05   | 2.00<br>(2.00)                    | D    | C48354        | Grey slightly sandy slightly gravelly slightly organic CLAY.                  | CI             | 17<br>(17%)              | 36         | 19         | 31.2                  |          |                                                                |                                 |                                            |                            |                                |
| WS08   | 1.50<br>(1.50)                    | D    | C48355        | Greenish brown occasionally light grey slightly sandy slightly gravelly CLAY. | CL             | 17<br>(17%)              | 32         | 15         | 20.4                  |          |                                                                |                                 |                                            |                            |                                |
|        |                                   |      |               |                                                                               |                |                          |            |            |                       |          |                                                                |                                 |                                            |                            |                                |

Remarks

AGS

NST - Not suitable for Test

For Standards followed see Laboratory Test Certificate

w% - ^ = Rock water content test; x = Aggregate moisture content test

QUT Water Contents: <Failure Zone>, [After test]

GEOTECHNICS

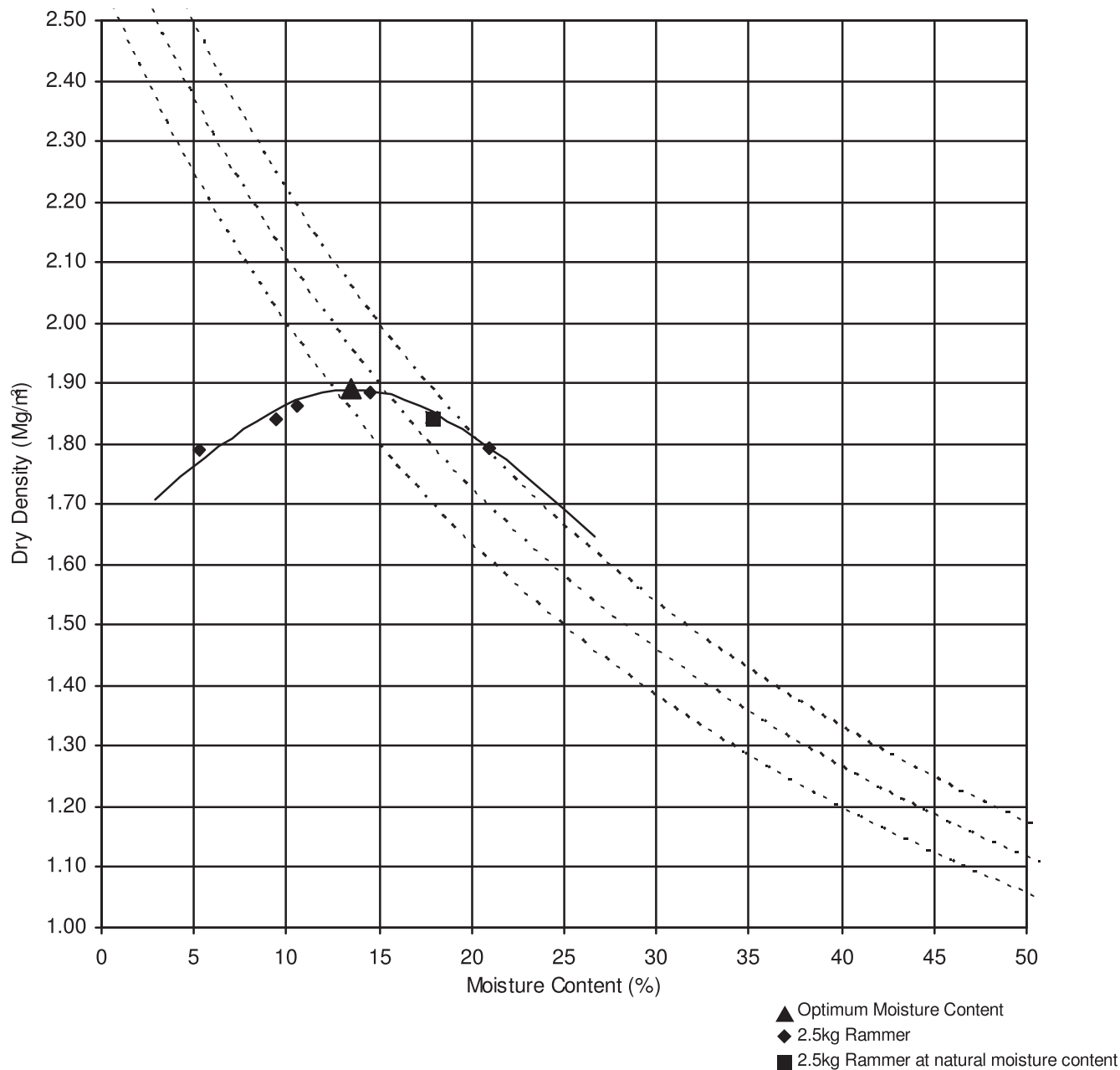
geotechnical and geoenvironmental specialists

# LABORATORY RESULTS - *Compaction*

**Project:** 2387 - WYNNSTAY, RUABON

**Hole** TP03  
**Sample Depth** 1.00m  
**Sample Type** B  
**Sample Ref** C48343

**Project No:** PC207961



**Optimum Moisture Content** 13.5  
**Maximum Dry Density** 1.89 Mg/m<sup>3</sup>

Particles retained on 37.5mm sieve 5 %  
 20mm sieve 12 %

Particle Density 2.85 (Ass'm) Mg/m<sup>3</sup>  
 Preparation Single Sample  
 2.5kg Rammer

Description MADE GROUND: dark grey mottled reddish brown sandy shale/gravel.

**Remarks**  BS1377 Part 4 1990 : Clause 3.3 and 3.4

**GEOTECHNICS**  
 geotechnical and geoenvironmental specialists

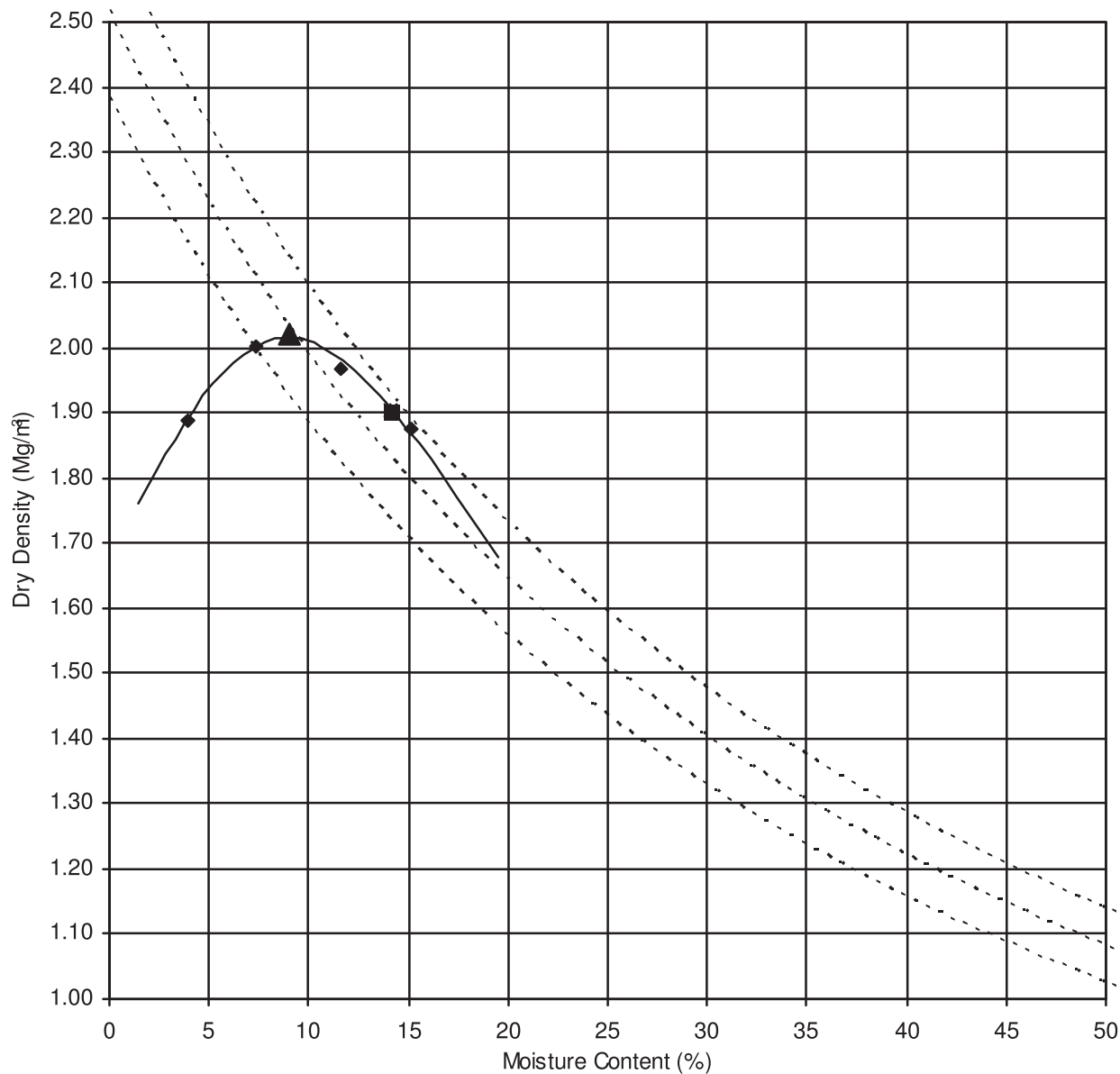
25/09/2020

# LABORATORY RESULTS - *Compaction*

**Project:** 2387 - WYNNSTAY, RUABON

**Project No:** PC207961

**Hole** TP06  
**Sample Depth** 1.00m  
**Sample Type** B  
**Sample Ref** C48346



▲ Optimum Moisture Content  
 ◆ 2.5kg Rammer  
 ■ 2.5kg Rammer at natural moisture content

**Optimum Moisture Content** 9.0  
**Maximum Dry Density** 2.02 Mg/m<sup>3</sup>

Particles retained on 37.5mm sieve 7 %  
 20mm sieve 14 %

Particle Density 2.65 (Assumed) Mg/m<sup>3</sup>  
 Preparation Single Sample  
 2.5kg Rammer

Description MADE GROUND: brown clayey shale/gravel (wet).

**Remarks**  BS1377 Part 4 1990 : Clause 3.3 and 3.4

**GEOTECHNICS**  
 geotechnical and geoenvironmental specialists

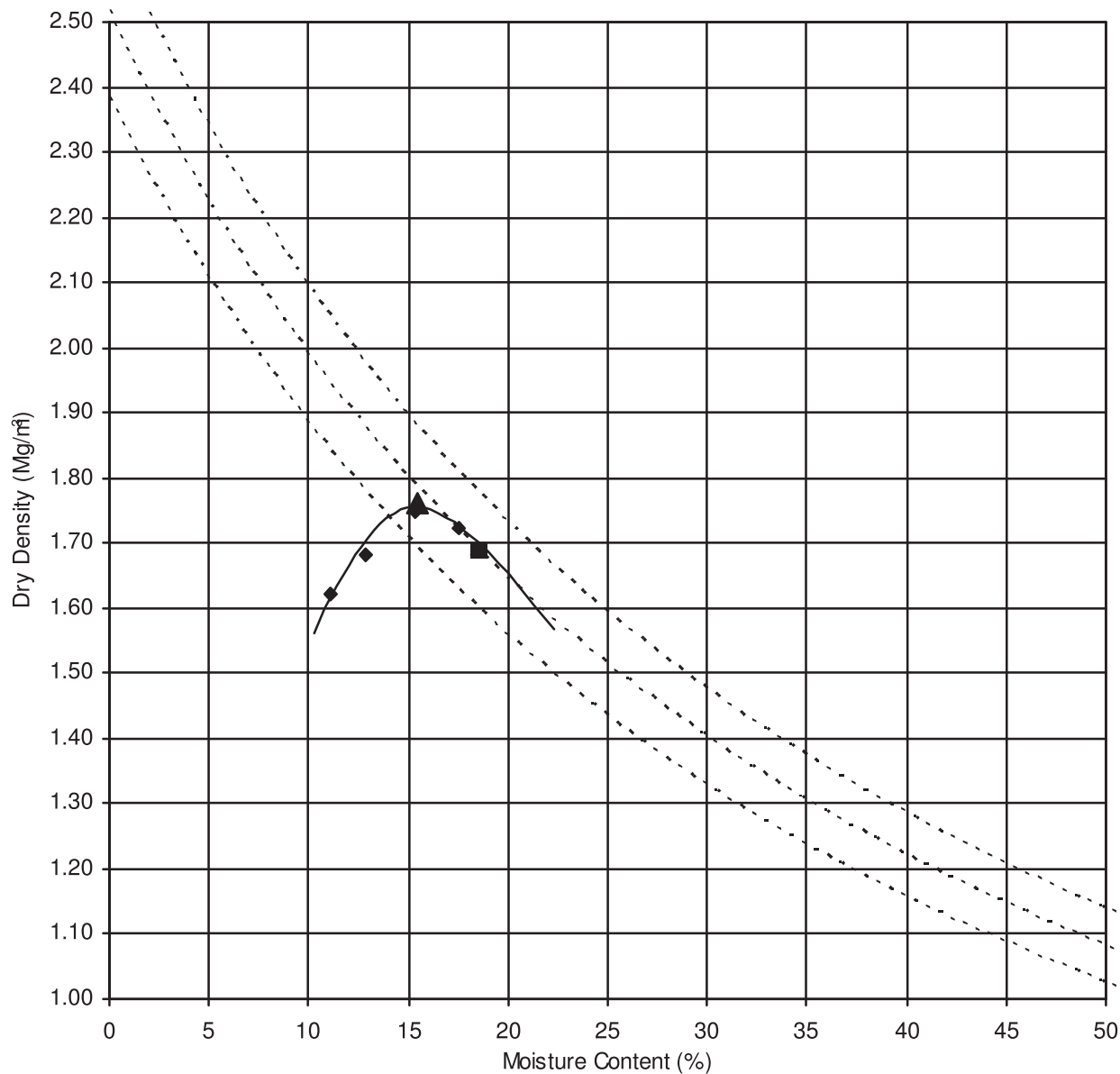
25/09/2020

# LABORATORY RESULTS - *Compaction*

**Project:** 2387 - WYNNSTAY, RUABON

**Project No:** PC207961

**Hole** TP09  
**Sample Depth** 0.50m  
**Sample Type** B  
**Sample Ref** C48349



▲ Optimum Moisture Content  
 ◆ 2.5kg Rammer  
 ■ 2.5kg Rammer at natural moisture content

**Optimum Moisture Content** 15.5  
**Maximum Dry Density** 1.76 Mg/m<sup>3</sup>

Particles retained on 37.5mm sieve 8 %  
 20mm sieve 23 %

Particle Density 2.65 (Assumed) Mg/m<sup>3</sup>  
 Preparation Single Sample  
 2.5kg Rammer

Description MADE GROUND: dark brown clayey sandy shale/gravel with brick fragments.

**Remarks**  BS1377 Part 4 1990 : Clause 3.3 and 3.4

**GEOTECHNICS**  
 geotechnical and geoenvironmental specialists

25/09/2020

LABORATORY RESULTS - MCV, Compaction, CBR

Project 2387 - WYNNSTAY, RUABON

Project No: PC207961

| Sample |                                   |      |               |                                                                               | MCV |        | Compaction |                 |                               |                                 |                                          | CBR  |          |        |          |        |
|--------|-----------------------------------|------|---------------|-------------------------------------------------------------------------------|-----|--------|------------|-----------------|-------------------------------|---------------------------------|------------------------------------------|------|----------|--------|----------|--------|
| Hole   | Depth<br>(Specimen<br>Depth)<br>m | Type | Sample<br>Ref | Description                                                                   | MCV | w<br>% | Type       | w<br>(Opt)<br>% | $\rho_d$<br>Mg/m <sup>3</sup> | $\gamma_b$<br>Mg/m <sup>3</sup> | $\gamma_d$<br>(Max)<br>Mg/m <sup>3</sup> | Type | Top      |        | Bottom   |        |
|        |                                   |      |               |                                                                               |     |        |            |                 |                               |                                 |                                          |      | CBR<br>% | w<br>% | CBR<br>% | w<br>% |
| TP03   | 1.00<br>(1.00)                    | B    | C48343        | MADE GROUND: dark grey<br>mottled reddish brown sandy<br>shale/gravel.        |     |        | 2.5kg      | (13.5)          | 2.85a                         |                                 | (1.89)                                   |      |          |        |          |        |
|        |                                   |      |               |                                                                               |     |        |            | 10.6            |                               | 2.06                            | 1.86                                     |      |          |        |          |        |
|        |                                   |      |               |                                                                               |     |        |            | 14.5            |                               | 2.16                            | 1.89                                     |      |          |        |          |        |
|        |                                   |      |               |                                                                               |     |        |            | 17.9*           |                               | *2.18                           | *1.85                                    |      |          |        |          |        |
|        |                                   |      |               |                                                                               |     |        |            | 21.0            |                               | 2.17                            | 1.79                                     |      |          |        |          |        |
|        |                                   |      |               |                                                                               |     |        |            | 5.3             |                               | 1.88                            | 1.79                                     |      |          |        |          |        |
|        |                                   |      |               |                                                                               |     |        |            | 9.4             |                               | 2.01                            | 1.84                                     |      |          |        |          |        |
| TP06   | 1.00<br>(1.00)                    | B    | C48346        | MADE GROUND: brown clayey<br>shale/gravel (wet).                              |     |        | 2.5kg      | (9.0)           | 2.65a                         |                                 | (2.02)                                   |      |          |        |          |        |
|        |                                   |      |               |                                                                               |     |        |            | 14.1*           |                               | *2.17                           | *1.91                                    |      |          |        |          |        |
|        |                                   |      |               |                                                                               |     |        |            | 11.7            |                               | 2.20                            | 1.97                                     |      |          |        |          |        |
|        |                                   |      |               |                                                                               |     |        |            | 15.2            |                               | 2.16                            | 1.88                                     |      |          |        |          |        |
|        |                                   |      |               |                                                                               |     |        |            | 4.0             |                               | 1.96                            | 1.89                                     |      |          |        |          |        |
| TP09   | 0.50<br>(0.50)                    | B    | C48349        | MADE GROUND: dark brown<br>clayey sandy shale/gravel with brick<br>fragments. |     |        | 2.5kg      | (15.5)          | 2.65a                         |                                 | (1.76)                                   |      |          |        |          |        |
|        |                                   |      |               |                                                                               |     |        |            | 12.9            |                               | 1.90                            | 1.68                                     |      |          |        |          |        |
|        |                                   |      |               |                                                                               |     |        |            | 15.3            |                               | 2.02                            | 1.75                                     |      |          |        |          |        |
|        |                                   |      |               |                                                                               |     |        |            | 17.5            |                               | 2.03                            | 1.72                                     |      |          |        |          |        |
|        |                                   |      |               |                                                                               |     |        |            | 18.5*           |                               | *2.00                           | *1.69                                    |      |          |        |          |        |
|        |                                   |      |               |                                                                               |     |        |            | 11.1            |                               | 1.80                            | 1.62                                     |      |          |        |          |        |
|        |                                   |      |               |                                                                               |     |        |            |                 |                               |                                 |                                          |      |          |        |          |        |
|        |                                   |      |               |                                                                               |     |        |            |                 |                               |                                 |                                          |      |          |        |          |        |
|        |                                   |      |               |                                                                               |     |        |            |                 |                               |                                 |                                          |      |          |        |          |        |
|        |                                   |      |               |                                                                               |     |        |            |                 |                               |                                 |                                          |      |          |        |          |        |

Remarks

Particle Density - a=assumed, m=measured  
w% - \* = at natural moisture content; x = aggregate moisture content  
# = stabilised, see relevant test plot for details  
NST = Not suitable for Test  
For Standards followed see Laboratory Test Certificate

LABORATORY RESULTS - Particle Size Distribution

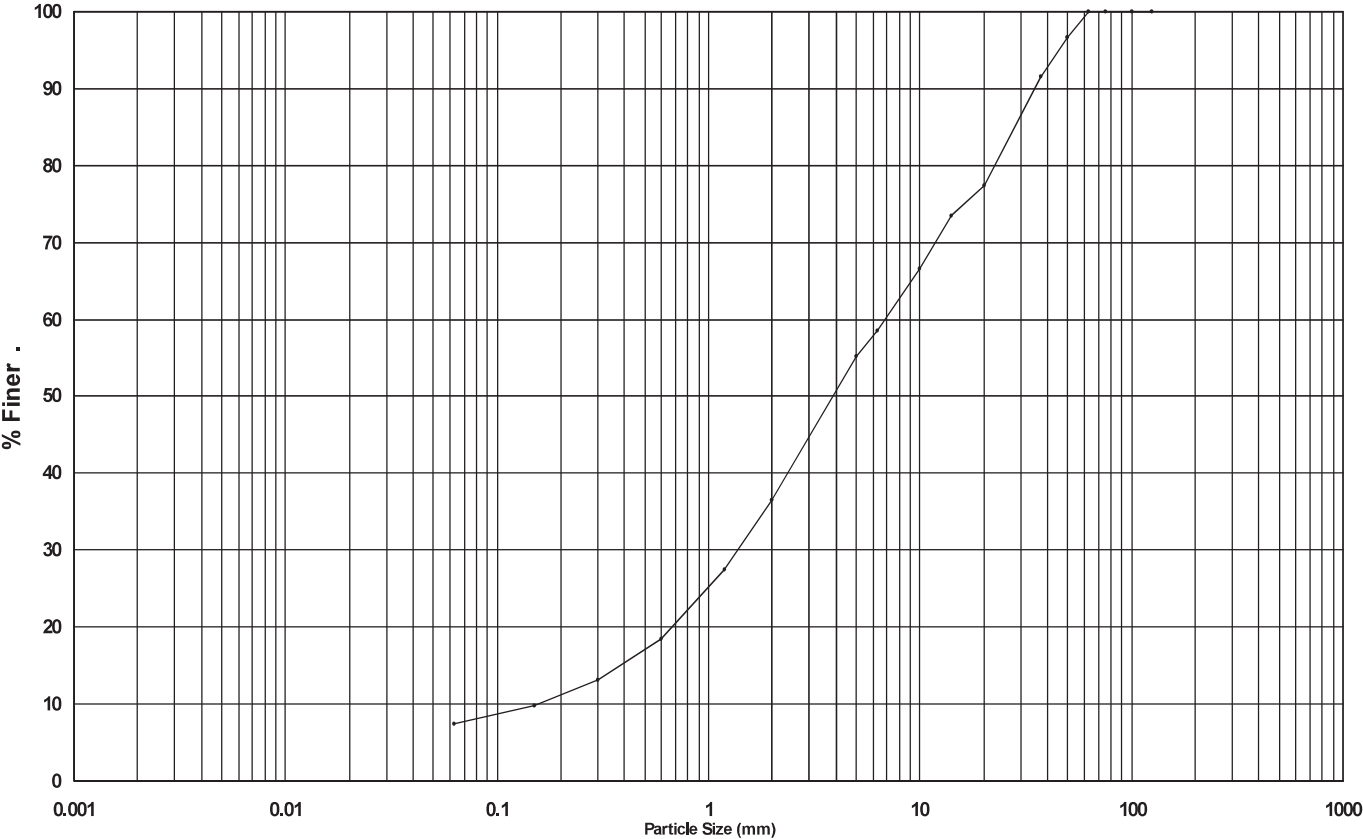
Project: 2387 - WYNNSTAY, RUABON

Project No: PC207961

Hole TP01  
Sample Depth 0.50m  
Sample Type B  
Sample Ref C48341

Sample Description

MADE GROUND: dark grey clayey very sandy shale/gravel.



| Classification | Fine | Medium | Coarse | Fine | Medium | Coarse | Fine   | Medium | Coarse | Cobbles | Boulders |
|----------------|------|--------|--------|------|--------|--------|--------|--------|--------|---------|----------|
| CLAY           | SILT |        |        | SAND |        |        | Gravel |        |        |         |          |

| Classification        | % of each |
|-----------------------|-----------|
|                       |           |
| SILT (including CLAY) | 7         |
| SAND                  | 30        |
| GRAVEL                | 63        |
| COBBLES               | 0         |
| BOULDERS              | 0         |

| Size    | % Finer |
|---------|---------|
| 125 mm  | 100     |
| 100 mm  | 100     |
| 75 mm   | 100     |
| 63 mm   | 100     |
| 50 mm   | 97      |
| 37.5 mm | 92      |
| 20 mm   | 77      |
| 14 mm   | 73      |
| 10 mm   | 67      |
| 6.3 mm  | 59      |
| 5 mm    | 55      |
| 2 mm    | 37      |
| 1.18 mm | 27      |
| 600 µm  | 19      |
| 300 µm  | 13      |
| 150 µm  | 10      |

| Size  | % Finer |
|-------|---------|
| 63 µm | 7       |

| Uniformity Coefficient  |  |
|-------------------------|--|
| 44.71                   |  |
| Sieving Method          |  |
| Wet sieve               |  |
| Fine Particle Analysis  |  |
| Method                  |  |
| Pre-treated with        |  |
| % loss on Pre-treatment |  |
| Particle Density        |  |

Remarks Sieve:-Test performed in accordance with BS EN ISO 17892-4:2016

25/09/2020



LABORATORY RESULTS - Particle Size Distribution

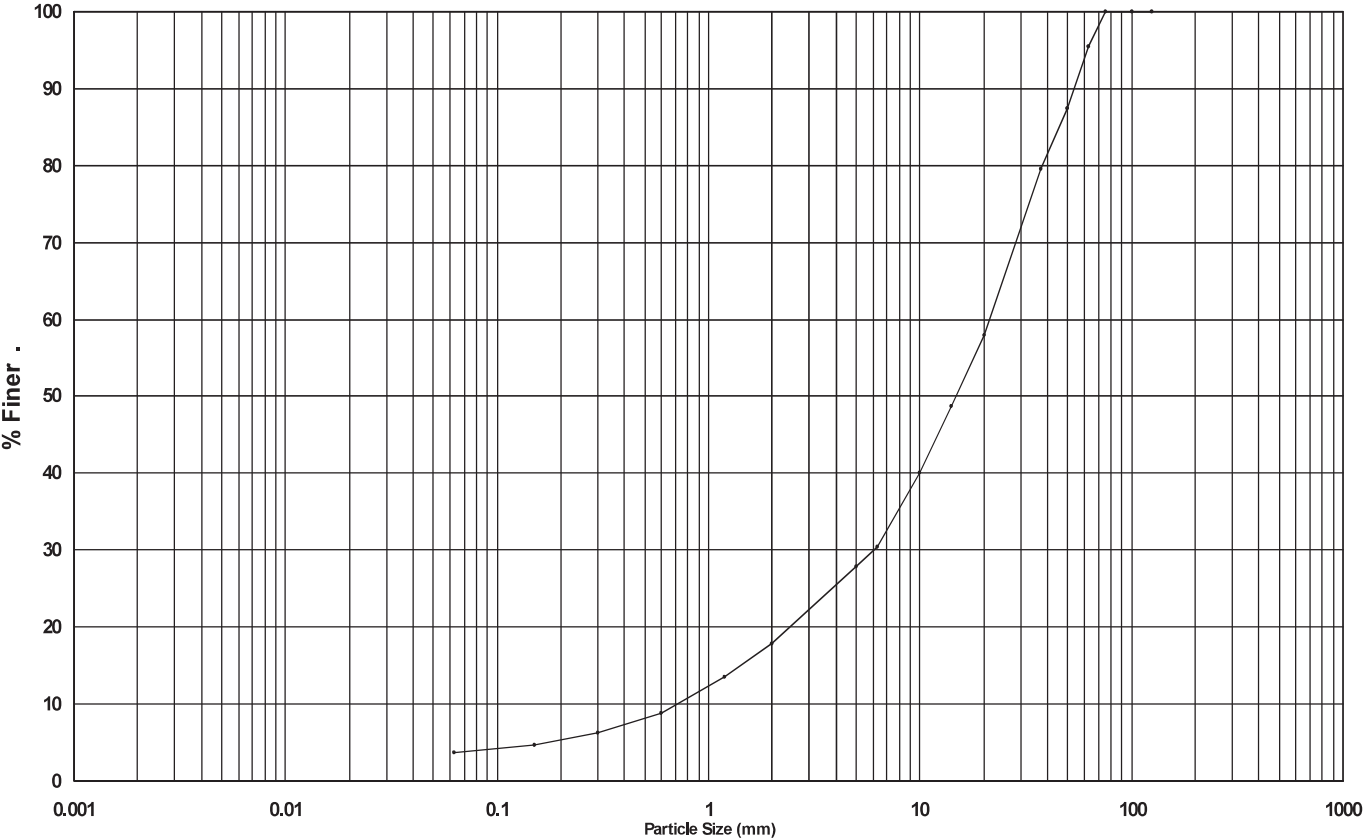
Project: 2387 - WYNNSTAY, RUABON

Project No: PC207961

Hole TP02  
Sample Depth 1.00m  
Sample Type B  
Sample Ref C48342

Sample Description

MADE GROUND: reddish brown slightly clayey sandy gravel with roots and occasional cobbles.  
Gravel/cobble are mainly brick fragments.



| Classification | CLAY | Fine | Medium | Coarse | Fine | Medium | Coarse | Fine   | Medium | Coarse | Cobbles | Boulders |
|----------------|------|------|--------|--------|------|--------|--------|--------|--------|--------|---------|----------|
|                |      | SILT |        |        | SAND |        |        | Gravel |        |        |         |          |

| Classification        | % of each |
|-----------------------|-----------|
|                       |           |
| SILT (including CLAY) | 4         |
| SAND                  | 14        |
| GRAVEL                | 78        |
| COBBLES               | 4         |
| BOULDERS              | 0         |

| Size    | % Finer |
|---------|---------|
| 125 mm  | 100     |
| 100 mm  | 100     |
| 75 mm   | 100     |
| 63 mm   | 96      |
| 50 mm   | 87      |
| 37.5 mm | 80      |
| 20 mm   | 58      |
| 14 mm   | 49      |
| 10 mm   | 40      |
| 6.3 mm  | 31      |
| 5 mm    | 28      |
| 2 mm    | 18      |
| 1.18 mm | 14      |
| 600 μm  | 9       |
| 300 μm  | 6       |
| 150 μm  | 5       |

| Size  | % Finer |
|-------|---------|
| 63 μm | 4       |

| Uniformity Coefficient  |  |
|-------------------------|--|
| 29.77                   |  |
| Sieving Method          |  |
| Wet sieve               |  |
| Fine Particle Analysis  |  |
| Method                  |  |
| Pre-treated with        |  |
| % loss on Pre-treatment |  |
| Particle Density        |  |

Remarks Sieve:-Test performed in accordance with BS EN ISO 17892-4:2016

25/09/2020

LABORATORY RESULTS - Particle Size Distribution

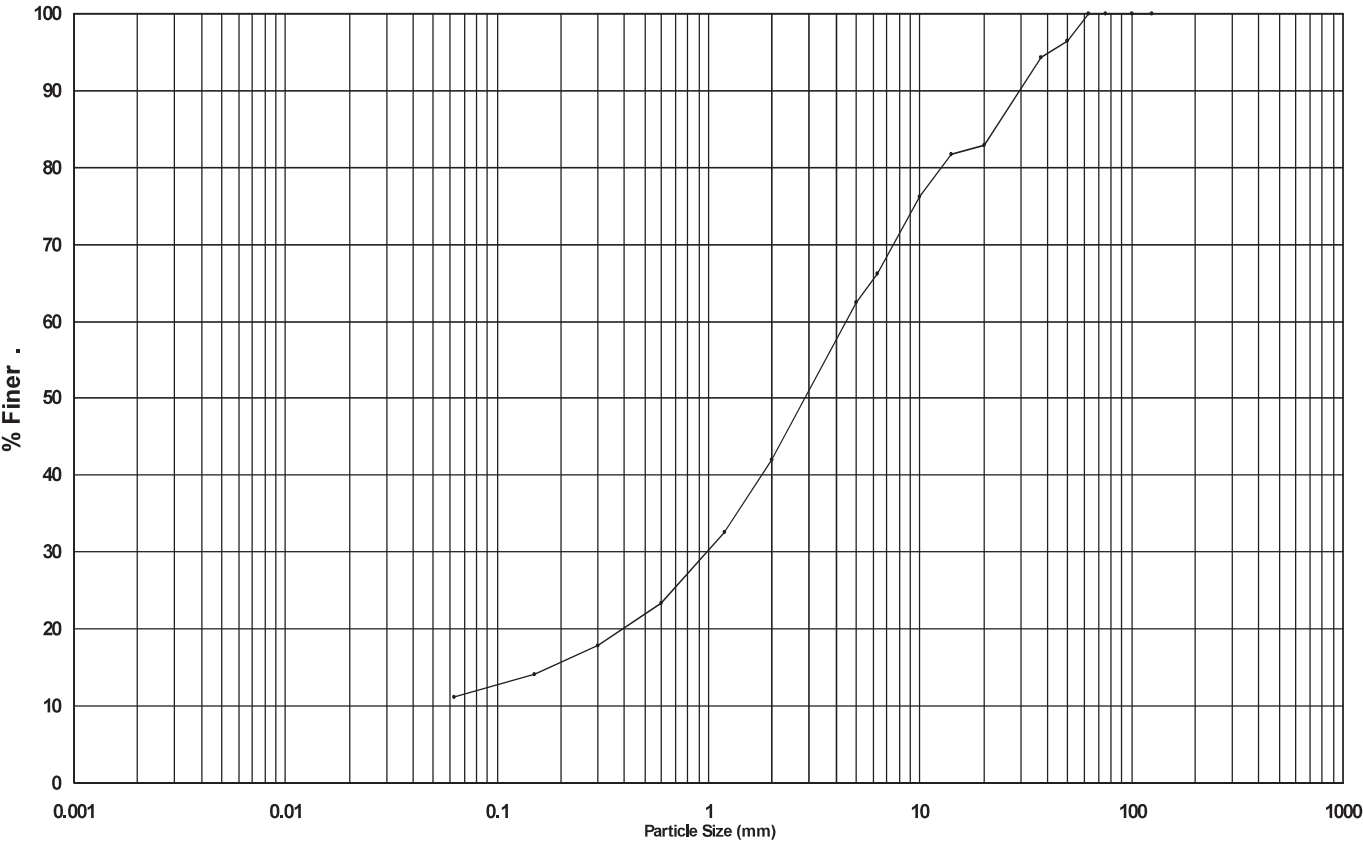
Project: 2387 - WYNNSTAY, RUABON

Project No: PC207961

Hole TP03  
Sample Depth 1.00m  
Sample Type B  
Sample Ref C48343

Sample Description

MADE GROUND: dark grey mottled reddish brown sandy shale/gravel.



| Classification | CLAY | Fine | Medium | Coarse | Fine | Medium | Coarse | Fine   | Medium | Coarse | Cobbles | Boulders |
|----------------|------|------|--------|--------|------|--------|--------|--------|--------|--------|---------|----------|
|                |      | SILT |        |        | SAND |        |        | Gravel |        |        |         |          |

| Classification        | % of each |
|-----------------------|-----------|
|                       |           |
| SILT (including CLAY) | 11        |
| SAND                  | 31        |
| GRAVEL                | 58        |
| COBBLES               | 0         |
| BOULDERS              | 0         |

| Size    | % Finer |
|---------|---------|
| 125 mm  | 100     |
| 100 mm  | 100     |
| 75 mm   | 100     |
| 63 mm   | 100     |
| 50 mm   | 97      |
| 37.5 mm | 94      |
| 20 mm   | 83      |
| 14 mm   | 82      |
| 10 mm   | 76      |
| 6.3 mm  | 66      |
| 5 mm    | 63      |
| 2 mm    | 42      |
| 1.18 mm | 33      |
| 600 μm  | 23      |
| 300 μm  | 18      |
| 150 μm  | 14      |

| Size  | % Finer |
|-------|---------|
| 63 μm | 11      |

| Uniformity Coefficient  |  |
|-------------------------|--|
| Not Available           |  |
| Sieving Method          |  |
| Wet sieve               |  |
| Fine Particle Analysis  |  |
| Method                  |  |
| Pre-treated with        |  |
| % loss on Pre-treatment |  |
| Particle Density        |  |

Remarks Sieve:-Test performed in accordance with BS EN ISO 17892-4:2016

25/09/2020

LABORATORY RESULTS - Particle Size Distribution

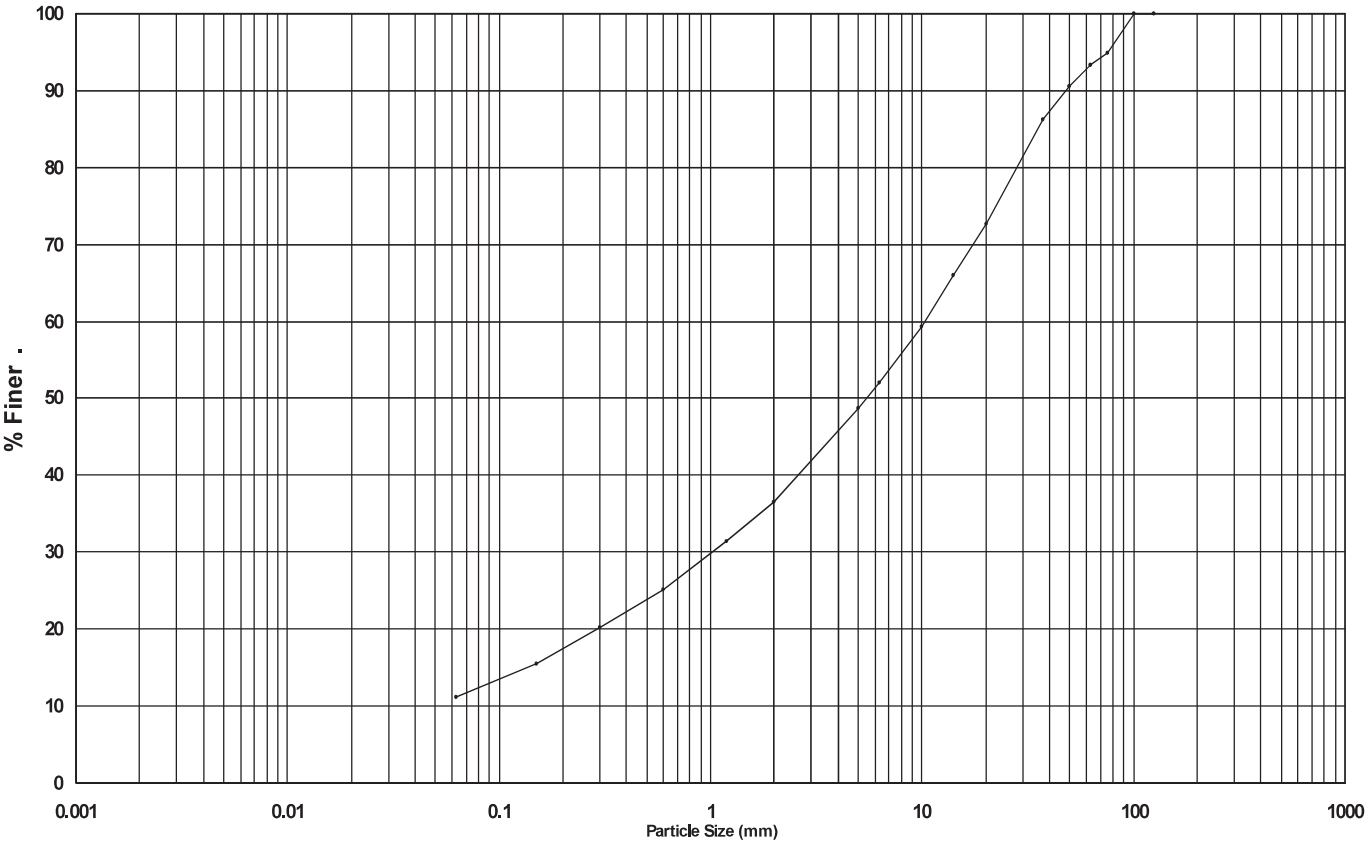
Project: 2387 - WYNNSTAY, RUABON

Project No: PC207961

Hole TP04  
Sample Depth 0.50m  
Sample Type B  
Sample Ref C48344

Sample Description

MADE GROUND: dark grey clayey sandy gravel with occasional brick fragments.



| Classification | Fine | Medium | Coarse | Fine | Medium | Coarse | Fine   | Medium | Coarse | Cobbles | Boulders |
|----------------|------|--------|--------|------|--------|--------|--------|--------|--------|---------|----------|
| CLAY           | SILT |        |        | SAND |        |        | Gravel |        |        |         |          |

| Classification        | % of each |
|-----------------------|-----------|
| SILT (including CLAY) | 11        |
| SAND                  | 26        |
| GRAVEL                | 56        |
| COBBLES               | 7         |
| BOULDERS              | 0         |

| Size    | % Finer |
|---------|---------|
| 125 mm  | 100     |
| 100 mm  | 100     |
| 75 mm   | 95      |
| 63 mm   | 93      |
| 50 mm   | 90      |
| 37.5 mm | 86      |
| 20 mm   | 73      |
| 14 mm   | 66      |
| 10 mm   | 59      |
| 6.3 mm  | 52      |
| 5 mm    | 49      |
| 2 mm    | 37      |
| 1.18 mm | 31      |
| 600 μm  | 25      |
| 300 μm  | 20      |
| 150 μm  | 15      |

| Size  | % Finer |
|-------|---------|
| 63 μm | 11      |

| Uniformity Coefficient  |  |
|-------------------------|--|
| Not Available           |  |
| Sieving Method          |  |
| Wet sieve               |  |
| Fine Particle Analysis  |  |
| Method                  |  |
| Pre-treated with        |  |
| % loss on Pre-treatment |  |
| Particle Density        |  |

Remarks Sieve:-Test performed in accordance with BS EN ISO 17892-4:2016

25/09/2020

LABORATORY RESULTS - Particle Size Distribution

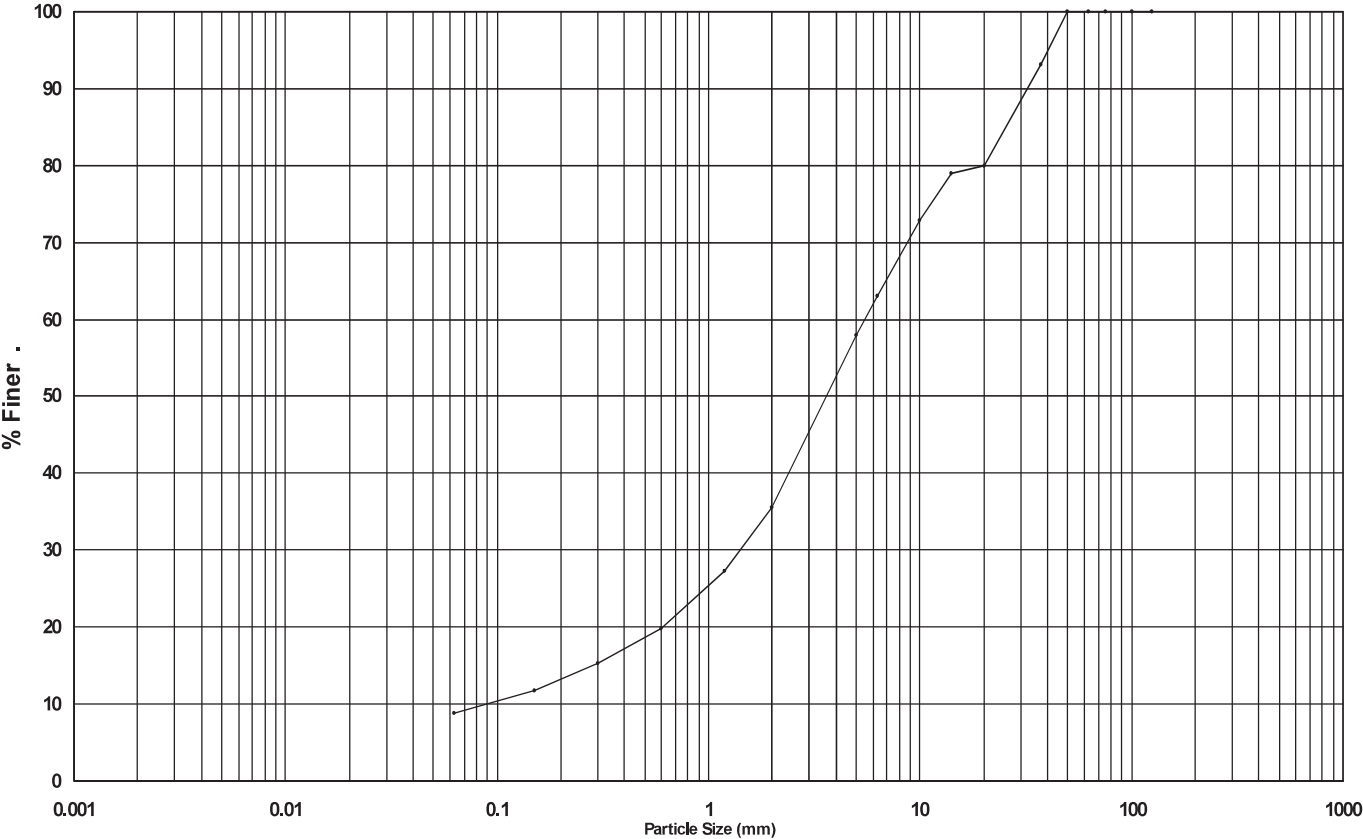
Project: 2387 - WYNNSTAY, RUABON

Project No: PC207961

Hole TP05  
Sample Depth 0.50m  
Sample Type B  
Sample Ref C48345

Sample Description

MADE GROUND: dark grey clayey sandy shale/gravel.



| Classification | Fine | Medium | Coarse | Fine | Medium | Coarse | Fine   | Medium | Coarse | Cobbles | Boulders |
|----------------|------|--------|--------|------|--------|--------|--------|--------|--------|---------|----------|
| CLAY           | SILT |        |        | SAND |        |        | Gravel |        |        |         |          |

| Classification        | % of each |
|-----------------------|-----------|
| SILT (including CLAY) | 9         |
| SAND                  | 27        |
| GRAVEL                | 64        |
| COBBLES               | 0         |
| BOULDERS              | 0         |

| Size    | % Finer |
|---------|---------|
| 125 mm  | 100     |
| 100 mm  | 100     |
| 75 mm   | 100     |
| 63 mm   | 100     |
| 50 mm   | 100     |
| 37.5 mm | 93      |
| 20 mm   | 80      |
| 14 mm   | 79      |
| 10 mm   | 73      |
| 6.3 mm  | 63      |
| 5 mm    | 58      |
| 2 mm    | 36      |
| 1.18 mm | 27      |
| 600 µm  | 20      |
| 300 µm  | 15      |
| 150 µm  | 12      |

| Size  | % Finer |
|-------|---------|
| 63 µm | 9       |

| Uniformity Coefficient  |  |
|-------------------------|--|
| 61.07                   |  |
| Sieving Method          |  |
| Wet sieve               |  |
| Fine Particle Analysis  |  |
| Method                  |  |
| Pre-treated with        |  |
| % loss on Pre-treatment |  |
| Particle Density        |  |

Remarks Sieve:-Test performed in accordance with BS EN ISO 17892-4:2016

25/09/2020



LABORATORY RESULTS - Particle Size Distribution

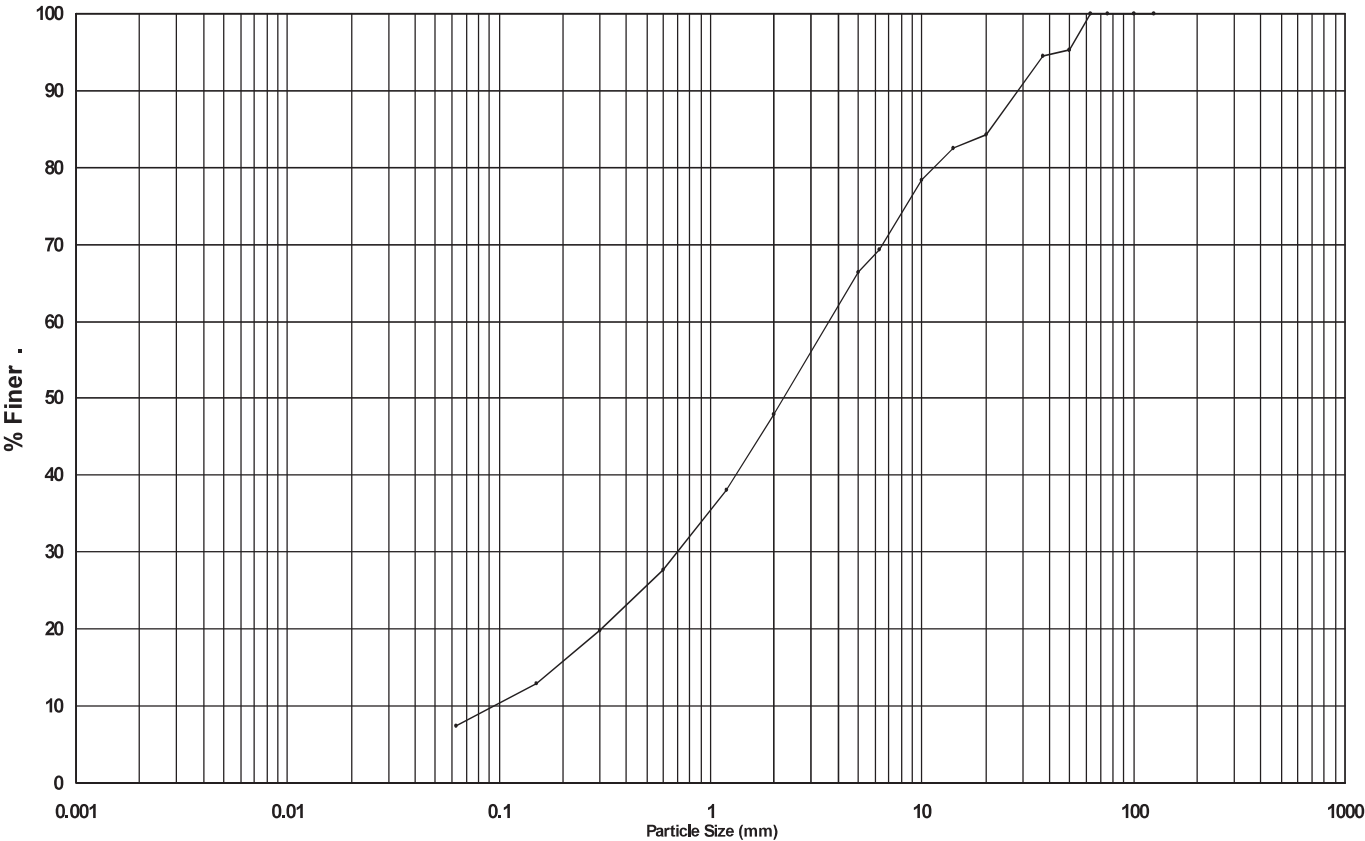
Project: 2387 - WYNNSTAY, RUABON

Project No: PC207961

Hole TP07  
Sample Depth 1.00m  
Sample Type B  
Sample Ref C48347

Sample Description

MADE GROUND: dark grey clayey very sandy shale/gravel with brick fragments.



| Classification | Fine | Medium | Coarse | Fine | Medium | Coarse | Fine   | Medium | Coarse | Cobbles | Boulders |
|----------------|------|--------|--------|------|--------|--------|--------|--------|--------|---------|----------|
| CLAY           | SILT |        |        | SAND |        |        | Gravel |        |        |         |          |

| Classification        | % of each |
|-----------------------|-----------|
| SILT (including CLAY) | 7         |
| SAND                  | 41        |
| GRAVEL                | 52        |
| COBBLES               | 0         |
| BOULDERS              | 0         |

| Size    | % Finer |
|---------|---------|
| 125 mm  | 100     |
| 100 mm  | 100     |
| 75 mm   | 100     |
| 63 mm   | 100     |
| 50 mm   | 95      |
| 37.5 mm | 94      |
| 20 mm   | 84      |
| 14 mm   | 83      |
| 10 mm   | 78      |
| 6.3 mm  | 69      |
| 5 mm    | 66      |
| 2 mm    | 48      |
| 1.18 mm | 38      |
| 600 µm  | 28      |
| 300 µm  | 20      |
| 150 µm  | 13      |

| Size  | % Finer |
|-------|---------|
| 63 µm | 7       |

| Uniformity Coefficient  |  |
|-------------------------|--|
| 38.43                   |  |
| Sieving Method          |  |
| Wet sieve               |  |
| Fine Particle Analysis  |  |
| Method                  |  |
| Pre-treated with        |  |
| % loss on Pre-treatment |  |
| Particle Density        |  |

Remarks Sieve:-Test performed in accordance with BS EN ISO 17892-4:2016

25/09/2020

LABORATORY RESULTS - Particle Size Distribution

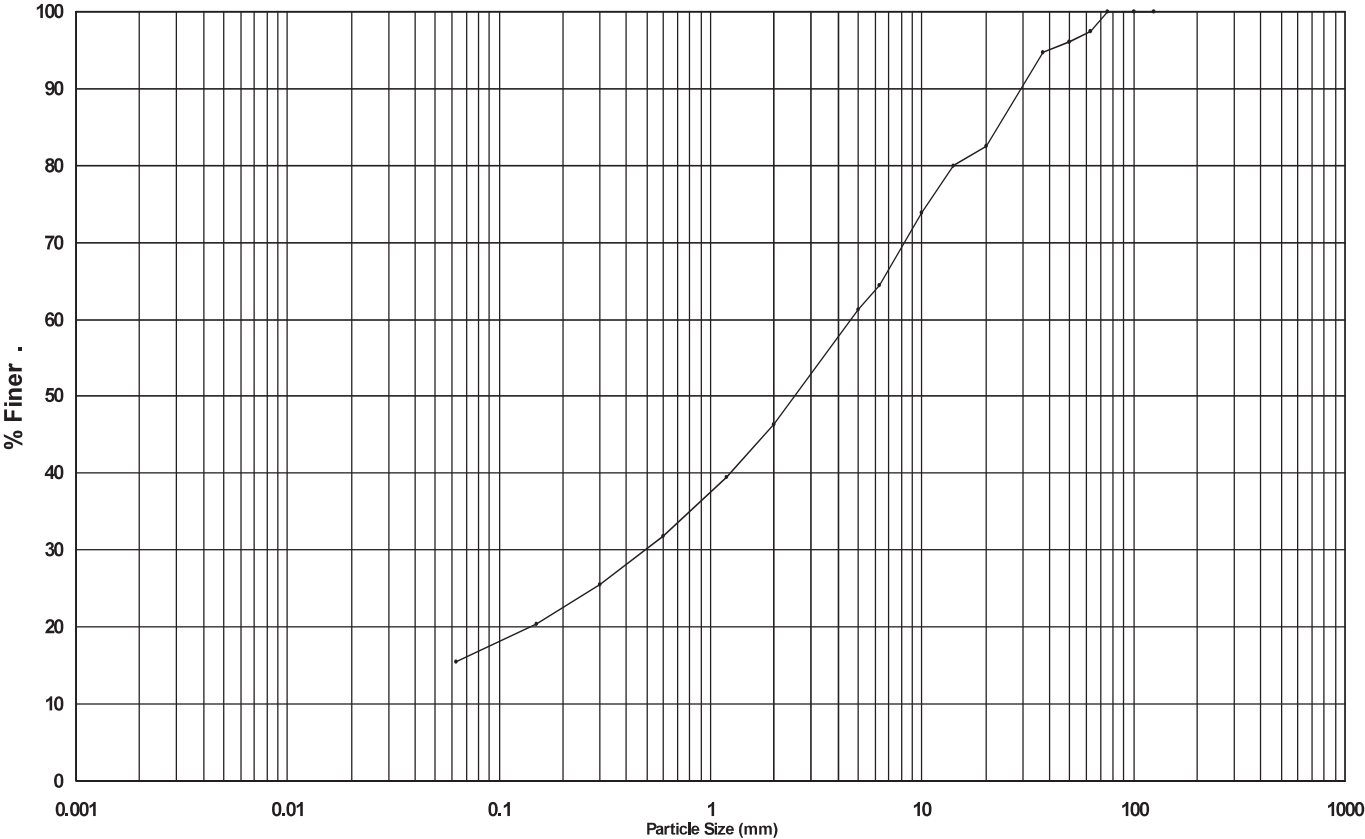
Project: 2387 - WYNNSTAY, RUABON

Project No: PC207961

Hole TP08  
Sample Depth 1.00m  
Sample Type B  
Sample Ref C48348

Sample Description

MADE GROUND: brown clayey very sandy shale/gravel with brick and roots.



| Classification | CLAY | Fine | Medium | Coarse | Fine | Medium | Coarse | Fine   | Medium | Coarse | Cobbles | Boulders |
|----------------|------|------|--------|--------|------|--------|--------|--------|--------|--------|---------|----------|
|                |      | SILT |        |        | SAND |        |        | Gravel |        |        |         |          |

| Classification        | % of each |
|-----------------------|-----------|
|                       |           |
| SILT (including CLAY) | 15        |
| SAND                  | 31        |
| GRAVEL                | 52        |
| COBBLES               | 2         |
| BOULDERS              | 0         |

| Size    | % Finer |
|---------|---------|
| 125 mm  | 100     |
| 100 mm  | 100     |
| 75 mm   | 100     |
| 63 mm   | 98      |
| 50 mm   | 96      |
| 37.5 mm | 95      |
| 20 mm   | 83      |
| 14 mm   | 80      |
| 10 mm   | 74      |
| 6.3 mm  | 64      |
| 5 mm    | 61      |
| 2 mm    | 46      |
| 1.18 mm | 40      |
| 600 μm  | 32      |
| 300 μm  | 26      |
| 150 μm  | 20      |

| Size  | % Finer |
|-------|---------|
| 63 μm | 15      |

| Uniformity Coefficient  |  |
|-------------------------|--|
| Not Available           |  |
| Sieving Method          |  |
| Wet sieve               |  |
| Fine Particle Analysis  |  |
| Method                  |  |
| Pre-treated with        |  |
| % loss on Pre-treatment |  |
| Particle Density        |  |

Remarks Sieve:-Test performed in accordance with BS EN ISO 17892-4:2016

25/09/2020

LABORATORY RESULTS - Particle Size Distribution

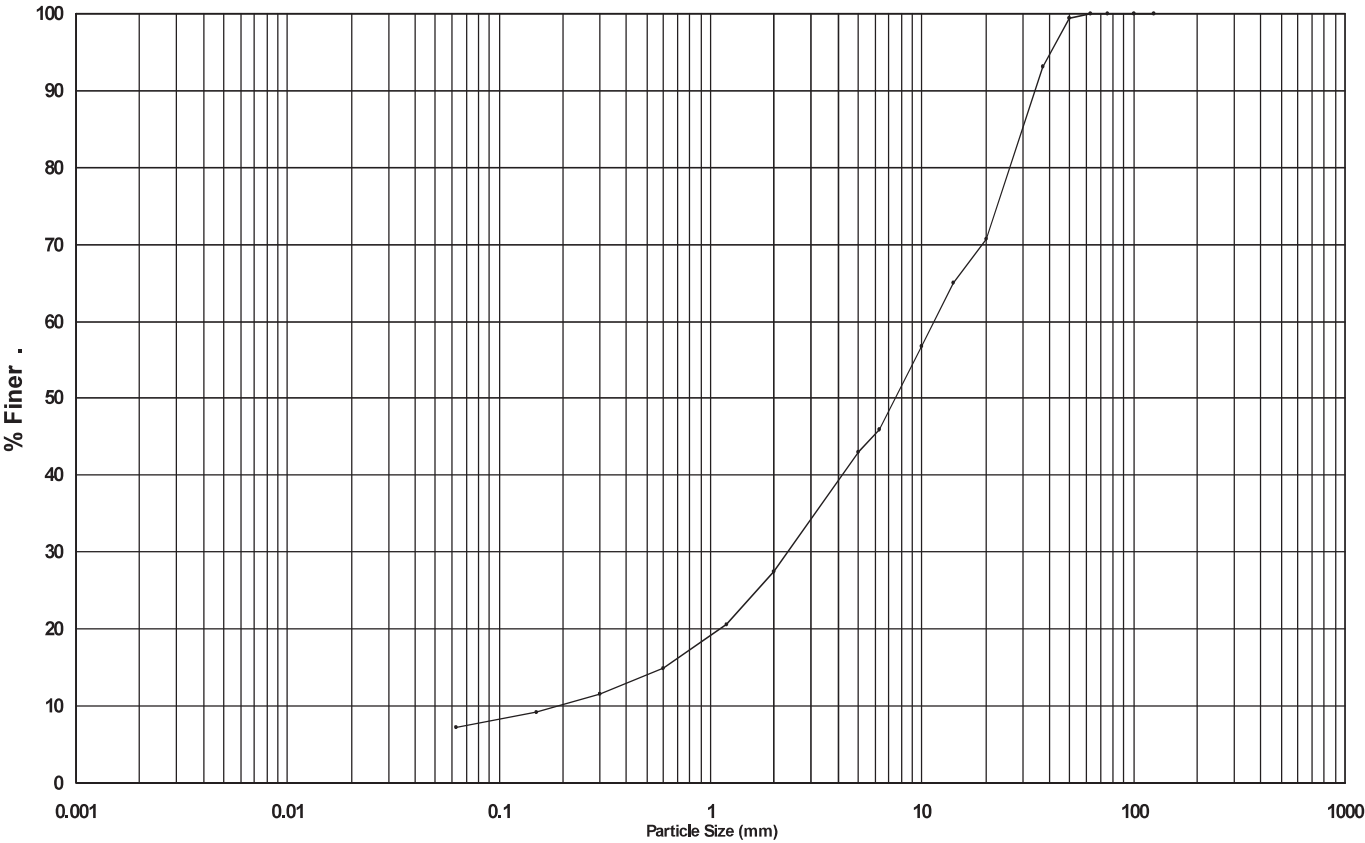
Project: 2387 - WYNNSTAY, RUABON

Project No: PC207961

Hole TP09  
Sample Depth 0.50m  
Sample Type B  
Sample Ref C48349

Sample Description

MADE GROUND: dark brown clayey sandy shale/gravel with brick fragments.



| Classification | Fine | Medium | Coarse | Fine | Medium | Coarse | Fine   | Medium | Coarse | Cobbles | Boulders |
|----------------|------|--------|--------|------|--------|--------|--------|--------|--------|---------|----------|
| CLAY           | SILT |        |        | SAND |        |        | Gravel |        |        |         |          |

| Classification        | % of each |
|-----------------------|-----------|
| SILT (including CLAY) | 7         |
| SAND                  | 21        |
| GRAVEL                | 72        |
| COBBLES               | 0         |
| BOULDERS              | 0         |

| Size    | % Finer |
|---------|---------|
| 125 mm  | 100     |
| 100 mm  | 100     |
| 75 mm   | 100     |
| 63 mm   | 100     |
| 50 mm   | 99      |
| 37.5 mm | 93      |
| 20 mm   | 71      |
| 14 mm   | 65      |
| 10 mm   | 57      |
| 6.3 mm  | 46      |
| 5 mm    | 43      |
| 2 mm    | 28      |
| 1.18 mm | 21      |
| 600 µm  | 15      |
| 300 µm  | 12      |
| 150 µm  | 9       |

| Size  | % Finer |
|-------|---------|
| 63 µm | 7       |

| Uniformity Coefficient  |  |
|-------------------------|--|
| 59.81                   |  |
| Sieving Method          |  |
| Wet sieve               |  |
| Fine Particle Analysis  |  |
| Method                  |  |
| Pre-treated with        |  |
| % loss on Pre-treatment |  |
| Particle Density        |  |

Remarks Sieve:-Test performed in accordance with BS EN ISO 17892-4:2016

25/09/2020



LABORATORY RESULTS - Particle Size Distribution

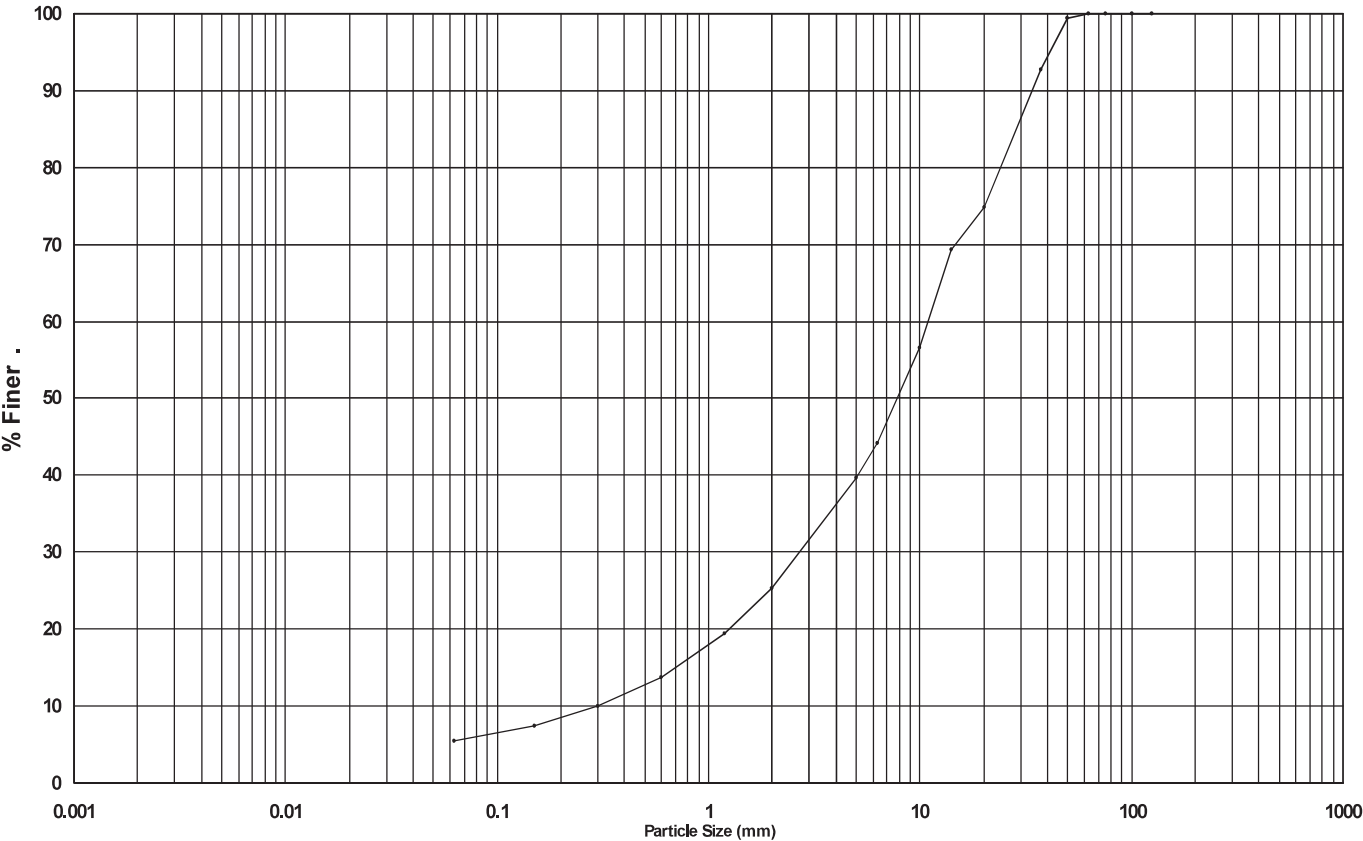
Project: 2387 - WYNNSTAY, RUABON

Project No: PC207961

Hole TP10  
Sample Depth 1.00m  
Sample Type B  
Sample Ref C48350

Sample Description

MADE GROUND: dark grey slightly clayey shale gravel with brick.



| Classification | Fine | Medium | Coarse | Fine | Medium | Coarse | Fine   | Medium | Coarse | Cobbles | Boulders |
|----------------|------|--------|--------|------|--------|--------|--------|--------|--------|---------|----------|
| CLAY           | SILT |        |        | SAND |        |        | Gravel |        |        |         |          |

| Classification        | % of each |
|-----------------------|-----------|
| SILT (including CLAY) | 5         |
| SAND                  | 20        |
| GRAVEL                | 75        |
| COBBLES               | 0         |
| BOULDERS              | 0         |

| Size    | % Finer |
|---------|---------|
| 125 mm  | 100     |
| 100 mm  | 100     |
| 75 mm   | 100     |
| 63 mm   | 100     |
| 50 mm   | 99      |
| 37.5 mm | 93      |
| 20 mm   | 75      |
| 14 mm   | 69      |
| 10 mm   | 56      |
| 6.3 mm  | 44      |
| 5 mm    | 40      |
| 2 mm    | 25      |
| 1.18 mm | 20      |
| 600 μm  | 14      |
| 300 μm  | 10      |
| 150 μm  | 7       |

| Size  | % Finer |
|-------|---------|
| 63 μm | 5       |

| Uniformity Coefficient  |  |
|-------------------------|--|
| 36.73                   |  |
| Sieving Method          |  |
| Wet sieve               |  |
| Fine Particle Analysis  |  |
| Method                  |  |
| Pre-treated with        |  |
| % loss on Pre-treatment |  |
| Particle Density        |  |

Remarks Sieve:-Test performed in accordance with BS EN ISO 17892-4:2016

25/09/2020



# LABORATORY REPORT



**Contract Number: PSL23/5350**

Report Date: 14 August 2023

Client's Reference: 2949

Client Name: Groundsolve Ltd  
Unit 1 Well House Barns  
Chester Road  
Bretton  
Flintshire  
CH4 0DH

**For the attention of: Sam Fishburne**

Contract Title: Ruabon Business Park

Date Received: 5/7/2023

Date Commenced: 5/7/2023

Date Completed: 12/8/2023

**Notes: Opinions and Interpretations are outside the UKAS Accreditation**

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

A Watkins  
(Director)

R Berriman  
(Quality Manager)

S Royle  
(Laboratory Manager)

L Knight  
(Assistant Laboratory Manager)

S Eyre  
(Senior Technician)

T Watkins  
(Senior Technician)

5 – 7 Hexthorpe Road,  
Hexthorpe,  
Doncaster,  
DN4 0AR  
Tel: 01302 768098  
Email: [rberriman@prosoils.co.uk](mailto:rberriman@prosoils.co.uk)  
[awatkins@prosoils.co.uk](mailto:awatkins@prosoils.co.uk)

Page 1 of



(BS1377 : PART 2 : 1990)

**SYMBOLS: NP : Non Plastic**

\* : Liquid Limit and Plastic Limit Wet Sieved.



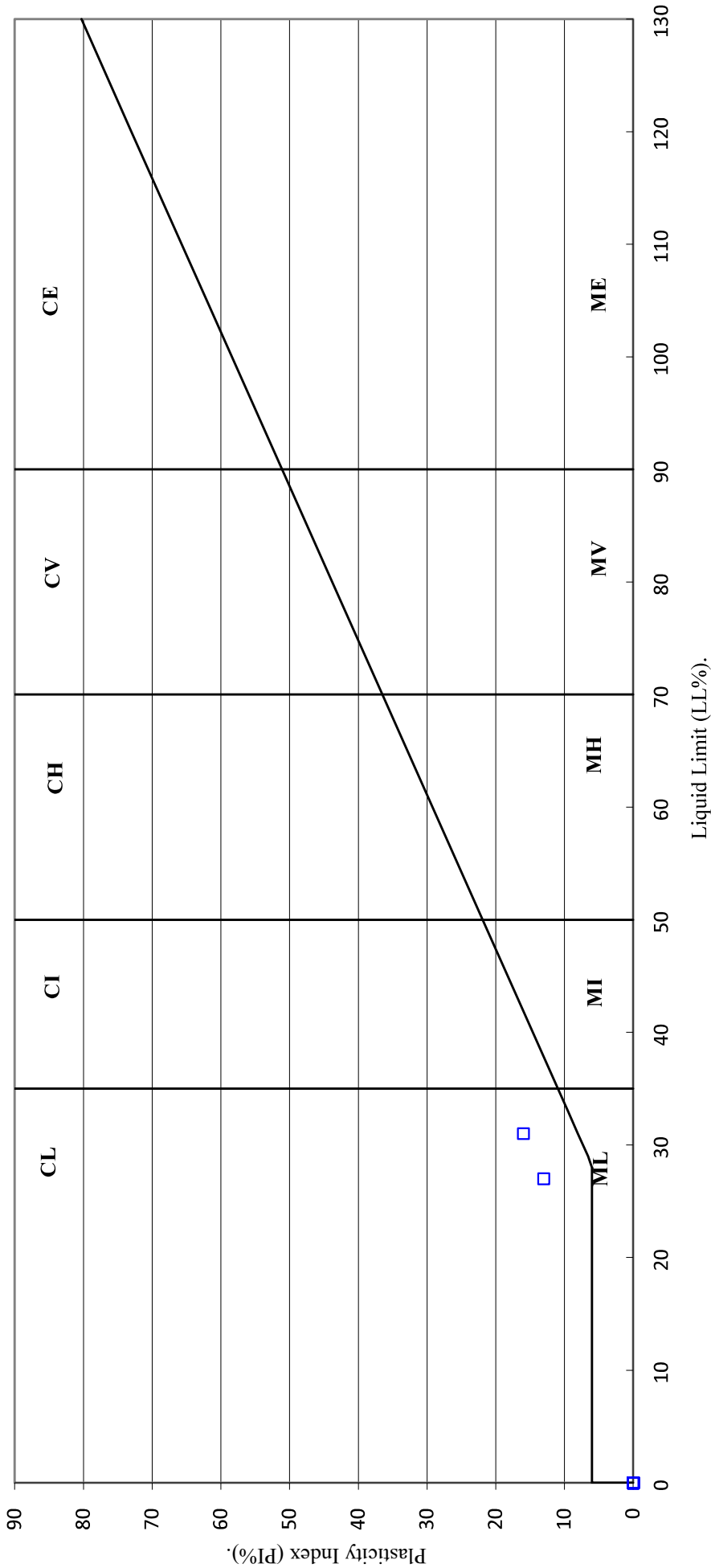
## Ruabon Business Park

**Contract No:**

PSL23/5350

**Client Ref:**

# PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



Ruabon Business Park

Contract No:

PSL23/5350

Client Ref:

03/01/2023

Approved By: L Pavey

Issue No. 1

PSLRF006

# PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

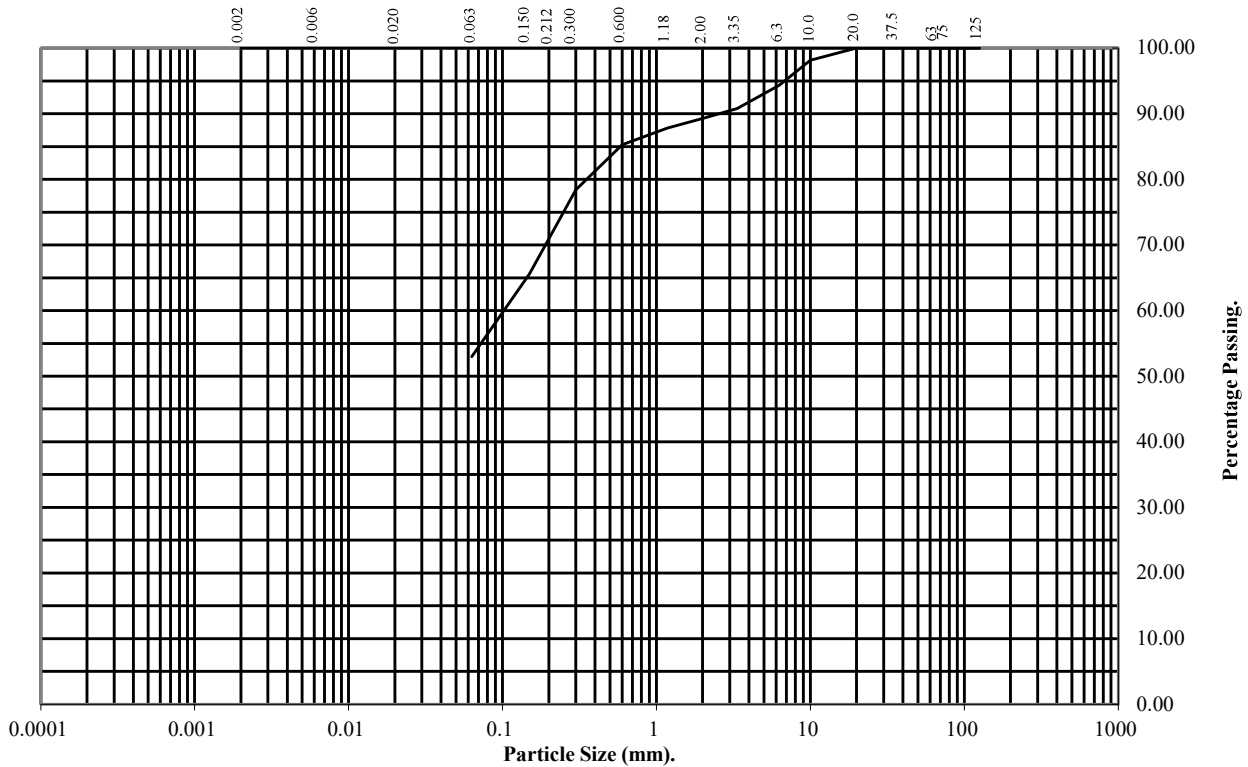
Hole Number: SA01

Top Depth (m): 2.50

Sample Number:

Base Depth(m):

Sample Type: B



| BS Test Sieve (mm) | Percentage Passing |
|--------------------|--------------------|
| 125                | 100                |
| 75                 | 100                |
| 63                 | 100                |
| 37.5               | 100                |
| 20                 | 100                |
| 10                 | 98                 |
| 6.3                | 94                 |
| 3.35               | 91                 |
| 2                  | 89                 |
| 1.18               | 88                 |
| 0.6                | 85                 |
| 0.3                | 78                 |
| 0.212              | 72                 |
| 0.15               | 66                 |
| 0.063              | 53                 |

| Soil Fraction | Total Percentage |
|---------------|------------------|
| Cobbles       | 0                |
| Gravel        | 11               |
| Sand          | 36               |
| Silt/Clay     | 53               |

## Remarks:

See Summary of Soil Descriptions



Ruabon Business Park

Contract No:

PSL23/5350

Client Ref:

# PARTICLE SIZE DISTRIBUTION TEST

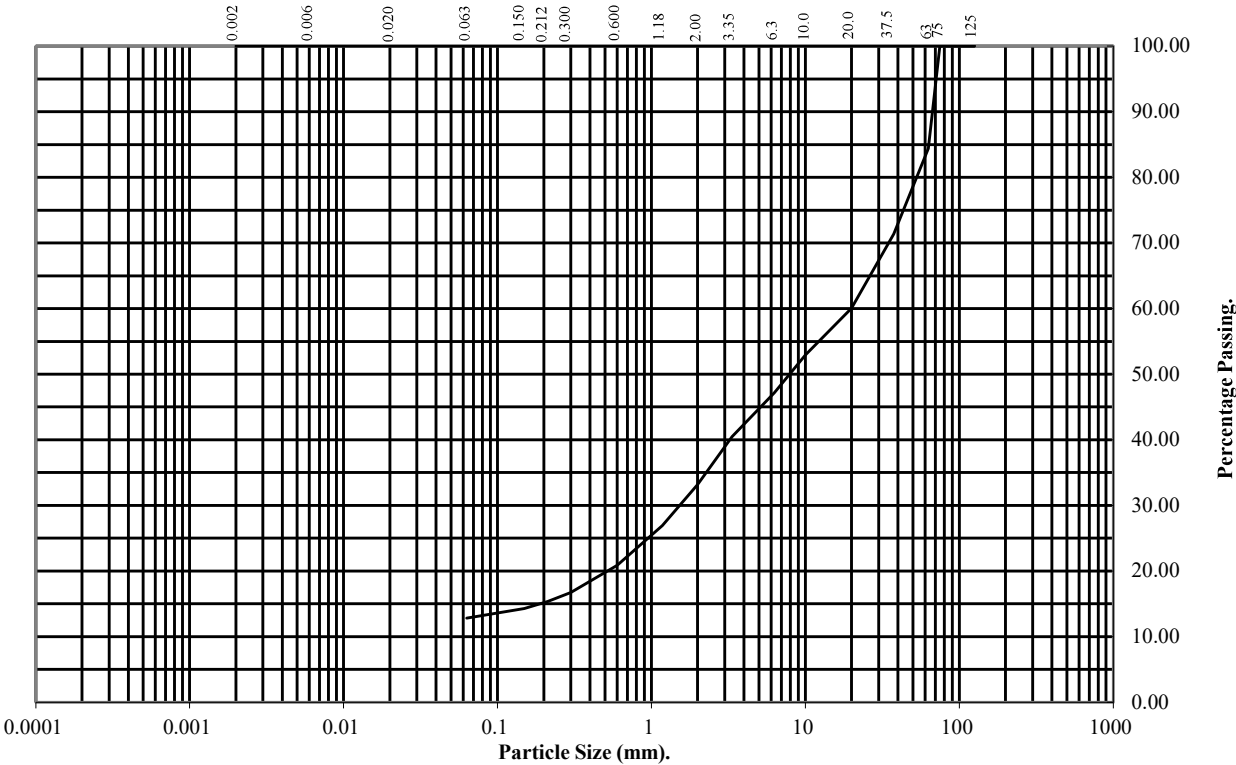
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TT01 Top Depth (m): 0.95

Sample Number: Base Depth(m):

Sample Type: B



| BS Test Sieve (mm) | Percentage Passing |
|--------------------|--------------------|
| 125                | 100                |
| 75                 | 100                |
| 63                 | 84                 |
| 37.5               | 71                 |
| 20                 | 60                 |
| 10                 | 53                 |
| 6.3                | 47                 |
| 3.35               | 41                 |
| 2                  | 33                 |
| 1.18               | 27                 |
| 0.6                | 21                 |
| 0.3                | 17                 |
| 0.212              | 15                 |
| 0.15               | 14                 |
| 0.063              | 13                 |

| Soil Fraction | Total Percentage |
|---------------|------------------|
| Cobbles       | 16               |
| Gravel        | 51               |
| Sand          | 20               |
| Silt/Clay     | 13               |

**Remarks:**  
See Summary of Soil Descriptions



Ruabon Business Park

|              |
|--------------|
| Contract No: |
| PSL23/5350   |
| Client Ref:  |
|              |

# PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

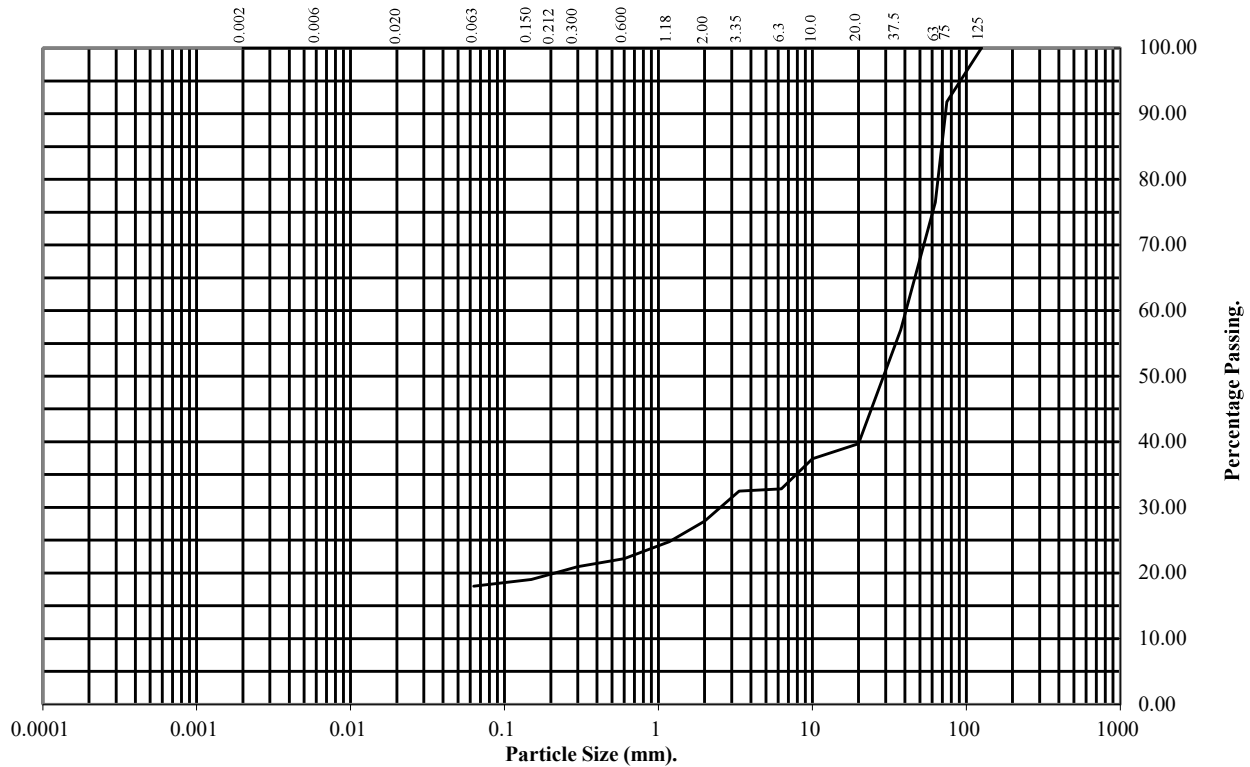
Hole Number: TT03

Top Depth (m): 1.00

Sample Number:

Base Depth(m):

Sample Type: B



| BS Test Sieve (mm) | Percentage Passing |
|--------------------|--------------------|
| 125                | 100                |
| 75                 | 92                 |
| 63                 | 77                 |
| 37.5               | 57                 |
| 20                 | 40                 |
| 10                 | 37                 |
| 6.3                | 33                 |
| 3.35               | 32                 |
| 2                  | 28                 |
| 1.18               | 25                 |
| 0.6                | 22                 |
| 0.3                | 21                 |
| 0.212              | 20                 |
| 0.15               | 19                 |
| 0.063              | 18                 |

| Soil Fraction | Total Percentage |
|---------------|------------------|
| Cobbles       | 23               |
| Gravel        | 49               |
| Sand          | 10               |
| Silt/Clay     | 18               |

## Remarks:

See Summary of Soil Descriptions



Ruabon Business Park

Contract No:

PSL23/5350

Client Ref:



# PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

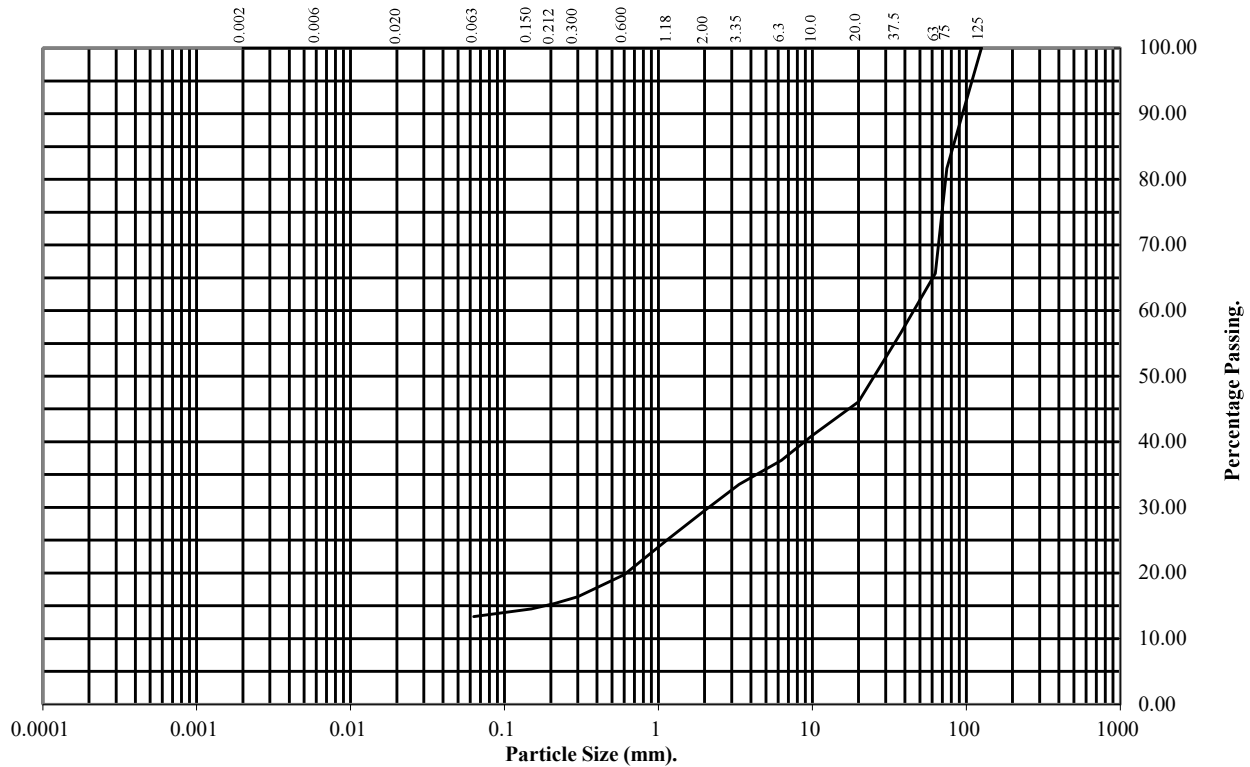
Hole Number: TT05

Top Depth (m): 1.50

Sample Number:

Base Depth(m):

Sample Type: B



| BS Test Sieve (mm) | Percentage Passing |
|--------------------|--------------------|
| 125                | 100                |
| 75                 | 82                 |
| 63                 | 66                 |
| 37.5               | 57                 |
| 20                 | 46                 |
| 10                 | 41                 |
| 6.3                | 37                 |
| 3.35               | 34                 |
| 2                  | 30                 |
| 1.18               | 25                 |
| 0.6                | 20                 |
| 0.3                | 16                 |
| 0.212              | 15                 |
| 0.15               | 15                 |
| 0.063              | 13                 |

| Soil Fraction | Total Percentage |
|---------------|------------------|
| Cobbles       | 34               |
| Gravel        | 36               |
| Sand          | 17               |
| Silt/Clay     | 13               |

## Remarks:

See Summary of Soil Descriptions



Ruabon Business Park

Contract No:

PSL23/5350

Client Ref:

# DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

Non compliance with BS 1377 : Part 4 : Clause 3.6 : 1990

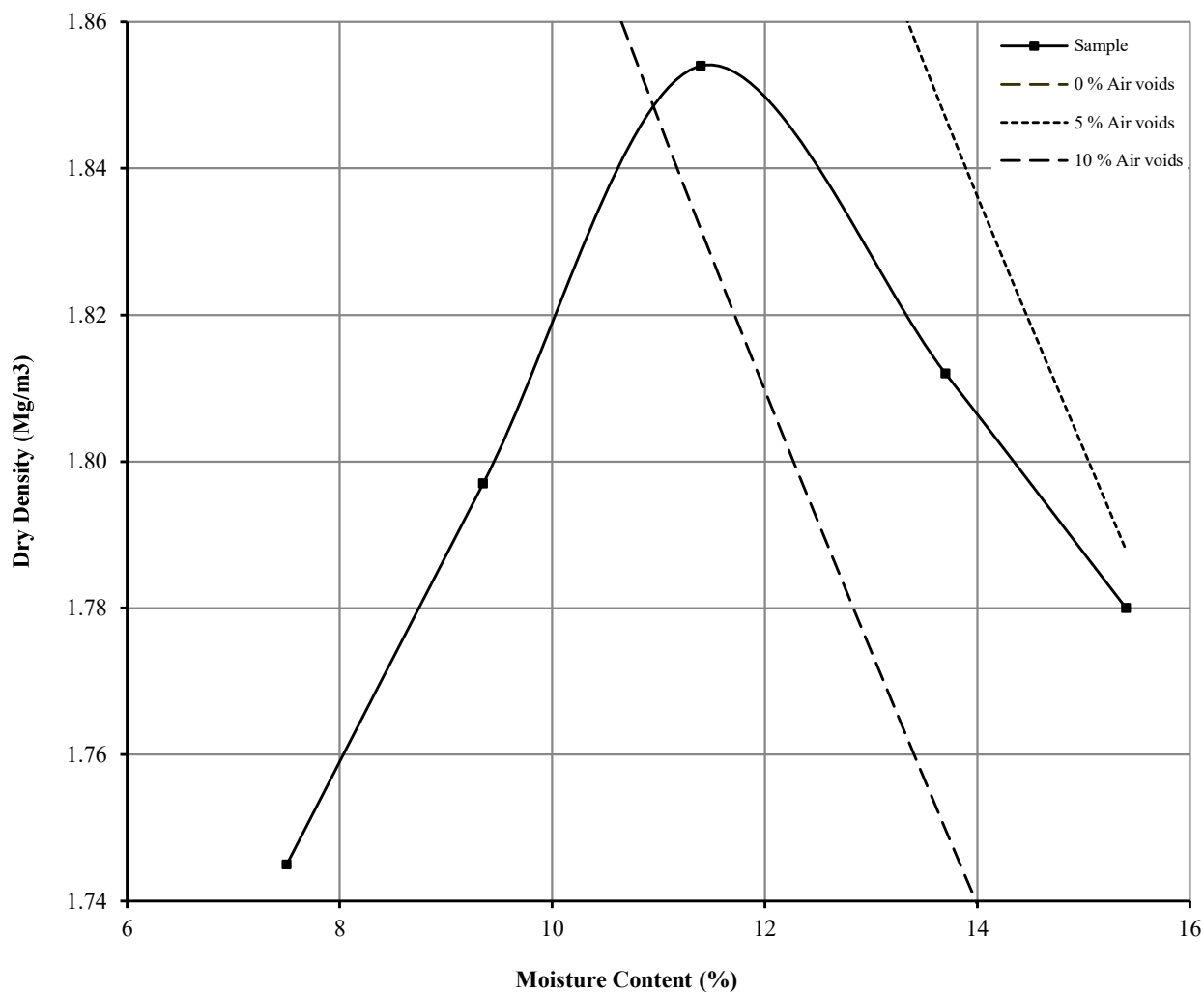
Hole Number: TT01

Top Depth (m) : 0.95

Sample Number:

Base Depth (m) :

Sample Type: B



|                                           |      |                       |                                              |                  |
|-------------------------------------------|------|-----------------------|----------------------------------------------|------------------|
| Initial Moisture Content:                 | 9.3  | Method of Compaction: | 4.5kg                                        | Separate Samples |
| Particle Density (Mg/m <sup>3</sup> ):    | 2.65 | Assumed               | Material Retained on 37.5 mm Test Sieve (%): | 29               |
| Maximum Dry Density (Mg/m <sup>3</sup> ): | 1.85 |                       | Material Retained on 20.0 mm Test Sieve (%): | 11               |
| Optimum Moisture Content (%):             | 11   |                       |                                              |                  |
| Remarks See summary of soil descriptions  |      |                       |                                              |                  |



Ruabon Business Park

Contract  
PSL23/5350  
Client Ref

# DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

Non compliance with BS 1377 : Part 4 : Clause 3.6 : 1990

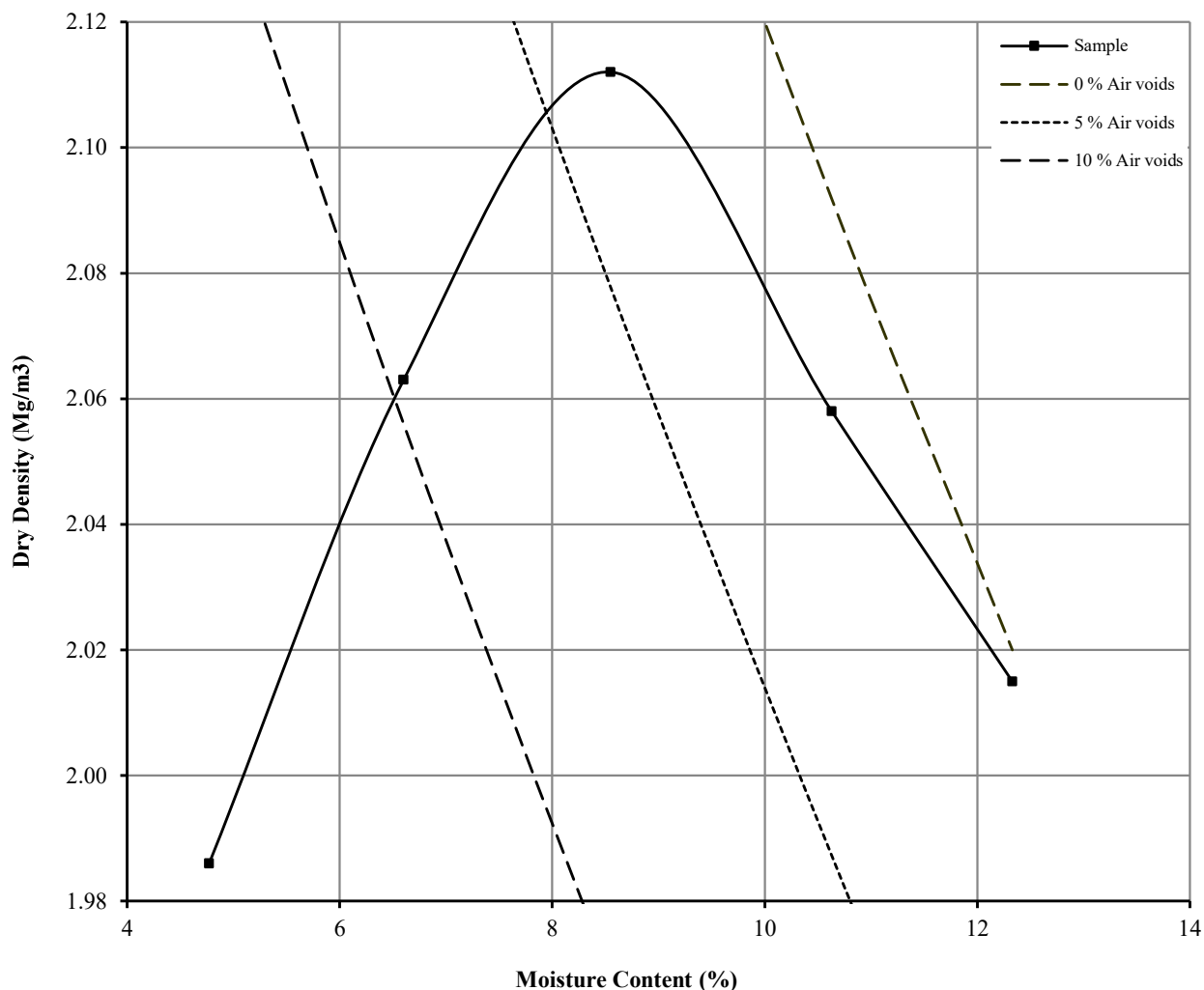
Hole Number: TT03

Top Depth (m) : 1.00

Sample Number:

Base Depth (m) :

Sample Type: B



|                                           |      |                       |                                              |                  |
|-------------------------------------------|------|-----------------------|----------------------------------------------|------------------|
| Initial Moisture Content:                 | 4.8  | Method of Compaction: | 4.5kg                                        | Separate Samples |
| Particle Density (Mg/m <sup>3</sup> ):    | 2.69 | Assumed               | Material Retained on 37.5 mm Test Sieve (%): | 43               |
| Maximum Dry Density (Mg/m <sup>3</sup> ): | 2.11 |                       | Material Retained on 20.0 mm Test Sieve (%): | 17               |
| Optimum Moisture Content (%):             | 9    |                       |                                              |                  |
| Remarks See summary of soil descriptions  |      |                       |                                              |                  |

|  |  |                             |            |
|--|--|-----------------------------|------------|
|  |  | <b>Ruabon Business Park</b> | Contract   |
|  |  |                             | PSL23/5350 |
|  |  |                             | Client Ref |
|  |  |                             |            |

# DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

Non compliance with BS 1377 : Part 4 : Clause 3.6 : 1990

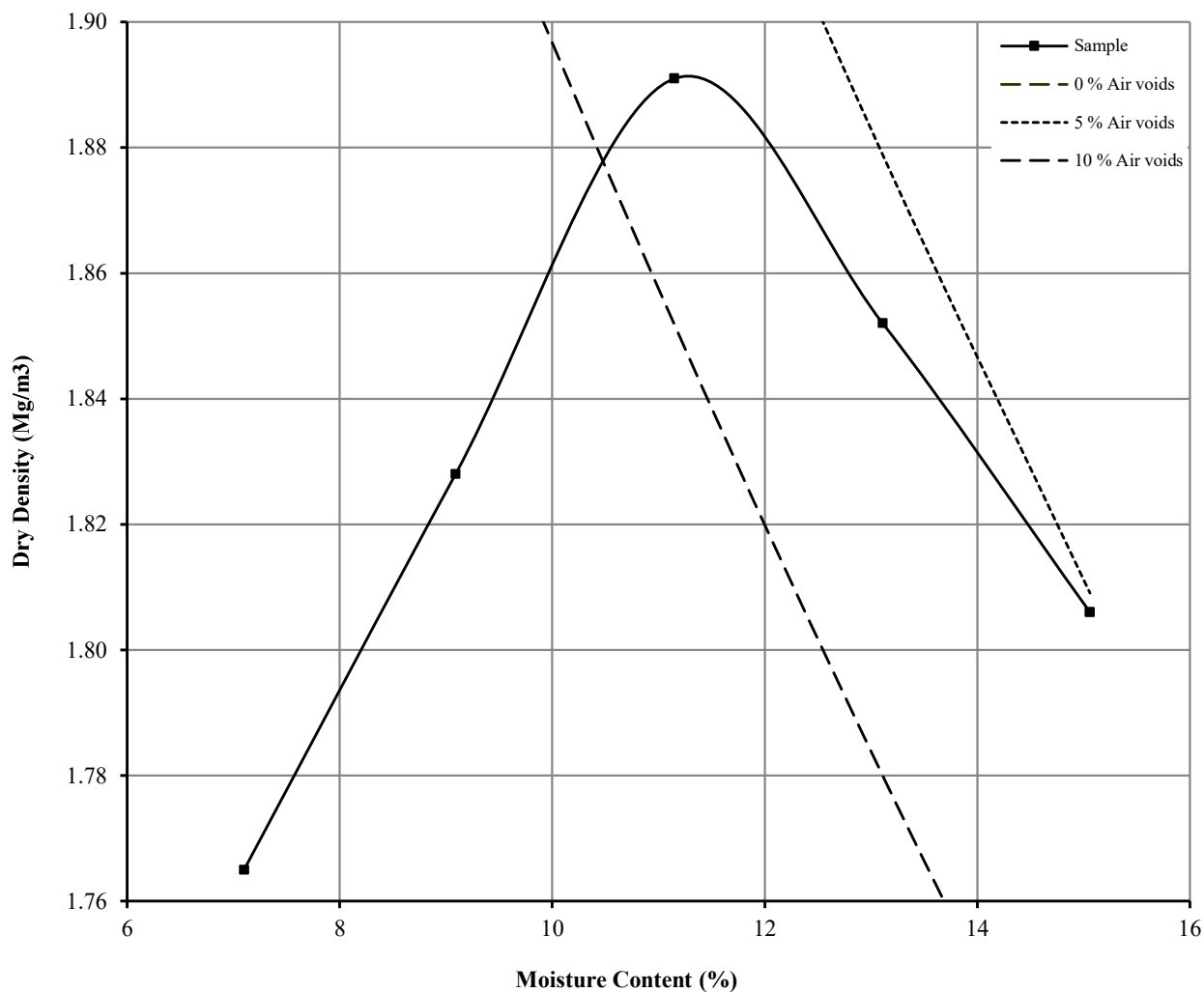
Hole Number: TT05

Top Depth (m) : 1.50

Sample Number:

Base Depth (m) :

Sample Type: B



|                                           |      |                       |                                              |                  |
|-------------------------------------------|------|-----------------------|----------------------------------------------|------------------|
| Initial Moisture Content:                 | 17   | Method of Compaction: | 4.5kg                                        | Separate Samples |
| Particle Density (Mg/m <sup>3</sup> ):    | 2.67 | Assumed               | Material Retained on 37.5 mm Test Sieve (%): | 43               |
| Maximum Dry Density (Mg/m <sup>3</sup> ): | 1.89 |                       | Material Retained on 20.0 mm Test Sieve (%): | 11               |
| Optimum Moisture Content (%):             | 11   |                       |                                              |                  |
| Remarks See summary of soil descriptions  |      |                       |                                              |                  |



Ruabon Business Park

Contract  
PSL23/5350  
Client Ref



4161



7 - 11 Harding Street  
Leicester  
LE1 4DH

**Professional Soils Laboratory**

5/7 Hexthorpe Road

Hexthorpe

Doncaster

DN4 0AR

**Analytical Test Report: L23/04119/PSL - 23-36107**Your Project Reference: **PSL23/5350 Ruabon Business Park**

Your Order Number: PSL23/5350

Samples Received / Instructed: 04/08/2023 / 04/08/2023

Report Issue Number: 1

Sample Tested: 04/08 to 14/08/2023

Samples Analysed: 1 soil sample

Report issued: 14/08/2023

Signed

**James Gane**

Analytical Services Manager

CTS Group

**Notes:****General**

Please refer to Methodologies page for details pertaining to the analytical methods undertaken.

Samples will be retained for 14 days after issue of this report unless otherwise requested.

Moisture Content was determined in accordance with CTS method statement MS - CL - Sample Prep, oven dried at &lt;30°C.

Moisture Content is reported as a percentage of the dry mass of soil, this calculation is in accordance with BS1377, Part 2, 1990, Clause 3.2

**Where specification limits are included these are for guidance only. Where a measured value has been highlighted this is not implying acceptance or failure and certainty of measurement values have not been taken into account.****Uncertainty of measurement values are available on request.**

Samples were supplied by customer, results apply to the samples as received.

**Deviating Samples**

On receipt samples are compared against our sample holding and handling protocols, where any deviations have been noted these are reported on our deviating sample page (if present)

**Accreditation Key**

UKAS = UKAS Accreditation, MCERTS = MCERTS Accreditation, u = Unaccredited

MCERTS Accreditation only covers the SAND, CLAY and LOAM matrices

Date of Issue: 26.07.23

Issued by: J. Gane

Issue No: 4

Rev No: 2



4161



7 - 11 Harding Street  
Leicester  
LE1 4DH

L23/04119/PSL - 23-36107

Project Reference - PSL23/5350 Ruabon Business Park

#### Analytical Test Results - Chemical Analysis

| Lab Reference | 308180 |
|---------------|--------|
|---------------|--------|

|                        |      |
|------------------------|------|
| Client Sample ID       | -    |
| Client Sample Location | SA01 |
| Client Sample Type     | B    |
| Client Sample Number   | -    |
| Depth - Top (m)        | -    |
| Depth - Bottom (m)     | -    |
| Date of Sampling       | -    |
| Time of Sampling       | -    |
| Sample Matrix          | Sand |

| Determinant                                  | Units    | Accreditation |      |
|----------------------------------------------|----------|---------------|------|
| Water soluble sulphate (as SO <sub>4</sub> ) | (mg/l)   | u             | 70   |
| Acid Soluble Sulphate                        | (%)      | u             | 0.74 |
| Total Sulphur                                | (%)      | UKAS          | 0.32 |
| pH Value                                     | pH Units | MCERTS        | 4.8  |
| Water Soluble Chloride                       | (mg/l)   | u             | 5.0  |
| Water Soluble Nitrate (As NO <sub>3</sub> )  | (mg/l)   | u             | 5.7  |



4161



7 - 11 Harding Street  
Leicester  
LE1 4DH

L23/04119/PSL - 23-36107

Project Reference - PSL23/5350 Ruabon Business Park

#### Sample Descriptions

| Lab Reference | Client Sample ID | Client Sample Location | Client Sample Type | Client Sample Number | Description                                      | Moisture Content (%) | Stone Content (%) | Passing 2mm test sieve (%) |
|---------------|------------------|------------------------|--------------------|----------------------|--------------------------------------------------|----------------------|-------------------|----------------------------|
| 308180        | -                | SA01                   | B                  | -                    | Dark grey gravelly silty sand with rare rootlets | -                    | -                 | 30                         |



4161



7 - 11 Harding Street  
Leicester  
LE1 4DH

**L23/04119/PSL - 23-36107**

**Project Reference - PSL23/5350 Ruabon Business Park**

**Sample Comments**

| Lab Reference | Client Sample ID | Client Sample Location | Client Sample Type | Client Sample Number | Comments |
|---------------|------------------|------------------------|--------------------|----------------------|----------|
| 308180        | -                | SA01                   | B                  | -                    |          |





4161



7 - 11 Harding Street  
Leicester  
LE1 4DH

**L23/04119/PSL - 23-36107**

**Project Reference - PSL23/5350 Ruabon Business Park**

### Analysis Methodologies

| Test Code  | Test Name / Reference                     | Sample condition for analysis | Sample Preparation      | Test Details                                                                                                                           |
|------------|-------------------------------------------|-------------------------------|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| ANIONSS    | MS - CL - Anions by Aquakem (2:1 Extract) | Oven dried                    | Passing 2mm test sieve  | Determination of Anions (inc Sulphate, chloride etc.) in soils by Aquakem. Analysis is based on a 2:1 water to soil extraction ratio   |
| PHS        | MS - CL - pH in Soils                     | As received                   | Passing 10mm test sieve | Determination of pH in soils using a pH probe (using a 1:3 soil to water extraction)                                                   |
| ASSO4S     | MS - CL - Acid Soluble Sulphate           | Oven Dried                    | Passing 2mm test sieve  | Determination of total sulphate in soils by acid extraction followed by ICP analysis                                                   |
| SAMPLEPREP | MS - CL - Sample Preparation              | -                             | -                       | Preparation of samples (including determination of moisture content) to allow for subsequent analysis                                  |
| 1377TS-ELT | BS1377 Total Sulphur Content by HTC       | Oven dried                    | BS1377 : Part 1 : 2016  | Total Sulphur Content testing of Soil in accordance with BS 1377 : Part 3 : 2018 + A1 : 2021 Clause 7.10 (using Eltra CS-800 Analyser) |



4161



7 - 11 Harding Street  
Leicester  
LE1 4DH

**L23/04119/PSL - 23-36107**

**Project Reference - PSL23/5350 Ruabon Business Park**

#### Sample Deviations

Deviations are listed below against each sample and associated test method, where deviation(s) are noted it means data may not be representative of the sample at the time of sampling and it is possible that results provided may be compromised.

#### Observations on receipt

A - No date of sampling provided

C - Received in inappropriate container

H - Contains headspace

T - Temperature on receipt exceeds storage temperature

R - Date of sampling to receipt insufficient to allow analysis to be completed without deviation, Please note this is only a deviation if 'X' is also recorded against the sample

#### Observations whilst in laboratory

X - Exceeds sampling to extraction or analysis timescales

| Lab Reference | Client Sample ID | Client Sample Location | Client Sample Type | Client Sample Number | Test | Deviations |
|---------------|------------------|------------------------|--------------------|----------------------|------|------------|
| 308180        | -                | SA01                   | B                  | -                    |      | A          |

## **APPENDIX H – SUMMARY OF CHEMICAL TESTING**

POS(resi) (1% SOM)

|                      | WS01  | WS03   | WS03 | WS05   | WS05 | WS05 | WS05   | WS05  | Exceedance |
|----------------------|-------|--------|------|--------|------|------|--------|-------|------------|
| Metals & Non-Metals  | 1.00  | 0.50   | 1.00 | 0.50   | 1.00 | 1.00 | 1.00   | 1.00  | s          |
| Arsenic              | 25    | 15     | -    | 8      | -    | -    | 25     | 79    | 0          |
| Cadmium              | 0.2   | < 0.1  | -    | < 0.1  | -    | -    | 0.2    | 220   | 0          |
| Chromium III         | 7.2   | 12     | -    | 5.4    | -    | -    | 12     | 1500  | 0          |
| Chromium, Hexavalent | < 1.0 | < 1.0  | -    | < 1.0  | -    | -    | < 1.0  | 21    | 0          |
| Copper               | 30    | 36     | -    | 13     | -    | -    | 36     | 12000 | 0          |
| Lead                 | 21    | 22     | -    | 0.9    | -    | -    | 22     | 630   | 0          |
| Mercury              | 0.05  | < 0.05 | -    | < 0.05 | -    | -    | < 0.05 | 16    | 0          |
| Nickel               | 34    | 23     | -    | 6.8    | -    | -    | 34     | 230   | 0          |
| Phenol - Monohydric  | 6.7   | 0.8    | -    | < 0.3  | -    | -    | 6.7    | 440   | 0          |
| Selenium             | 1.5   | 0.6    | -    | < 0.5  | -    | -    | 1.5    | 1100  | 0          |
| Zinc                 | 72    | 33     | -    | 6      | -    | -    | 72     | 81000 | 0          |

|                        | WS01   | WS03   | WS03 | WS05   | WS05 | WS05 | WS05   | WS05 | Exceedance |
|------------------------|--------|--------|------|--------|------|------|--------|------|------------|
| Petroleum Hydrocarbons | 1.00   | 0.50   | 1.00 | 0.50   | 1.00 | 1.00 | 1.00   | 1.00 | s          |
| Aliphatic C5-C8        | < 0.01 | < 0.01 | -    | < 0.01 | -    | -    | < 0.01 | 0.01 | 0          |
| Aliphatic C8-C8        | < 0.01 | < 0.01 | -    | < 0.01 | -    | -    | < 0.01 | 0.01 | 0          |
| Aliphatic C8-C10       | < 0.01 | < 0.01 | -    | < 0.01 | -    | -    | < 0.01 | 0.01 | 0          |
| Aliphatic >EC10-EC12   | < 1.5  | < 1.5  | -    | < 1.5  | -    | -    | < 1.5  | 1.5  | 0          |
| Aliphatic >EC12-EC16   | < 1.2  | < 1.2  | -    | < 1.2  | -    | -    | < 1.2  | 1.2  | 0          |
| Aliphatic >EC16-EC35   | < 3.4  | < 3.4  | -    | < 3.4  | -    | -    | < 3.4  | 3.4  | 0          |
| Aliphatic >EC35-EC40   | < 3.4  | < 3.4  | -    | < 3.4  | -    | -    | < 3.4  | 3.4  | 0          |
| Aromatic C5-C7         | < 0.01 | < 0.01 | -    | < 0.01 | -    | -    | < 0.01 | 0.01 | 0          |
| Aromatic C7-C8         | < 0.01 | < 0.01 | -    | < 0.01 | -    | -    | < 0.01 | 0.01 | 0          |
| Aromatic C8-C10        | < 0.01 | < 0.01 | -    | < 0.01 | -    | -    | < 0.01 | 0.01 | 0          |
| Aromatic >EC10-EC12    | < 0.9  | < 0.9  | -    | < 0.9  | -    | -    | < 0.9  | 0.9  | 0          |
| Aromatic >EC12-EC16    | < 0.5  | < 0.5  | -    | < 0.5  | -    | -    | < 0.5  | 0.5  | 0          |
| Aromatic >EC16-EC21    | < 0.6  | < 0.6  | -    | < 0.6  | -    | -    | < 0.6  | 0.6  | 0          |
| Aromatic >EC21-EC35    | < 1.4  | < 1.4  | -    | < 1.4  | -    | -    | < 1.4  | 1.4  | 0          |
| Aromatic >EC35-EC40    | < 1.4  | < 1.4  | -    | < 1.4  | -    | -    | < 1.4  | 1.4  | 0          |

|                                 | WS01   | WS03   | WS03 | WS05   | WS05 | WS05 | WS05   | WS05 | Exceedance |
|---------------------------------|--------|--------|------|--------|------|------|--------|------|------------|
| Polyaromatic Hydrocarbons (PAH) | 1.00   | 0.50   | 1.00 | 0.50   | 1.00 | 1.00 | 1.00   | 1.00 | s          |
| Acenaphthene                    | < 0.03 | < 0.03 | -    | < 0.03 | -    | -    | < 0.03 | 0.03 | 0          |
| Acenaphthylene                  | < 0.03 | < 0.03 | -    | < 0.03 | -    | -    | < 0.03 | 0.03 | 0          |
| Anthracene                      | < 0.03 | < 0.03 | -    | < 0.03 | -    | -    | < 0.03 | 0.03 | 0          |
| Benzo(a)anthracene              | < 0.03 | < 0.03 | -    | < 0.03 | -    | -    | < 0.03 | 0.03 | 0          |
| Benzo(b)pyrene                  | < 0.03 | < 0.03 | -    | < 0.03 | -    | -    | < 0.03 | 0.03 | 0          |
| Benzo(b)fluoranthene            | < 0.03 | < 0.03 | -    | < 0.03 | -    | -    | < 0.03 | 0.03 | 0          |
| Benzo(g,h,i)perylene            | < 0.03 | < 0.03 | -    | < 0.03 | -    | -    | < 0.03 | 0.03 | 0          |
| Benzo(k)fluoranthene            | < 0.03 | < 0.03 | -    | < 0.03 | -    | -    | < 0.03 | 0.03 | 0          |
| Chrysene                        | < 0.03 | < 0.03 | -    | < 0.03 | -    | -    | < 0.03 | 0.03 | 0          |
| Dibenzo(a,h)anthracene          | < 0.03 | < 0.03 | -    | < 0.03 | -    | -    | < 0.03 | 0.03 | 0          |
| Fluoranthene                    | < 0.03 | < 0.03 | -    | < 0.03 | -    | -    | < 0.03 | 0.03 | 0          |
| Fluorene                        | < 0.03 | < 0.03 | -    | < 0.03 | -    | -    | < 0.03 | 0.03 | 0          |
| Indeno(1,2,3-c,d)pyrene         | < 0.03 | < 0.03 | -    | < 0.03 | -    | -    | < 0.03 | 0.03 | 0          |
| Naphthalene                     | 0.29   | < 0.03 | -    | < 0.03 | -    | -    | < 0.03 | 0.12 | 0          |
| Phenanthrene                    | 0.13   | < 0.03 | -    | < 0.03 | -    | -    | < 0.03 | 0.13 | 0          |
| Pyrene                          | < 0.03 | < 0.03 | -    | < 0.03 | -    | -    | < 0.03 | 0.03 | 0          |

|                                 | WS01 | WS03 | WS03 | WS05  | WS05 | WS05 | WS05  | WS05  | Exceedance |
|---------------------------------|------|------|------|-------|------|------|-------|-------|------------|
| Other Contaminants / Testing    | 1.00 | 0.50 | 1.00 | 0.50  | 1.00 | 1.00 | 1.00  | 1.00  | s          |
| Organic Matter                  | 0.8  | 0.2  | -    | 0.6   | -    | -    | 0.2   | 0.53  | -          |
| pH                              | 4.8  | 5.5  | 5.1  | 8.1   | 8.2  | 8.2  | 8.2   | 6.34  | -          |
| Sulphide                        | 20   | 24   | -    | 20    | -    | -    | 20    | 21.33 | -          |
| Cyanide, Total                  | 0.3  | 0.2  | -    | < 0.1 | -    | -    | < 0.1 | 0.3   | -          |
| Sulphur (free)                  | 17   | 2.4  | -    | 2.3   | -    | -    | 2.3   | 17    | -          |
| Sulphate Aqueous Extract as SO4 | 90   | 47   | 45   | 37    | 130  | 130  | 130   | 69.8  | -          |

## **APPENDIX I – CURRENT GUIDANCE FOR GROUND GAS RISK ASSESSMENT**

## Current Guidance for Ground Gas Risk Assessment

### Origin of Ground and Landfill Gases

When carrying out a ground gas risk assessment for permanent ground gases (e.g., methane and carbon dioxide), the origin or source of the gases is important as potential risks will vary depending on the source. This Appendix relates to the risk of the two main ground gases of concern: methane and carbon dioxide and does not apply to other ground gases (e.g., radon or vapours from hydrocarbon spills). Methane and carbon dioxide are major constituents of landfill gas but can also occur from a variety of anthropogenic and natural sources, as summarised in Table G1 below:

| Table G1. Potential Sources of Ground Gases |                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                        |
|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Gas                                         | Source                                                                                                                                                                                                                                                                                                                                                       | Comments                                                                                                                                                                                                                                                               |
| Landfill Gas                                | Anaerobic decomposition of degradable waste within landfill sites. Typically, 60% methane and 40% carbon dioxide during methanogenic phase.                                                                                                                                                                                                                  | Composition varies over time, particularly in early stages. Contains a range of minor constituents (particularly carbon monoxide and hydrogen sulphide).                                                                                                               |
| Landfill Associated Gases                   | <ul style="list-style-type: none"> <li>- Anaerobic degradation of leachate external to the site;</li> <li>- Degassing of dissolved gases in groundwater;</li> <li>- Evolution of gases following interaction between leachate and groundwater</li> </ul>                                                                                                     | Can result in secondary (external) production of methane or carbon dioxide.                                                                                                                                                                                            |
| Made Ground                                 | Anaerobic degradation of organic components                                                                                                                                                                                                                                                                                                                  | Very variable depending on source                                                                                                                                                                                                                                      |
| Sewer Gas, Cess Pits                        | Anaerobic degradation of organic components of sewage producing methane and carbon dioxide.                                                                                                                                                                                                                                                                  | Often characterised by hydrogen sulphide odour.                                                                                                                                                                                                                        |
| Mains Gas                                   | Leakage from underground pipework or storage tanks. Mainly methane but often contains higher alkanes.                                                                                                                                                                                                                                                        | An odouriser is added to permit detection of leaks. Typically, 90% CH <sub>4</sub> , but 1 to 27% C <sub>2</sub> -C <sub>4</sub> alkanes, May also contain other trace gases e.g., CO, helium and CO <sub>2</sub> (from degradation of CH <sub>4</sub> in the ground). |
| Other Anthropogenic Sources                 | <ul style="list-style-type: none"> <li>- Degradation of leaked or spilled hydrocarbons or other industrial chemicals;</li> <li>- Anaerobic degradation of organic contaminants in groundwaters (e.g., silage liquor);</li> <li>- Reactions between monitoring well construction components and environment;</li> <li>- Burial grounds/cemeteries.</li> </ul> | Hydrocarbon spillages often have an 'oily' odour. Fuel spillages common – Petrol or Diesel and can contain a wide range of VOC's. Can degrade to produce methane / carbon dioxide.                                                                                     |
| Alluvium / Marsh / Peat Gas                 | Anaerobic microbial degradation of organic material (usually waterlogged vegetation / peat). Often associated with the presence of alluvial deposits or dredgings.                                                                                                                                                                                           |                                                                                                                                                                                                                                                                        |
| Geogenic Gas                                | Natural seepages of carbon dioxide and hydrocarbon gases derived from geologic sources such as coal seams and deep oil / gas source formations. Can be present in solution in groundwaters.                                                                                                                                                                  | Methane most common but can contain carbon dioxide and higher alkanes.                                                                                                                                                                                                 |
| Mine Gases                                  | Various types. Most common is "fire damp" with high methane, produced by the desorption of gas trapped in coal. "Black damp" (Stythe gas) with high carbon dioxide and denser than air. "White damp" is high in carbon monoxide.                                                                                                                             | Methane most common. Can contain higher alkanes, carbon dioxide and carbon monoxide. Often low in oxygen.                                                                                                                                                              |
| Natural Shallow Ground Gas                  | Various types <ul style="list-style-type: none"> <li>- high carbon dioxide formed by subsurface aerobic activity leading to depleted oxygen and elevated carbon dioxide;</li> <li>- chemical degradation of rocks (e.g., carbonates) producing carbon dioxide;</li> <li>- carbon dioxide production in root zone of soils by plants.</li> </ul>              | Gases can be emitted from ground under falling barometric pressure conditions.                                                                                                                                                                                         |

This Appendix concentrates on the assessment of risk from methane and carbon dioxide. This Appendix does not provide guidance for the assessment of risk when other gases are present due to 'Other Sources' from the above table (particularly organic compounds such as BTEX and VOC's or for the risk from radon or hydrogen sulphide).

To determine the origin of the gas a range of factors must be considered together, including;

1. Proximity of likely sources;
2. Ground conditions (geology, hydrogeology, anthropogenic pathways etc);
3. Properties of gases present including:
  - a. Chemical composition;
  - b. Physical properties;
  - c. Ratios of components e.g., methane : carbon dioxide.
4. Timeframe of activities such as infilling periods, capping works, installation of gas control systems etc.

Identification of the originating source may be problematic given that there may be more than one source present and trace gas analysis may be required. Identification of the sources of the gases encountered during monitoring is usually carried out through a process of eliminating the most unlikely potential sources (given the site setting) and selecting those which are the more likely candidates.

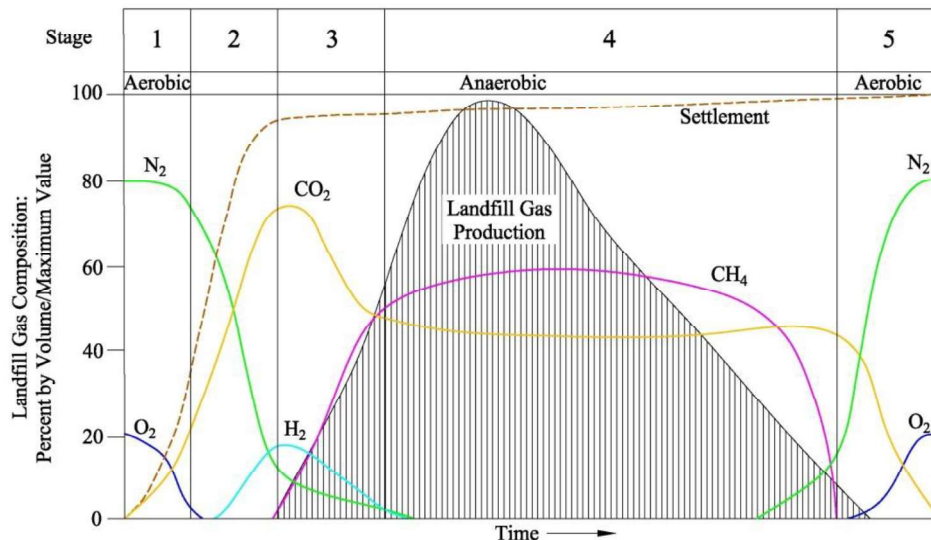
### **Hazards Associated with Presence of Ground Gases**

Methane gas is combustible and potentially explosive. When the concentration of methane in air is between the limits of 5.0%v/v and 15.0%v/v an explosive mixture is formed. The Lower Explosive Limit (LEL) of methane is 5.0%v/v, which is equivalent to 100% LEL. The 15.0%v/v limit is known as the Upper Explosive Limit (UEL), but concentrations above this level cannot be assumed to represent safe concentrations. Further, the LEL and UEL will vary (up and down) depending upon the proportion of other gases (including oxygen). However, the fact that methane is a colourless, odourless gas means that there is no simple indicator of the presence of the gas until such a time as explosive limits are reached, and an incident occurs. Methane is lighter than air and has a low toxicity. However, at high concentrations it can result in asphyxiation due to oxygen displacement.

Carbon dioxide is a colourless, odourless gas, which, although non-flammable, is both toxic and an asphyxiant. As carbon dioxide is denser than air, it will collect in low points and depressions. The UK Health & Safety Executive (HSE) has published information relating to concentrations of carbon dioxide that humans may be exposed to, which uses concentrations contained in the Control of Substances Hazardous to Health Regulations 2002 (as amended). These are the Long-Term Occupational Exposure Limit (LTOEL, 8-hour period) and the Short-Term Occupational Exposure Limit (STOEL, 15-minute period), which are 0.5% and 1.5% carbon dioxide, respectively.

## Parameters Influencing the Rate of Ground Gas Production

Figure G2 is taken from EA guidance document LFTGN 03 illustrates typical ground gas generation curves from biodegradable materials:



**Figure G2. Idealised Representation of Landfill Gas Generation.**

The production of methane and carbon dioxide at a landfill site may be expected to be considerable and ongoing. Concentrations of methane will eventually decrease, followed by concentrations of carbon dioxide, but the duration and rate of gas production can vary markedly between sites. Five distinct phases of gas production occur during the process which are, in order of event (as marked on Figure G2), as follows:

1. An aerobic phase involving oxygen depletion and temperature increase through aerobic respiration;
2. The establishment of anaerobic conditions and the evolution of carbon dioxide and hydrogen through acidogenic activity;
3. Commencement of methanogenic activity; the establishment of populations of methanogenic bacteria;
4. A phase of stable methanogenic activity, which may go on for many tens of years;
5. A phase of decreasing methanogenic activity, representing depletion of the organic material and a return to aerobic conditions.

The time scale for the return to the normal ground gas concentrations will be highly variable, depending upon the types and quantities of materials present. In addition, the optimum parameters influencing the rate of decomposition and ground gas production within the ground at a site are as follows:

- High water content with adequate rainfall and water infiltration to provide moisture content between approximately 20 to 26%;



- Conditions that either are or are very close to anaerobic;
- High proportion of biodegradable materials;
- A pH between 6.5 and 8.5, ideally verging slightly on the acidic between pH 6 to 7;
- Temperature between 25°C and 55°C;
- The ratio of the biochemical and chemical oxygen demands (BOD:COD);
- High permeability;
- Small particle size, as finer subsurface materials possess a greater surface area to provide a growing 'face' for the micro-organisms but high fines levels reduces permeability and reduces decomposition rate.

For this reason, it is vital that sources of methane and carbon dioxide are identified prior to the commencement of any work on a construction site, and that the ground gas regime is characterised at the worst temporal conditions a site may experience. From this, a risk assessment is carried out to identify the risk at the site from ground gases so that suitable protection measures can be designed and incorporated into a development to prevent a dangerous build-up of gas occurring.

### **Factors Influencing the Migration and Behaviour of Ground Gases**

There are many factors that influence the migration of ground gases which can affect the risk from a gassing source:

- driving force – pressure differential along a pathway, diffusion and dissolved in solution;
- meteorological conditions – short term and seasonal conditions including atmospheric pressure changes (e.g., rapidly falling pressure causes gas to expand increasing emission rates), rainfall, frozen ground and thawing, temperature;
- geological and groundwater conditions – these can have the over-riding influence on the direction/pathways and quantity of migrating gas;
- anthropogenic influences – man-made pathways include mine shafts, service runs/drains, foundation piles, underground voids/pits/basements, foundation/building design/construction

### **Guidance Documents**

Currently in the UK, there are no statutory threshold limits for hazardous gases in the ground as site specific variables mean that standard threshold values cannot be applied. The published guidance relating to development of sites where methane and carbon dioxide are present has been produced in response to building projects on or close to landfill sites, as both gases are principal constituents of landfill gas. Much of the historic guidance that has been produced on gas risk assessment focused on landfill sites and as a result there has previously been a lack of clarity when relating the process to gas conditions on non-landfill sites.

Statutory guidance regarding methane in the ground has previously taken a limiting concentration of 1.0 % by volume methane (equal to 20% of the lower explosive limit of methane in air) above which necessary actions will be appropriate. For carbon dioxide the limiting recommended trigger was 1.5 % by volume (the Long-Term Exposure Limit for carbon dioxide). Above these concentrations the Building Regulations Approved Document C (1992) stated that consideration should be given to whether actions may be appropriate, whilst more specific solutions would be likely to be necessary at concentrations greater than 5% by volume of carbon dioxide (Building Regulations Approved Document C, 1992). However, the latest fully revised version of Approved Document C (DoE, 2004) no longer endorses this approach and instead requires the use of a risk-based approach in interpreting the findings of a gas monitoring survey. Further, the latest EA documentation on landfill gas (LFTGN 03, 2004) continues to sanction the use of a risk-based approach through a structured approach to the assessment of ground gases and links with the risk assessment process outlined within CLR 11 for soil contaminants.

With the above in mind, recent guidance has been produced in 2006 and 2007 with the aim of providing up to date advice in relation to residential and commercial development. The guidance does not address issues associated with gas derived from landfills, for this refer to “*Guidance on the Management of Landfill Gas*” (Environment Agency 2004) for an overview.

Recent guidance relevant to gas assessments for residential and commercial development includes;

- **Wilson *et al.* (CIRIA C665, December 2007) “Assessing Risks Posed by Hazardous Ground Gases for Buildings.”**

This document provides up to date advice on all aspects of ground gas risk assessment such as investigation, monitoring programmes, data collection and interpretation. The guidance presents separate methodologies for the characterisation of:

- **All development types except low rise housing with gardens and for Low Rise Buildings without a 150mm void** (Situation A) (Table 8.5 CIRIA C665)
  - and;
  - **Low rise housing with gardens with a 150mm ventilated sub-floor void** (Situation B) (Table 8.7 CIRIA C665)
- (See below for further explanation of the methods of characterisation)

- **Boyle and Witherington (NHBC / RSK Group, Report 10627-R01(04) January 2007) “Guidance on the Evaluation of Development Proposals on Sites where Methane and Carbon Dioxide are Present.”**

This document presents the “Traffic Lights System” detailed below and is relevant only for low rise properties (e.g., bungalows and town houses) that have a ventilated sub-floor void (i.e., Situation B as described in CIRIA C665).

- **Wilson and Card (CIEH, expected 2011) “Ground Gas Handbook for Designers and Regulators”**

This document is expected to provide practical guidance on ground gas assessments and the design and evaluation of protection measures.

- **British Standard (BS 8485+A1, January 2019) “Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings”**

This document provides an overview of gas characterisation and assessment. The Standard is intended to be used by designers of gas protection measures and regulators involved in the assessment of design solutions. The Standard provides a framework in line with CLR11 allowing designers to judge the adequacy of ground gas and related site investigation data. The document provides an approach to determine appropriate ground gas parameters that can be used to identify a range of possible construction solutions mitigating against the presence of ground gas on a development site.

Each of these documents continues to highlight the importance of, and give further guidance towards, carrying out a tiered risk-based decision-making process in accord with government policy on dealing with contamination from historic or natural sources and highlight the importance of the Conceptual Model in site characterisation. These documents also stress the importance that the assessor should be confident that the ground gas monitoring results are representative of the likely worse case ground gas regime on a site and that the data collected from the site is sufficient. With this in mind, CIRIA C665 sets out ideal monitoring periods as below.

| Idealised Frequency and Period of Monitoring (after Table 5.5a and 5.5b, CIRIA C665)                                                                                                                                                                                                                                                                                                                                        |                                 |                                |     |          |       |           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|--------------------------------|-----|----------|-------|-----------|
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                 | Generation Potential of Source |     |          |       |           |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                 | Very Low                       | Low | Moderate | High  | Very High |
| Sensitivity of Development                                                                                                                                                                                                                                                                                                                                                                                                  | Low (Commercial)                | 4/1                            | 6/2 | 6/3      | 12/6  | 12/12     |
|                                                                                                                                                                                                                                                                                                                                                                                                                             | Moderate (Flats)                | 6/2                            | 6/3 | 9/6      | 12/12 | 24/24     |
|                                                                                                                                                                                                                                                                                                                                                                                                                             | High (Residential with Gardens) | 6/3                            | 9/6 | 12/6     | 24/12 | 24/24     |
| <b>Notes</b><br>1. First number is the number of readings and the second is the minimum period in months (e.g., 6/2 – six sets of readings over two months).<br>2. At least two sets of readings must be at low (preferably under 1,000 mb) and falling pressure.<br>3. High sensitivity end use on high or very high hazard site will not normally be acceptable unless the source is treated to reduce gassing potential. |                                 |                                |     |          |       |           |

Before the latest guidance, good practice for site characterisation had been based upon the method proposed by Wilson and Card (1999). CIRIA C665 (2007) effectively supersedes Wilson and Card (1999) and includes a modified version of the Wilson and Card method (Tables 8.5, 8.6 and Box 8.1). Gas concentrations and flow rates for either methane and/or carbon dioxide measured at a site to ‘Characteristic Situations.’ Appropriate protection measures are selected from Table 8.6 (if using modified Wilson & Card method) and from Box 8.4 from CIRIA C665 (if using the NHBC traffic lights method). Throughout the risk assessment process, strong regard must be given to the nature of the gassing source, the flow rates and the estimated surface emissions. Note that certain protection measures are stated in CIRIA Report 149 that are now considered wholly inappropriate to certain developments and consequently should not be used without modification. Throughout the process, it is important to remember that these tables are not

intended to be used as a definitive design tool and have been prepared to show the typical scope of measures for gas control.

Both the NHBC (2007) and CIRIA (2007) guidance documents and BS 8485+A1 (2019) propose that both ground gas concentrations and flow rates are used to calculate the limiting gas well gas volume flow rates for methane and carbon dioxide, based on the ground gas conditions monitored for during the worse-case temporal conditions. This limiting gas well volume flow rate is termed the Gas Screening Value (GSV, note that this was termed borehole gas volume flow), and is calculated as follows:

$$\text{GSV (l/hr)} = \frac{[\text{gas well gas concentration (\%v/v)}] \times [\text{gas well flow rate (l/hr)}]}{100}$$

These GSVs are then compared to generic 'Traffic Lights' contained within the NHBC guidance, which present typical maximum gas concentrations and limiting GSV's, for 'Situation B Development' (Low rise housing with gardens).

| Table 8.7 NHBC Traffic light system for 150 mm void                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                      |                                                  |                                                      |                                                  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|--------------------------------------------------|------------------------------------------------------|--------------------------------------------------|
| Traffic Light                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Methane <sup>1</sup>                                 |                                                  | Carbon Dioxide <sup>2</sup>                          |                                                  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Typical max concentration <sup>3</sup> (% by volume) | Gas Screening Value <sup>2,4</sup> (litres/hour) | Typical max concentration <sup>3</sup> (% by volume) | Gas Screening Value <sup>2,4</sup> (litres/hour) |
| Green                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1                                                    | 0.13                                             | 5                                                    | 0.78                                             |
| Amber 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 5                                                    | 0.63                                             | 10                                                   | 1.6                                              |
| Amber 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 20                                                   | 1.60                                             | 30                                                   | 3.10                                             |
| Red                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                      |                                                  |                                                      |                                                  |
| <b>Notes:</b> <ol style="list-style-type: none"> <li>1. The worst-case ground gas regime identified on the site, either methane or carbon dioxide, at the worst-case temporal conditions that the site may be expected to encounter will be the decider as to what Traffic Light is allocated;</li> <li>2. Borehole Gas Volume Flow Rate, in litres per hour as defined in Wilson and Card (1999), is the borehole flow rate multiplied by the concentration in the air stream of the particular gas being considered;</li> <li>3. The Typical Maximum Concentrations can be exceeded in certain circumstances should the Conceptual Site Model indicate it is safe to do so;</li> <li>4. The Gas Screening Value thresholds should not generally be exceeded without the completion of a detailed ground gas risk assessment taking into account site-specific conditions.</li> </ol> |                                                      |                                                  |                                                      |                                                  |

**Box 8.4 of CIRIA C665 Gas protection measures for low-rise housing development based upon allocated NHBC Traffic light (Boyle and Witherington, 2007)**

| Traffic Light Classification | Protection Measures Required                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Green                        | Negligible gas regime identified, and gas protection measures are not considered necessary.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Amber 1                      | Low to intermediate gas regime identified, which requires low-level gas protection measures, comprising a membrane and ventilated sub-floor void to create a permeability contrast to limit the ingress of gas into buildings. Gas protection measures should be as prescribed in BRE Report 414. Ventilation of the sub-floor void should facilitate a minimum of one complete volume change per 24 hours.                                                                                                                                                                                           |
| Amber 2                      | Intermediate to high gas regime identified, which requires high-level gas protection measures, comprising a membrane and ventilated sub-floor void to create a permeability contrast to prevent the ingress of gas into buildings. Gas protection measures should be as prescribed in BRE Report 414. Membranes should always be fitted by a specialist Contractor. As with Amber 1, ventilation of the sub-floor void should facilitate a minimum of one complete volume change per 24 hours. Certification that these passive protection measures have been installed correctly should be provided. |
| Red                          | High gas regime identified. It is considered that standard residential housing would not normally be acceptable without a further Gas Risk Assessment and/or possible remedial mitigation measures to reduce and/or remove the source of gas.                                                                                                                                                                                                                                                                                                                                                         |

For a ‘Situation A Development’ (All development except low rise housing with gardens), the GSV value is used to derive the appropriate Characteristic Situation from Table 8.5 of CIRIA C665 (below):

**Table 8.5 from CIRIA C665 Modified Wilson and Card Classification**

| Characteristic Situation (CIRIA R149) | Comparable Partners in Technology gas Regime (see Box 8.2) | Risk Classification   | Gas Screening Value (CH <sub>4</sub> or CO <sub>2</sub> ) (l/hr) <sup>1</sup> | Additional Factors                                                                                     | Typical Source of Generation                                                |
|---------------------------------------|------------------------------------------------------------|-----------------------|-------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| 1                                     | A                                                          | Very low risk         | <0.07                                                                         | Typically, methane ≤ 1% and/or carbon dioxide ≤ 5%. Otherwise consider increase to Situation 2         | Natural soils with low organic content “Typical” made ground                |
| 2                                     | B                                                          | Low risk              | <0.7                                                                          | Borehole air flow rate not to exceed 70l/hr. Otherwise consider increase to characteristic Situation 3 | Natural soil, high peat/organic content. “Typical” made ground              |
| 3                                     | C                                                          | Moderate risk         | <3.5                                                                          |                                                                                                        | Old landfill, inert waste, mine working flooded                             |
| 4                                     | D                                                          | Moderate to high risk | <15                                                                           | Quantitative risk assessment required to evaluate scope of protective measures.                        | Mine working susceptible to flooding, completed landfill (WMP 26B criteria) |
| 5                                     | E                                                          | High risk             | <70                                                                           |                                                                                                        | Mine working unflooded inactive with shallow workings near surface          |
| 6                                     | F                                                          | Very high risk        | >70                                                                           |                                                                                                        | Recent landfill site                                                        |

It was intended in CIRIA C665 that the characteristic situation allocated to the development from the table above would then be used in Table 8.6 of CIRIA C665 in order to determine the level of gas protection the development requires. However, BS8485:2015 superseded this document and a different set of mitigation standards were put forward.

The recommended minimum gas protection score (points) be selected based on the building type (Table 3 which defines four building types) and the ground gas Characteristic Situation as detailed in Table 4 of BS8485:2015+A1:2019 (see below).

The first step in the decision-making process is to obtain the level of gas protection necessary in the range 0 to 7.5 from Table 4. Then a combination of structural barriers (Table 5) ventilation protection measures (Table 6) and/or gas resistant membranes (Table 8) should be chosen to meet that requirement. The level of gas protection necessary should take into account the characteristic gas situation and a number of other factors. The whole decision-making process should be made transparent, where all parties can see the approach being taken, can understand the various steps and decisions made and be confident that a risk-assessed solution has been designed and installed commensurate with the construction and site constraints.

Where the gas Characteristic Situation is 4 or more (and for NHBC Red situations according to CIRIA C665), the site requires a comprehensive risk assessment to confirm the scope of protection measures. These are higher risk sites and reliance on Table 4 alone is not sufficient.

| <b>BS8485:2015+A1:2019 Table 3 Building Types</b>                 |               |                                                     |                        |                                         |
|-------------------------------------------------------------------|---------------|-----------------------------------------------------|------------------------|-----------------------------------------|
|                                                                   | <b>Type A</b> | <b>Type B</b>                                       | <b>Type C</b>          | <b>Type D</b>                           |
| Ownership                                                         | Private       | Private or commercial/<br>public, possible multiple | Commercial /<br>public | Commercial /<br>industrial              |
| Control (change of use,<br>structural alterations,<br>ventilation | None          | Some but not all                                    | Full                   | Full                                    |
| Room sizes                                                        | Small         | Small / medium                                      | Small to large         | Large industrial /<br>retail park style |

| BS8485:2015+A1:2019 Table 4 Gas Protection Score by CS and Type of Building                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                        |                    |          |        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----------|--------|
| CS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Required Gas Protection                                                                                                                                                                                                                                                                                                                                                                                                |                    |          |        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | High risk                                                                                                                                                                                                                                                                                                                                                                                                              | Medium risk        | Low risk |        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Type A                                                                                                                                                                                                                                                                                                                                                                                                                 | Type B             | Type C   | Type D |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0                                                                                                                                                                                                                                                                                                                                                                                                                      | 0                  | 0        | 0      |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 3.5                                                                                                                                                                                                                                                                                                                                                                                                                    | 3.5                | 2.5      | 1.5    |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 4.5                                                                                                                                                                                                                                                                                                                                                                                                                    | 4                  | 3        | 2.5    |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 6.5 <sup>(A)</sup>                                                                                                                                                                                                                                                                                                                                                                                                     | 5.5 <sup>(A)</sup> | 4.5      | 3.5    |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | (B)                                                                                                                                                                                                                                                                                                                                                                                                                    | 6 <sup>(A)</sup>   | 5.5      | 4.5    |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | (B)                                                                                                                                                                                                                                                                                                                                                                                                                    | (B)                | (B)      | 6      |
| a)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Residential building should not be built on CS4 or higher sites unless the type of construction or site circumstances allow additional levels of protection to be incorporated, e.g., high-performance ventilation or pathway intervention measures, and an associated sustainable system of management of maintenance of the gas control system, e.g., in institutional and/or fully serviced contractual situations. |                    |          |        |
| b)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | The gas hazard is too high for this empirical method to be used to define the gas protection measures                                                                                                                                                                                                                                                                                                                  |                    |          |        |
| <p><small>NOTE 3</small> The NHBC has published guidance for use on residential developments, which utilise an alternative classification (“traffic light”) system. This guidance typically applies to Type A buildings utilising beam and block floor constructions with clear void ventilation. The design choice variables are limited to decisions relating to the membrane specification and verification recommendations (see Table 7). Designers utilising this system would therefore need to refer to NHBC to assess compliance for specific recommendations [see 8485:2015 for further on this note]</p> <p><small>NOTE 4</small> The method of selecting the combination of these types of protection is given in section 7.2 of BS8485:2015. Once type of measures has been decided, the detailed design and specification of the measures should be undertaken (section 7.3)</p> |                                                                                                                                                                                                                                                                                                                                                                                                                        |                    |          |        |

Section 7.2 defines the order of selecting protective measures. The first choice is provided by structural barriers as defined in Table 5.

| BS8485+A1:2019 Table 5 Gas protection scores for structural barriers                                                                                                    |          |                                                                                                                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------------------------------------------------------------------------------------------------------------------|
| PROTECTION ELEMENT/SYSTEM                                                                                                                                               | SCORE    | COMMENTS                                                                                                         |
| <b>Floor and substructure design</b>                                                                                                                                    |          |                                                                                                                  |
| <b>Floor slabs</b>                                                                                                                                                      |          |                                                                                                                  |
| Block and beam floor slab                                                                                                                                               | 0        | <i>General – score conditional that breaches of slab are sealed</i>                                              |
| Cast in situ ground-bearing floor slab (with only nominal mesh reinforcement)                                                                                           | 0.5      |                                                                                                                  |
| Cast in situ monolithic reinforced ground-bearing raft or reinforced cast in situ suspended floor slab with minimal penetrations (with only nominal mesh reinforcement) | 1 or 1.5 | <i>To achieve 1.5, raft or suspended slab to be well reinforced to prevent cracking and minimal penetrations</i> |
| Basement floor and walls to BS 8102:2009, Grade 2 waterproofing – See notes in BS8485:2015+A1:2019                                                                      | 2        |                                                                                                                  |
| Basement floor and walls to BS 8102:2009, Grade 3 waterproofing – See notes in BS8485:2015+A1:2019                                                                      | 2.5      | <i>Conditional that waterproofing is not based on geosynthetic clay liner</i>                                    |



Ventilation methods are detailed in Table 6, and points can only be gained from using one of the five types:

| BS8485:2015+A1:2019 Table 6 Gas Protection Scores for Ventilation Protection Measures                                                                                                                                                                                    |            |                                                                                                                                                                                                                                                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PROTECTION ELEMENT/SYSTEM                                                                                                                                                                                                                                                | SCORE      | COMMENTS                                                                                                                                                                                                                                                         |
| a) Pressure relief pathway (usually formed by low fines gravel or with a thin geocomposite blanket with strips terminating in a gravel trench external to the building)                                                                                                  | 0.5        | <i>Whenever possible, a pressure pathway relief pathway (as a minimum) should be installed in all gas protection measures systems.<br/>If a layer has a low permeability and/or is not terminating in a venting trench (or similar), then the score is zero.</i> |
| b) Passive sub floor dispersal layer                                                                                                                                                                                                                                     |            |                                                                                                                                                                                                                                                                  |
| Very good performance                                                                                                                                                                                                                                                    | 2.5        | <i>Performance criteria shown in Fig B.6 and B.7 of BS 8484:2015.[See Annex B]</i>                                                                                                                                                                               |
| Good performance                                                                                                                                                                                                                                                         | 1.5        |                                                                                                                                                                                                                                                                  |
| Media used to provide the dispersal layer are:                                                                                                                                                                                                                           |            |                                                                                                                                                                                                                                                                  |
| <ul style="list-style-type: none"> <li>• Clear void</li> <li>• Polystyrene void forming blanket</li> <li>• Geocomposite void former blanket</li> <li>• No-fines gravel layer with gas drains</li> <li>• No-fines gravel layer</li> </ul>                                 |            |                                                                                                                                                                                                                                                                  |
| c) Active dispersal layer, usually comprising fans with active abstraction (suction) from a subfloor dilution layer, with roof level vents. The dilution layer may comprise a clear void or be formed of geocomposite or polystyrene void formers                        | 1.5 to 2.5 | <i>This system relies on continued serviceability of the pumps; therefore, alarm and response systems should be in place. [See Annex B].</i>                                                                                                                     |
| d) Active positive pressurisation by the creation of a blanket of external fresh air beneath the building floor slab by pumps supplying air to points across the central footprint of the building into a permeable layer, usually formed of a thin geocomposite blanket | 1.5 to 2.5 | <i>This system relies on continued operation of the pumps; therefore, alarm and response systems should be in place. [See Annex B].</i>                                                                                                                          |
| e) Ventilated car park (floor slab of occupied part of the building under consideration is underlain by a basement or undercroft)                                                                                                                                        | 4          | <i>Assumes car park is vented , designed to Building Regulations 2000, Approved Document F.</i>                                                                                                                                                                  |

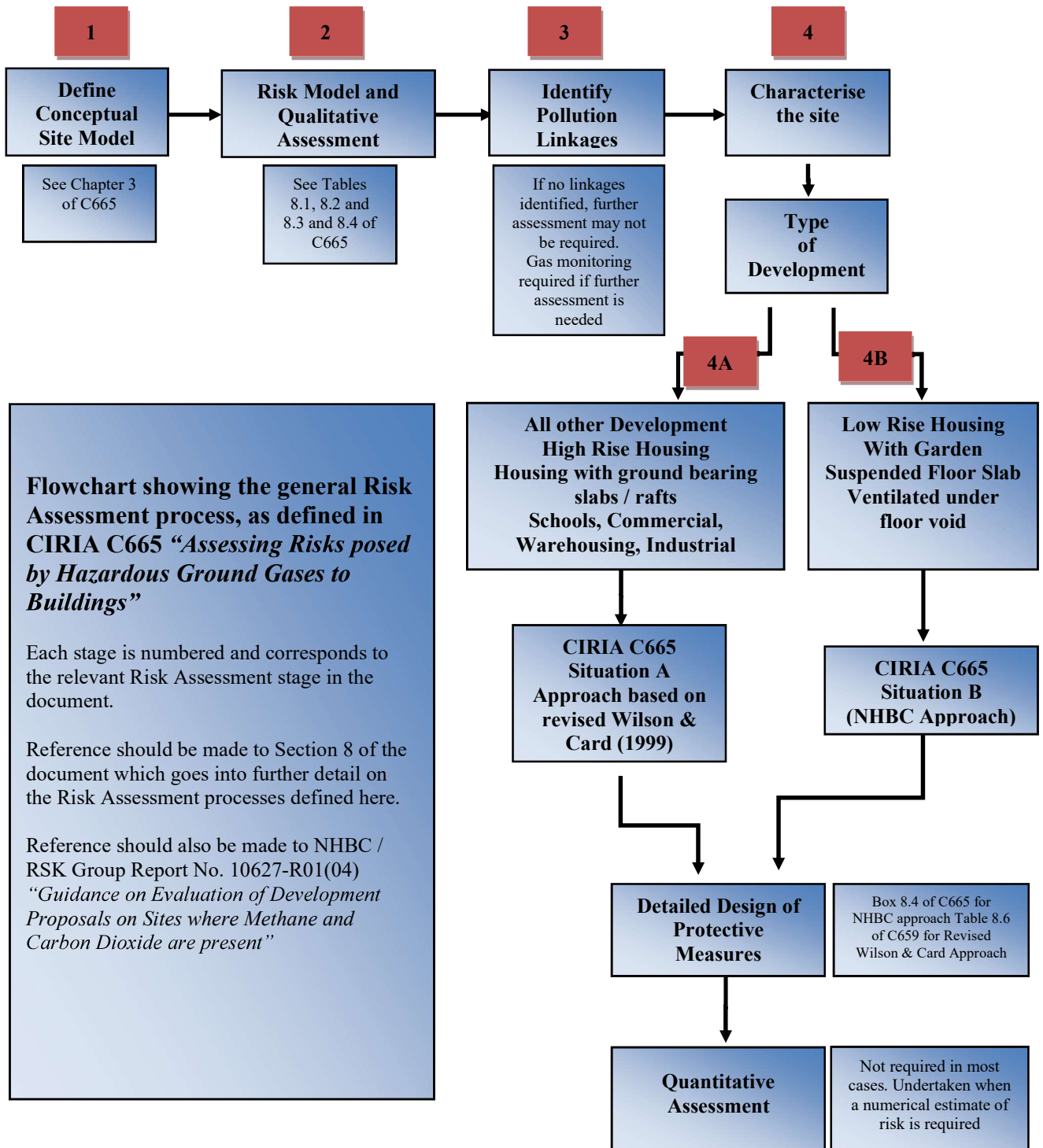


Membrane methods are detailed in Table 7.

| BS8485:2015+A1:2019 Table 7 Gas protection score for gas resistant membrane                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |       |                                                                                                                                                                                                                                                                                 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PROTECTION ELEMENT/SYSTEM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | SCORE | COMMENTS                                                                                                                                                                                                                                                                        |
| Gas resistant membrane meeting all of the following criteria: <ul style="list-style-type: none"> <li>• Sufficiently impervious to gases with a methane gas transmission rate <math>&lt;40.0 \text{ ml/day/m}^2/\text{atm}</math> (average) for sheet and joints (tested in accordance with BS ISO 15105-1 manometric method)</li> <li>• Sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions;</li> <li>• Sufficiently strong to withstand in-service stresses (e.g., settlement if placed below a floor slab);</li> <li>• Sufficiently strong to withstand the installation process and following trades until covered (e.g., penetration from steel fibres in fibre reinforced concrete, dropping tools etc); and to withstand in-service stresses (e.g., settlement if placed below a floor slab)</li> <li>• capable, after installation, of providing a complete barrier to the entry of the relevant gas; and</li> <li>• verified in accordance with CIRIA C735</li> </ul> | 2     | <i>The performance of membranes is heavily dependent on the quality and design of the installation, resistance to damage after installation, and the integrity of joints.</i><br><br><i>If a membrane is installed that does not meet the criteria, then the score is zero.</i> |
| See notes in BS8485:2015+A1:2019 regarding membrane requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                                                                                                                                                                                                                                                                                 |

For a site which is impacted by migratory gases from an off source, the development may be protected by imposing pathway intervention methods, which if successfully validated, could also remove the need for further analysis. It is essential that the gas regime in these circumstances has been fully characterised and that the only source impacting the site is located off site and that the pathway is clearly defined and its interception equally proven before construction commences. Pathway intervention methods may include vertical membrane installations, venting trenches, rows of stone columns, activated trenches and various proprietary systems. These systems are particularly relevant to domestic housing where there is limited scope for foundation type solutions.

Following the choice of protection measures, detailed design should be entered into [Section 8 of BS 8485:2015+A1:2019].



## **APPENDIX J – GUIDANCE FOR CLASSIFICATION OF SOIL FOR OFF SITE DISPOSAL AT A LANDFILL SITE**

## **Guidance for Classification of Soil for Off Site Disposal at a Landfill Site**

Many site developments create a portion of excess soils and Made Ground which if not re-usable, are required to be disposed off-site at a suitably licensed landfill site. The regulations and associated guidance published by the Environment Agency is relatively complex and lengthy. This guidance provides a summary of the following documents which should be referred to when assessing soil (and common constituents found within Made Ground on remediation sites) for off-site disposal:

- Guidance for Waste destined for disposal in landfills: Interpretation of the Waste Acceptance Requirements of the Landfill (England and Wales) Regulations 2002 (as amended) (EA, 2004);
- Guidance on Sampling and Testing of Wastes to Meet Landfill Waste Acceptance Procedures (EA, April 2005);
- WM3 - Hazardous Waste: Interpretation of the Definition and Classification of Hazardous Wastes (EA, May 2015);
- European Regulation No 1272/2008 on Classification, Labelling and Packaging of substances 2015 (CLP 2015);
- Guidance on Waste Destined for Disposal in Landfill (EA, June 2006);
- Treatment of Non-hazardous wastes for Landfill (EA, February 2007).

It is important to distinguish between the waste classification system and the designation of materials as “suitable for use” on site. A material may be retained on site for an appropriate end use if that end-use is clearly designated and that a site-specific risk assessment ensures that it does not pose a risk to human health or controlled waters. However, if this material is excavated and sent for disposal, the material is then subject to waste management regulations and the two systems cannot be directly correlated. It is therefore important to note that classifying a material as hazardous (should it be excavated and become a waste) does not necessarily indicate that it might not be suitable to be kept on site for re-use. Separate guidance in the form of a Code of Practice (CL:AIRE Version 2, 2011) has been developed jointly between the development industry and the Environment Agency to provide best practice when assessing whether materials are wastes or not, and for determining when waste can cease to be waste for a particular use.

In accordance with the current waste regulations (or Landfill Directive, as they are more commonly known), from 30<sup>th</sup> October 2007 all waste materials produced from construction sites have to be pre-treated prior to disposal. Pre-treatment includes waste minimisation, recovery (e.g., separation of demolition waste to be used as hardcore) and separation of materials into different waste categories (e.g., separate inert waste from hazardous waste etc). Mixing of different waste types shall be avoided and intentional mixing of inert materials with hazardous waste to ‘dilute it’ and hence change its waste classification, is illegal.

The current waste regulations (based on the EU landfill directive) introduced a two-tier classification system for waste materials, defining them as either being hazardous or non-hazardous. Landfills are licensed to take wastes based on a three-tier classification system with the non- hazardous waste divided into two sub-categories:

- Non-Hazardous - inert;
- Non-Hazardous - non-hazardous;
- Hazardous.

Waste materials are categorised with a six-figure numeric code in the European Waste Catalogue. Commonly found construction and demolition wastes including excavated soil from contaminated sites and Made Ground with their waste codes are summarised below (this is not a comprehensive list):

| Waste Code                                                                                      | What is it?                                                                                                                                                                           | Likely Waste Category– |               |                 |
|-------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|---------------|-----------------|
|                                                                                                 |                                                                                                                                                                                       | Inert Waste            | Non-Hazardous | Hazardous Waste |
| <b>17 01 01</b> Concrete                                                                        | Concrete, possibly with reinforcement (from Construction & Demolition)                                                                                                                | ✓                      |               |                 |
| <b>17 01 02</b> Bricks                                                                          |                                                                                                                                                                                       | ✓                      |               |                 |
| <b>17 01 06*</b> Mixtures of concrete, bricks, tiles & ceramics containing dangerous substances | These are not normally considered hazardous but if they are contaminated (e.g., by asbestos) then could be hazardous – see comment above                                              |                        |               | ✓               |
| <b>17 01 07</b> Mixtures of concrete, bricks, tiles & ceramics other than those in 17 01 06     | This is mixed inerts c.f. 17 09 04                                                                                                                                                    | ✓                      |               |                 |
| <b>17 05 03*</b> soils and stones containing dangerous substances                               |                                                                                                                                                                                       |                        |               | ✓               |
| <b>17 05 04</b> soils and stones other than those mentioned in 17 05 03                         | Soil and stones only (excluding top soil, peat, soil and stones from contaminated sites)                                                                                              | ✓                      |               |                 |
| <b>17 06 05*</b> Construction materials containing asbestos                                     | e.g., corrugated asbestos sheeting                                                                                                                                                    |                        |               | ✓               |
| <b>17 08 02</b> Gypsum-based construction materials other than those mentioned in 17 08 01      | Plaster & plasterboard (although specific disposal requirements are required for high sulphate waste – see EA guidance ‘Understanding the Landfill Directive’ version 1.0 March 2010. |                        | ✓             |                 |
| <b>17 09 01*</b> Construction & demolition wastes containing mercury                            |                                                                                                                                                                                       |                        |               | ✓               |
| <b>17 09 02*</b> Construction & demolition wastes containing PCBs                               | Waste with more than 50 mg/kg of PCB’s are hazardous                                                                                                                                  |                        |               | ✓               |

| Waste Code                                                                                                         | What is it?                                                                                                                                                                           | Likely Waste Category– |               |                 |
|--------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|---------------|-----------------|
|                                                                                                                    |                                                                                                                                                                                       | Inert Waste            | Non-Hazardous | Hazardous Waste |
| <b>17 09 03*</b> Other mixed construction & demolition wastes containing dangerous substances                      | Broad range of potentially (see notes below – if asterix the waste is hazardous) hazardous wastes                                                                                     |                        |               | ✓               |
| <b>17 09 04</b> Mixed construction & demolition wastes other than those mentioned in 17 09 01, 17 09 02 & 17 09 03 | Mixed inerts with soil, tarmac, cables, vegetation, plaster, etc. (this waste can only be considered inert if it passes the waste acceptance criteria identified in the regulations). | ✓                      | ✓             |                 |

**Note:** all wastes with an asterix code are hazardous regardless of whether they are mirror or absolute entries in the EWC list the decision to with regard to composition must come before applying the code for mirror entries.

Some materials are classified as Inert Waste based in its origin (e.g., 17 01 01 Concrete, or glass) without any requirement for laboratory chemical analysis.

However, most soils will require laboratory testing to confirm whether they are classified as Hazardous Waste. The protocol for assessing these materials and the appropriate threshold values is complicated and are set out in the Environment Agency’s “Technical Guidance WM3 Hazardous Waste – Interpretation of the Definition and Classification of Hazardous Waste” (2015). If the test results for the waste indicates that it is not hazardous then further analysis of the waste is required to determine whether it is Inert Waste. If the waste does not meet the criteria for either Hazardous or Inert, then it is by default classified as Non-hazardous Waste.

As an alternative location to landfills for off-site disposal of inert and non-hazardous waste, there are a number of sites which have Waste Permit Exemptions that can accept certain categories of inert and non-hazardous wastes. Additionally, some quarries can accept certain types of wastes to be used for quarry restoration material. For both alternatives to disposal at landfill sites the material still requires chemical testing as these sites have site specific acceptance criteria for wastes. It should also be noted that these types of sites do not incur landfill tax which in the 2018/19 tax year is £2.80 for inactive waste (inert and some types of non-hazardous waste) and £88.95/Tonne for active waste (some types of non-hazardous waste and hazardous waste. Note that the Inland Revenue uses a different classification scheme for waste for tax purposes to the European Waste Classification scheme.

## Waste Categorisation

The process of determining the category of wastes is a three-stage process:

- Stage 1 – is the waste either Hazardous or Inert by definition without the requirement for chemical analysis (if it is then Stages 2 and 3 are not required);
- Stage 2 - Waste characterisation;
- Stage 3 - WAC classification.

Waste characterisation determines if a waste is hazardous or not. Excavated soil is characterised using a system based on the contaminants present and their hazardous properties. The system uses total concentrations of the contaminants. Thresholds (as a percentage of the waste) have been set for the various hazardous properties.

Fourteen hazardous properties together with other scenarios where material could cause a hazard have been defined:

- Hazardous properties: explosive, oxidising, highly flammable/flammable, irritant, harmful, toxic, carcinogenic, corrosive, infectious, toxic for reproduction, mutagenic and ecotoxic;
- Substances which can release toxic/very toxic gases in contact with water, acid or air;
- Substances which, after disposal, can yield another substance, e.g., a leachate, which possesses any of the above hazardous properties.

Some of the hazardous properties are sub-divided e.g., there are three categories of carcinogenic, mutagenic and toxic for reproduction substances. The hazardous properties were originally defined in the European Hazardous Waste Directive 91/689/EC. Should a waste contain a contaminant with one or more of the listed hazardous properties at a concentration equal to or above the threshold value for the particular property, then the waste is hazardous. The hazardous properties of a wide range of chemicals are sourced from CLP 2015.

There are many reasons why waste soil is classified as being hazardous, but the majority of reasons can be divided into the following four groups:

- Hydrocarbons – this is probably the most common reason for the hazardous classification of soils. For most soils hydrocarbon analysis will be required for both Polycyclic Aromatic Hydrocarbons (PAH) and speciated Petroleum Hydrocarbons (PHCs) but depending on the site's history other groups of organic contaminants may also be included in any analysis suite for soil samples;
- Metals – Particularly sites from former metal processing or mining sites and also some types of ash have metal concentrations that are sufficiently high to characterise materials requiring disposal as hazardous waste.
- Asbestos;
- Anions – e.g., sulphate in plasterboard (there are special disposal requirements for high sulphate waste and specific WAC requirements); it is possible that sulphate salts of metals and semi-metals could make the waste hazardous – the sulphate concentration could possibly be significant under H12, H13 and H14.

The characterisation of wastes with significant metal concentrations involves some processing of the analysis data. The chemical analysis results for inorganic substances are generally reported as total concentrations e.g., total lead, total arsenic, total sulphate etc. However, CLP 2015 deals with the hazardous properties of actual compounds e.g., lead sulphate, arsenic pentoxide, nickel carbonate. Therefore, the total metal results have to be converted into assessed chemical analysis results for the compound most likely to be present in the soil samples. For example, if the sample contains high total lead concentrations and high sulphate concentrations, then the lead is likely to be present

in the soil as lead sulphate. The most likely compounds can often be determined from a desk study or previous site uses. If the site has been derelict for a number of years, consideration should be given as to whether water soluble compounds should or should not be chosen, as rainfall could have removed them from the soil (this does not apply if the soil has been taken from below under a concrete slab etc). Chemical knowledge and common sense needs to be used in choosing a suitable compound.

If no data is available, then a worst-case scenario has to be assumed and the most hazardous compound likely to be present has to be chosen. For example, metal chromates (lead chromate, nickel chromate) are often the most hazardous compounds formed by many metals, but if the chromium concentrations in the soil are low, chromates are unlikely to be present. It should also be noted that for many of the hazard categories, the cumulative hazard from different compounds is added (e.g., add the concentrations of the copper, lead and zinc compounds together to assess the Hazard Category H14 Ecotoxicity).

If the results of the above assessment determine that the waste is hazardous, it must then be analysed for the Waste Acceptance Criteria (WAC) analysis contained within appropriate Environmental Permitting Regulations (this comprises mainly leachate but also analysis for TOC and Loss on ignition). WAC limit values have been set for the listed determinands. If any of the determinands exceed their limit value, the waste must be pre-treated to reduce concentrations to below the limit values before the waste may be disposed of at a landfill site licensed to take hazardous waste.

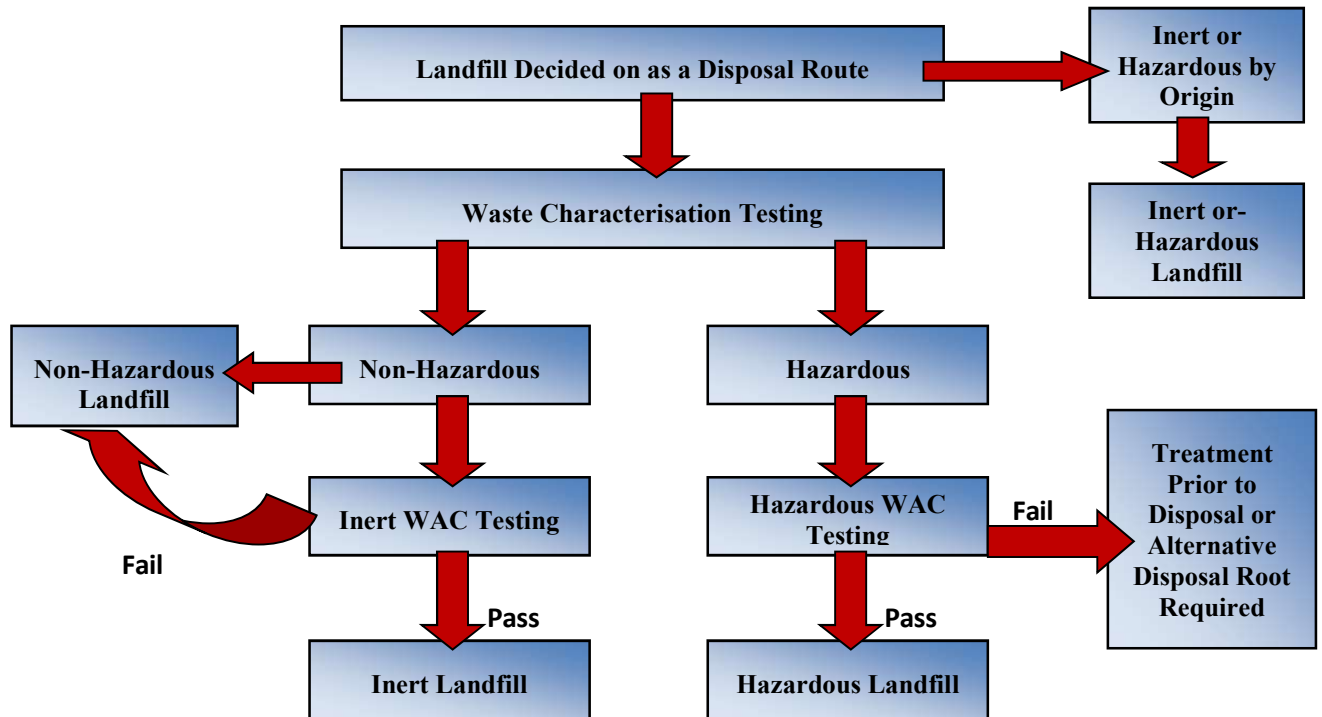
For waste classified as not being hazardous, then there are two options available. Currently, waste correctly characterised as not being hazardous may be disposed of without WAC testing to a non-hazardous landfill. Alternatively, WAC testing for Inert Waste can be carried out (this is similar to the list for hazardous waste with the addition of PAH's, BTEX and Mineral Oil). If the results pass the Inert WAC criteria it can be disposed of at an Inert Waste Landfill. If any of the WAC test results exceed the Inert WAC criteria the waste has to be disposed at a non- hazardous landfill. There are WAC limits for non-hazardous waste set for pH and TOC. If these two criteria are not met then the waste must be pre-treated to so that it meets the criteria before it can be disposed.

If materials fail the WAC criteria it may be possible to pre-treat the waste on-site or be taken to a soil treatment centre for pre-treatment to reduce the soil's hazardous properties (e.g., by bioremediation of hydrocarbons).

It should be noted that in order to dispose of Hazardous Waste, the site must register as a producer of Hazardous Waste with the Environment Agency. When disposing of waste materials to landfill sites the appropriate Duty of Care Waste Transfer procedures must be followed.



## Landfilled Waste Decision Tree



## Landfill Tax

It should be noted that HM Revenue and Customs (HMRC) classify wastes for tax purposes using a different scheme to the threefold landfill EU Landfill Directive scheme (i.e., the hazardous, non-hazardous and inert). HMRC have a two-fold system for landfill tax. The Standard Landfill Tax is currently £88.95/T and applies to all wastes unless they qualify for the reduced rate of landfill tax of £2.80/T. The wastes that qualify for the reduced rate of Landfill Tax are set out in The Landfill Tax (Qualifying Material) Order 2011 with supplementary information on the interpretation of these regulations in HMRS "Notice LFT1 – A General Guide to Landfill Tax" (May 2012) and HMRC Briefing Notes 15/12 and 18/12.

## **APPENDIX K – UNFORESEEN GROUND CONTAMINATION**

## **Unforeseen Ground Contamination**

There is the potential for areas of previously unexpected contamination to be present, as is the case with any “brownfield” site. Any significant quantities of asbestos, significant ashy soils, unusual, brightly coloured or significantly oily or odorous material should be considered in this category. If unexpected contamination is found the following procedures should be adhered to:

1. All site works at the position of the suspected contamination will cease.
2. A suitably trained geo-environmental specialist should assess the visual and olfactory observations of the condition of the ground and the extent of contamination, and the Client and the Local Authority should be informed of the discovery. Should the contamination be likely to affect controlled waters the Environment Agency shall also be informed.
3. The suspected contaminated material will be investigated and tested appropriately in accordance with the assessed risks. The investigation works will be carried out in the presence of a suitably qualified geo-environmental engineer. The investigation works shall commence to recover samples for testing and, using visual and olfactory observations of the condition of the ground, delineate the area over which contaminated materials are present.
4. The unexpected, contaminated material will either be left in situ or be stockpiled whilst testing is carried out and suitable assessments completed to determine whether the material can be re-used on site or requires to be disposed as appropriate.
5. Where the material is left in situ awaiting results it will be reburied or covered with plastic sheeting.
6. Where the potentially contaminated material is to be temporarily stockpiled it will either be placed either on a prepared surface of clayey Alluvium, or on 2000-gauge Visqueen sheeting (or other impermeable surface) and covered to prevent dust and odour emissions.
7. Any areas where unexpected visual or olfactory ground contamination will be surveyed, a photographic record kept, and testing results incorporated into the Verification Report.
8. A photographic record will be made of relevant observations.
9. The testing suite will be determined by the independent geo-environmental specialist on the basis of visual and olfactory observations.
10. Test results will be compared against current assessment criteria suitable for the future use of the area of the site affected.
11. The results of the investigation and testing of any suspect unexpected contamination will be used to determine the relevant actions. After consultation with the Local Authority and if necessary the Environment Agency, materials should either be:
  - re-used in areas where test results indicate that it meets compliance targets so it can be reused without treatment; or
  - treatment of material on site to meet compliance targets so it can be reused; or

- removal from site to a treatment centre or to a suitably licensed landfill or permitted treatment facility.

12. Verification Report will be produced for the work.

## **Asbestos**

Asbestos cement products and asbestos fibres have not been encountered in the soils at the site but based on the age of the Made Ground material containing asbestos could be expected to be encountered. If non-notifiable asbestos (e.g., chrysotile asbestos cement board) is encountered in excavations then it will be dealt with in accordance with the Control of Asbestos Regulations 2012 (CAR 2012) and the HSE's ACoP for asbestos (2013). Finding non-notifiable asbestos is a very common occurrence on brownfield sites and is a relatively low risk activity and can be dealt with as a matter of routine. Therefore, it is not proposed that the Council will be notified but an appropriate record will be kept of confirmatory testing and disposal. This will be included in remediation verification reports.

If suspect notifiable asbestos is encountered then the Council and the HSE will be notified. An appropriate action plan will be agreed with the Council and the HSE in accordance with CAR 2012. The action plan will include the preparation of the Risk Assessment and Plan of Work in accordance with CAR and other statutory requirements including:

- Site mobilisation;
- Excavation methodology;
- Handling, movement and storage on-site of excavation arisings;
- Any processing of excavation arisings containing ACMs;
- Movement and placement of arisings to final destination;
- Placing of cover system over soils with and ACMs remaining on-site;
- Off-site disposal of ACMs;
- Licences;
- PPE & RPE; and,
- Dust and fibre monitoring.

Potential mitigation measures that would be required include:

- Ensuring works are carried out by suitably trained and experienced personnel with working with asbestos;
- Site investigation and risk assessment;
- Removal or treatment of asbestos hotspots;
- Use of PPE and RPE by construction workers; and,

- Compliance monitoring.

### **Unexpected Tanks**

No buried underground fuel storage tanks have been encountered during the site investigation works; however, there remains a low risk that tanks are present on-site. Should an underground tank be encountered, operations should cease in the area. Additionally, there may be pipework associated with these tanks which could have oily residues. The following procedures are to be adhered to if tanks and pipework are identified:

1. All site works at the position of the tanks/pipework should stop.
2. A description of the tank should be made by the geo-environmental engineer including; condition and surround, along with visual and olfactory observations should any contents in the tank be apparent. A photographic record will also be made of relevant observations.
3. The tank's position and depth should be determined and marked on a plan of the site.
4. The independent geo-environmental engineer will inform Client and the Local Authority.
5. During the presence of the independent geo-environmental engineer, investigation works should be undertaken to obtain samples of any liquid or sludge contents and to establish dimensions of the tank.
6. Testing will be determined on the basis of visual and olfactory observations by independent geo-environmental engineer.
7. Test results will be compared against current assessment criteria and proposals for disposal of any contents determined in agreement with the appropriate Regulatory Parties.
8. Emptying the tank and disposal of contents to a suitable licenced disposal facility.
9. Degassing and removal of the tank by a suitably qualified contractor will be required, and a Naked Flame Certificate should be provided.
10. Once the tank has been emptied in accordance with the above proposals, it is to be removed for disposal to a licensed waste management facility. Copies of the relevant waste consignment notes are to be kept and included in the Verification Report.
11. Excavation and remediation of any contaminated soils around the tank will be carried out.
12. Samples of the base and sides of the resultant hole will be sampled and supervised by the independent geo-environmental engineer to confirm whether risks to human health or controlled waters.