

# **ENVIRONMENTAL IMPACT ASSESSMENT REPORT**

## **VOLUME III APPENDICES**

### Appendix 11-2 Groundwater Analysis Results





Project Ref: 10117216

Project Title: Cleeves Riverside Quarter EIAR

Project site: Cleeves, Limerick

Client: Limerick City and County Council, in partnership with Limerick Twenty Thirty DAC

Appendix 11-2 Groundwater Quality Monitoring results

|                                     |         | Sample Type                                                                       |                                     | Groundwater | Groundwater | Groundwater | Groundwater | Groundwater | Groundwater | Groundwater | Groundwater | Groundwater | Groundwater | Groundwater | Groundwater | Groundwater |            |
|-------------------------------------|---------|-----------------------------------------------------------------------------------|-------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|------------|
|                                     |         | Sampled Date                                                                      |                                     | 20/05/2025  | 20/05/2025  | 20/05/2025  | 20/05/2025  | 20/05/2025  | 20/05/2025  | 20/05/2025  | 20/05/2025  | 20/05/2025  | 08/07/2025  | 08/07/2025  | 08/07/2025  | 08/07/2025  | 08/07/2025 |
|                                     |         | Sample ID                                                                         |                                     | 1977763     | 1977764     | 1977765     | 1977766     | 1977767     | 1977772     | 1977773     | 1977774     | 1999294     | 1999298     | 1999299     | 1999300     | 1999301     |            |
|                                     |         | Sample Location                                                                   |                                     | BH311       | BH312       | BH314       | BH302       | BH310       | BH306       | BH309       | BH308       | BH302       | BH311       | BH312       | BH313       | BH314       |            |
|                                     |         | Sample condition                                                                  |                                     |             |             |             |             |             |             |             |             |             |             |             |             |             |            |
| Parameter                           | Units   | Groundwater Regulation Value (Sl. No. 9 of 2010 as amended - Sl. No. 366 of 2016) | Interim Guidelines Value (EPA 2003) |             |             |             |             |             |             |             |             |             |             |             |             |             |            |
|                                     |         |                                                                                   |                                     |             |             |             |             |             |             |             |             |             |             |             |             |             |            |
| pH at 20C                           |         | ≥ 6.5 and ≤ 9.5                                                                   | 7.7                                 | 8.0         | 7.8         | 8.0         | 8.1         | 8.1         | 9.9         | 8.4         | 8.3         | 8.2         | 8.1         | 8.2         | 8.0         |             |            |
| Electrical Conductivity at 25C      | µS/cm   | 1000                                                                              | 570                                 | 530         | 750         | 590         | 680         | 630         | 640         | 760         | 500         | 500         | 500         | 590         | 730         |             |            |
| Suspended Solids At 105C            | mg/l    |                                                                                   | 480                                 | 110000      | 570         | 780         | 30000       | 5400        | 12000       | I/S         | 820         | 87          | 9000        | 13000       | 2200        |             |            |
| Total Dissolved Solids              | mg/l    | 1000                                                                              | 370                                 | 340         | 480         | 380         | 440         | 410         | 420         | 490         | 330         | 320         | 330         | 380         | 470         |             |            |
| Biochemical Oxygen Demand Low Level | mg O2/l |                                                                                   | 1.0                                 | < 1.0       | 1.0         | 1.0         | < 1.0       | < 1.0       | < 1.0       | < 1.0       | 4.0         | 4.0         | 4.0         | 5.0         | 2.0         |             |            |
| Chemical Oxygen Demand Low Level    | mg O2/l |                                                                                   | 15                                  | 13          | 2.3         | 8.3         | 22          | 20          | 64          | 19          | 16          | 17          | 17          | 20          | 11          |             |            |
| Dissolved Oxygen                    | mg O2/l |                                                                                   | 8.5                                 | 8.4         | 8.5         | 7.9         | 9.5         | 8.9         | 8.8         | 8.9         | 9.1         | 8.9         | 8.9         | 8.8         | 8.7         |             |            |
| Redox Potential                     | mV      |                                                                                   | 200                                 | 200         | 210         | 190         | 210         | 200         | 190         | 200         | 190         | 200         | 200         | 200         | 210         |             |            |
| Alkalinity (Total)                  | mg/l    |                                                                                   | 550                                 | 210         | 630         | 200         | 580         | 640         | 110         | I/S         | 180         | 250         | 210         | 180         | 190         |             |            |
| Chloride                            | mg/l    | 240 - 187.5                                                                       | 30                                  | 22          | 38          | 31          | 31          | 33          | 23          | 39          | I/S         | 19          | 18          | 23          | 32          |             |            |
| Ammoniacal Nitrogen                 | mg/l    |                                                                                   | 0.15                                | 0.20        | 0.20        | 0.21        | 0.23        | 0.29        | 1.0         | 1.6         | I/S         | 0.35        | 0.30        | 0.37        | 0.40        |             |            |
| Nitrate as NO3                      | mg/l    | 37.5                                                                              | 25                                  | 3.2         | < 0.50      | 22          | 11          | 15          | 11          | < 0.50      | I/S         | 6.8         | 4.9         | 2.5         | < 0.50      |             |            |
| Phosphate                           | mg/l    | 106.4                                                                             | 0.03                                | < 0.20      | < 0.20      | < 0.20      | < 0.20      | 0.46        | < 0.20      | < 0.20      | I/S         | < 0.20      | < 0.20      | < 0.20      | < 0.20      |             |            |
| Sulphate                            | mg/l    | 187.5                                                                             | 200                                 | 29          | 46          | 61          | 78          | 88          | 55          | 210         | I/S         | 81          | 31          | 24          | 61          |             |            |
| Calcium (Dissolved)                 | mg/l    |                                                                                   | 200                                 | 91          | 61          | 120         | 83          | 94          | 99          | 71          | I/S         | 72          | 76          | 77          | 60          |             |            |
| Potassium (Dissolved)               | mg/l    |                                                                                   | 5                                   | 4.0         | 11          | 2.6         | 3.8         | 2.9         | 0.98        | 26          | I/S         | 4.4         | 3.8         | 4.1         | 2.6         |             |            |
| Magnesium (Dissolved)               | mg/l    |                                                                                   | 50                                  | 7.2         | 16          | 19          | 9.3         | 6.5         | 7.5         | 0.39        | I/S         | 8.2         | 6.4         | 7.4         | 13          |             |            |
| Sodium (Dissolved)                  | mg/l    |                                                                                   | 150                                 | 11          | 15          | 19          | 16          | 43          | 37          | 48          | I/S         | 15          | 12          | 14          | 44          |             |            |
| Arsenic (Dissolved)                 | µg/l    | 7.5                                                                               | 10                                  | 1.2         | 0.90        | < 0.20      | 0.33        | 1.5         | 0.41        | 5.8         | I/S         | 0.53        | 0.71        | 0.84        | 4.8         |             |            |
| Barium (Dissolved)                  | µg/l    |                                                                                   | 100                                 | 64          | 36          | 40          | 76          | 35          | 24          | 48          | I/S         | 56          | 44          | 26          | 55          |             |            |
| Cadmium (Dissolved)                 | µg/l    | 3.75                                                                              | 5                                   | 0.30        | < 0.11      | < 0.11      | < 0.11      | < 0.11      | < 0.11      | < 0.11      | I/S         | < 0.11      | < 0.11      | < 0.11      | < 0.11      |             |            |
| Copper (Dissolved)                  | µg/l    | 1500                                                                              | 30                                  | 10          | 0.94        | < 0.50      | 4.2         | 5.4         | 3.3         | 32          | I/S         | 4.4         | 7.4         | 1.9         | 1.5         |             |            |
| Iron (Dissolved)                    | µg/l    |                                                                                   | 200                                 | < 5.0       | 20          | < 5.0       | < 5.0       | < 5.0       | < 5.0       | 23          | I/S         | < 5.0       | < 5.0       | < 5.0       | < 5.0       |             |            |
| Manganese (Dissolved)               | µg/l    |                                                                                   | 50                                  | 29          | 99          | < 0.50      | < 0.50      | 24          | 37          | 0.52        | I/S         | < 0.50      | 24          | 120         | 550         |             |            |
| Molybdenum (Dissolved)              | µg/l    |                                                                                   |                                     | 2.0         | 69          | 0.59        | 8.0         | 8.3         | 1.3         | 87          | I/S         | 5.6         | 1.5         | 9.3         | 10          |             |            |
| Nickel (Dissolved)                  | µg/l    | 15                                                                                | 20                                  | 6.2         | 4.1         | 0.51        | 0.63        | 1.7         | 0.74        | 11          | I/S         | 1.1         | 2.6         | 2.5         | 3.0         |             |            |
| Lead (Dissolved)                    | µg/l    | 7.5                                                                               | 10                                  | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | 0.84        | I/S         | < 0.50      | < 0.50      | < 0.50      | < 0.50      |             |            |
| Antimony (Dissolved)                | µg/l    |                                                                                   |                                     | 1.2         | 0.75        | < 0.50      | < 0.50      | 0.94        | < 0.50      | 2.9         | I/S         | 0.78        | 0.75        | < 0.50      | 0.77        |             |            |
| Selenium (Dissolved)                | µg/l    |                                                                                   |                                     | < 0.50      | < 0.50      | 1.8         | 1.0         | 2.8         | 6.8         | 1.2         | I/S         | 2.5         | 1.1         | 1.1         | 1.6         |             |            |
| Zinc (Dissolved)                    | µg/l    | 75                                                                                | 100                                 | 19          | 3.4         | 6.4         | 8.0         | 7.3         | 9.7         | < 2.5       | I/S         | 22          | 23          | 4.0         | 4.2         |             |            |
| Mercury Low Level                   | µg/l    | 0.75                                                                              | 1                                   | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | I/S         | I/S         | < 0.010     | < 0.010     | < 0.010     | < 0.010     |             |            |
| Chromium (Trivalent)                | µg/l    |                                                                                   |                                     | < 20        | < 20        | < 20        | < 20        | < 20        | < 20        | < 20        | I/S         | < 20        | < 20        | < 20        | < 20        |             |            |
| Low-Level Chromium (Hexavalent)     | µg/l    | 7.5                                                                               |                                     | 0.33        | < 0.10      | 0.75        | 0.44        | 0.25        | 0.14        | 1.4         | I/S         | < 0.10      | < 0.10      | < 0.10      | < 0.10      |             |            |
| Aliphatic TPH >C5-C6                | µg/l    |                                                                                   |                                     | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      |             |            |
| Aliphatic TPH >C6-C8                | µg/l    |                                                                                   |                                     | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      |             |            |
| Aliphatic TPH >C8-C10               | µg/l    |                                                                                   |                                     | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      |             |            |
| Aliphatic TPH >C10-C12              | µg/l    |                                                                                   |                                     | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      |             |            |
| Aliphatic TPH >C12-C16              | µg/l    |                                                                                   |                                     | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      |             |            |
| Aliphatic TPH >C16-C21              | µg/l    |                                                                                   |                                     | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      |             |            |
| Aliphatic TPH >C21-C35              | µg/l    |                                                                                   |                                     | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      |             |            |
| Aliphatic TPH >C35-C44              | µg/l    |                                                                                   |                                     | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      |             |            |
| Total Aliphatic Hydrocarbons        | µg/l    |                                                                                   |                                     | < 5.0       | < 5.0       | < 5.0       | < 5.0       | < 5.0       | < 5.0       | < 5.0       | < 5.0       | < 5.0       | < 5.0       | < 5.0       | < 5.0       |             |            |
| Aromatic TPH >C5-C7                 | µg/l    |                                                                                   |                                     | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      |             |            |
| Aromatic TPH >C7-C8                 | µg/l    |                                                                                   |                                     | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      |             |            |
| Aromatic TPH >C8-C10                | µg/l    |                                                                                   |                                     | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      |             |            |
| Aromatic TPH >C10-C12               | µg/l    |                                                                                   |                                     | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      |             |            |
| Aromatic TPH >C12-C16               | µg/l    |                                                                                   |                                     | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      |             |            |
| Aromatic TPH >C16-C21               | µg/l    |                                                                                   |                                     | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      |             |            |
| Aromatic TPH >C21-C35               | µg/l    |                                                                                   |                                     | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      |             |            |
| Aromatic TPH >C35-C44               | µg/l    |                                                                                   |                                     | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      | < 0.10      |             |            |
| Total Aromatic Hydrocarbons         | µg/l    |                                                                                   |                                     | < 5.0       | < 5.0       | < 5.0       | < 5.0       | < 5.0       | < 5.0       | < 5.0       | < 5.0       | < 5.0       | < 5.0       | < 5.0       | < 5.0       |             |            |
| Total Petroleum Hydrocarbons        | µg/l    |                                                                                   |                                     | < 10        | < 10        | < 10        | < 10        | < 10        | < 10        | < 10        | < 10        | < 10        | < 10        | < 10        | < 10        |             |            |
| Dichlorodifluoromethane             | µg/l    |                                                                                   |                                     | < 1.0       | < 1.0       | < 1.0       | < 1.0       | I/S         | I/S         | I/S         | I/S         | < 1.0       | < 1.0       | < 1.0       | < 1.0       |             |            |
| Chloromethane                       | µg/l    |                                                                                   |                                     | < 1.0       | < 1.0       | < 1.0       | < 1.0       | I/S         | I/S         | I/S         | I/S         | < 1.0       | < 1.0       | < 1.0       | < 1.0       |             |            |
| Vinyl Chloride                      | µg/l    | 0.375                                                                             |                                     | < 1.0       | < 1.0       | < 1.0       | < 1.0       | I/S         | I/S         | I/S         | I/S         | < 1.0       | < 1.0       | < 1.0       | < 1.0       |             |            |
| Bromomethane                        | µg/l    |                                                                                   |                                     | < 5         | < 5         | < 5         | < 5         | I/S         | I/S         | I/S         | I/S         | < 5         | < 5         | < 5         | < 5         |             |            |
| Chloroethane                        | µg/l    |                                                                                   |                                     | < 2.0       | < 2.0       | < 2.0       | < 2.0       | I/S         | I/S         | I/S         | I/S         | < 2.0       | < 2.0       | < 2.0       | < 2.0       |             |            |
| Trichlorofluoromethane              | µg/l    |                                                                                   |                                     | < 1.0       | < 1.0       | < 1.0       | < 1.0       | I/S         | I/S         | I/S         | I/S         | < 1.0       | < 1.0       | < 1.0       | < 1.0       |             |            |
| 1,1-Dichloroethene                  | µg/l    |                                                                                   |                                     | < 1.0       | < 1.0       | < 1.0       | < 1.0       | I/S         | I/S         | I/S         | I/S         | < 1.0       | < 1.0       | < 1.0       | < 1.0       |             |            |
| Trans 1,2-Dichloroethene            | µg/l    |                                                                                   |                                     | < 1.0       | < 1.0       | < 1.0       | < 1.0       | I/S         | I/S         | I/S         | I/S         | < 1.0       | < 1.0       | < 1.0       | < 1.0       |             |            |
| 1,1-Dichloroethane                  | µg/l    | 2.25                                                                              |                                     | < 1.0       | < 1.0       | < 1.0       | < 1.0       | I/S         | I/S         | I/S         | I/S         | < 1.0       | < 1.0       | &lt         |             |             |            |

AtkinsRéalis - Baseline / Référence

|           |                          | Sample Type                                                                       |                                     | Groundwater | Groundwater | Groundwater | Groundwater | Groundwater | Groundwater | Groundwater | Groundwater | Groundwater | Groundwater | Groundwater | Groundwater | Groundwater |
|-----------|--------------------------|-----------------------------------------------------------------------------------|-------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
|           |                          | Sampled Date                                                                      |                                     | 20/05/2025  | 20/05/2025  | 20/05/2025  | 20/05/2025  | 20/05/2025  | 20/05/2025  | 20/05/2025  | 20/05/2025  | 20/05/2025  | 08/07/2025  | 08/07/2025  | 08/07/2025  | 08/07/2025  |
|           |                          | Sample ID                                                                         |                                     | 1977763     | 1977764     | 1977765     | 1977766     | 1977767     | 1977772     | 1977773     | 1977774     | 1999294     | 1999298     | 1999299     | 1999300     | 1999301     |
|           |                          | Sample Location                                                                   |                                     | BH311       | BH312       | BH314       | BH302       | BH310       | BH306       | BH309       | BH308       | BH302       | BH311       | BH312       | BH313       | BH314       |
|           |                          | Sample condition                                                                  |                                     |             |             |             |             |             |             |             |             |             |             |             |             |             |
| Parameter | Units                    | Groundwater Regulation Value (Sl. No. 9 of 2010 as amended - Sl. No. 366 of 2016) | Interim Guidelines Value (EPA 2003) |             |             |             |             |             |             |             |             |             |             |             |             |             |
|           | µg/l                     |                                                                                   | 0.05 <sup>A</sup>                   | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      |
|           | µg/l                     | 0.0075 <sup>A</sup>                                                               | 0.01 <sup>A</sup>                   | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      |
|           | µg/l                     |                                                                                   | 0.05 <sup>A</sup>                   | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      |
|           | µg/l                     |                                                                                   |                                     | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      |
|           | µg/l                     |                                                                                   | 0.05 <sup>A</sup>                   | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      |
|           | µg/l                     |                                                                                   |                                     | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      | < 0.50      |
|           | µg/l                     |                                                                                   |                                     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     |
|           | µg/l                     |                                                                                   |                                     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     |
|           | µg/l                     |                                                                                   |                                     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     |
|           | µg/l                     |                                                                                   |                                     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     |
|           | µg/l                     |                                                                                   |                                     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     |
|           | µg/l                     |                                                                                   |                                     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     |
|           | µg/l                     |                                                                                   |                                     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     |
|           | µg/l                     |                                                                                   |                                     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     |
|           | Total PCBs (7 congeners) |                                                                                   |                                     | 0.01        | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     | < 0.010     |

Shaded values denote exceedance of relevant regulation value

<sup>A</sup> LOD exceeds GAC