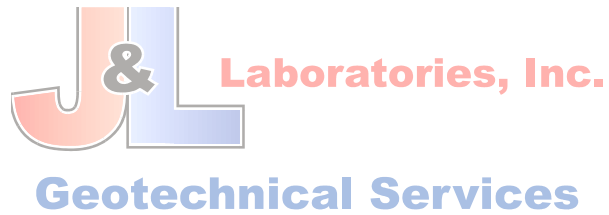


**APPENDIX B**  
**GEOTECHNICAL LABORATORY REPORT**

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**LABORATORY TESTING DATA**

FOR

**RAVENNA APP**

**RAVENNA,  
PORTAGE COUNTY, OHIO  
J&L PROJECT NO. JL03433**

PREPARED FOR

**SPEC-PRO, INC.**

**Ms. Chantelle Carrol**

PREPARED BY

**J&L LABORATORIES, INC.**  
215 Rainbow Street, Wadsworth Ohio 44281  
Ph: (330) 335-0606 Fax: (330) 335-0908

**January 7, 2004**

CLIENTS NAME: **Spec Pro**  
 PROJECT MANAGER: **Chantelle Garro**  
 PROJECT NAME: **Fuze Booster Quarry**  
 LAB CONTACT: **Paris Twp., Portage Co., Ohio**

CLIENTS ADDRESS: **8451 S.R. 5, Ravenna, OH 44266**  
 PHONE NUMBER: **(330) 358-1753**  
 PROJECT LOCATION (Twp., City, County, State): **Paris Twp., Portage Co., Ohio**

LABORATORY ADDRESS: **Paris Twp., Portage Co., Ohio**  
 PHONE NUMBER: **(330) 358-1753**

PROPOSAL NUMBER: **(330) 358-1754**  
 PROJECT NUMBER: **(330) 358-1754**  
 FAX NUMBER: **(330) 358-1754**

| SAMPLE DESCRIPTION | COLLECTION DATE | COLLECTION TIME | MATRIX SOIL/WATER | CONTAINERS |             |              | PRESERVATIVE | LAB SAMPLE # | ANALYSIS REQUIRED |            |                |      |                  |            |          | COMMENTS |            |    |
|--------------------|-----------------|-----------------|-------------------|------------|-------------|--------------|--------------|--------------|-------------------|------------|----------------|------|------------------|------------|----------|----------|------------|----|
|                    |                 |                 |                   | NO.        | TYPE (VOL.) | LAB SAMPLE # |              |              | Moist. Content    | Grain Size | Atterberg Lim. | USCS | Specific Gravity | Bulk Dens. | Porosity |          | Hyd. Cond. | PH |
| FBQHR-178-0354-SO  | 9-24-03         | 11:55           | Soil              | 2          | 80%         |              |              |              | X                 | X          | X              | X    | X                | X          | X        | X        | X          |    |
| FBQHR-178-0355-SO  | 9-24-03         | 12:35           | Soil              | 2          |             |              |              |              | X                 | X          | X              | X    | X                | X          | X        | X        | X          |    |
| FBQHR-179-0356-SO  | 9-24-03         | 15:38           | Soil              | 2          |             |              |              |              | X                 | X          | X              | X    | X                | X          | X        | X        | X          |    |
| FBQHR-179-0357-SO  | 9-24-03         | 16:30           | Soil              | 2          |             |              |              |              | X                 | X          | X              | X    | X                | X          | X        | X        | X          |    |
| FBQHR-180-0358-SO  | 9-30-03         | 12:05           | Soil              | 2          |             |              |              |              | X                 | X          | X              | X    | X                | X          | X        | X        | X          |    |
| FBQHR-180-0359-SO  | 9-30-03         | 12:55           | Soil              | 2          |             |              |              |              | X                 | X          | X              | X    | X                | X          | X        | X        | X          |    |
| FBQHR-181-0360-SO  | 9-30-03         | 09:30           | Soil              | 2          |             |              |              |              | X                 | X          | X              | X    | X                | X          | X        | X        | X          |    |
| FBQHR-181-0361-SO  | 9-30-03         | 10:10           | Soil              | 2          |             |              |              |              | X                 | X          | X              | X    | X                | X          | X        | X        | X          |    |
| FBQHR-182-0362-SO  | 9-30-03         | 14:20           | Soil              | 2          |             |              |              |              | X                 | X          | X              | X    | X                | X          | X        | X        | X          |    |
| FBQHR-182-0363-SO  | 9-30-03         | 15:05           | Soil              | 2          |             |              |              |              | X                 | X          | X              | X    | X                | X          | X        | X        | X          |    |

TAT:  24 Hours  48 Hours  72 Hours  Standard 7 or 14 Days

REPORTING:  Verbal  Fax  Hardcopy

Submit data via  Verbal  Fax  Hardcopy

SAMPLED BY (Please Print Name): **Mark F. Deering**  
 RELINQUISHED BY / AFFILIATION (Print Name / Signature): **Mark F. Deering**  
 DATE: **10-1-03** TIME: **1515**

ACCEPTED BY / AFFILIATION (Print Name / Signature): **James Lee / Arc**  
 DATE: **10/1/03** TIME: **17:30**

ADDITIONAL COMMENTS: **PST = partial Shelby tube**

| Sample ID         | Moisture Content (%) | 3/8" | Percent Passing (by weight) |      |      |        |      |        |      | Particle Size Distribution |      |    |    |    | Atterberg Limits |     | USCS Classification | Specific Gravity |       | Bulk Density (pcf) |       | Porosity | Hyd. Cond. (cm/s)           |     | pH |
|-------------------|----------------------|------|-----------------------------|------|------|--------|------|--------|------|----------------------------|------|----|----|----|------------------|-----|---------------------|------------------|-------|--------------------|-------|----------|-----------------------------|-----|----|
|                   |                      |      | #4                          | #10  | #40  | #100   | #200 | Gravel | Cor. | Sand                       |      | LL | PL | PI | Wet              | Dry |                     | Wet              | Dry   | Wet                | Dry   |          |                             |     |    |
|                   |                      |      | #40                         | #100 | #200 | Gravel | Cor. | Med.   | Fine | Silt                       | Clay |    |    |    |                  |     |                     |                  |       |                    |       |          | Fines                       |     |    |
| FBQtr-178-0354-50 | 17.7                 | 100  | 99                          | 97   | 93   | 85     | 81   | 1      | 2    | 4                          | 12   | 34 | 47 | 81 | 40               | 21  | 19                  | 2.742            | 2.742 | 131.3              | 111.6 | 0.348    | 2.39 · 10 <sup>-8</sup>     | 6.7 |    |
| FBQtr-178-0355-50 | 12.8                 | 99   | 96                          | 91   | 80   | 70     | 67   | 4      | 5    | 11                         | 13   | 27 | 40 | 67 | 30               | 17  | 13                  | 2.743            | 2.743 | 135.0              | 119.7 | 0.301    | 3.51 · 10 <sup>-8</sup>     | 7.9 |    |
| FBQtr-179-0356-50 | 16.6                 | 98   | 96                          | 94   | 89   | 81     | 78   | 4      | 2    | 5                          | 11   | 28 | 50 | 78 | 41               | 20  | 21                  | 2.740            | 2.740 | 134.4              | 115.3 | 0.326    | 1.34 · 10 <sup>-8</sup>     | 7.0 |    |
| FBQtr-179-0357-50 | 17.5                 | 100  | 100                         | 99   | 96   | 92     | 90   | 0      | 1    | 3                          | 6    | 30 | 60 | 90 | 36               | 20  | 16                  | 2.762            | 2.762 | 132.2              | 112.5 | 0.348    | 5.87 · 10 <sup>-8</sup>     | 7.5 |    |
| FBQtr-180-0358-50 | 20.8                 | 100  | 99                          | 99   | 96   | 91     | 88   | 1      | 0    | 3                          | 8    | 27 | 61 | 88 | 47               | 22  | 25                  | 2.750            | 2.750 | 129.5              | 107.2 | 0.376    | 1.11 · 10 <sup>-8</sup>     | 6.3 |    |
| FBQtr-180-0359-50 | 12.0                 | 97   | 96                          | 95   | 92   | 88     | 85   | 4      | 1    | 3                          | 7    | 26 | 59 | 85 | 39               | 21  | 18                  | 2.724            | 2.724 | 116.0              | 103.6 | 0.391    | 6.11 · 10 <sup>-7</sup> (1) | 8.0 |    |
| FBQtr-181-0360-50 | 21.6                 | 100  | 98                          | 96   | 91   | 81     | 78   | 2      | 2    | 5                          | 13   | 39 | 39 | 78 | 29               | 20  | 9                   | 2.685            | 2.685 | 127.9              | 105.2 | 0.372    | 2.05 · 10 <sup>-7</sup>     | 6.1 |    |
| FBQtr-181-0361-50 | 12.3                 | 87   | 79                          | 72   | 59   | 31     | 24   | 21     | 7    | 13                         | 35   | 16 | 8  | 24 | NP               | NP  | NP                  | 2.688            | 2.688 | 134.7              | 119.9 | 0.285    | 1.03 · 10 <sup>-6</sup> (1) | 7.1 |    |
| FBQtr-182-0362-50 | 21.4                 | 90   | 89                          | 88   | 85   | 81     | 78   | 11     | 1    | 3                          | 7    | 27 | 51 | 78 | 49               | 23  | 26                  | 2.726            | 2.726 | 127.4              | 104.9 | 0.383    | 2.96 · 10 <sup>-8</sup>     | 4.7 |    |
| FBQtr-182-0363-50 | 13.5                 | 96   | 92                          | 87   | 76   | 42     | 38   | 8      | 5    | 11                         | 38   | 19 | 19 | 38 | NP               | NP  | NP                  | 2.671            | 2.671 | 123.8              | 109.1 | 0.346    | 9.14 · 10 <sup>-7</sup> (1) | 5.0 |    |

Notes: (1) - Sample recompactd for permeability test

JL03433

1/7/2004

**Sample Data** ASTMD 2216

| Sample Number     | Sample (m) | Depth (ft) | Tare Number | Tare Weight | Wet Weight | Dry Weight | Sample Weight | pH   | Moisture Content |
|-------------------|------------|------------|-------------|-------------|------------|------------|---------------|------|------------------|
| FBQtr-178-0354-50 | --         | --         | 247         | 9.53        | 336.38     | 287.32     | 277.79        | 6.73 | 17.7%            |

**Bulk Density** ASTMD 2937

| Total Weight | Tube Weight | Sample Weight | Diameter (in) | Length (in) | Volume (cm <sup>3</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|-------------|---------------|---------------|-------------|---------------------------|-------------------|-------------------|
| 1138.6       | 0.00        | 1138.6        | 2.856         | 5.158       | 541.563                   | 131.3             | 111.6             |

**Specific Gravity (-10 Material)** ASTM D 854

| Sample Weight (Mo) | Full Pycno (Mb) | Temp (°C) | Density Water d(T <sub>b</sub> ) | Correction K | Pycno/Water (M <sub>a</sub> at T <sub>b</sub> ) | Specific Gravity (T <sub>b</sub> ) | Specific Gravity (T <sub>20</sub> ) | Porosity (n) | V <sub>s</sub> | V <sub>w</sub> | V <sub>a</sub> |
|--------------------|-----------------|-----------|----------------------------------|--------------|---|------------------------------------|-------------------------------------|--------------|----------------|----------------|----------------|
| 39.17              | 188.74          | 22.8      | 0.99762                          | 0.9994       | 163.85  | 2.744                              | 2.742                               | 0.348        | 65.2%          | 31.6%          | 3.3%           |

**Particle Size Distribution** ASTM D 422

| Sieve | Percent Passing (by weight) |      |      | Sand       |          |          |          |          |          |           |
|-------|-----------------------------|------|------|------------|----------|----------|----------|----------|----------|-----------|
|       | #4                          | #10  | #200 | Gravel (%) | Cor. (%) | Med. (%) | Fine (%) | Silt (%) | Clay (%) | Fines (%) |
| 3/8"  | 98.8                        | 97.5 | 85.4 | 1.2        | 1.3      | 4.4      | 11.8     | 34.5     | 46.8     | 81.3      |

**Limits** ASTM D 4318 Classification

| Atterberg Limits |      | USCS Classification |                            |      |     |
|------------------|------|---------------------|----------------------------|------|-----|
| LL               | PL   | PI                  | Cu                         | Cc   | D60 |
| 39.9             | 20.9 | 19.0                | 10                         | 0.90 | D60 |
|                  |      |                     | <b>LEAN CLAY WITH SAND</b> |      |     |

# Permeability Test Report

Project: Ravenna Arsenal (FBQtr-178-0354-50)

Client: SpecPro, Inc.

**Sample Data:**

| Sample Number     | Sample Type | Depth (ft) |
|-------------------|-------------|------------|
| FBQtr-178-0354-50 | ST          | --         |

$K_{20^{\circ}\text{C}} = 2.39\text{E-}08 \text{ cm/sec}$

**Test Conditions:**

| Permeant Liquid           | Back Pressure | Hydraulic Gradient | Consolidation Stress |           | Total Test Time (min) | Total Flow (cc) |
|---------------------------|---------------|--------------------|----------------------|-----------|-----------------------|-----------------|
|                           |               |                    | Max (psi)            | Min (psi) |                       |                 |
| De-aired/De-ionized water | 45 psi        | 5 psi              | 6                    | 2         | 4386                  | 6.9             |

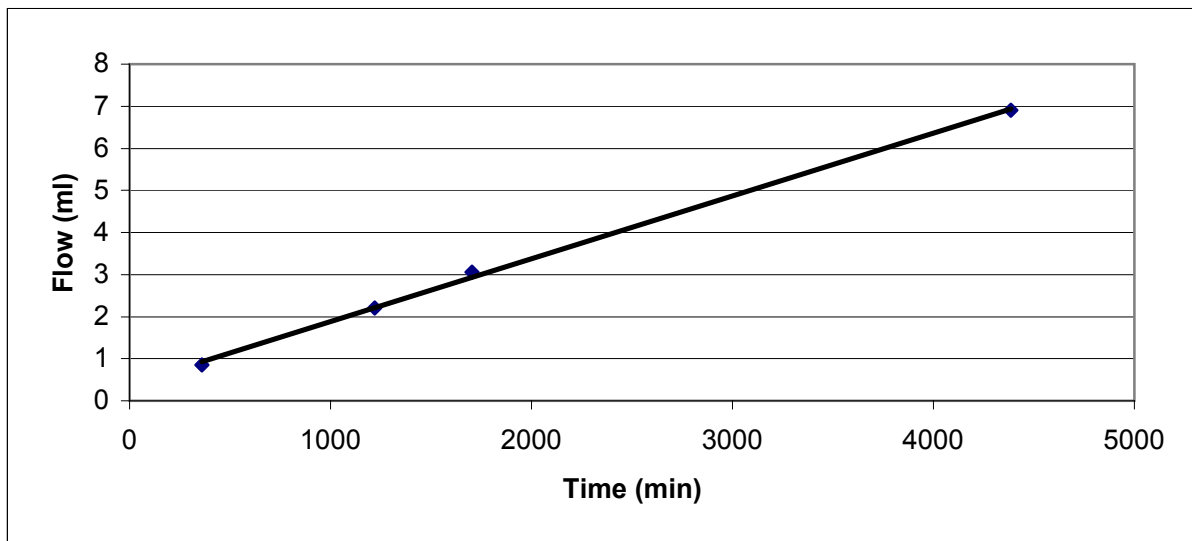
**Initial Sample Data:**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 23.0         | 90.6           | 7.255         | 13.100      | 41.34                   | 131.3             | 111.6             |

**Final Sample Data**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 18.4         | 100.0          | 7.222         | 13.137      | 40.96                   | 134.1             | 113.2             |

| Reading | Time (h:m) | Chamber | Upper | Lower | Flow | K <sub>20</sub> (cm/s) |
|---------|------------|---------|-------|-------|------|------------------------|
| 1       | 0:00       | 8.6     | 24.3  | 1.6   | 0.0  | --                     |
| 2       | 6:00       | 8.8     | 23.5  | 2.5   | 0.9  | 3.59E-08               |
| 3       | 20:19      | 8.7     | 22.1  | 3.8   | 2.2  | 2.74E-08               |
| 4       | 28:25      | 9.0     | 21.2  | 4.6   | 3.1  | 2.72E-08               |
| 5       | 73:06      | 9.5     | 17.4  | 8.5   | 6.9  | 2.39E-08               |



J&L Laboratories, Inc.

1/7/2004

**Laboratory Test Summary**  
**JL03433**  
**1/7/2004**

**Sample Data**

ASTM D 2216

| Sample Number     | Depth (m) | Depth (ft) | Tare Number | Tare Weight | Wet Weight | Dry Weight | Sample Weight | Moisture Content |
|-------------------|-----------|------------|-------------|-------------|------------|------------|---------------|------------------|
| FBQtr-178-0355-50 | --        | --         | 248         | 9.59        | 239.58     | 213.40     | 203.81        | 12.8%            |
|                   |           |            |             |             |            |            |               | 7.86             |

**Bulk Density**

ASTM D 2937

| Total Weight | Tube Weight | Sample Weight | Diameter (in) | Length (in) | Volume (cm <sup>3</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|-------------|---------------|---------------|-------------|---------------------------|-------------------|-------------------|
| 612.4        | 0.00        | 612.4         | 2.880         | 2.652       | 283.107                   | 135.0             | 119.7             |

**Specific Gravity (-10 Material)**

ASTM D 854

| Sample Weight (Mo) | Full Pycno (Mb) | Temp (°C) | Density Water d(T <sub>b</sub> ) | Correction K | Pynco/Water (M <sub>a</sub> at T <sub>b</sub> ) | Specific Gravity (T <sub>b</sub> ) | Specific Gravity (T <sub>20</sub> ) | Porosity (n) | V <sub>s</sub> | V <sub>w</sub> | V <sub>a</sub> |
|--------------------|-----------------|-----------|----------------------------------|--------------|---|------------------------------------|-------------------------------------|--------------|----------------|----------------|----------------|
| 40.74              | 188.89          | 22.9      | 0.99759                          | 0.9994       | 162.99  | 2.744                              | 2.743                               | 0.301        | 69.9%          | 24.6%          | 5.5%           |

**Particle Size Distribution**

ASTM D 422

| 3/8" | Percent Passing (by weight) |      |      |      | Sand     |          | Clay (%) | Fines (%) |      |      |      |      |
|------|-----------------------------|------|------|------|----------|----------|----------|-----------|------|------|------|------|
|      | #4                          | #10  | #100 | #200 | Cor. (%) | Med. (%) |          |           |      |      |      |      |
| 99.3 | 95.8                        | 91.5 | 80.8 | 70.7 | 67.4     | 4.2      | 4.3      | 10.7      | 13.4 | 27.7 | 39.7 | 67.4 |

**Limits** ASTM D 4318 Classification

ASTM D 2487

| Atterberg Limits | USCS Classification | Cu   | Cc | D10             | D30 | D50  | D60   |       |       |       |
|------------------|---------------------|------|----|-----------------|-----|------|-------|-------|-------|-------|
| LL               | PI                  |      |    |                 |     |      |       |       |       |       |
| 29.9             | 17.2                | 12.7 | CL | SANDY LEAN CLAY | 24  | 0.38 | 0.001 | 0.003 | 0.012 | 0.024 |



# Permeability Test Report

Project: Ravenna Arsenal (FBQtr-178-0355-50)

Client: SpecPro, Inc.

**Sample Data:**

| Sample Number     | Sample Type | Depth (ft) |
|-------------------|-------------|------------|
| FBQtr-178-0355-50 | ST          | --         |

$K_{20^{\circ}\text{C}} = 3.51\text{E-}08 \text{ cm/sec}$

**Test Conditions:**

| Permeant Liquid           | Back Pressure | Hydraulic Gradient | Consolidation Stress |           | Total Test Time (min) | Total Flow (cc) |
|---------------------------|---------------|--------------------|----------------------|-----------|-----------------------|-----------------|
|                           |               |                    | Max (psi)            | Min (psi) |                       |                 |
| De-aired/De-ionized water | 45 psi        | 5 psi              | 6                    | 2         | 4387                  | 20.1            |

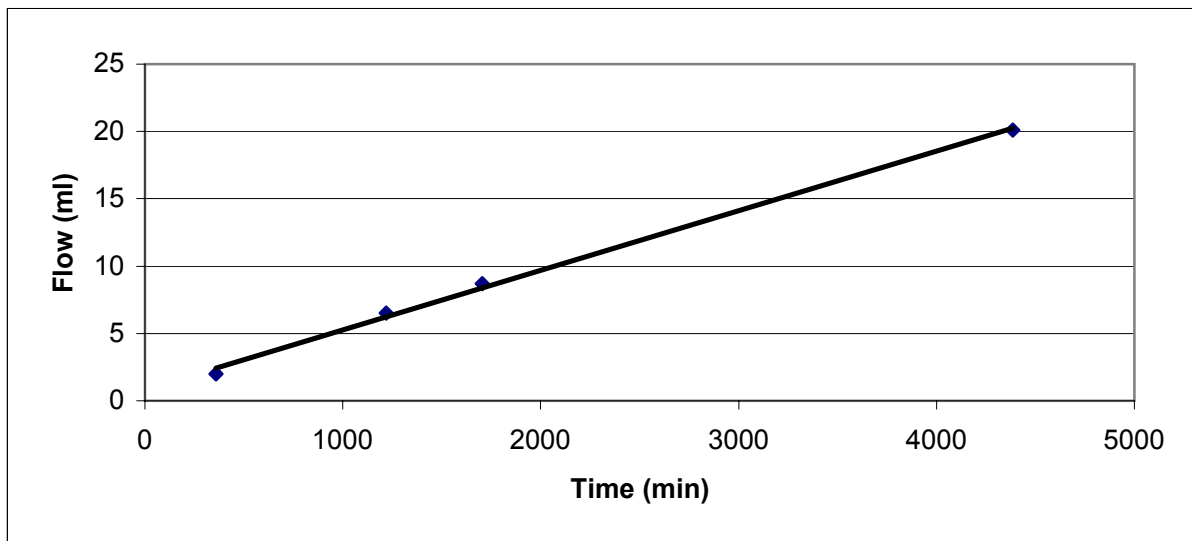
**Initial Sample Data:**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 10.8         | 81.8           | 7.315         | 6.736       | 42.03                   | 135.0             | 119.7             |

**Final Sample Data**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 16.1         | 100.0          | 7.272         | 6.725       | 41.53                   | 140.1             | 120.6             |

| Reading | Time (h:m) | Chamber | Upper | Lower | Flow | K <sub>20</sub> (cm/s) |
|---------|------------|---------|-------|-------|------|------------------------|
| 1       | 0:00       | 6.4     | 24.0  | 1.7   | 0.0  | --                     |
| 2       | 6:00       | 6.6     | 22.0  | 3.7   | 2.0  | 4.26E-08               |
| 3       | 20:20      | 7.0     | 17.5  | 8.2   | 6.5  | 4.09E-08               |
| 4       | 28:26      | 7.3     | 15.3  | 10.4  | 8.7  | 3.91E-08               |
| 5       | 73:07      | 8.0     | 3.9   | 21.8  | 20.1 | 3.51E-08               |



**Laboratory Test Summary**  
**JL03433**  
 1/7/2004

**Sample Data**

ASTM D 2216

| Sample Number     | Sample (m) | Depth (ft) | Tare Number | Tare Weight | Wet Weight | Dry Weight | Sample Weight | Moisture Content |
|-------------------|------------|------------|-------------|-------------|------------|------------|---------------|------------------|
| FBQtr-179-0356-50 | --         | --         | 249         | 9.48        | 248.37     | 214.31     | 204.83        | <b>6.96</b>      |

**Bulk Density**

ASTM D 2937

| Total Weight | Tube Weight | Sample Weight | Diameter (in) | Length (in) | Volume (cm <sup>3</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|-------------|---------------|---------------|-------------|---------------------------|-------------------|-------------------|
| 1023.0       | 0.00        | 1023.0        | 2.870         | 4.480       | 475.025                   | <b>134.4</b>      | <b>115.3</b>      |

**Specific Gravity (-10 Material)**

ASTM D 854

| Sample Weight (Mo) | Full Pycno (Mb) | Temp (°C) | Density Water d(T <sub>b</sub> ) | Correction K | Pycno/Water (M <sub>a</sub> at T <sub>b</sub> ) | Specific Gravity (T <sub>b</sub> ) | Specific Gravity (T <sub>20</sub> ) | Porosity (n) | V <sub>s</sub> | V <sub>w</sub> | V <sub>a</sub> |
|--------------------|-----------------|-----------|----------------------------------|--------------|---|------------------------------------|-------------------------------------|--------------|----------------|----------------|----------------|
| 39.35              | 188.21          | 22.9      | 0.99759                          | 0.9994       | 163.21  | 2.741                              | <b>2.740</b>                        | <b>0.326</b> | <b>67.4%</b>   | <b>30.7%</b>   | <b>1.9%</b>    |

**Particle Size Distribution**

ASTM D 422

| 3/8" | Percent Passing (by weight) |      |      |      | Sand       |          |          |          |          |          |           |
|------|-----------------------------|------|------|------|------------|----------|----------|----------|----------|----------|-----------|
|      | #4                          | #10  | #100 | #200 | Gravel (%) | Cor. (%) | Med. (%) | Fine (%) | Silt (%) | Clay (%) | Fines (%) |
| 97.5 | 96.3                        | 94.3 | 89.1 | 81.0 | 77.8       | 2.0      | 5.2      | 11.3     | 27.9     | 49.9     | 77.8      |

**Limits**

ASTM D 4318 Classification

| Atterberg Limits |             | USCS Classification |                            |
|------------------|-------------|---------------------|----------------------------|
| LL               | PI          | Cc                  | Cu                         |
| <b>40.9</b>      | <b>21.0</b> | <b>CL</b>           | <b>LEAN CLAY WITH SAND</b> |
|                  |             | <b>11</b>           | <b>0.82</b>                |
|                  |             | <b>0.001</b>        | <b>0.003</b>               |
|                  |             | <b>D10</b>          | <b>D30</b>                 |
|                  |             | <b>D50</b>          | <b>D60</b>                 |
|                  |             | <b>0.005</b>        | <b>0.011</b>               |

ASTM D 2487

# Permeability Test Report

Project: Ravenna Arsenal (FBQtr-179-0356-50)

Client: SpecPro, Inc.

**Sample Data:**

| Boring Number     | Sample Type | Depth (ft) |
|-------------------|-------------|------------|
| FBQtr-179-0356-50 | ST          | --         |

$K_{20^{\circ}\text{C}} = 1.34\text{E-}08 \text{ cm/sec}$

**Test Conditions:**

| Permeant Liquid           | Back Pressure | Hydraulic Gradient | Consolidation Stress |           | Total Test Time (min) | Total Flow (cc) |
|---------------------------|---------------|--------------------|----------------------|-----------|-----------------------|-----------------|
|                           |               |                    | Max (psi)            | Min (psi) |                       |                 |
| De-aired/De-ionized water | 40 psi        | 5 psi              | 6                    | 2         | 2820                  | 2.9             |

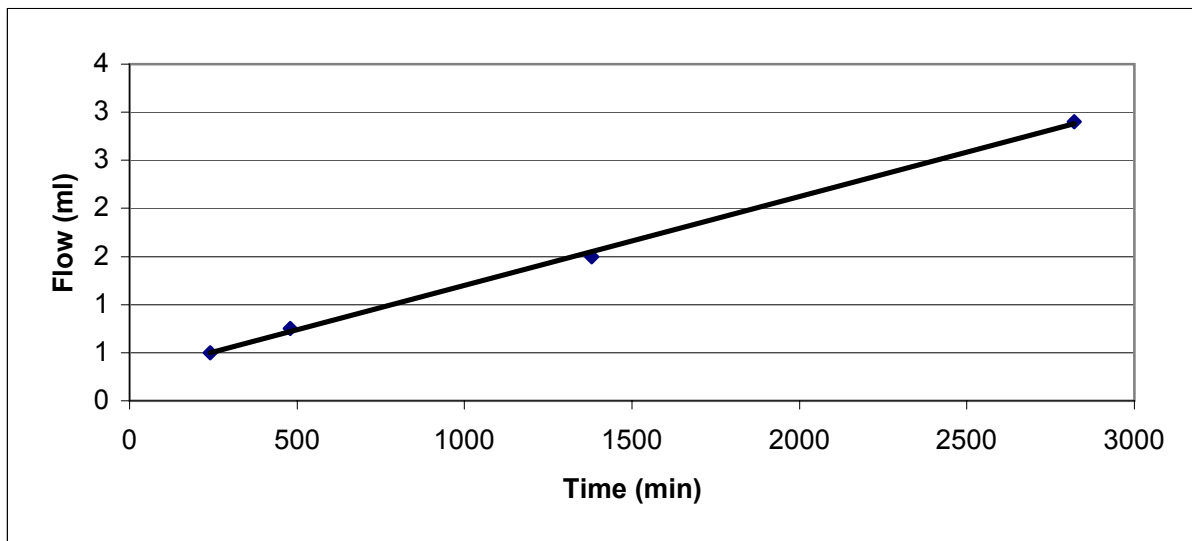
**Initial Sample Data:**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 16.8         | 94.2           | 7.290         | 11.380      | 41.74                   | 134.4             | 115.3             |

**Final Sample Data**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 17.4         | 100.0          | 7.263         | 11.412      | 41.43                   | 137.8             | 117.4             |

| Reading | Time (h:m) | Chamber | Upper | Lower | Flow | K <sub>20</sub> (cm/s) |
|---------|------------|---------|-------|-------|------|------------------------|
| 1       | 0:00       | 5.8     | 24.4  | 1.5   | 0.0  | --                     |
| 2       | 4:00       | 5.0     | 23.9  | 2.0   | 0.5  | 2.72E-08               |
| 3       | 8:00       | 5.4     | 23.6  | 2.2   | 0.7  | 2.04E-08               |
| 4       | 23:00      | 5.3     | 22.9  | 3.0   | 1.5  | 1.42E-08               |
| 5       | 47:00      | 5.2     | 21.5  | 4.4   | 2.9  | 1.34E-08               |



J&L Laboratories, Inc.

1/7/2004

**Laboratory Test Summary**  
**JL03433**  
 1/7/2004

**Sample Data**

ASTM D 2216

| Sample Number     | Sample (m) | Depth (ft) | Tare Number | Tare Weight | Wet Weight | Dry Weight | Sample Weight | Moisture Content |
|-------------------|------------|------------|-------------|-------------|------------|------------|---------------|------------------|
| FBQtr-179-0357-50 | --         | --         | 250         | 9.38        | 238.70     | 204.59     | 195.21        | 17.5%            |

**Bulk Density**

ASTM D 2937

| Total Weight | Tube Weight | Sample Weight | Diameter (in) | Length (in) | Volume (cm <sup>3</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|-------------|---------------|---------------|-------------|---------------------------|-------------------|-------------------|
| 933.8        | 0.00        | 933.8         | 2.876         | 4.145       | 441.089                   | 132.2             | 112.5             |

**Specific Gravity (-10 Material)**

ASTM D 854

| Sample Weight (Mo) | Full Pycno (Mb) | Temp (°C) | Density Water d(T <sub>b</sub> ) | Correction K | Pycno/Water (M <sub>a</sub> at T <sub>b</sub> ) | Specific Gravity (T <sub>b</sub> ) | Specific Gravity (T <sub>20</sub> ) | Porosity (n) | V <sub>s</sub> | V <sub>w</sub> | V <sub>a</sub> |
|--------------------|-----------------|-----------|----------------------------------|--------------|---|------------------------------------|-------------------------------------|--------------|----------------|----------------|----------------|
| 39.38              | 187.51          | 23.0      | 0.99756                          | 0.9993       | 162.38  | 2.764                              | 2.762                               | 0.348        | 65.2%          | 31.5%          | 3.3%           |

**Particle Size Distribution**

ASTM D 422

| 3/8"  | #4   | Percent Passing (by weight) |      |      | Sand       |          |          | Clay (%) | Fines (%) |      |      |
|-------|------|-----------------------------|------|------|------------|----------|----------|----------|-----------|------|------|
|       |      | #10                         | #100 | #200 | Gravel (%) | Cor. (%) | Med. (%) |          |           |      |      |
| 100.0 | 99.9 | 98.6                        | 95.4 | 91.5 | 89.4       | 0.1      | 1.3      | 3.2      | 29.7      | 59.7 | 89.4 |

**Limits**

ASTM D 4318 Classification

| Atterberg Limits | USCS Classification | ASTM D 2487 |    |           |     |      |       |       |       |       |
|------------------|---------------------|-------------|----|-----------|-----|------|-------|-------|-------|-------|
| LL               | PI                  | Cu          | Cc | D10       | D30 | D50  | D60   |       |       |       |
| 35.4             | 19.6                | 15.8        | CL | LEAN CLAY | 5   | 0.80 | 0.001 | 0.002 | 0.003 | 0.005 |

# Permeability Test Report

Project: Ravenna Arsenal (FBQtr-179-0357-50)

Client: SpecPro, Inc.

**Sample Data:**

| Sample Number     | Sample Type | Depth (ft) |
|-------------------|-------------|------------|
| FBQtr-179-0357-50 | ST          | --         |

$K_{20^{\circ}\text{C}} = 5.87\text{E-}08 \text{ cm/sec}$

**Test Conditions:**

| Permeant Liquid           | Back Pressure | Hydraulic Gradient | Consolidation Stress |           | Total Test Time (min) | Total Flow (cc) |
|---------------------------|---------------|--------------------|----------------------|-----------|-----------------------|-----------------|
|                           |               |                    | Max (psi)            | Min (psi) |                       |                 |
| De-aired/De-ionized water | 50 psi        | 5 psi              | 6                    | 2         | 2820                  | 14.0            |

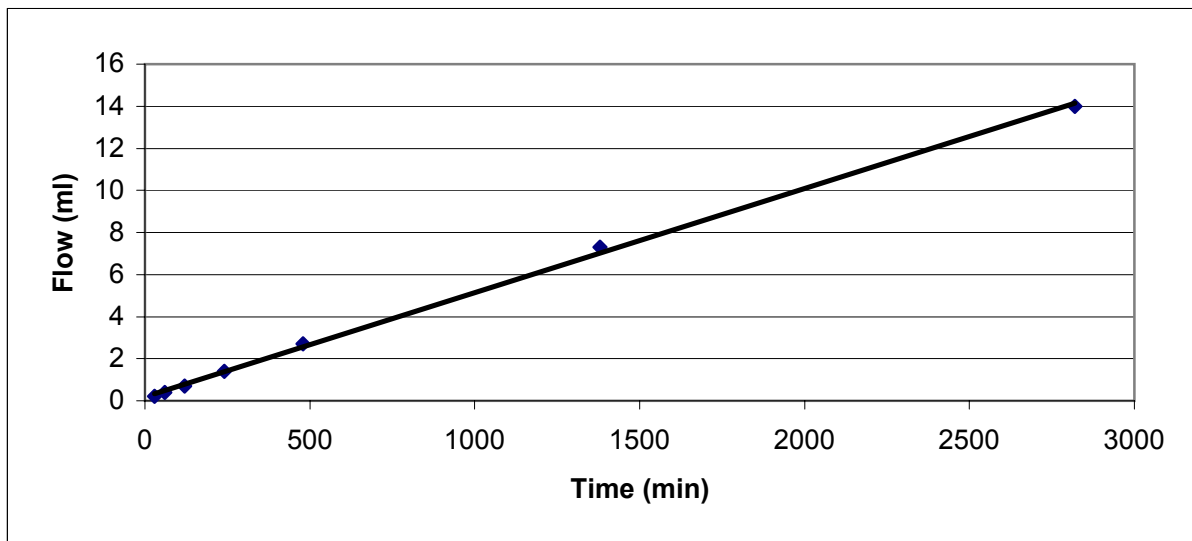
**Initial Sample Data:**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 18.4         | 90.6           | 7.304         | 10.528      | 41.90                   | 132.2             | 112.5             |

**Final Sample Data**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 20.2         | 100.0          | 7.355         | 10.602      | 42.48                   | 132.0             | 109.8             |

| Reading | Time (h:m) | Chamber | Upper | Lower | Flow | K <sub>20</sub> (cm/s) |
|---------|------------|---------|-------|-------|------|------------------------|
| 1       | 0:00       | 4.8     | 24.3  | 4.0   | 0.0  | --                     |
| 2       | 0:30       | 4.6     | 24.1  | 4.2   | 0.2  | 7.88E-08               |
| 3       | 1:00       | 4.5     | 23.9  | 4.4   | 0.4  | 7.88E-08               |
| 4       | 2:00       | 4.3     | 23.6  | 4.7   | 0.7  | 6.90E-08               |
| 5       | 4:00       | 3.7     | 22.9  | 5.4   | 1.4  | 6.90E-08               |
| 6       | 8:00       | 4.0     | 21.6  | 6.7   | 2.7  | 6.65E-08               |
| 7       | 23:00      | 4.0     | 17.0  | 11.3  | 7.3  | 6.25E-08               |
| 8       | 47:00      | 4.2     | 10.3  | 18.0  | 14.0 | 5.87E-08               |



J&L Laboratories, Inc.

1/7/2004

**Laboratory Test Summary**  
**JL03433**  
 1/7/2004

**Sample Data**

ASTM D 2216

| Sample Number     | Sample (m) | Depth (ft) | Tare Number | Tare Weight | Wet Weight | Dry Weight | Sample Weight | pH          | Moisture Content |
|-------------------|------------|------------|-------------|-------------|------------|------------|---------------|-------------|------------------|
| FBQtr-180-0358-50 | --         | --         | 251         | 9.53        | 267.31     | 222.88     | 213.35        | <b>6.30</b> | <b>20.8%</b>     |

**Bulk Density**

ASTM D 2937

| Total Weight | Tube Weight | Sample Weight | Diameter (in) | Length (in) | Volume (cm <sup>3</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|-------------|---------------|---------------|-------------|---------------------------|-------------------|-------------------|
| 965.6        | 0.00        | 965.6         | 2.854         | 4.441       | 465.404                   | <b>129.5</b>      | <b>107.2</b>      |

**Specific Gravity (-10 Material)**

ASTM D 854

| Sample Weight (Mo) | Full Pycno (Mb) | Temp (°C) | Density Water d(T <sub>b</sub> ) | Correction K | Pycno/Water (M <sub>a</sub> at T <sub>b</sub> ) | Specific Gravity (T <sub>b</sub> ) | Specific Gravity (T <sub>20</sub> ) | Porosity (n) | V <sub>s</sub> | V <sub>w</sub> | V <sub>a</sub> |
|--------------------|-----------------|-----------|----------------------------------|--------------|---|------------------------------------|-------------------------------------|--------------|----------------|----------------|----------------|
| 39.15              | 188.98          | 24.3      | 0.99724                          | 0.9990       | 164.05  | 2.753                              | <b>2.750</b>                        | <b>0.376</b> | <b>62.4%</b>   | <b>35.8%</b>   | <b>1.8%</b>    |

**Particle Size Distribution**

ASTM D 422

| 3/8"  | #4   | #10  | #40  | #100 | #200 | Sand       |          |          | Silt (%) | Clay (%) | Fines (%) |      |
|-------|------|------|------|------|------|------------|----------|----------|----------|----------|-----------|------|
|       |      |      |      |      |      | Gravel (%) | Cor. (%) | Med. (%) |          |          |           |      |
| 100.0 | 99.4 | 98.6 | 95.3 | 90.6 | 87.9 | 0.6        | 0.8      | 3.3      | 7.4      | 27.2     | 60.7      | 87.9 |

**Limits**

ASTM D 4318 Classification

| Atterberg Limits |             | USCS Classification |              |                  |              |
|------------------|-------------|---------------------|--------------|------------------|--------------|
| LL               | PL          | PI                  | Cc           | Cu               | D60          |
| <b>46.8</b>      | <b>22.3</b> | <b>24.5</b>         | <b>0.80</b>  | <b>5</b>         | <b>D60</b>   |
|                  |             |                     | <b>CL</b>    | <b>LEAN CLAY</b> | <b>0.003</b> |
|                  |             |                     | <b>0.001</b> | <b>0.002</b>     | <b>0.005</b> |

# Permeability Test Report

Project: Ravenna Arsenal (FBQtr-180-0358-50)

Client: SpecPro, Inc.

**Sample Data:**

| Sample Number     | Sample Type | Depth (ft) |
|-------------------|-------------|------------|
| FBQtr-180-0358-50 | ST          | --         |

$K_{20^{\circ}\text{C}} = 1.11\text{E-}08 \text{ cm/sec}$

**Test Conditions:**

| Permeant Liquid           | Back Pressure | Hydraulic Gradient | Consolidation Stress |           | Total Test Time (min) | Total Flow (cc) |
|---------------------------|---------------|--------------------|----------------------|-----------|-----------------------|-----------------|
|                           |               |                    | Max (psi)            | Min (psi) |                       |                 |
| De-aired/De-ionized water | 35 psi        | 5 psi              | 6                    | 2         | 2820                  | 2.5             |

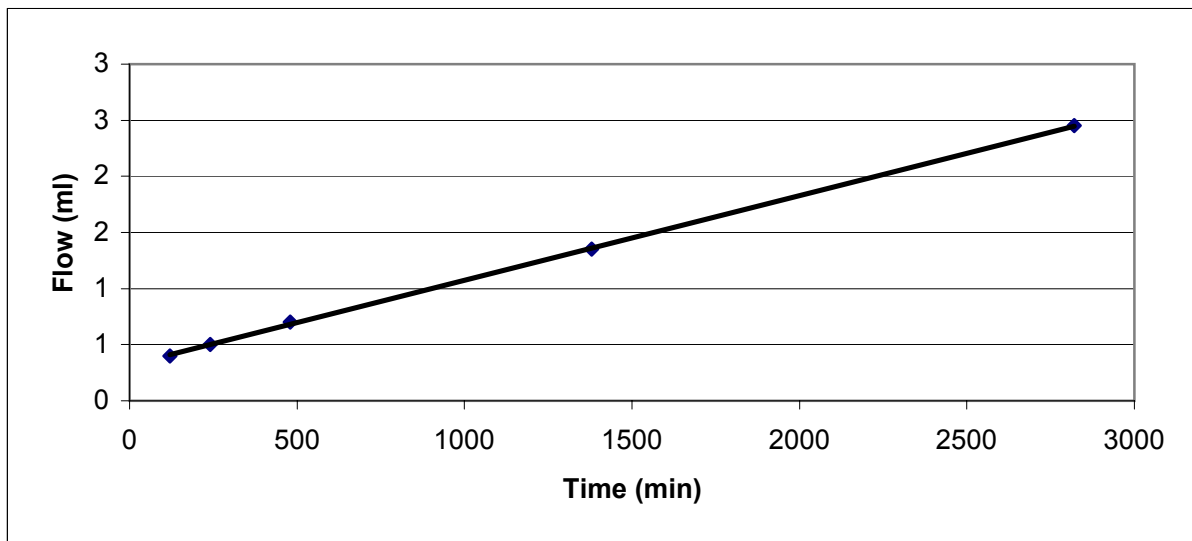
**Initial Sample Data:**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 21.7         | 95.2           | 7.248         | 11.279      | 41.26                   | 129.5             | 107.2             |

**Final Sample Data**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 20.6         | 100.0          | 7.264         | 11.201      | 41.44                   | 130.8             | 108.4             |

| Reading | Time (h:m) | Chamber | Upper | Lower | Flow | $K_{20}$ (cm/s) |
|---------|------------|---------|-------|-------|------|-----------------|
| 1       | 0:00       | 7.2     | 24.6  | 1.0   | 0.0  | --              |
| 2       | 2:00       | 7.0     | 24.2  | 1.4   | 0.4  | 4.27E-08        |
| 3       | 4:00       | 6.4     | 24.1  | 1.5   | 0.5  | 2.67E-08        |
| 4       | 8:00       | 6.7     | 23.9  | 1.7   | 0.7  | 1.87E-08        |
| 5       | 23:00      | 6.7     | 23.2  | 2.3   | 1.4  | 1.25E-08        |
| 6       | 47:00      | 6.8     | 22.1  | 3.4   | 2.5  | 1.11E-08        |



J&L Laboratories, Inc.

1/7/2004

JL03433

1/7/2004

Sample Data

ASTM D 2216

| Sample Number     | Sample (m) | Depth (ft) | Tare Number | Tare Weight | Wet Weight | Dry Weight | Sample Weight | pH   | Moisture Content |
|-------------------|------------|------------|-------------|-------------|------------|------------|---------------|------|------------------|
| FBQtr-180-0359-50 | --         | --         | 252         | 9.56        | 245.06     | 219.86     | 210.30        | 8.03 | 12.0%            |

Bulk Density

ASTM D 2937

| Total Weight | Tube Weight | Sample Weight | Diameter (in) | Length (in) | Volume (cm <sup>3</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|-------------|---------------|---------------|-------------|---------------------------|-------------------|-------------------|
| 498.3        | 0.00        | 498.3         | 2.851         | 2.563       | 268.061                   | 116.0             | 103.6             |

Specific Gravity (-10 Material)

ASTM D 854

| Sample Weight (Mo) | Full Pycno (Mb) | Temp (°C) | Density Water d(T <sub>b</sub> ) | Correction K | Pycno/Water (M <sub>a</sub> at T <sub>b</sub> ) | Specific Gravity (T <sub>b</sub> ) | Specific Gravity (T <sub>20</sub> ) | Porosity (n) | V <sub>s</sub> | V <sub>w</sub> | V <sub>a</sub> |
|--------------------|-----------------|-----------|----------------------------------|--------------|---|------------------------------------|-------------------------------------|--------------|----------------|----------------|----------------|
| 39.59              | 187.22          | 24.2      | 0.99727                          | 0.9990       | 162.15  | 2.727                              | 2.724                               | 0.391        | 60.9%          | 19.9%          | 19.2%          |

Particle Size Distribution

ASTM D 422

| 3/8" | #4   | #10  | #40  | #100 | #200 | Sand       |          |          | Silt (%) | Clay (%) | Fines (%) |
|------|------|------|------|------|------|------------|----------|----------|----------|----------|-----------|
|      |      |      |      |      |      | Gravel (%) | Cor. (%) | Med. (%) |          |          |           |
| 97.2 | 96.4 | 94.9 | 92.1 | 87.7 | 85.2 | 3.6        | 1.5      | 2.8      | 26.6     | 58.6     | 85.2      |

Limits

ASTM D 4318 Classification

| LL   | PL   | PI   | USCS Classification | Cu | Cc   | D10   | D30   | D50   | D60   |
|------|------|------|---------------------|----|------|-------|-------|-------|-------|
| 38.6 | 21.1 | 17.5 | CL LEAN CLAY        | 5  | 0.80 | 0.001 | 0.002 | 0.003 | 0.005 |



# Permeability Test Report

Project: Ravenna Arsenal (FBQtr-180-0359-50)

Client: SpecPro, Inc.

**Sample Data:**

| Sample Number     | Sample Type | Depth (ft) |
|-------------------|-------------|------------|
| FBQtr-180-0359-50 | ST          | --         |

$K_{20^{\circ}\text{C}} = 6.11\text{E-}07 \text{ cm/sec}$

**Test Conditions:**

| Permeant Liquid           | Back Pressure | Hydraulic Gradient | Consolidation Stress |           | Total Test Time (min) | Total Flow (cc) |
|---------------------------|---------------|--------------------|----------------------|-----------|-----------------------|-----------------|
|                           |               |                    | Max (psi)            | Min (psi) |                       |                 |
| De-aired/De-ionized water | 50 psi        | 5 psi              | 6                    | 2         | 240                   | 18.7            |

**Initial Sample Data:**

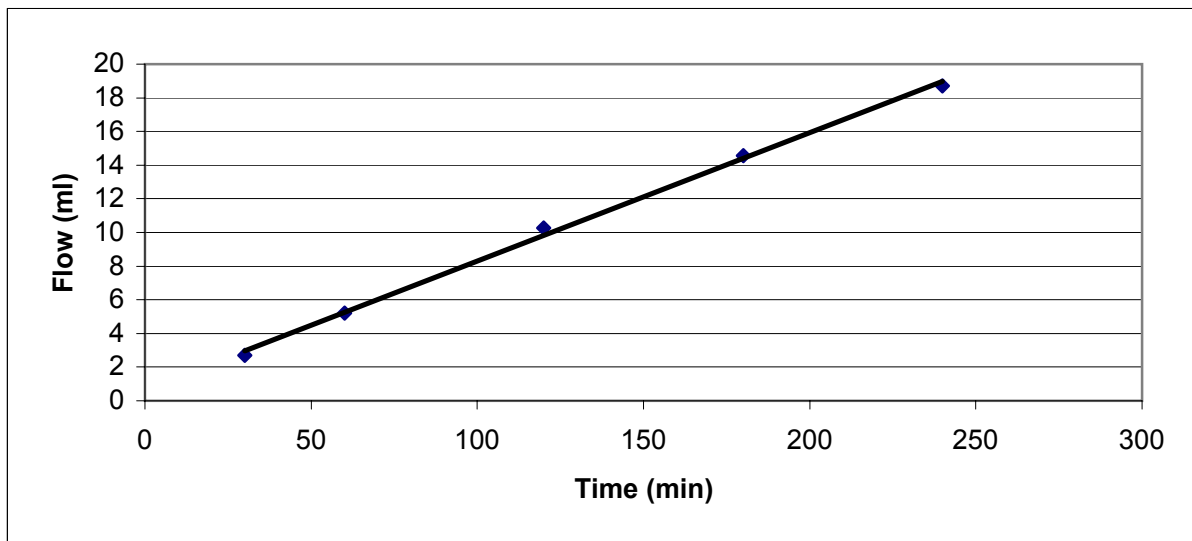
| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 10.8         | 50.9           | 7.241         | 6.510       | 41.18                   | 116.0             | 103.6             |

**Final Sample Data**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 23.6         | 100.0          | 7.069         | 6.493       | 39.24                   | 130.0             | 105.2             |

| Reading | Time (h:m) | Chamber | Upper | Lower | Flow | K <sub>20</sub> (cm/s) |
|---------|------------|---------|-------|-------|------|------------------------|
| 1       | 0:00       | 10.7    | 21.8  | 3.5   | 0.0  | --                     |
| 2       | 0:30       | 10.8    | 19.1  | 6.2   | 2.7  | 7.05E-07               |
| 3       | 1:00       | 10.8    | 16.6  | 8.7   | 5.2  | 6.79E-07               |
| 4       | 2:00       | 10.8    | 11.6  | 13.8  | 10.3 | 6.69E-07               |
| 5       | 3:00       | 10.8    | 7.3   | 18.1  | 14.6 | 6.33E-07               |
| 6       | 4:00       | 10.8    | 3.1   | 22.2  | 18.7 | 6.11E-07               |

Note: Recompact Sample



**Laboratory Test Summary**  
**JL03433**  
 1/7/2004

**Sample Data**

ASTM D 2216

| Sample Number     | Sample (m) | Depth (ft) | Tare Number | Tare Weight | Wet Weight | Dry Weight | Sample Weight | pH          | Moisture Content |
|-------------------|------------|------------|-------------|-------------|------------|------------|---------------|-------------|------------------|
| FBQtr-181-0360-50 | --         | --         | 253         | 9.43        | 253.77     | 210.44     | 201.01        | <b>6.12</b> | <b>21.6%</b>     |

**Bulk Density**

ASTM D 2937

| Total Weight | Tube Weight | Sample Weight | Diameter (in) | Length (in) | Volume (cm <sup>3</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|-------------|---------------|---------------|-------------|---------------------------|-------------------|-------------------|
| 962.1        | 0.00        | 962.1         | 2.843         | 4.514       | 469.653                   | <b>127.9</b>      | <b>105.2</b>      |

**Specific Gravity (-10 Material)**

ASTM D 854

| Sample Weight (Mo) | Full Pycno (Mb) | Temp (°C) | Density Water d(T <sub>b</sub> ) | Correction K | Pynco/Water (M <sub>a</sub> at T <sub>b</sub> ) | Specific Gravity (T <sub>b</sub> ) | Specific Gravity (T <sub>20</sub> ) | Porosity (n) | V <sub>s</sub> | V <sub>w</sub> | V <sub>a</sub> |
|--------------------|-----------------|-----------|----------------------------------|--------------|---|------------------------------------|-------------------------------------|--------------|----------------|----------------|----------------|
| 39.78              | 187.01          | 23.0      | 0.99756                          | 0.9993       | 162.04  | 2.687                              | <b>2.685</b>                        | <b>0.372</b> | <b>62.8%</b>   | <b>36.3%</b>   | <b>0.9%</b>    |

**Particle Size Distribution**

ASTM D 422

| 3/8" | #4   | #10  | #40  | #100 | #200 | Sand       |          |          | Silt (%) | Clay (%) | Fines (%) |      |
|------|------|------|------|------|------|------------|----------|----------|----------|----------|-----------|------|
|      |      |      |      |      |      | Gravel (%) | Cor. (%) | Med. (%) |          |          |           |      |
| 99.6 | 98.3 | 96.4 | 91.0 | 81.8 | 78.2 | 1.7        | 1.9      | 5.4      | 12.8     | 38.7     | 39.5      | 78.2 |

**Limits**

ASTM D 4318 Classification

| Atterberg Limits | USCS Classification | ASTM D 2487 |           |             |              |              |              |              |
|------------------|---------------------|-------------|-----------|-------------|--------------|--------------|--------------|--------------|
| LL               | PL                  | PI          | Cu        | Cc          | D10          | D30          | D50          | D60          |
| <b>29.3</b>      | <b>19.9</b>         | <b>9.4</b>  | <b>16</b> | <b>0.56</b> | <b>0.001</b> | <b>0.003</b> | <b>0.009</b> | <b>0.016</b> |

# Permeability Test Report

Project: Ravenna Arsenal (FBQtr-181-0360-50)

Client: SpecPro, Inc.

**Sample Data:**

| Sample Number     | Sample Type | Depth (ft) |
|-------------------|-------------|------------|
| FBQtr-181-0360-50 | ST          | --         |

$K_{20^{\circ}\text{C}} = 2.05\text{E-}07 \text{ cm/sec}$

**Test Conditions:**

| Permeant Liquid           | Back Pressure | Hydraulic Gradient | Consolidation Stress |           | Total Test Time (min) | Total Flow (cc) |
|---------------------------|---------------|--------------------|----------------------|-----------|-----------------------|-----------------|
|                           |               |                    | Max (psi)            | Min (psi) |                       |                 |
| De-aired/De-ionized water | 45 psi        | 5 psi              | 6                    | 2         | 1310                  | 20.7            |

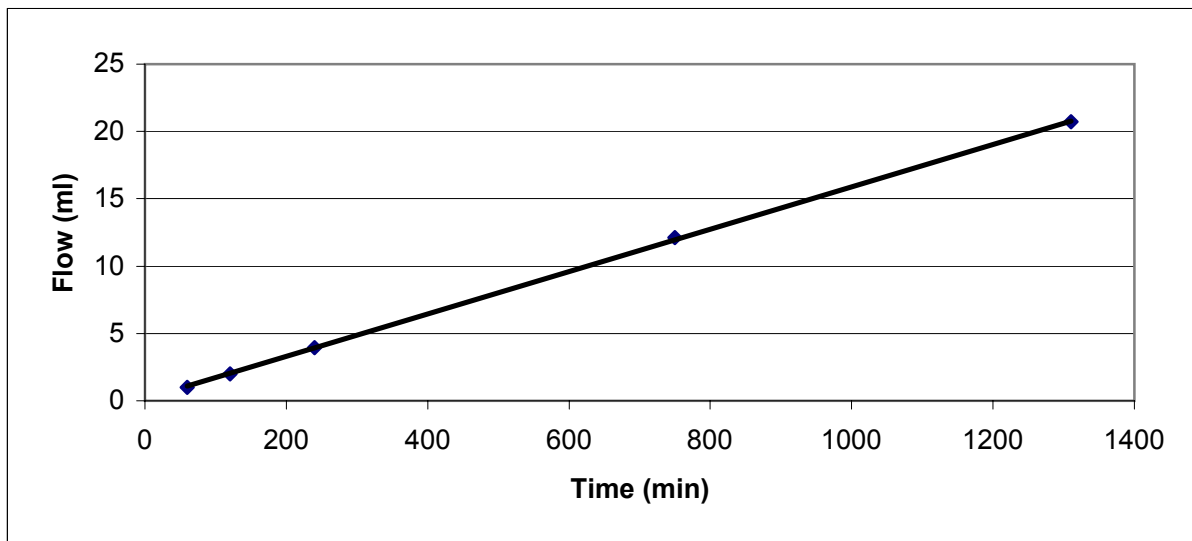
**Initial Sample Data:**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 10.8         | 97.6           | 7.222         | 11.465      | 40.96                   | 127.9             | 105.2             |

**Final Sample Data**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 21.2         | 100.0          | 7.231         | 11.247      | 41.07                   | 129.8             | 107.1             |

| Reading | Time (h:m) | Chamber | Upper | Lower | Flow | K <sub>20</sub> (cm/s) |
|---------|------------|---------|-------|-------|------|------------------------|
| 1       | 0:00       | 10.4    | 24.0  | 2.7   | 0.0  | --                     |
| 2       | 1:00       | 10.4    | 23.0  | 3.7   | 1.0  | 2.16E-07               |
| 3       | 2:00       | 10.5    | 21.9  | 4.6   | 2.0  | 2.16E-07               |
| 4       | 4:00       | 10.5    | 19.9  | 6.5   | 4.0  | 2.13E-07               |
| 5       | 12:30      | 10.6    | 11.9  | 14.8  | 12.1 | 2.09E-07               |
| 6       | 21:50      | 10.6    | 3.3   | 23.4  | 20.7 | 2.05E-07               |



**Laboratory Test Summary**  
**JL03433**  
 1/7/2004

**Sample Data**

ASTM D 2216

| Sample Number     | Sample (m) | Depth (ft) | Tare Number | Tare Weight | Wet Weight | Dry Weight | Sample Weight | Moisture Content |
|-------------------|------------|------------|-------------|-------------|------------|------------|---------------|------------------|
| FBQtr-181-0361-50 | --         | --         | 254         | 9.55        | 379.85     | 339.21     | 329.66        | 12.3%            |
|                   |            |            |             |             |            |            |               | 7.13             |

**Bulk Density**

ASTM D 2937

| Total Weight | Tube Weight | Sample Weight | Diameter (in) | Length (in) | Volume (cm <sup>3</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|-------------|---------------|---------------|-------------|---------------------------|-------------------|-------------------|
| 767.9        | 0.00        | 767.9         | 2.854         | 3.394       | 355.853                   | 134.7             | 119.9             |

**Specific Gravity (-10 Material)**

ASTM D 854

| Sample Weight (Mo) | Full Pycno (Mb) | Temp (°C) | Density Water d(T <sub>b</sub> ) | Correction K | Pynco/Water (M <sub>a</sub> at T <sub>b</sub> ) | Specific Gravity (T <sub>b</sub> ) | Specific Gravity (T <sub>20</sub> ) | Porosity (n) | V <sub>s</sub> | V <sub>w</sub> | V <sub>a</sub> |
|--------------------|-----------------|-----------|----------------------------------|--------------|---|------------------------------------|-------------------------------------|--------------|----------------|----------------|----------------|
| 39.68              | 187.33          | 24.2      | 0.99727                          | 0.9990       | 162.40  | 2.690                              | 2.688                               | 0.285        | 71.5%          | 23.7%          | 4.8%           |

**Particle Size Distribution**

ASTM D 422

| Sieve | Percent Passing (by weight) |      |      | Sand     |          |          |
|-------|-----------------------------|------|------|----------|----------|----------|
|       | #4                          | #10  | #200 | Cor. (%) | Med. (%) | Fine (%) |
| 3/8"  | 79.0                        | 71.8 | 58.6 | 7.2      | 13.2     | 34.4     |
| 86.7  |                             |      | 24.2 | 21.0     | 16.0     | 8.2      |
|       |                             |      | 31.2 | 7.2      | 16.0     | 24.2     |

**Limits**

ASTM D 4318 Classification

| Atterberg Limits | USCS Classification | ASTM D 2487                                |      |       |       |       |       |
|------------------|---------------------|--|------|-------|-------|-------|-------|
| LL               | PI                  | Cu   | Cc   | D10   | D30   | D50   | D60   |
| NP               | NP                  | 74   | 3.96 | 0.008 | 0.137 | 0.339 | 0.592 |
|                  |                     | <b>SC-SM SILTY CLAYEY SAND WITH GRAVEL</b> |      |       |       |       |       |

# Permeability Test Report

Project: Ravenna Arsenal (FBQtr-181-0361-50)

Client: SpecPro, Inc.

**Sample Data:**

| Sample Number     | Sample Type | Depth (ft) |
|-------------------|-------------|------------|
| FBQtr-181-0361-50 | ST          | --         |

$K_{20^{\circ}\text{C}} = 1.03\text{E-}06 \text{ cm/sec}$

**Test Conditions:**

| Permeant Liquid           | Back Pressure | Hydraulic Gradient | Consolidation Stress |           | Total Test Time (min) | Total Flow (cc) |
|---------------------------|---------------|--------------------|----------------------|-----------|-----------------------|-----------------|
|                           |               |                    | Max (psi)            | Min (psi) |                       |                 |
| De-aired/De-ionized water | 45 psi        | 5 psi              | 6                    | 2         | 180                   | 19.2            |

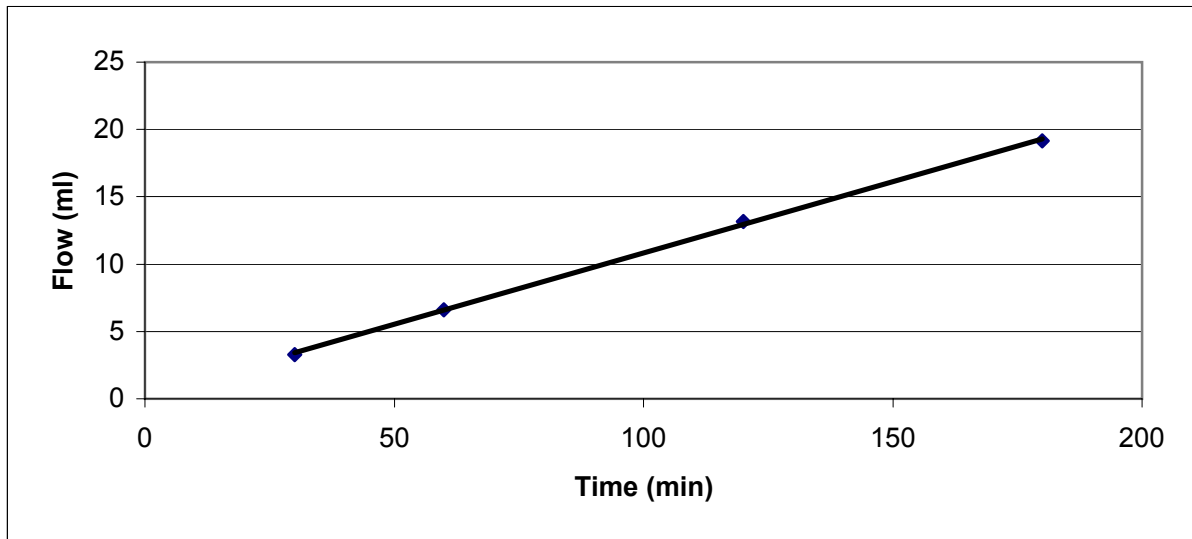
**Initial Sample Data:**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 23.0         | 83.0           | 7.250         | 8.620       | 41.28                   | 134.7             | 119.9             |

**Final Sample Data**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 12.8         | 100.0          | 7.232         | 8.396       | 41.08                   | 127.9             | 113.4             |

| Reading | Time (h:m) | Chamber | Upper | Lower | Flow | K <sub>20</sub> (cm/s) |
|---------|------------|---------|-------|-------|------|------------------------|
| 1       | 0:00       | 4.7     | 20.1  | 4.8   | 0.0  | --                     |
| 2       | 0:30       | 4.6     | 16.8  | 8.1   | 3.3  | 1.06E-06               |
| 3       | 1:00       | 4.6     | 13.5  | 11.4  | 6.6  | 1.06E-06               |
| 4       | 2:00       | 4.6     | 6.9   | 17.9  | 13.2 | 1.06E-06               |
| 5       | 3:00       | 4.6     | 0.9   | 23.9  | 19.2 | 1.03E-06               |



**Laboratory Test Summary**  
**JL03433**  
 1/7/2004

**Sample Data**

ASTM D 2216

| Sample Number     | Sample (m) | Depth (ft) | Tare Number | Tare Weight | Wet Weight | Dry Weight | Sample Weight | pH   | Moisture Content |
|-------------------|------------|------------|-------------|-------------|------------|------------|---------------|------|------------------|
| FBQtr-182-0362-50 | --         | --         | 255         | 9.50        | 281.45     | 233.44     | 223.94        | 4.73 | 21.4%            |

**Bulk Density**

ASTM D 2937

| Total Weight | Tube Weight | Sample Weight | Diameter (in) | Length (in) | Volume (cm <sup>3</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|-------------|---------------|---------------|-------------|---------------------------|-------------------|-------------------|
| 999.3        | 0.00        | 999.3         | 2.857         | 4.661       | 489.577                   | 127.4             | 104.9             |

**Specific Gravity (-10 Material)**

ASTM D 854

| Sample Weight (Mo) | Full Pycno (Mb) | Temp (°C) | Density Water d(T <sub>b</sub> ) | Correction K | Pynco/Water (M <sub>a</sub> at T <sub>b</sub> ) | Specific Gravity (T <sub>b</sub> ) | Specific Gravity (T <sub>20</sub> ) | Porosity (n) | V <sub>s</sub> | V <sub>w</sub> | V <sub>a</sub> |
|--------------------|-----------------|-----------|----------------------------------|--------------|---|------------------------------------|-------------------------------------|--------------|----------------|----------------|----------------|
| 38.93              | 187.37          | 24.3      | 0.99724                          | 0.9990       | 162.71  | 2.729                              | 2.726                               | 0.383        | 61.7%          | 36.0%          | 2.3%           |

**Particle Size Distribution**

ASTM D 422

| Sieve | Percent Passing (by weight) |      |      | Sand       |          |          |
|-------|-----------------------------|------|------|------------|----------|----------|
|       | #10                         | #40  | #200 | Gravel (%) | Cor. (%) | Med. (%) |
| 3/8"  | 87.6                        | 84.9 | 78.0 | 11.2       | 1.2      | 2.7      |
| 89.8  | 88.8                        | 84.9 | 80.4 | 6.9        | 27.4     | 50.6     |
|       |                             |      |      |            |          | 78.0     |

**Limits**

ASTM D 4318 Classification

| Atterberg Limits | USCS Classification | ASTM D 2487 |    |                     |     |      |       |       |       |       |
|------------------|---------------------|-------------|----|---------------------|-----|------|-------|-------|-------|-------|
| LL               | PI                  | Cu          | Cc | D10                 | D30 | D50  | D60   |       |       |       |
| 48.5             | 23.3                | 25.2        | CL | LEAN CLAY WITH SAND | 10  | 0.90 | 0.001 | 0.003 | 0.005 | 0.010 |

# Permeability Test Report

Project: Ravenna Arsenal (FBQtr-182-0362-50)

Client: SpecPro, Inc.

**Sample Data:**

| Sample Number     | Sample Type | Depth (ft) |
|-------------------|-------------|------------|
| FBQtr-182-0362-50 | ST          | --         |

$K_{20^{\circ}\text{C}} = 2.96\text{E-}08 \text{ cm/sec}$

**Test Conditions:**

| Permeant Liquid           | Back Pressure | Hydraulic Gradient | Consolidation Stress |           | Total Test Time (min) | Total Flow (cc) |
|---------------------------|---------------|--------------------|----------------------|-----------|-----------------------|-----------------|
|                           |               |                    | Max (psi)            | Min (psi) |                       |                 |
| De-aired/De-ionized water | 40 psi        | 5 psi              | 6                    | 2         | 1680                  | 3.7             |

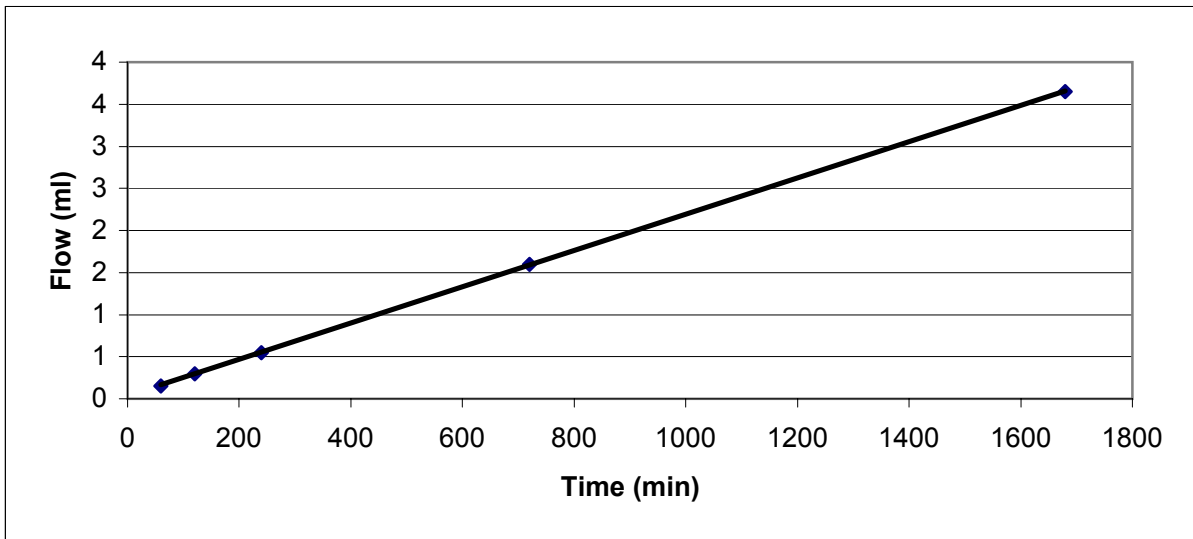
**Initial Sample Data:**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 23.0         | 94.0           | 7.256         | 11.840      | 41.35                   | 127.4             | 104.9             |

**Final Sample Data**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 23.6         | 100.0          | 7.233         | 11.803      | 41.09                   | 130.2             | 105.3             |

| Reading | Time (h:m) | Chamber | Upper | Lower | Flow | K <sub>20</sub> (cm/s) |
|---------|------------|---------|-------|-------|------|------------------------|
| 1       | 0:00       | 13.2    | 24.6  | 1.0   | 0.0  | --                     |
| 2       | 1:00       | 13.2    | 24.5  | 1.2   | 0.2  | 3.40E-08               |
| 3       | 2:00       | 13.2    | 24.4  | 1.4   | 0.3  | 3.40E-08               |
| 4       | 4:00       | 13.2    | 24.1  | 1.6   | 0.6  | 3.12E-08               |
| 5       | 12:00      | 13.4    | 23.0  | 2.6   | 1.6  | 3.02E-08               |
| 6       | 28:00      | 13.6    | 21.0  | 4.7   | 3.7  | 2.96E-08               |



**Laboratory Test Summary**  
**JL03433**  
 1/7/2004

**Sample Data**

ASTM D 2216

| Sample Number     | Sample (m) | Depth (ft) | Tare Number | Tare Weight | Wet Weight | Dry Weight | Sample Weight | pH   | Moisture Content |
|-------------------|------------|------------|-------------|-------------|------------|------------|---------------|------|------------------|
| FBQtr-182-0363-50 | --         | --         | 256         | 9.50        | 243.70     | 215.85     | 206.35        | 5.00 | 13.5%            |

**Bulk Density**

ASTM D 2937

| Total Weight | Tube Weight | Sample Weight | Diameter (in) | Length (in) | Volume (cm <sup>3</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|-------------|---------------|---------------|-------------|---------------------------|-------------------|-------------------|
| 648.2        | 0.00        | 648.2         | 2.841         | 3.145       | 326.746                   | 123.8             | 109.1             |

**Specific Gravity (-10 Material)**

ASTM D 854

| Sample Weight (Mo) | Full Pycno (Mb) | Temp (°C) | Density Water d(T <sub>b</sub> ) | Correction K | Pynco/Water (M <sub>a</sub> at T <sub>b</sub> ) | Specific Gravity (T <sub>b</sub> ) | Specific Gravity (T <sub>20</sub> ) | Porosity (n) | V <sub>s</sub> | V <sub>w</sub> | V <sub>a</sub> |
|--------------------|-----------------|-----------|----------------------------------|--------------|---|------------------------------------|-------------------------------------|--------------|----------------|----------------|----------------|
| 39.30              | 186.06          | 22.7      | 0.99763                          | 0.9994       | 161.47  | 2.672                              | 2.671                               | 0.346        | 65.4%          | 23.6%          | 11.0%          |

**Particle Size Distribution**

ASTM D 422

| 3/8" | Percent Passing (by weight) |      |      |      |            |          |          |          |          |          |           |      |
|------|-----------------------------|------|------|------|------------|----------|----------|----------|----------|----------|-----------|------|
|      | #4                          | #10  | #100 | #200 | Sand       |          |          |          |          |          |           |      |
|      |                             |      |      |      | Gravel (%) | Cor. (%) | Med. (%) | Fine (%) | Silt (%) | Clay (%) | Fines (%) |      |
| 96.2 | 92.3                        | 87.4 | 76.2 | 42.5 | 37.7       | 7.7      | 4.9      | 11.2     | 38.5     | 19.2     | 18.5      | 37.7 |

**Limits**

ASTM D 4318 Classification

| Atterberg Limits |    | USCS Classification |                          |
|------------------|----|---------------------|--------------------------|
| LL               | PL | PI                  |                          |
| NP               | NP | NP                  | SC-SM SILTY, CLAYEY SAND |
|                  |    | 98                  | 0.50                     |
|                  |    | 0.003               | 0.021                    |
|                  |    | D10                 | D30                      |
|                  |    | Cc                  | D50                      |
|                  |    | Cu                  | D60                      |
|                  |    | 0.211               | 0.293                    |

ASTM D 2487



# Permeability Test Report

Project: Ravenna Arsenal (FBQtr-182-0363-50)

Client: SpecPro, Inc.

**Sample Data:**

| Sample Number     | Sample Type | Depth (ft) |
|-------------------|-------------|------------|
| FBQtr-182-0363-50 | ST          | --         |

$K_{20^{\circ}\text{C}} = 9.14\text{E-}07 \text{ cm/sec}$

**Test Conditions:**

| Permeant Liquid           | Back Pressure | Hydraulic Gradient | Consolidation Stress |           | Total Test Time (min) | Total Flow (cc) |
|---------------------------|---------------|--------------------|----------------------|-----------|-----------------------|-----------------|
|                           |               |                    | Max (psi)            | Min (psi) |                       |                 |
| De-aired/De-ionized water | 45 psi        | 5 psi              | 6                    | 2         | 238                   | 23.6            |

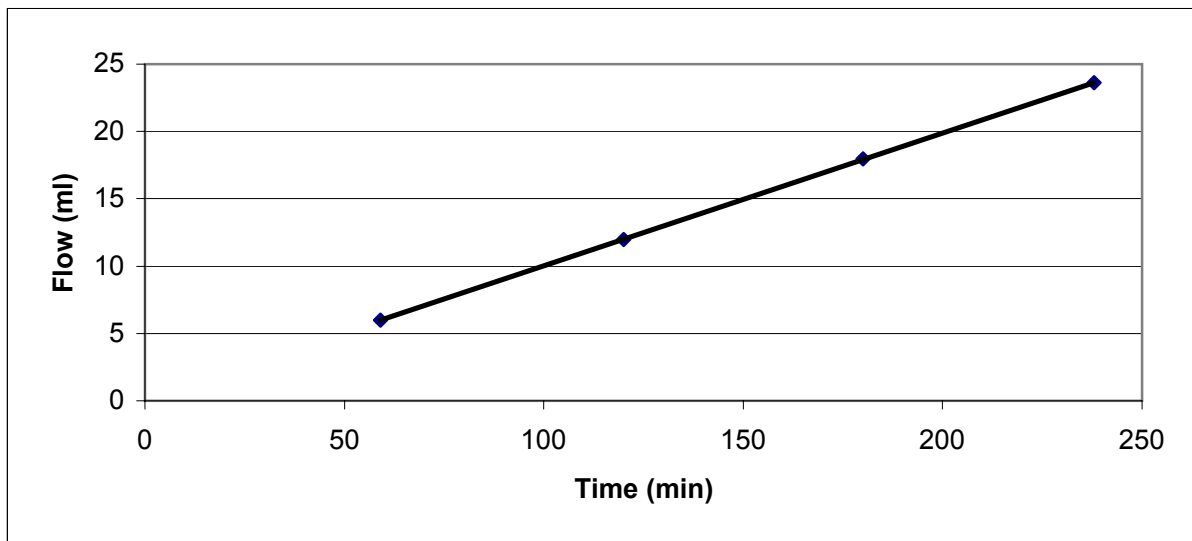
**Initial Sample Data:**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 12.8         | 68.3           | 7.217         | 7.987       | 40.91                   | 123.8             | 109.1             |

**Final Sample Data**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 19.5         | 100.0          | 7.224         | 7.978       | 40.98                   | 125.1             | 104.6             |

| Reading | Time (h:m) | Chamber | Upper | Lower | Flow | $K_{20}$ (cm/s) |
|---------|------------|---------|-------|-------|------|-----------------|
| 1       | 0:00       | 3.1     | 23.8  | 0.9   | 0.0  | --              |
| 2       | 0:59       | 3.1     | 17.8  | 6.9   | 6.0  | 9.38E-07        |
| 3       | 2:00       | 3.2     | 11.8  | 12.9  | 12.0 | 9.22E-07        |
| 4       | 3:00       | 3.2     | 5.9   | 18.9  | 18.0 | 9.20E-07        |
| 5       | 3:58       | 3.2     | 0.2   | 24.5  | 23.6 | 9.14E-07        |



| Sample Number     | Moisture Content (%) | Particle Size Distribution  |     |      |      |      |        |      |      |      |       | Atterberg Limits |    | USCS Classification | Bulk Density |     | Porosity | Hyd. Cond. |       |        |       |                         |      |
|-------------------|----------------------|-----------------------------|-----|------|------|------|--------|------|------|------|-------|------------------|----|---------------------|--------------|-----|----------|------------|-------|--------|-------|-------------------------|------|
|                   |                      | Percent Passing (by weight) |     | Sand |      |      | Gravel | Cor. | Silt | Clay | Fines | LL               | PL |                     | PI           | Wet |          | Dry        | (pcf) | (cm/s) | (1)   |                         |      |
|                   |                      | #4                          | #10 | #40  | #100 | #200 |        |      |      |      |       |                  |    |                     |              |     |          |            |       |        |       | 3/8"                    | Med. |
| FBQII-183-0364-50 | 19.0                 | 99                          | 99  | 98   | 93   | 85   | 81     | 1    | 1    | 5    | 12    | 43               | 38 | 81                  | 35           | 21  | 14       | CL         | 132.3 | 111.1  | 0.338 | 2.83 · 10 <sup>-7</sup> | 4.8  |
| FBQII-183-0365-50 | 17.1                 | 92                          | 90  | 87   | 79   | 59   | 52     | 10   | 3    | 8    | 27    | 30               | 21 | 51                  | 27           | 19  | 8        | CL         | 126.4 | 107.9  | 0.349 | 6.47 · 10 <sup>-7</sup> | 4.6  |

CLIENTS NAME: Spec Pro  
 PROJECT MANAGER: Whiteke Carroll  
 PROJECT NAME: Fizee Booster Quarry  
 CLIENTS ADDRESS: 8451 S.R. 5, Ravenna, OH 44266  
 PHONE NUMBER: (330) 358-1753  
 PROJECT LOCATION (Twp., City, County, State): Paris Twp., Portage Co., Ohio  
 LABORATORY ADDRESS: Paris Twp., Portage Co., Ohio  
 PHONE NUMBER: (330) 358-1754  
 FAX NUMBER: (330) 358-1754  
 PROPOSAL NUMBER:  
 PROJECT NUMBER:  
 FAX NUMBER:

**ANALYSIS REQUIRED**

TAT:  24 Hours  48 Hours  72 Hours  Standard 7 or 14 Days

REPORTING: Submit data via  Verbal  Fax  Hardcopy

| SAMPLE DESCRIPTION | COLLECTION DATE | COLLECTION TIME | MATRIX SOIL/WATER | CONTAINERS |             | PRESERVATIVE | LAB SAMPLE # | COMMENTS         |
|--------------------|-----------------|-----------------|-------------------|------------|-------------|--------------|--------------|------------------|
|                    |                 |                 |                   | NO.        | TYPE (VOL.) |              |              |                  |
| FBC4R-183-0364-50  | 10-01-03        | 0930            | Soil              | 2          | 8oz         |              | 2            | Moist. Content   |
| FBC4R-183-0365-50  | 10-01-03        | 1030            | Soil              | 2          | "           |              | 2            | Grain Size       |
|                    |                 |                 |                   |            |             |              |              | Attorneys Lim.   |
|                    |                 |                 |                   |            |             |              |              | USGS             |
|                    |                 |                 |                   |            |             |              |              | Specific Gravity |
|                    |                 |                 |                   |            |             |              |              | Bulk Dens.       |
|                    |                 |                 |                   |            |             |              |              | Barosty          |
|                    |                 |                 |                   |            |             |              |              | Hxd Cond.        |
|                    |                 |                 |                   |            |             |              |              | #                |

**SAMPLED BY (Please Print Name)** Mark F. Leering  
**ACCEPTED BY / AFFILIATION (Print Name / Signature)** [Signature] / [Signature]  
**RELINQUISHED BY / AFFILIATION (Print Name / Signature)** M.F. Leering  
**DATE** 10-1-03  
**TIME** 1515  
**DATE** 10/1/03  
**TIME** 17:30  
**ADDITIONAL COMMENTS** PST = Partial Shelby tube

**Laboratory Test Summary**  
**JL03433**  
 1/7/2004

**Sample Data**

ASTM D 2216

| Sample Number     | Sample (m) | Depth (ft) | Tare Number | Tare Weight | Wet Weight | Dry Weight | Sample Weight | pH   | Moisture Content |
|-------------------|------------|------------|-------------|-------------|------------|------------|---------------|------|------------------|
| FBQtr-183-0364-50 | --         | --         | 257         | 9.57        | 279.91     | 236.69     | 227.12        | 4.82 | 19.0%            |

**Bulk Density**

ASTM D 2937

| Total Weight | Tube Weight | Sample Weight | Diameter (in) | Length (in) | Volume (cm <sup>3</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|-------------|---------------|---------------|-------------|---------------------------|-------------------|-------------------|
| 1020.8       | 0.00        | 1020.8        | 2.874         | 4.534       | 481.832                   | 132.3             | 111.1             |

**Specific Gravity (-10 Material)**

ASTM D 854

| Sample Weight (Mo) | Full Pycno (Mb) | Temp (°C) | Density Water d(T <sub>b</sub> ) | Correction K | Pynco/Water (M <sub>a</sub> at T <sub>b</sub> ) | Specific Gravity (T <sub>b</sub> ) | Specific Gravity (T <sub>20</sub> ) | Porosity (n) | V <sub>s</sub> | V <sub>w</sub> | V <sub>a</sub> |
|--------------------|-----------------|-----------|----------------------------------|--------------|---|------------------------------------|-------------------------------------|--------------|----------------|----------------|----------------|
| 40.09              | 188.97          | 24.4      | 0.99723                          | 0.9990       | 163.77  | 2.693                              | 2.690                               | 0.338        | 66.2%          | 33.9%          | 0.0%           |

**Particle Size Distribution**

ASTM D 422

| 3/8" | Percent Passing (by weight) |      |      |      | Sand       |          |          |          |          |          |           |      |
|------|-----------------------------|------|------|------|------------|----------|----------|----------|----------|----------|-----------|------|
|      | #4                          | #10  | #100 | #200 | Gravel (%) | Cor. (%) | Med. (%) | Fine (%) | Silt (%) | Clay (%) | Fines (%) |      |
| 99.4 | 99.1                        | 97.8 | 93.3 | 84.9 | 80.7       | 0.9      | 1.3      | 4.5      | 12.6     | 43.1     | 37.6      | 80.7 |

**Limits**

ASTM D 4318 Classification

| Atterberg Limits |      | USCS Classification        |       |
|------------------|------|----------------------------|-------|
| LL               | PI   | Cu                         | Cc    |
| 35.1             | 20.6 | 17                         | 0.53  |
|                  |      | <b>LEAN CLAY WITH SAND</b> |       |
|                  | 14.5 | 0.001                      | 0.003 |
|                  |      | D10                        | D30   |
|                  |      | D50                        | D60   |
|                  |      | 0.011                      | 0.017 |

ASTM D 2487

# Permeability Test Report

Project: Ravenna Arsenal (FBQtr-183-0364-50)

Client: SpecPro, Inc.

**Sample Data:**

| Sample Number     | Sample Type | Depth (ft) |
|-------------------|-------------|------------|
| FBQtr-183-0364-50 | ST          | --         |

$K_{20^{\circ}\text{C}} = 2.83\text{E-}07 \text{ cm/sec}$

**Test Conditions:**

| Permeant Liquid           | Back Pressure | Hydraulic Gradient | Consolidation Stress |           | Total Test Time (min) | Total Flow (cc) |
|---------------------------|---------------|--------------------|----------------------|-----------|-----------------------|-----------------|
|                           |               |                    | Max (psi)            | Min (psi) |                       |                 |
| De-aired/De-ionized water | 40 psi        | 5 psi              | 6                    | 2         | 975                   | 21.0            |

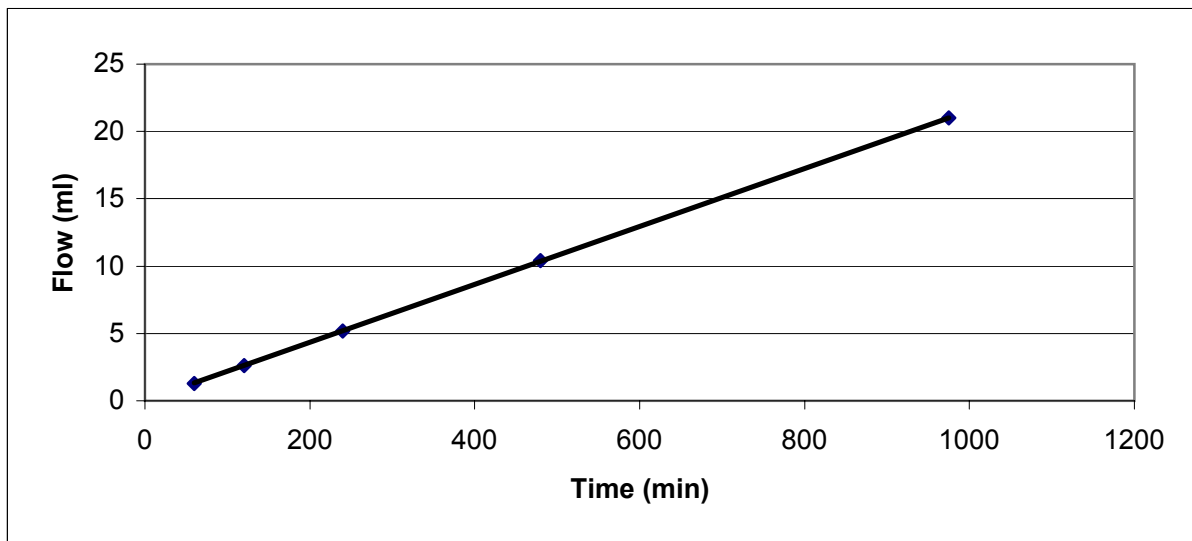
**Initial Sample Data:**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 23.0         | 100.1          | 7.299         | 11.516      | 41.84                   | 132.3             | 111.1             |

**Final Sample Data**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 18.4         | 100.0          | 7.269         | 11.519      | 41.49                   | 134.6             | 113.6             |

| Reading | Time (h:m) | Chamber | Upper | Lower | Flow | K <sub>20</sub> (cm/s) |
|---------|------------|---------|-------|-------|------|------------------------|
| 1       | 0:00       | 7.5     | 23.2  | 2.5   | 0.0  | --                     |
| 2       | 1:00       | 7.6     | 21.9  | 3.8   | 1.3  | 2.85E-07               |
| 3       | 2:00       | 7.6     | 20.6  | 5.1   | 2.6  | 2.85E-07               |
| 4       | 4:00       | 7.7     | 18.0  | 7.7   | 5.2  | 2.85E-07               |
| 5       | 8:00       | 7.8     | 12.8  | 12.9  | 10.4 | 2.85E-07               |
| 6       | 16:15      | 7.9     | 2.2   | 23.5  | 21.0 | 2.83E-07               |



**Laboratory Test Summary**  
**JL03433**  
 1/7/2004

**Sample Data**

ASTM D 2216

| Sample Number     | Sample (m) | Depth (ft) | Tare Number | Tare Weight | Wet Weight | Dry Weight | Sample Weight | pH          | Moisture Content |
|-------------------|------------|------------|-------------|-------------|------------|------------|---------------|-------------|------------------|
| FBQtr-183-0365-50 | --         | --         | 258         | 9.51        | 280.07     | 240.52     | 231.01        | <b>4.56</b> | <b>17.1%</b>     |

**Bulk Density**

ASTM D 2937

| Total Weight | Tube Weight | Sample Weight | Diameter (in) | Length (in) | Volume (cm <sup>3</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|-------------|---------------|---------------|-------------|---------------------------|-------------------|-------------------|
| 625.5        | 0.00        | 625.5         | 2.839         | 2.978       | 309.028                   | <b>126.4</b>      | <b>107.9</b>      |

**Specific Gravity (-10 Material)**

ASTM D 854

| Sample Weight (Mo) | Full Pycno (Mb) | Temp (°C) | Density Water d(T <sub>b</sub> ) | Correction K | Pynco/Water (M <sub>a</sub> at T <sub>b</sub> ) | Specific Gravity (T <sub>b</sub> ) | Specific Gravity (T <sub>20</sub> ) | Porosity (n) | V <sub>s</sub> | V <sub>w</sub> | V <sub>a</sub> |
|--------------------|-----------------|-----------|----------------------------------|--------------|---|------------------------------------|-------------------------------------|--------------|----------------|----------------|----------------|
| 40.21              | 187.55          | 24.4      | 0.99721                          | 0.9990       | 162.47  | 2.658                              | <b>2.655</b>                        | <b>0.349</b> | <b>65.1%</b>   | <b>29.6%</b>   | <b>5.3%</b>    |

**Particle Size Distribution**

ASTM D 422

| 3/8" | Percent Passing (by weight) |          |          |          |          |
|------|-----------------------------|----------|----------|----------|----------|
|      | #4                          | #10      | #100     | #200     | Sand     |
|      | Gravel (%)                  | Cor. (%) | Fine (%) | Silt (%) | Clay (%) |
| 91.8 | 89.9                        | 86.6     | 78.3     | 58.4     | 51.3     |
|      |                             |          |          | 3.3      | 8.3      |
|      |                             |          |          | 27.0     | 30.1     |
|      |                             |          |          |          | 21.2     |
|      |                             |          |          |          | 51.3     |

**Limits**

ASTM D 4318 Classification

| Atterberg Limits | USCS Classification       |
|------------------|---------------------------|
| LL PL PI         | Cu Cc                     |
| 27.0 18.8 8.2    | <b>CL SANDY LEAN CLAY</b> |
|                  | D60 D50 D30 D10           |
|                  | <b>0.073 0.010 0.003</b>  |

ASTM D 2487

# Permeability Test Report

Project: Ravenna Arsenal (FBQtr-183-0365-50)

Client: SpecPro, Inc.

**Sample Data:**

| Sample Number     | Sample Type | Depth (ft) |
|-------------------|-------------|------------|
| FBQtr-183-0365-50 | ST          | --         |

$K_{20^{\circ}\text{C}} = 6.47\text{E-}07 \text{ cm/sec}$

**Test Conditions:**

| Permeant Liquid           | Back Pressure | Hydraulic Gradient | Consolidation Stress |           | Total Test Time (min) | Total Flow (cc) |
|---------------------------|---------------|--------------------|----------------------|-----------|-----------------------|-----------------|
|                           |               |                    | Max (psi)            | Min (psi) |                       |                 |
| De-aired/De-ionized water | 50 psi        | 5 psi              | 6                    | 2         | 300                   | 22.3            |

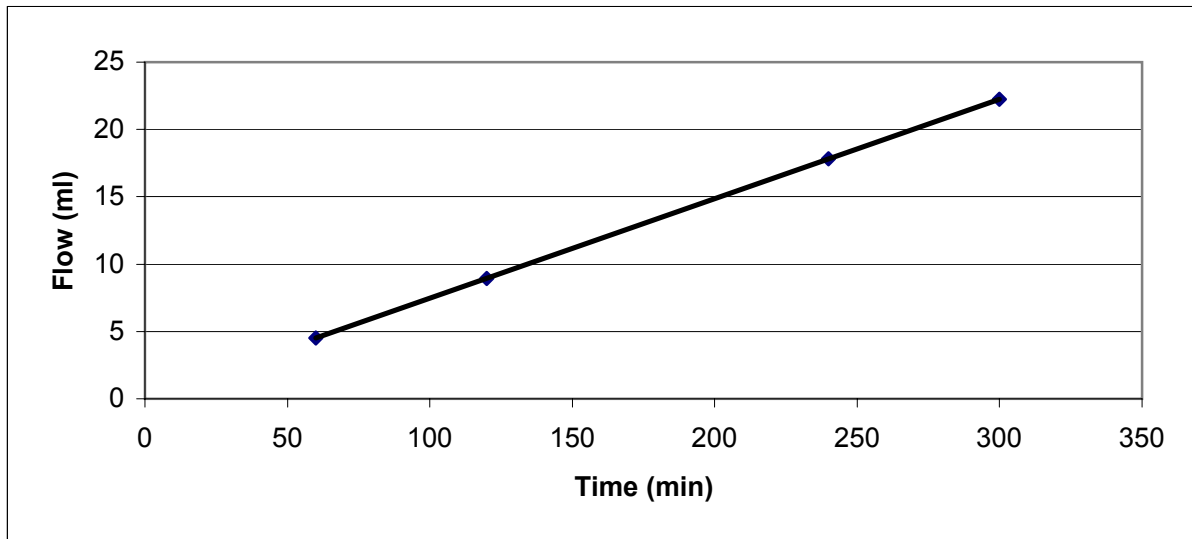
**Initial Sample Data:**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 23.0         | 84.8           | 7.212         | 7.565       | 40.85                   | 126.4             | 107.9             |

**Final Sample Data**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 25.7         | 100.0          | 7.221         | 7.546       | 40.96                   | 134.4             | 106.9             |

| Reading | Time (h:m) | Chamber | Upper | Lower | Flow | K <sub>20</sub> (cm/s) |
|---------|------------|---------|-------|-------|------|------------------------|
| 1       | 0:00       | 7.3     | 22.6  | 1.8   | 0.0  | --                     |
| 2       | 1:00       | 7.3     | 18.1  | 6.3   | 4.5  | 6.55E-07               |
| 3       | 2:00       | 7.4     | 13.7  | 10.8  | 9.0  | 6.51E-07               |
| 4       | 4:00       | 7.4     | 4.8   | 19.6  | 17.8 | 6.47E-07               |
| 5       | 5:00       | 7.5     | 0.3   | 24.0  | 22.3 | 6.47E-07               |



| Sample ID    | Moisture Content (%) | Particle Size Distribution  |     |     |      |      |        |      |       |    |    | Atterberg Limits |     | USCS Classification | Specific Gravity |     | Bulk Density (pcf) |       | Porosity | Hyd. Cond. (cm/s) |       | pH    |       |                         |      |     |     |
|--------------|----------------------|-----------------------------|-----|-----|------|------|--------|------|-------|----|----|------------------|-----|---------------------|------------------|-----|--------------------|-------|----------|-------------------|-------|-------|-------|-------------------------|------|-----|-----|
|              |                      | Percent Passing (by weight) |     |     | Sand |      |        | Clay | Fines | LL | PL | PI               | Wet |                     | Dry              | Wet | Dry                | Wet   |          | Dry               |       |       |       |                         |      |     |     |
|              |                      | #4                          | #10 | #40 | #100 | #200 | Gravel |      |       |    |    |                  |     |                     |                  |     |                    |       |          |                   | Cor.  |       | Med.  | Fine                    | Silt |     |     |
| FBQ-177      | 17.2                 | 100                         | 98  | 95  | 88   | 80   | 77     | 2    | 3     | 7  | 11 | 30               | 47  | 77                  | 41               | 19  | 22                 | CL    | 2.741    | 2.741             | 124.2 | 94.7  | 0.402 | 1.41 · 10 <sup>-6</sup> | (1)  | 4.6 | 7.0 |
| FBQ-176      | 31.2                 | 98                          | 97  | 89  | 76   | 73   | 3      | 0    | 8     | 16 | 51 | 22               | 73  | NP                  | NP               | NP  | NP                 | ML    | 2.537    | 2.537             | 131.3 | 117.7 | 0.307 | 2.58 · 10 <sup>-6</sup> | (1)  | 4.7 |     |
| FBQ-172      | 11.5                 | 66                          | 61  | 58  | 51   | 38   | 32     | 39   | 3     | 7  | 19 | 18               | 14  | 32                  | NP               | NP  | NP                 | SC-SM | 2.722    | 2.722             | 104.8 | 89.0  | 0.468 | 2.51 · 10 <sup>-6</sup> |      | 5.7 |     |
| FBQ-168 ST-1 | 17.6                 | 97                          | 95  | 92  | 84   | 72   | 68     | 5    | 3     | 8  | 16 | 40               | 28  | 68                  | 27               | 20  | 7                  | CL    | 2.680    | 2.680             | 129.6 | 113.6 | 0.329 | 1.03 · 10 <sup>-6</sup> |      | 4.9 |     |
| FBQ-168 ST-2 | 14.1                 | 95                          | 93  | 90  | 80   | 55   | 49     | 7    | 3     | 10 | 31 | 27               | 22  | 49                  | NP               | NP  | NP                 | SC    | 2.713    | 2.713             | 130.0 | 110.4 | 0.357 | 5.67 · 10 <sup>-8</sup> |      | 7.2 |     |
| FBQ-166 ST-3 | 17.8                 | 97                          | 95  | 93  | 89   | 83   | 80     | 5    | 2     | 4  | 9  | 34               | 46  | 80                  | 31               | 17  | 14                 | CL    | 2.748    | 2.748             | 134.5 | 116.4 | 0.324 | 1.96 · 10 <sup>-8</sup> |      | 6.9 |     |
| FBQ-166 ST-2 | 15.5                 | 98                          | 95  | 87  | 70   | 56   | 52     | 5    | 8     | 17 | 18 | 17               | 35  | 52                  | 34               | 17  | 17                 | CL    | 2.759    | 2.759             | 123.9 | 107.8 | 0.368 | 3.62 · 10 <sup>-7</sup> |      | 5.3 |     |
| FBQ-166 ST-1 | 14.9                 | 91                          | 81  | 67  | 46   | 35   | 31     | 19   | 14    | 21 | 15 | 10               | 21  | 31                  | 35               | 18  | 17                 | SC    | 2.731    | 2.731             | 128.6 | 117.2 | 0.304 | 2.61 · 10 <sup>-6</sup> |      | 4.8 |     |
| FBQ-174      | 9.7                  | 71                          | 67  | 64  | 51   | 25   | 18     | 33   | 3     | 13 | 33 | 8                | 10  | 18                  | NP               | NP  | NP                 | SC-SM | 2.697    | 2.697             |       |       |       |                         |      |     |     |

Notes: (1) - Sample recompactd for permeability test



CLIENTS ADDRESS

CLIENTS NAME: **Spec Pro**  
 PROJECT MANAGER: **Mauxie Carroll**  
 PROJECT NAME: **Rivad - Fuzie / Boobler**  
 LAB CONTACT: **C. Carni**

PHONE NUMBER: **330-358-1753**  
 PROJECT LOCATION (Twp., City, County, State): **Ravenna Arsenal**  
 LABORATORY ADDRESS: **Ravenna Arsenal**  
 FAX NUMBER: **330-358-1754**  
 PHONE NUMBER: **ccarn11@specpro-inc.com**  
 PROPOSAL NUMBER: **330-358-1754**  
 PROJECT NUMBER: **330-358-1754**  
 FAX NUMBER: **330-358-1754**

**ANALYSIS REQUIRED**

TAT:  24 Hours  48 Hours  72 Hours  Standard 7 or 14 Days

REPORTING: Submit data via  Verbal  Fax  Hardcopy

| SAMPLE DESCRIPTION | COLLECTION DATE | COLLECTION TIME | MATRIX SOIL/WATER | CONTAINERS |             | PRESERVATIVE | LAB SAMPLE # | ANALYSIS REQUIRED |                     |                   |     |      |          |                        |    | COMMENTS |
|--------------------|-----------------|-----------------|-------------------|------------|-------------|--------------|--------------|-------------------|---------------------|-------------------|-----|------|----------|------------------------|----|----------|
|                    |                 |                 |                   | NO.        | TYPE (VOL.) |              |              | USCS              | Particle Size Dist. | LiA/PASTIC LIMITS | SPG | Psib | Parasite | Hydraulic Conductivity | PH |          |
| FBQ-177            | 10/6            | 1022            | SOIL              | 2          | ST          |              |              | X                 | X                   | X                 | X   | X    | X        | X                      | X  |          |
| FBQ-176            | 10/7            | 810             | SOIL              | 2          | ST          |              |              | X                 | X                   | X                 | X   | X    | X        | X                      | X  |          |
| FBQ-172            | 10/8            | 1240            | SOIL              | 2          | ST          |              |              | X                 | X                   | X                 | X   | X    | X        | X                      | X  |          |
| FBQ-168 ST-2       | 10/7            | 1345            | SOIL              | 1          | ST          |              |              | X                 | X                   | X                 | X   | X    | X        | X                      | X  |          |
| FBQ-168 ST-1       | 10/7            | 1340            | SOIL              | 1          | ST          |              |              | X                 | X                   | X                 | X   | X    | X        | X                      | X  |          |
| FBQ-166 ST-3       | 10/8            | 0920            | SOIL              | 2          | ST          |              |              | X                 | X                   | X                 | X   | X    | X        | X                      | X  |          |
| FBQ-166 ST-2       | 10/8            | 0905            | SOIL              | 1          | ST          |              |              | X                 | X                   | X                 | X   | X    | X        | X                      | X  |          |
| FBQ-166 ST-1       | 10/8            | 0845            | SOIL              | 1          | ST          |              |              | X                 | X                   | X                 | X   | X    | X        | X                      | X  |          |
| FBQ-174            | 10/10           | 0945            | SOIL              | 1          | ST          |              |              | X                 | X                   | X                 | X   | X    | X        | X                      | X  |          |

ADDITIONAL COMMENTS

SAMPLED BY (Signature)

RELINQUISHED BY / AFFILIATION (Print Name / Signature)

| DATE  | TIME  | ACCEPTED BY / AFFILIATION (Print Name / Signature) | DATE  | TIME  |
|-------|-------|--|-------|-------|
| 10/10 | 15:24 | James J. Cole / JACE L. COLE                       | 10/10 | 15:24 |
|       |       |  |       |       |
|       |       |  |       |       |

**Sample Data**

ASTM D 2216

| Sample Number | Sample (m) | Depth (ft) | Tare Number | Tare Weight | Wet Weight | Dry Weight | Sample Weight | Moisture Content |
|---------------|------------|------------|-------------|-------------|------------|------------|---------------|------------------|
| FBQ-177       | --         | 0-2        | 259         | 9.57        | 500.24     | 428.36     | 418.79        | 17.2%            |

**Bulk Density**

ASTM D 2937

| Total Weight | Tube Weight | Sample Weight | Diameter (in) | Length (in) | Volume (cm <sup>3</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|-------------|---------------|---------------|-------------|---------------------------|-------------------|-------------------|
| --           | --          | --            | --            | --          | --                        | --                | --                |

**Specific Gravity (-10 Material)**

ASTM D 854

| Sample Weight (Mo) | Full Pycno (Mb) | Temp (°C) | Density Water d(T <sub>b</sub> ) | Correction K | Pycno/Water (M <sub>a</sub> at T <sub>b</sub> ) | Specific Gravity (T <sub>b</sub> ) | Specific Gravity (T <sub>20</sub> ) | Porosity (n) | V <sub>s</sub> | V <sub>w</sub> | V <sub>a</sub> |
|--------------------|-----------------|-----------|----------------------------------|--------------|---|------------------------------------|-------------------------------------|--------------|----------------|----------------|----------------|
| 40.24              | 188.07          | 20.8      | 0.99806                          | 0.9998       | 162.51  | 2.741                              | 2.741                               | --           | --             | --             | -              |

**Particle Size Distribution**

ASTM D 422

| Sieve | Percent Passing (by weight) |      |      | Sand       |          |          |
|-------|-----------------------------|------|------|------------|----------|----------|
|       | #4                          | #10  | #200 | Gravel (%) | Cor. (%) | Med. (%) |
| 100.0 | 98.1                        | 95.3 | 88.1 | 1.9        | 2.8      | 7.2      |
|       |                             |      | 76.8 |            |          |          |
|       |                             |      | 79.9 |            |          |          |
|       |                             |      |      |            |          | 11.3     |
|       |                             |      |      |            |          | 30.3     |
|       |                             |      |      |            |          | 46.5     |
|       |                             |      |      |            |          | 76.8     |

**Limits**

ASTM D 4318 Classification

| Atterberg Limits | USCS Classification           |
|------------------|-------------------------------|
| LL PL 40.9 19.1  | PI 21.8                       |
|                  | CL LEAN CLAY WITH SAND        |
|                  | Cu 13 Cc 0.69                 |
|                  | D10 0.001 D30 0.003 D60 0.013 |

ASTM D 2487

**Laboratory Test Summary**  
**JL03433**  
 1/7/2004

**Sample Data**

ASTM D 2216

| Sample Number | Sample (m) | Depth (ft) | Tare Number | Tare Weight | Wet Weight | Dry Weight | Sample Weight | Moisture Content |
|---------------|------------|------------|-------------|-------------|------------|------------|---------------|------------------|
| FBQ-176       | --         | --         | 260         | 9.60        | 374.67     | 287.82     | 278.22        | 31.2%            |

**Bulk Density**

ASTM D 2937

| Total Weight | Tube Weight | Sample Weight | Diameter (in) | Length (in) | Volume (cm <sup>3</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|-------------|---------------|---------------|-------------|---------------------------|-------------------|-------------------|
| 732.3        | 0.00        | 732.27        | 2.759         | 3.758       | 368.035                   | 124.2             | 94.7              |

**Specific Gravity (-10 Material)**

ASTM D 854

| Sample Weight (Mo) | Full Pycno (Mb) | Temp (°C) | Density Water d(T <sub>b</sub> ) | Correction K | Pynco/Water (M <sub>a</sub> at T <sub>b</sub> ) | Specific Gravity (T <sub>b</sub> ) | Specific Gravity (T <sub>20</sub> ) | Porosity (n) | V <sub>s</sub> | V <sub>w</sub> | V <sub>a</sub> |
|--------------------|-----------------|-----------|----------------------------------|--------------|---|------------------------------------|-------------------------------------|--------------|----------------|----------------|----------------|
| 40.09              | 186.82          | 20.6      | 0.99810                          | 0.9999       | 162.53  | 2.537                              | 2.537                               | 0.402        | 59.8%          | 47.3%          | -7.1%          |

Note: Sample over saturated

**Particle Size Distribution**

ASTM D 422

| 3/8" | Percent Passing (by weight) |      |      |      | Sand       |          |          |          |          |          |           |
|------|-----------------------------|------|------|------|------------|----------|----------|----------|----------|----------|-----------|
|      | #4                          | #10  | #100 | #200 | Gravel (%) | Cor. (%) | Med. (%) | Fine (%) | Silt (%) | Clay (%) | Fines (%) |
| 98.4 | 97.4                        | 96.8 | 89.3 | 76.2 | 73.1       | 0.6      | 7.5      | 16.2     | 51.0     | 22.1     | 73.1      |

**Limits**

ASTM D 4318 Classification

| Atterberg Limits |    | USCS Classification |                          |
|------------------|----|---------------------|--------------------------|
| LL               | PL | PI                  | Cu                       |
| NP               | NP | NP                  | 7                        |
|                  |    |                     | <b>ML SILT WITH SAND</b> |

ASTM D 2487

| LL | PL | PI | Cc   | D10   | D30   | D50   | D60   |
|----|----|----|------|-------|-------|-------|-------|
| NP | NP | NP | 0.74 | 0.003 | 0.007 | 0.015 | 0.022 |

# Permeability Test Report

Project: Ravenna Arsenal (FBQ-176)

Client: SpecPro, Inc.

**Sample Data:**

| Sample Number | Sample Type | Depth (ft) |
|---------------|-------------|------------|
| FBQ-176       | ST          | --         |

$K_{20^{\circ}\text{C}} = 1.41\text{E-}06 \text{ cm/sec}$

**Test Conditions:**

| Permeant Liquid           | Back Pressure | Hydraulic Gradient | Consolidation Stress |           | Total Test Time (min) | Total Flow (cc) |
|---------------------------|---------------|--------------------|----------------------|-----------|-----------------------|-----------------|
|                           |               |                    | Max (psi)            | Min (psi) |                       |                 |
| De-aired/De-ionized water | 40 psi        | 5 psi              | 6                    | 2         | 1440                  | 173.3           |

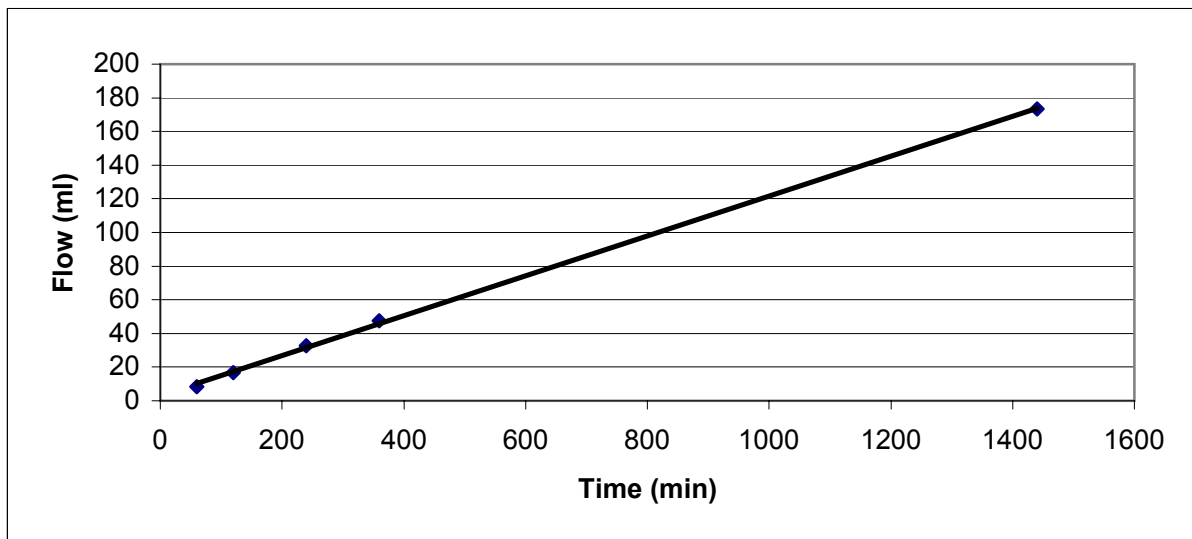
**Initial Sample Data:**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 15.8         | 117.7          | 7.007         | 9.544       | 38.56                   | 124.2             | 94.7              |

**Final Sample Data**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 22.2         | 100.0          | 6.947         | 9.370       | 37.91                   | 129.7             | 106.1             |

| Reading | Time (h:m) | Chamber | Upper | Lower | Flow  | K <sub>20</sub> (cm/s) |
|---------|------------|---------|-------|-------|-------|------------------------|
| 1       | 0:00       | 53.5    | 371.5 | 33.4  | 0.0   | --                     |
| 2       | 1:00       | 51.8    | 363.3 | 41.6  | 8.2   | 1.60E-06               |
| 3       | 2:00       | 51.8    | 354.2 | 49.7  | 16.8  | 1.64E-06               |
| 4       | 4:00       | 51.8    | 337.8 | 65.2  | 32.7  | 1.60E-06               |
| 5       | 6:00       | 51.8    | 323.1 | 79.9  | 47.4  | 1.54E-06               |
| 6       | 24:00      | 51.8    | 200.1 | 208.6 | 173.3 | 1.41E-06               |



J&L Laboratories, Inc.

1/7/2004

**Laboratory Test Summary**  
**JL03433**  
 1/7/2004

**Sample Data**

ASTM D 2216

| Sample Number | Sample (m) | Depth (ft) | Tare Number | Tare Weight | Wet Weight | Dry Weight | Sample Weight | Moisture Content |
|---------------|------------|------------|-------------|-------------|------------|------------|---------------|------------------|
| FBQ-172       | --         | 0-2        | 261         | 9.48        | 400.38     | 359.93     | 350.45        | 11.5%            |

**Bulk Density**

ASTM D 2937

| Total Weight | Tube Weight | Sample Weight | Diameter (in) | Length (in) | Volume (cm <sup>3</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|-------------|---------------|---------------|-------------|---------------------------|-------------------|-------------------|
| 728.7        | 0.00        | 728.69        | 2.857         | 3.299       | 346.498                   | 131.3             | 117.7             |

**Specific Gravity (-10 Material)**

ASTM D 854

| Sample Weight (Mo) | Full Pycno (Mb) | Temp (°C) | Density Water d(T <sub>b</sub> ) | Correction K | Pynco/Water (M <sub>a</sub> at T <sub>b</sub> ) | Specific Gravity (T <sub>b</sub> ) | Specific Gravity (T <sub>20</sub> ) | Porosity (n) | V <sub>s</sub> | V <sub>w</sub> | V <sub>a</sub> |
|--------------------|-----------------|-----------|----------------------------------|--------------|---|------------------------------------|-------------------------------------|--------------|----------------|----------------|----------------|
| 40.82              | 189.64          | 20.8      | 0.99805                          | 0.9998       | 163.82  | 2.722                              | 2.722                               | 0.307        | 69.3%          | 21.8%          | 9.0%           |

**Particle Size Distribution**

ASTM D 422

| 3/8" | Percent Passing (by weight) |      |      |            |          |          |          |          |          |           |      |      |
|------|-----------------------------|------|------|------------|----------|----------|----------|----------|----------|-----------|------|------|
|      | #4                          | #10  | #100 | #200       | Sand     |          |          |          |          |           |      |      |
|      | #40                         | #100 | #200 | Gravel (%) | Cor. (%) | Med. (%) | Fine (%) | Silt (%) | Clay (%) | Fines (%) |      |      |
| 66.0 | 60.9                        | 57.6 | 51.1 | 38.2       | 31.7     | 39.1     | 3.3      | 6.5      | 19.4     | 17.9      | 13.8 | 31.7 |

**Limits**

ASTM D 4318 Classification

ASTM D 2487

| Atterberg Limits | USCS Classification                 |
|------------------|-------------------------------------|
| LL PL PI         | Cu Cc                               |
| NP NP NP         | D10 D30 D60                         |
|                  | SC-SM SILTY CLAYEY SAND WITH GRAVEL |
|                  | 1333 0.28 0.003 0.058 0.402 4.00    |

# Permeability Test Report

Project: Ravenna Arsenal (FBQ-172)

Client: SpecPro, Inc.

**Sample Data:**

| Sample Number | Sample Type | Depth (ft) |
|---------------|-------------|------------|
| FBQ-172       | ST          | 0-2        |

$K_{20^{\circ}\text{C}} = 2.58\text{E-}06 \text{ cm/sec}$

**Test Conditions:**

| Permeant Liquid           | Back Pressure | Hydraulic Gradient | Consolidation Stress |           | Total Test Time (min) | Total Flow (cc) |
|---------------------------|---------------|--------------------|----------------------|-----------|-----------------------|-----------------|
|                           |               |                    | Max (psi)            | Min (psi) |                       |                 |
| De-aired/De-ionized water | 50 psi        | 5 psi              | 6                    | 2         | 300                   | 80.5            |

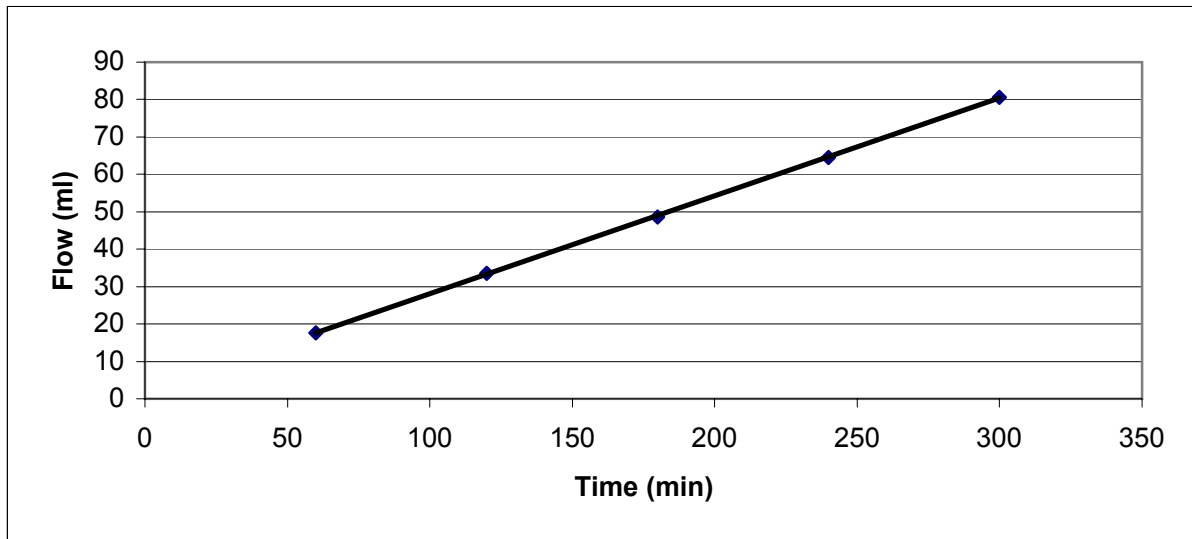
**Initial Sample Data:**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 14.7         | 70.8           | 7.256         | 8.379       | 41.35                   | 131.3             | 117.7             |

**Final Sample Data**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 16.6         | 100.0          | 7.242         | 8.358       | 41.20                   | 135.1             | 115.9             |

| Reading | Time (h:m) | Chamber | Upper | Lower | Flow | K <sub>20</sub> (cm/s) |
|---------|------------|---------|-------|-------|------|------------------------|
| 1       | 0:00       | 50.2    | 377.2 | 26.1  | 0.0  | --                     |
| 2       | 1:00       | 50.2    | 359.2 | 43.2  | 17.6 | 2.82E-06               |
| 3       | 2:00       | 48.6    | 342.8 | 58.7  | 33.5 | 2.68E-06               |
| 4       | 3:00       | 50.2    | 328.0 | 74.2  | 48.6 | 2.60E-06               |
| 5       | 4:00       | 50.2    | 311.6 | 89.7  | 64.6 | 2.59E-06               |
| 6       | 5:00       | 50.2    | 295.2 | 105.1 | 80.5 | 2.58E-06               |



J&L Laboratories, Inc.

1/7/2004

**Laboratory Test Summary**  
**JL03433**  
 1/7/2004

**Sample Data**

ASTM D 2216

| Sample Number | Sample (m) | Depth (ft) | Tare Number | Tare Weight | Wet Weight | Dry Weight | Sample Weight | Moisture Content |
|---------------|------------|------------|-------------|-------------|------------|------------|---------------|------------------|
| FBQ-168-ST1   | --         | 0-2        | 262         | 9.60        | 528.18     | 450.40     | 440.80        | 17.6%            |

**Bulk Density**

ASTM D 2937

| Total Weight | Tube Weight | Sample Weight | Diameter (in) | Length (in) | Volume (cm <sup>3</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|-------------|---------------|---------------|-------------|---------------------------|-------------------|-------------------|
| 537.3        | 0.00        | 537.3         | 2.785         | 3.207       | 320.213                   | 104.8             | 89.0              |

**Specific Gravity (-10 Material)**

ASTM D 854

| Sample Weight (Mo) | Full Pycno (Mb) | Temp (°C) | Density Water d(T <sub>b</sub> ) | Correction K | Pynco/Water (M <sub>a</sub> at T <sub>b</sub> ) | Specific Gravity (T <sub>b</sub> ) | Specific Gravity (T <sub>20</sub> ) | Porosity (n) | V <sub>s</sub> | V <sub>w</sub> | V <sub>a</sub> |
|--------------------|-----------------|-----------|----------------------------------|--------------|---|------------------------------------|-------------------------------------|--------------|----------------|----------------|----------------|
| 40.68              | 188.27          | 20.7      | 0.99809                          | 0.9999       | 162.77  | 2.680                              | 2.679                               | 0.468        | 53.2%          | 25.2%          | 21.6%          |

**Particle Size Distribution**

ASTM D 422

| 3/8" | #4   | #10  | #40  | #100 | #200 | Sand       |          |          | Silt (%) | Clay (%) | Fines (%) |      |
|------|------|------|------|------|------|------------|----------|----------|----------|----------|-----------|------|
|      |      |      |      |      |      | Gravel (%) | Cor. (%) | Med. (%) |          |          |           |      |
| 96.8 | 94.6 | 92.1 | 84.1 | 72.1 | 67.6 | 5.4        | 2.5      | 8.0      | 16.5     | 39.6     | 28.0      | 67.6 |

**Limits**

ASTM D 4318 Classification

| LL   | PL   | PI  | USCS Classification | Cu | Cc   | D10   | D30   | D50   | D60   |
|------|------|-----|---------------------|----|------|-------|-------|-------|-------|
| 27.2 | 20.0 | 7.2 | CL SANDY LEAN CLAY  | 10 | 0.41 | 0.003 | 0.006 | 0.019 | 0.029 |

# Permeability Test Report

Project: Ravenna Arsenal (FBQ-168-ST1)

Client: SpecPro, Inc.

**Sample Data:**

| Sample Number | Sample Type | Depth (ft) |
|---------------|-------------|------------|
| FBQ-168-ST1   | ST          | 0-2        |

$K_{20^{\circ}\text{C}} = 2.51\text{E-}06 \text{ cm/sec}$

**Test Conditions:**

| Permeant Liquid           | Back Pressure | Hydraulic Gradient | Consolidation Stress |           | Total Test Time (min) | Total Flow (cc) |
|---------------------------|---------------|--------------------|----------------------|-----------|-----------------------|-----------------|
|                           |               |                    | Max (psi)            | Min (psi) |                       |                 |
| De-aired/De-ionized water | 40 psi        | 5 psi              | 6                    | 2         | 360                   | 92.8            |

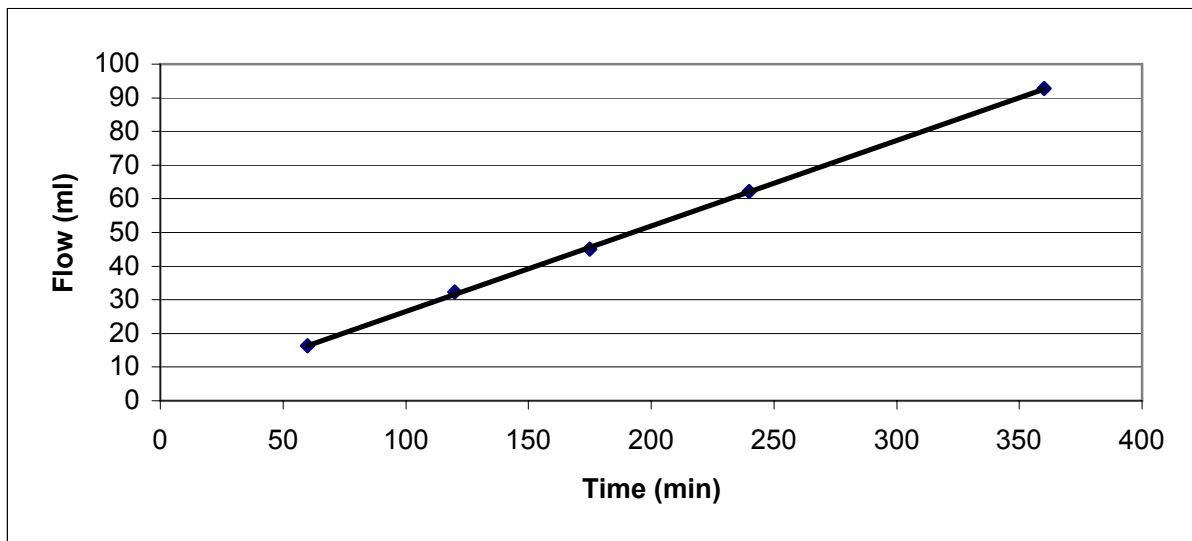
**Initial Sample Data:**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 34.1         | 53.8           | 7.074         | 8.147       | 39.31                   | 104.8             | 89.0              |

**Final Sample Data**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 28.5         | 100.0          | 7.089         | 8.128       | 39.47                   | 110.2             | 85.7              |

| Reading | Time (h:m) | Chamber | Upper | Lower | Flow | K <sub>20</sub> (cm/s) |
|---------|------------|---------|-------|-------|------|------------------------|
| 1       | 0:00       | 90.7    | 385.4 | 24.5  | 0.0  | --                     |
| 2       | 1:00       | 90.7    | 369.0 | 40.8  | 16.4 | 2.66E-06               |
| 3       | 2:00       | 90.7    | 352.6 | 56.2  | 32.3 | 2.62E-06               |
| 4       | 2:55       | 89.1    | 336.2 | 65.2  | 45.0 | 2.51E-06               |
| 5       | 4:00       | 89.1    | 321.4 | 84.8  | 62.1 | 2.53E-06               |
| 6       | 6:00       | 87.5    | 287.8 | 112.5 | 92.8 | 2.51E-06               |



J&L Laboratories, Inc.

1/7/2004



**Laboratory Test Summary**  
**JL03433**  
 1/7/2004

**Sample Data**

ASTM D 2216

| Sample Number | Sample (m) | Depth (ft) | Depth (m) | Tare Number | Tare Weight (in) | Tare Weight (cm <sup>3</sup> ) | Wet Weight | Dry Weight | Sample Weight | Moisture Content |
|---------------|------------|------------|-----------|-------------|------------------|--------------------------------|------------|------------|---------------|------------------|
| FBQ-168-ST2   | --         | --         | --        | 263         | 9.59             | 401.075                        | 556.06     | 488.61     | 479.02        | 14.1%            |

**Bulk Density**

ASTM D 2937

| Total Weight | Tube Weight | Sample Weight | Diameter (in) | Length (in) | Volume (cm <sup>3</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|-------------|---------------|---------------|-------------|---------------------------|-------------------|-------------------|
| 832.7        | 0.00        | 832.71        | 2.832         | 3.886       | 401.075                   | 129.6             | 113.6             |

**Specific Gravity (-10 Material)**

ASTM D 854

| Sample Weight (Mo) | Full Pycno (Mb) | Temp (°C) | Density Water d(T <sub>b</sub> ) | Correction K | Pycno/Water (M <sub>a</sub> at T <sub>b</sub> ) | Specific Gravity (T <sub>b</sub> ) | Porosity (n) | Specific Gravity (T <sub>20</sub> ) | V <sub>s</sub> | V <sub>w</sub> | V <sub>a</sub> |
|--------------------|-----------------|-----------|----------------------------------|--------------|---|------------------------------------|--------------|-------------------------------------|----------------|----------------|----------------|
| 39.52              | 188.00          | 20.8      | 0.99806                          | 0.9998       | 163.04  | 2.714                              | 0.329        | 2.713                               | 67.1%          | 25.6%          | 7.3%           |

**Particle Size Distribution**

ASTM D 422

| 3/8" | #4   | Percent Passing (by weight) |      |      | Sand       |          |          | Clay (%) | Fines (%) |      |      |
|------|------|-----------------------------|------|------|------------|----------|----------|----------|-----------|------|------|
|      |      | #10                         | #100 | #200 | Gravel (%) | Cor. (%) | Med. (%) |          |           |      |      |
| 95.1 | 92.7 | 89.6                        | 79.6 | 54.6 | 7.3        | 3.1      | 10.0     | 31.2     | 27.0      | 21.4 | 48.4 |

**Limits**

ASTM D 4318 Classification

| LL   | PL   | PI   | USCS Classification | Cu | Cc   | D10   | D30   | D50   | D60   |
|------|------|------|---------------------|----|------|-------|-------|-------|-------|
| 25.8 | 15.6 | 10.2 | SC CLAYEY SAND      | 70 | 0.23 | 0.003 | 0.012 | 0.094 | 0.209 |

# Permeability Test Report

Project: Ravenna Arsenal (FBQ-168-ST2)

Client: SpecPro, Inc.

**Sample Data:**

| Sample Number | Sample Type | Depth (ft) |
|---------------|-------------|------------|
| FBQ-168-ST2   | ST          | --         |

$K_{20^{\circ}\text{C}} = 1.03\text{E-}06 \text{ cm/sec}$

**Test Conditions:**

| Permeant Liquid           | Back Pressure | Hydraulic Gradient | Consolidation Stress |           | Total Test Time (min) | Total Flow (cc) |
|---------------------------|---------------|--------------------|----------------------|-----------|-----------------------|-----------------|
|                           |               |                    | Max (psi)            | Min (psi) |                       |                 |
| De-aired/De-ionized water | 40 psi        | 5 psi              | 6                    | 2         | 1590                  | 143.5           |

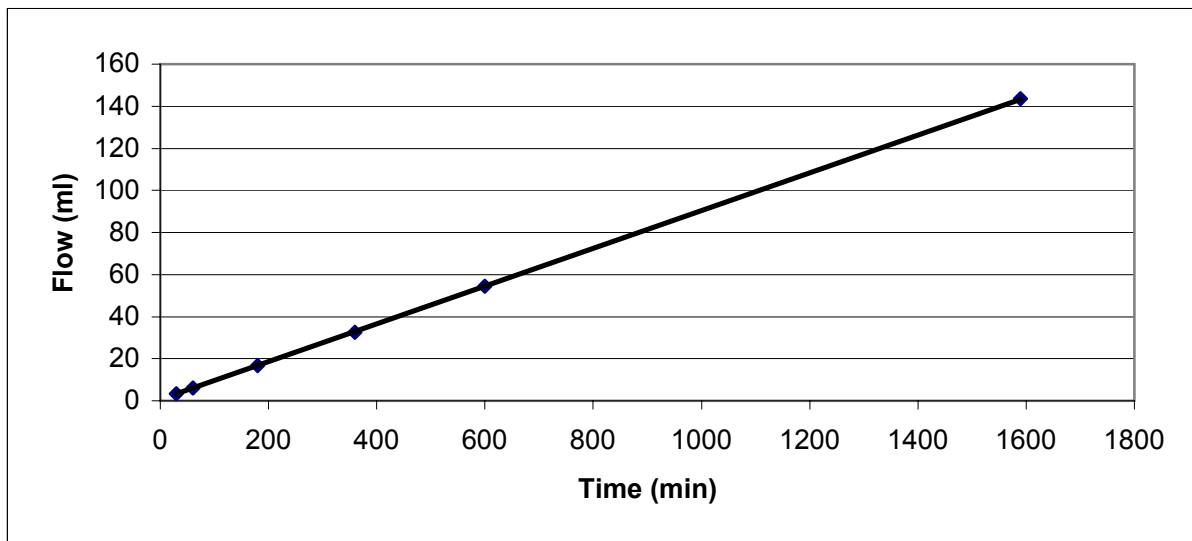
**Initial Sample Data:**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 16.8         | 77.8           | 7.193         | 9.869       | 40.64                   | 129.6             | 113.6             |

**Final Sample Data**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 19.3         | 100.0          | 7.159         | 9.666       | 40.25                   | 133.6             | 112.0             |

| Reading | Time (h:m) | Chamber | Upper | Lower | Flow  | K <sub>20</sub> (cm/s) |
|---------|------------|---------|-------|-------|-------|------------------------|
| 1       | 0:00       | 38.9    | 385.4 | 20.4  | 0.0   | --                     |
| 2       | 0:30       | 40.5    | 381.3 | 22.8  | 3.3   | 1.24E-06               |
| 3       | 1:00       | 42.1    | 378.8 | 26.1  | 6.1   | 1.16E-06               |
| 4       | 3:00       | 40.5    | 370.6 | 39.1  | 16.8  | 1.06E-06               |
| 5       | 6:00       | 40.5    | 359.2 | 59.5  | 32.7  | 1.03E-06               |
| 6       | 10:00      | 37.3    | 331.3 | 75.0  | 54.4  | 1.03E-06               |
| 7       | 26:30      | 48.6    | 242.7 | 164.6 | 143.5 | 1.03E-06               |



**Laboratory Test Summary**  
**JL03433**  
 1/7/2004

**Sample Data**

ASTM D 2216

| Sample Number | Sample (m) | Depth (ft) | Tare Number | Tare Weight | Wet Weight | Dry Weight | Sample Weight | Moisture Content |
|---------------|------------|------------|-------------|-------------|------------|------------|---------------|------------------|
| FBQ-166-ST3   | --         | --         | 264         | 9.52        | 373.77     | 318.74     | 309.22        | 17.8%            |

**Bulk Density**

ASTM D 2937

| Total Weight | Tube Weight | Sample Weight | Diameter (in) | Length (in) | Volume (cm <sup>3</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|-------------|---------------|---------------|-------------|---------------------------|-------------------|-------------------|
| 918.6        | 0.00        | 918.55        | 2.830         | 4.278       | 441.001                   | 130.0             | 110.4             |

**Specific Gravity (-10 Material)**

ASTM D 854

| Sample Weight (Mo) | Full Pycno (Mb) | Temp (°C) | Density Water d(T <sub>b</sub> ) | Correction K | Pycno/Water (M <sub>a</sub> at T <sub>b</sub> ) | Specific Gravity (T <sub>b</sub> ) | Specific Gravity (T <sub>20</sub> ) | Porosity (n) | V <sub>s</sub> | V <sub>w</sub> | V <sub>a</sub> |
|--------------------|-----------------|-----------|----------------------------------|--------------|---|------------------------------------|-------------------------------------|--------------|----------------|----------------|----------------|
| 39.66              | 187.66          | 20.7      | 0.99809                          | 0.9999       | 162.43  | 2.749                              | 2.748                               | 0.357        | 64.3%          | 31.5%          | 4.2%           |

**Particle Size Distribution**

ASTM D 422

| 3/8" | Percent Passing (by weight) |      |      |      | Sand       |          |          |          |          |          |           |
|------|-----------------------------|------|------|------|------------|----------|----------|----------|----------|----------|-----------|
|      | #4                          | #10  | #100 | #200 | Gravel (%) | Cor. (%) | Med. (%) | Fine (%) | Silt (%) | Clay (%) | Fines (%) |
| 97.0 | 95.2                        | 93.2 | 88.9 | 80.1 | 4.8        | 2.0      | 4.3      | 8.8      | 34.0     | 46.1     | 80.1      |

**Limits** ASTM D 4318 Classification

ASTM D 2487

| Atterberg Limits |      | USCS Classification |    |      |       |
|------------------|------|---------------------|----|------|-------|
| LL               | PL   | PI                  | Cu | Cc   | D60   |
| 30.6             | 16.7 | 14.0                | 12 | 0.75 | D60   |
|                  |      |                     |    |      | D50   |
|                  |      |                     |    |      | D30   |
|                  |      |                     |    |      | D10   |
|                  |      |                     |    |      | D0.75 |
|                  |      |                     |    |      | 0.007 |
|                  |      |                     |    |      | 0.003 |
|                  |      |                     |    |      | 0.012 |

# Permeability Test Report

Project: Ravenna Arsenal (FBQ-166-ST3)

Client: SpecPro, Inc.

**Sample Data:**

| Sample Number | Sample Type | Depth (ft) |
|---------------|-------------|------------|
| FBQ-166-ST3   | ST          | --         |

$K_{20^{\circ}\text{C}} = 5.67\text{E-}08 \text{ cm/sec}$

**Test Conditions:**

| Permeant Liquid           | Back Pressure | Hydraulic Gradient | Consolidation Stress |           | Total Test Time (min) | Total Flow (cc) |
|---------------------------|---------------|--------------------|----------------------|-----------|-----------------------|-----------------|
|                           |               |                    | Max (psi)            | Min (psi) |                       |                 |
| De-aired/De-ionized water | 45 psi        | 5 psi              | 6                    | 2         | 1440                  | 6.6             |

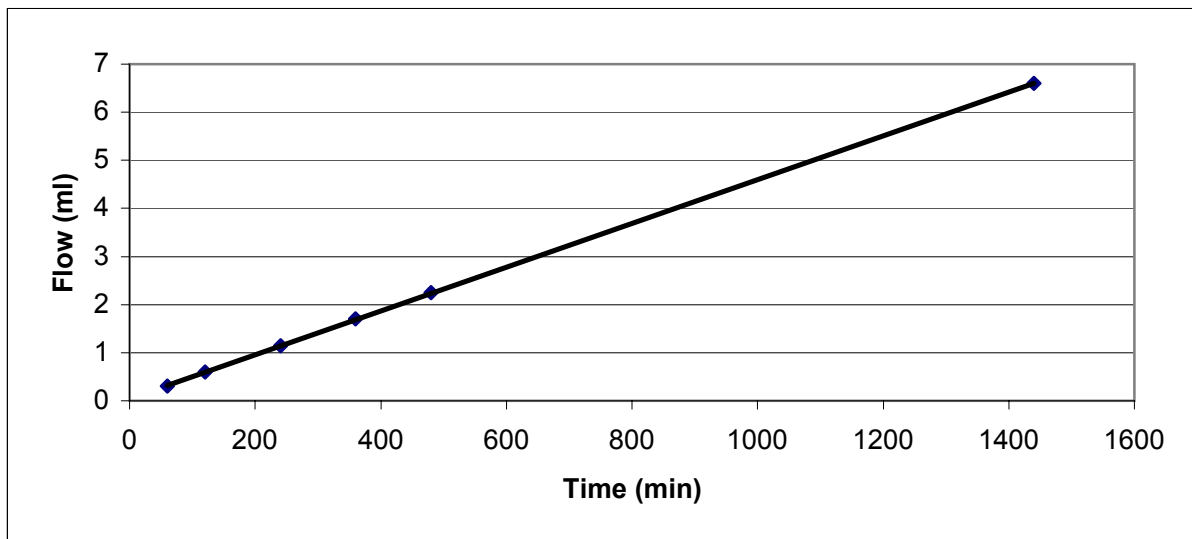
**Initial Sample Data:**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 17.8         | 88.2           | 7.188         | 10.867      | 40.58                   | 130.0             | 110.4             |

**Final Sample Data**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 21.7         | 100.0          | 7.248         | 10.772      | 41.26                   | 131.3             | 107.9             |

| Reading | Time (h:m) | Chamber | Upper | Lower | Flow | K <sub>20</sub> (cm/s) |
|---------|------------|---------|-------|-------|------|------------------------|
| 1       | 0:00       | 9.3     | 24.9  | 1.7   | 0.0  | --                     |
| 2       | 1:00       | 9.2     | 24.6  | 2.0   | 0.3  | 6.18E-08               |
| 3       | 2:00       | 9.2     | 24.3  | 2.3   | 0.6  | 6.18E-08               |
| 4       | 4:00       | 9.2     | 23.7  | 2.8   | 1.2  | 5.93E-08               |
| 5       | 6:00       | 9.1     | 23.2  | 3.4   | 1.7  | 5.84E-08               |
| 6       | 8:00       | 9.1     | 22.7  | 4.0   | 2.3  | 5.80E-08               |
| 7       | 24:00      | 9.0     | 18.3  | 8.3   | 6.6  | 5.67E-08               |



**Laboratory Test Summary**  
**JL03433**  
 1/7/2004

**Sample Data**

ASTM D 2216

| Sample Number | Sample (m) | Depth (ft) | Tare Number | Tare Weight | Wet Weight | Dry Weight | Sample Weight | Moisture Content |
|---------------|------------|------------|-------------|-------------|------------|------------|---------------|------------------|
| FBQ-166-ST2   | --         | 37656.00   | 121         | 9.41        | 642.95     | 558.04     | 548.63        | 15.5%            |

**Bulk Density**

ASTM D 2937

| Total Weight | Tube Weight | Sample Weight | Diameter (in) | Length (in) | Volume (cm <sup>3</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|-------------|---------------|---------------|-------------|---------------------------|-------------------|-------------------|
| 906.8        | 0.00        | 906.78        | 2.848         | 4.034       | 420.971                   | 134.5             | 116.4             |

**Specific Gravity (-10 Material)**

ASTM D 854

| Sample Weight (Mo) | Full Pycno (Mb) | Temp (°C) | Density Water d(T <sub>b</sub> ) | Correction K | Pycno/Water (M <sub>a</sub> at T <sub>b</sub> ) | Specific Gravity (T <sub>b</sub> ) | Specific Gravity (T <sub>20</sub> ) | Porosity (n) | V <sub>s</sub> | V <sub>w</sub> | V <sub>a</sub> |
|--------------------|-----------------|-----------|----------------------------------|--------------|---|------------------------------------|-------------------------------------|--------------|----------------|----------------|----------------|
| 41.28              | 187.83          | 20.8      | 0.99806                          | 0.9998       | 161.51  | 2.759                              | 2.759                               | 0.324        | 67.6%          | 28.9%          | 3.5%           |

**Particle Size Distribution**

ASTM D 422

| 3/8" | Percent Passing (by weight) |      |      | Sand       |          |          |
|------|-----------------------------|------|------|------------|----------|----------|
|      | #4                          | #10  | #200 | Gravel (%) | Cor. (%) | Med. (%) |
| 98.1 | 94.6                        | 87.3 | 70.6 | 5.4        | 7.3      | 16.7     |
|      |                             |      | 52.2 |            | 18.4     | 35.0     |
|      |                             |      | 55.7 |            | 17.2     | 52.2     |

**Limits**

ASTM D 4318 Classification

| Atterberg Limits |      | USCS Classification |                 |
|------------------|------|---------------------|-----------------|
| LL               | PI   | Cc                  | Cu              |
| 34.1             | 17.4 | 16.7                | 229             |
|                  |      | CL                  | SANDY LEAN CLAY |
|                  |      | D60                 | 0.032           |
|                  |      | D50                 | 0.003           |
|                  |      | D30                 | 0.001           |
|                  |      | D10                 | 0.003           |

ASTM D 2487

# Permeability Test Report

Project: Ravenna Arsenal (FBQ-166-ST2)

Client: SpecPro, Inc.

**Sample Data:**

| Sample Number | Sample Type | Depth (ft) |
|---------------|-------------|------------|
| FBQ-166-ST2   | ST          | 37656.0    |

$K_{20^{\circ}\text{C}} = 1.96\text{E-}08 \text{ cm/sec}$

**Test Conditions:**

| Permeant Liquid           | Back Pressure | Hydraulic Gradient | Consolidation Stress |           | Total Test Time (min) | Total Flow (cc) |
|---------------------------|---------------|--------------------|----------------------|-----------|-----------------------|-----------------|
|                           |               |                    | Max (psi)            | Min (psi) |                       |                 |
| De-aired/De-ionized water | 40 psi        | 5 psi              | 6                    | 2         | 1440                  | 2.4             |

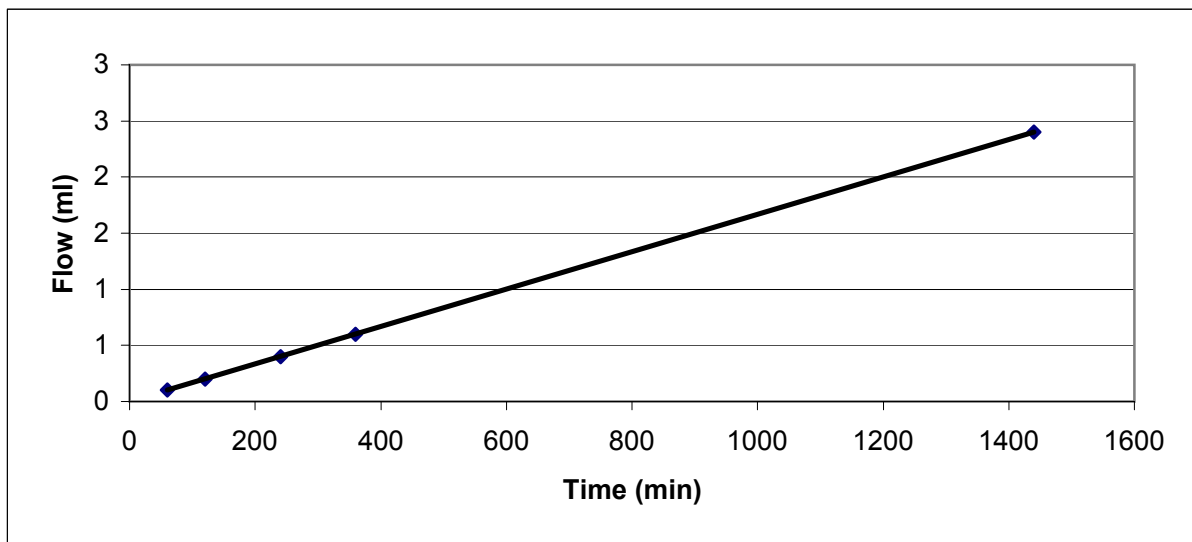
**Initial Sample Data:**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 12.2         | 89.1           | 7.233         | 10.245      | 41.09                   | 134.5             | 116.4             |

**Final Sample Data**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 17.5         | 100.0          | 7.250         | 10.235      | 41.28                   | 136.0             | 115.7             |

| Reading | Time (h:m) | Chamber | Upper | Lower | Flow | K <sub>20</sub> (cm/s) |
|---------|------------|---------|-------|-------|------|------------------------|
| 1       | 0:00       | 11.3    | 23.3  | 2.4   | 0.0  | --                     |
| 2       | 1:00       | 11.3    | 23.2  | 2.5   | 0.1  | 1.96E-08               |
| 3       | 2:00       | 11.5    | 23.1  | 2.6   | 0.2  | 1.96E-08               |
| 4       | 4:00       | 11.5    | 22.9  | 2.8   | 0.4  | 1.96E-08               |
| 5       | 6:00       | 11.3    | 22.7  | 3.0   | 0.6  | 1.96E-08               |
| 6       | 24:00      | 11.3    | 20.9  | 4.8   | 2.4  | 1.96E-08               |



**Laboratory Test Summary**  
**JL03433**  
 1/7/2004

**Sample Data**

ASTM D 2216

| Sample Number | Sample (m) | Depth (ft) | Tare Number | Tare Weight | Wet Weight | Dry Weight | Sample Weight | Moisture Content |
|---------------|------------|------------|-------------|-------------|------------|------------|---------------|------------------|
| FBQ-166-ST1   | --         | 0-2        | 122         | 9.36        | 605.87     | 528.41     | 519.05        | 14.9%            |

**Bulk Density**

ASTM D 2937

| Total Weight | Tube Weight | Sample Weight | Diameter (in) | Length (in) | Volume (cm <sup>3</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|-------------|---------------|---------------|-------------|---------------------------|-------------------|-------------------|
| 738.2        | 0.00        | 738.17        | 2.815         | 3.646       | 371.892                   | 123.9             | 107.8             |

**Specific Gravity (-10 Material)**

ASTM D 854

| Sample Weight (Mo) | Full Pycno (Mb) | Temp (°C) | Density Water d(T <sub>b</sub> ) | Correction K | Pycno/Water (M <sub>a</sub> at T <sub>b</sub> ) | Specific Gravity (T <sub>b</sub> ) | Porosity (n) | Specific Gravity (T <sub>20</sub> ) | V <sub>s</sub> | V <sub>w</sub> | V <sub>a</sub> |
|--------------------|-----------------|-----------|----------------------------------|--------------|---|------------------------------------|--------------|-------------------------------------|----------------|----------------|----------------|
| 39.53              | 188.79          | 20.8      | 0.99806                          | 0.9998       | 163.73  | 2.731                              | 0.368        | 2.731                               | 63.2%          | 25.8%          | 11.0%          |

**Particle Size Distribution**

ASTM D 422

| 3/8" | #4   | Percent Passing (by weight) |      |      | Sand       |          |          | Clay (%) | Fines (%) |      |      |
|------|------|-----------------------------|------|------|------------|----------|----------|----------|-----------|------|------|
|      |      | #10                         | #40  | #200 | Gravel (%) | Cor. (%) | Med. (%) |          |           |      |      |
| 91.4 | 81.1 | 67.5                        | 46.2 | 31.3 | 18.9       | 13.6     | 21.3     | 14.9     | 9.7       | 21.6 | 31.3 |

**Limits**

ASTM D 4318 Classification

| LL   | PL   | PI   | USCS Classification        | Cu | Cc   | D10   | D30   | D50   | D60   |
|------|------|------|----------------------------|----|------|-------|-------|-------|-------|
| 35.3 | 17.9 | 17.5 | SC CLAYEY SAND WITH GRAVEL | 28 | 0.04 | 0.001 | 0.001 | 0.015 | 0.028 |

# Permeability Test Report

Project: Ravenna Arsenal (FBQ-166-ST1)

Client: SpecPro, Inc.

**Sample Data:**

| Sample Number | Sample Type | Depth (ft) |
|---------------|-------------|------------|
| FBQ-166-ST1   | ST          | 0-2        |

$K_{20^{\circ}\text{C}} = 3.62\text{E-}07 \text{ cm/sec}$

**Test Conditions:**

| Permeant Liquid           | Back Pressure | Hydraulic Gradient | Consolidation Stress |           | Total Test Time (min) | Total Flow (cc) |
|---------------------------|---------------|--------------------|----------------------|-----------|-----------------------|-----------------|
|                           |               |                    | Max (psi)            | Min (psi) |                       |                 |
| De-aired/De-ionized water | 40 psi        | 2 psi              | 6                    | 2         | 1200                  | 15.8            |

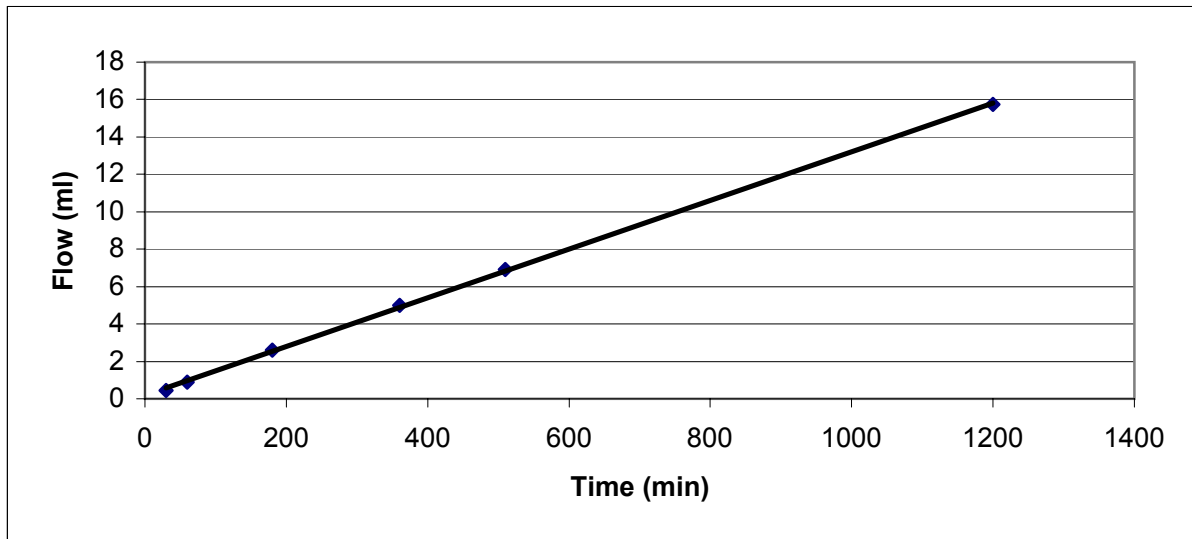
**Initial Sample Data:**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 21.9         | 70.1           | 7.151         | 9.261       | 40.16                   | 123.9             | 107.8             |

**Final Sample Data**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 25.3         | 100.0          | 7.097         | 9.223       | 39.56                   | 127.7             | 101.9             |

| Reading | Time (h:m) | Chamber | Upper | Lower | Flow | K <sub>20</sub> (cm/s) |
|---------|------------|---------|-------|-------|------|------------------------|
| 1       | 0:00       | 13.6    | 24.2  | 1.0   | 0.0  | --                     |
| 2       | 0:30       | 13.6    | 23.7  | 1.4   | 0.5  | 4.14E-07               |
| 3       | 1:00       | 13.7    | 23.3  | 1.9   | 0.9  | 4.14E-07               |
| 4       | 3:00       | 13.7    | 21.6  | 3.6   | 2.6  | 3.99E-07               |
| 5       | 6:00       | 13.6    | 19.2  | 6.0   | 5.0  | 3.83E-07               |
| 6       | 8:30       | 13.4    | 17.3  | 7.9   | 6.9  | 3.74E-07               |
| 7       | 20:00      | 13.6    | 8.5   | 16.8  | 15.8 | 3.62E-07               |



J&L Laboratories, Inc.

1/7/2004



**Laboratory Test Summary**  
**JL03433**  
 1/7/2004

**Sample Data**

ASTM D 2216

| Sample Number | Sample (m) | Depth (ft) | Tare Number | Tare Weight | Wet Weight | Dry Weight | Sample Weight | Moisture Content |
|---------------|------------|------------|-------------|-------------|------------|------------|---------------|------------------|
| FBQ-174       | --         | 0-2        | 120         | 9.40        | 638.72     | 582.83     | 573.43        | 9.7%             |

**Bulk Density**

ASTM D 2937

| Total Weight | Tube Weight | Sample Weight | Diameter (in) | Length (in) | Volume (cm <sup>3</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|-------------|---------------|---------------|-------------|---------------------------|-------------------|-------------------|
| 793.9        | 0.00        | 793.88        | 2.824         | 3.753       | 385.269                   | 128.6             | 117.2             |

**Specific Gravity (-10 Material)**

ASTM D 854

| Sample Weight (Mo) | Full Pycno (Mb) | Temp (°C) | Density Water d(T <sub>b</sub> ) | Correction K | Pycno/Water (M <sub>a</sub> at T <sub>b</sub> ) | Specific Gravity (T <sub>b</sub> ) | Porosity (n) | Specific Gravity (T <sub>20</sub> ) | V <sub>w</sub> | V <sub>s</sub> | V <sub>a</sub> |
|--------------------|-----------------|-----------|----------------------------------|--------------|---|------------------------------------|--------------|-------------------------------------|----------------|----------------|----------------|
| 40.12              | 188.79          | 20.8      | 0.99806                          | 0.9998       | 163.55  | 2.697                              | 0.304        | 2.697                               | 18.3%          | 69.6%          | 12.1%          |

**Particle Size Distribution**

ASTM D 422

| 3/8" | #4   | Percent Passing (by weight) |      |      | Sand       |          |          |          |          |          |           |
|------|------|-----------------------------|------|------|------------|----------|----------|----------|----------|----------|-----------|
|      |      | #10                         | #40  | #100 | Gravel (%) | Cor. (%) | Med. (%) | Fine (%) | Silt (%) | Clay (%) | Fines (%) |
| 70.5 | 66.9 | 64.1                        | 51.6 | 24.9 | 33.1       | 2.8      | 12.5     | 33.4     | 8.1      | 10.1     | 18.2      |

**Limits**

ASTM D 4318 Classification

| LL | PL | PI | USCS Classification                 | Cu | Cc   | D10   | D30   | D50   | D60   |
|----|----|----|-------------------------------------|----|------|-------|-------|-------|-------|
| NP | NP | NP | SC-SM SILTY CLAYEY SAND WITH GRAVEL | 28 | 0.04 | 0.001 | 0.001 | 0.015 | 0.028 |

# Permeability Test Report

Project: Ravenna Arsenal (FBQ-174)

Client: SpecPro, Inc.

**Sample Data:**

| Sample Number | Sample Type | Depth (ft) |
|---------------|-------------|------------|
| FBQ-174       | ST          | 0-2        |

$K_{20^{\circ}\text{C}} = 2.61\text{E-}06 \text{ cm/sec}$

**Test Conditions:**

| Permeant Liquid           | Back Pressure | Hydraulic Gradient | Consolidation Stress |           | Total Test Time (min) | Total Flow (cc) |
|---------------------------|---------------|--------------------|----------------------|-----------|-----------------------|-----------------|
|                           |               |                    | Max (psi)            | Min (psi) |                       |                 |
| De-aired/De-ionized water | 55 psi        | 5 psi              | 6                    | 2         | 1320                  | 310.6           |

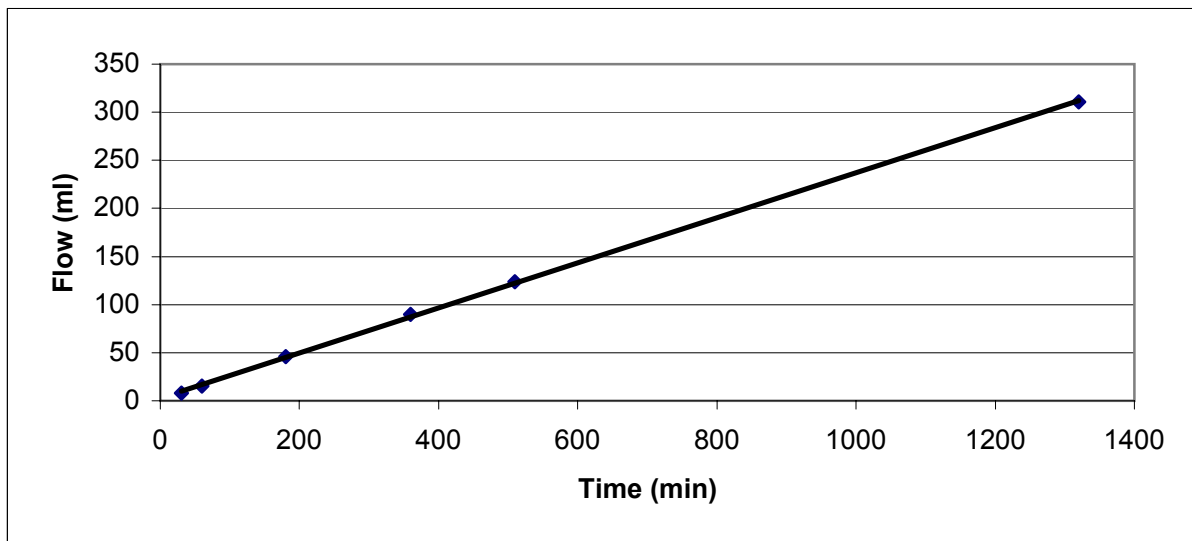
**Initial Sample Data:**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 10.8         | 60.3           | 7.174         | 9.532       | 40.42                   | 128.6             | 117.2             |

**Final Sample Data**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 15.3         | 100.0          | 7.147         | 9.406       | 40.11                   | 135.1             | 117.2             |

| Reading | Time (h:m) | Chamber | Upper | Lower | Flow  | K <sub>20</sub> (cm/s) |
|---------|------------|---------|-------|-------|-------|------------------------|
| 1       | 0:00       | 63.2    | 382.9 | 23.6  | 0.0   | --                     |
| 2       | 0:30       | 63.2    | 375.6 | 31.8  | 7.8   | 2.87E-06               |
| 3       | 1:00       | 64.8    | 367.4 | 39.1  | 15.5  | 2.88E-06               |
| 4       | 3:00       | 66.4    | 337.0 | 70.1  | 46.2  | 2.85E-06               |
| 5       | 6:00       | 59.9    | 293.6 | 114.1 | 89.9  | 2.77E-06               |
| 6       | 8:30       | 56.7    | 259.9 | 148.3 | 123.8 | 2.70E-06               |
| 7       | 22:00      | 66.4    | 73.8  | 335.8 | 310.6 | 2.61E-06               |



J&L Laboratories, Inc.

1/7/2004

| Sample ID    | Moisture Content (%) | Percent Passing (by weight) |    |     |     |      |      |        | Particle Size Distribution |      |      |      | Atterberg Limits |       | USCS Classification | Bulk Density |    | Hyd. Cond. (cm/s) | pH    |       |                          |           |
|--------------|----------------------|-----------------------------|----|-----|-----|------|------|--------|----------------------------|------|------|------|------------------|-------|---------------------|--------------|----|-------------------|-------|-------|--------------------------|-----------|
|              |                      | 3/8"                        | #4 | #10 | #40 | #100 | #200 | Gravel | Cor.                       | Med. | Fine | Silt | Clay             | Fines |                     | LL           | PL |                   |       | PI    | Wet (pcf)                | Dry (pcf) |
| FBQ-169      | 18                   | 96                          | 94 | 90  | 82  | 74   | 71   | 6      | 4                          | 8    | 11   | 25   | 46               | 71    | 45                  | 21           | 24 | 126.9             | 107.1 | 0.377 | $8.36 \cdot 10^{-8}$     | 5.9       |
| FBQ-173      | 13                   | 94                          | 91 | 86  | 77  | 62   | 56   | 9      | 5                          | 9    | 21   | 34   | 22               | 56    | 27                  | 17           | 10 | 129.0             | 113.7 | 0.301 | $2.52 \cdot 10^{-6}$     | 4.0       |
| FBQ-167 ST 2 | 13                   | 85                          | 79 | 71  | 55  | 41   | 36   | 21     | 8                          | 16   | 19   | 23   | 13               | 36    | 21                  | 17           | 4  | 144.1             | 128.0 | 0.245 | $4.15 \cdot 10^{-7}$ (1) | 6.3       |
| FBQ-167 ST 1 | 19                   | 99                          | 97 | 94  | 84  | 68   | 65   | 3      | 3                          | 10   | 19   | 23   | 42               | 65    | 36                  | 19           | 17 | 131.2             | 110.8 | 0.353 | $4.52 \cdot 10^{-6}$     | 6.0       |

Notes: (1) - Sample recompacted for permeability test

CLIENTS NAME: Spec Pro  
 PROJECT MANAGER: Chantelle Carroll  
 PROJECT NAME: RVAAP-FuzeBooster  
 PROJECT LOCATION (Twp, City, County, State): Arsenal (Littab)  
 LABORATORY ADDRESS:

CLIENTS ADDRESS: 8451 St 5, Ravenna OH  
 PHONE NUMBER: 330-330-1754  
 PROJECT NUMBER:   
 FAX NUMBER: 330-358-1754  
 PHONE NUMBER: ccarroll@specpro-inc.com  
 PROJECT NUMBER:   
 FAX NUMBER:

**ANALYSIS REQUIRED**

TAT:  24 Hours  48 Hours  72 Hours  Standard 7 or 14 Days

REPORTING:  Verbal  Fax  Hardcopy

| SAMPLE DESCRIPTION | COLLECTION DATE | COLLECTION TIME | MATRIX SOIL/WATER | CONTAINERS |             |              | PRESERVATIVE | LAB SAMPLE #         | COMMENTS |
|--------------------|-----------------|-----------------|-------------------|------------|-------------|--------------|--------------|----------------------|----------|
|                    |                 |                 |                   | NO.        | TYPE (VOL.) | LAB SAMPLE # |              |                      |          |
| FBQ-169            | 10/13/03        | 1135            | Soil              | 1          | 5T          |              |              | Moisture Content     |          |
| FBQ-173            | 10/13/03        | 1430            | Soil              | 1          | 5T          |              |              | USC                  |          |
| FBQ-167 5T-2       | 10/13/03        | 1655            | Soil              | 1          | 5T          |              |              | Particle Size Dist   |          |
| FBQ-167 5T-1       | 10/13/03        | 1640            | Soil              | 1          | 5T          |              |              | USC / Plastic Limits |          |
|                    |                 |                 |                   |            |             |              |              | SPG                  |          |
|                    |                 |                 |                   |            |             |              |              | Back Density         |          |
|                    |                 |                 |                   |            |             |              |              | Porosity             |          |
|                    |                 |                 |                   |            |             |              |              | Hydraulic Conduct    |          |
|                    |                 |                 |                   |            |             |              |              | pH                   |          |

SAMPLED BY (Please Print Name):  ACCEPTED BY / AFFILIATION (Print Name / Signature): Tom Maxwell / J&L

RELINQUISHED BY / AFFILIATION (Print Name / Signature): C. Carroll / Carroll DATE: 10/22 TIME: 10:00

DATE: 10/22 TIME: 10:10 AM

ADDITIONAL COMMENTS:

**Laboratory Test Summary**  
**JL03433**  
 1/7/2004

**Sample Data**

ASTM D 2216

| Sample Number | Sample (m) | Depth (ft) | Tare Number | Tare Weight | Wet Weight | Dry Weight | Sample Weight | pH   | Moisture Content |
|---------------|------------|------------|-------------|-------------|------------|------------|---------------|------|------------------|
| FBQ-169       | --         | --         | 100         | 9.42        | 698.47     | 591.15     | 581.73        | 5.89 | 18.4%            |

**Bulk Density**

ASTM D 2937

| Total Weight | Tube Weight | Sample Weight | Diameter (in) | Length (in) | Volume (cm <sup>3</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|-------------|---------------|---------------|-------------|---------------------------|-------------------|-------------------|
| 875.9        | 0.00        | 875.9         | 2.828         | 4.188       | 430.977                   | 126.9             | 107.1             |

**Specific Gravity (-10 Material)**

ASTM D 854

| Sample Weight (Mo) | Full Pycno (Mb) | Temp (°C) | Density Water d(T <sub>b</sub> ) | Correction K | Pycno/Water (M <sub>a</sub> at T <sub>b</sub> ) | Specific Gravity (T <sub>b</sub> ) | Specific Gravity (T <sub>20</sub> ) | Porosity (n) | V <sub>s</sub> | V <sub>w</sub> | V <sub>a</sub> |
|--------------------|-----------------|-----------|----------------------------------|--------------|---|------------------------------------|-------------------------------------|--------------|----------------|----------------|----------------|
| 39.16              | 187.74          | 20.8      | 0.99805                          | 0.9998       | 162.79  | 2.756                              | 2.756                               | 0.377        | 62.3%          | 31.7%          | 6.1%           |

**Particle Size Distribution**

ASTM D 422

| 3/8" | Percent Passing (by weight) |      |      |      | Sand       |          |          |          |          |          |           |      |
|------|-----------------------------|------|------|------|------------|----------|----------|----------|----------|----------|-----------|------|
|      | #4                          | #10  | #100 | #200 | Gravel (%) | Cor. (%) | Med. (%) | Fine (%) | Silt (%) | Clay (%) | Fines (%) |      |
| 96.4 | 93.9                        | 90.1 | 81.9 | 74.3 | 71.0       | 6.1      | 3.8      | 8.2      | 10.9     | 24.7     | 46.3      | 71.0 |

**Limits**

ASTM D 4318 Classification

ASTM D 2487

| Atterberg Limits | USCS Classification |      |                               |      |       |       |       |
|------------------|---------------------|------|-------------------------------|------|-------|-------|-------|
| LL               | PL                  | PI   | Cu                            | Cc   | D10   | D30   | D60   |
| 44.6             | 20.6                | 24.0 | 16                            | 0.56 | 0.001 | 0.003 | 0.016 |
|                  |                     |      | <b>CL LEAN CLAY WITH SAND</b> |      |       |       |       |

# Permeability Test Report

Project: Ravenna Arsenal (FBQ-169)

Client: SpecPro, Inc.

**Sample Data:**

| Sample Number | Sample Type | Depth (ft) |
|---------------|-------------|------------|
| FBQ-169       | ST          | --         |

$K_{20^{\circ}\text{C}} = 8.36\text{E-}08 \text{ cm/sec}$

**Test Conditions:**

| Permeant Liquid           | Back Pressure | Hydraulic Gradient | Consolidation Stress |           | Total Test Time (min) | Total Flow (cc) |
|---------------------------|---------------|--------------------|----------------------|-----------|-----------------------|-----------------|
|                           |               |                    | Max (psi)            | Min (psi) |                       |                 |
| De-aired/De-ionized water | 40 psi        | 5 psi              | 6                    | 2         | 1200                  | 8.3             |

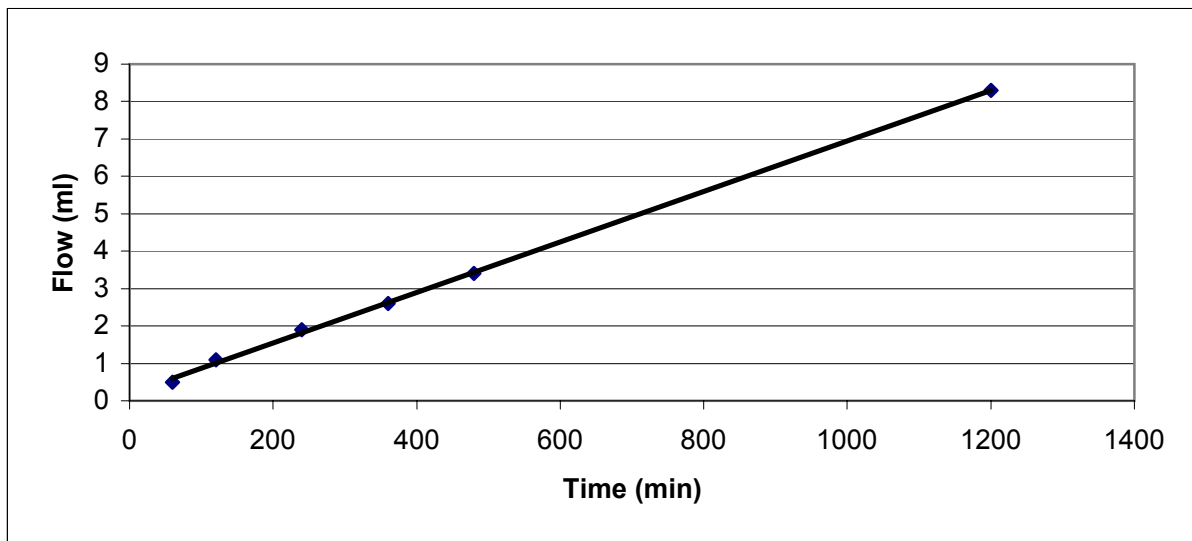
**Initial Sample Data:**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 20.6         | 83.9           | 7.183         | 10.636      | 40.52                   | 126.9             | 107.1             |

**Final Sample Data**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 24.3         | 100.0          | 7.245         | 10.523      | 41.23                   | 129.4             | 104.1             |

| Reading | Time (h:m) | Chamber | Upper | Lower | Flow | K <sub>20</sub> (cm/s) |
|---------|------------|---------|-------|-------|------|------------------------|
| 1       | 0:00       | 5.8     | 24.6  | 2.0   | 0.0  | --                     |
| 2       | 1:00       | 5.5     | 24.1  | 2.5   | 0.5  | 1.01E-07               |
| 3       | 2:00       | 5.4     | 23.5  | 3.1   | 1.1  | 1.11E-07               |
| 4       | 4:00       | 5.3     | 22.7  | 3.9   | 1.9  | 9.57E-08               |
| 5       | 6:00       | 5.2     | 22.0  | 4.6   | 2.6  | 8.73E-08               |
| 6       | 8:00       | 5.2     | 21.2  | 5.4   | 3.4  | 8.56E-08               |
| 7       | 20:00      | 5.2     | 16.3  | 10.3  | 8.3  | 8.36E-08               |



**Laboratory Test Summary**  
**JL03433**  
 1/7/2004

| Sample Data   |            |            |             |             |            |            |               |      |                  | ASTM D 2216 |
|---------------|------------|------------|-------------|-------------|------------|------------|---------------|------|------------------|-------------|
| Sample Number | Sample (m) | Depth (ft) | Tare Number | Tare Weight | Wet Weight | Dry Weight | Sample Weight | pH   | Moisture Content |             |
| FBQ-173       | --         | --         | 113         | 9.84        | 689.25     | 608.68     | 598.84        | 4.04 | 13.5%            |             |

| Bulk Density |             |               |               |             |                           |                   |                   |  |  | ASTM D 2937 |
|--------------|-------------|---------------|---------------|-------------|---------------------------|-------------------|-------------------|--|--|-------------|
| Total Weight | Tube Weight | Sample Weight | Diameter (in) | Length (in) | Volume (cm <sup>3</sup> ) | Wet Density (pcf) | Dry Density (pcf) |  |  |             |
| 818.2        | 0.00        | 818.2         | 2.811         | 3.893       | 395.831                   | 129.0             | 113.7             |  |  |             |

| Specific Gravity (-10 Material) |                 |           |                                  |              |   |                                    |                                     |              |                | ASTM D 854     |                |
|---------------------------------|-----------------|-----------|----------------------------------|--------------|---|------------------------------------|-------------------------------------|--------------|----------------|----------------|----------------|
| Sample Weight (Mo)              | Full Pycno (Mb) | Temp (°C) | Density Water d(T <sub>b</sub> ) | Correction K | Pynco/Water (M <sub>a</sub> at T <sub>b</sub> ) | Specific Gravity (T <sub>b</sub> ) | Specific Gravity (T <sub>20</sub> ) | Porosity (n) | V <sub>s</sub> | V <sub>w</sub> | V <sub>a</sub> |
| 39.31                           | 186.94          | 20.7      | 0.99809                          | 0.9999       | 162.71  | 2.606                              | 2.606                               | 0.301        | 69.9%          | 24.5%          | 5.6%           |

| Particle Size Distribution |      |                             |      |      |      |            |          |          |          | ASTM D 422 |          |           |
|----------------------------|------|-----------------------------|------|------|------|------------|----------|----------|----------|------------|----------|-----------|
| 3/8"                       | #4   | Percent Passing (by weight) |      |      |      |            | Sand     |          |          |            |          |           |
|                            |      | #10                         | #40  | #100 | #200 | Gravel (%) | Cor. (%) | Med. (%) | Fine (%) | Silt (%)   | Clay (%) | Fines (%) |
| 94.4                       | 91.2 | 85.7                        | 77.2 | 62.0 | 55.9 | 8.8        | 5.5      | 8.5      | 21.3     | 33.6       | 22.3     | 55.9      |

| Limits           |      |                     |    |                 |  |  |  |     |     | ASTM D 4318 Classification | ASTM D 2487 |       |       |       |
|------------------|------|---------------------|----|-----------------|--|--|--|-----|-----|----------------------------|-------------|-------|-------|-------|
| Atterberg Limits |      | USCS Classification |    |                 |  |  |  |     |     | Cu                         |             | Cc    |       |       |
| LL               | PL   | PI                  |    |                 |  |  |  | D10 | D30 | D50                        | D60         |       |       |       |
| 26.9             | 17.0 | 9.9                 | CL | SANDY LEAN CLAY |  |  |  |     | 42  | 0.22                       | 0.003       | 0.009 | 0.031 | 0.125 |

# Permeability Test Report

Project: Ravenna Arsenal (FBQ-173)

Client: SpecPro, Inc.

**Sample Data:**

| Sample Number | Sample Type | Depth (ft) |
|---------------|-------------|------------|
| FBQ-173       | ST          | --         |

$K_{20^{\circ}\text{C}} = 2.52\text{E-}06 \text{ cm/sec}$

**Test Conditions:**

| Permeant Liquid           | Back Pressure | Hydraulic Gradient | Consolidation Stress |           | Total Test Time (min) | Total Flow (cc) |
|---------------------------|---------------|--------------------|----------------------|-----------|-----------------------|-----------------|
|                           |               |                    | Max (psi)            | Min (psi) |                       |                 |
| De-aired/De-ionized water | 40 psi        | 5 psi              | 6                    | 2         | 1440                  | 304.9           |

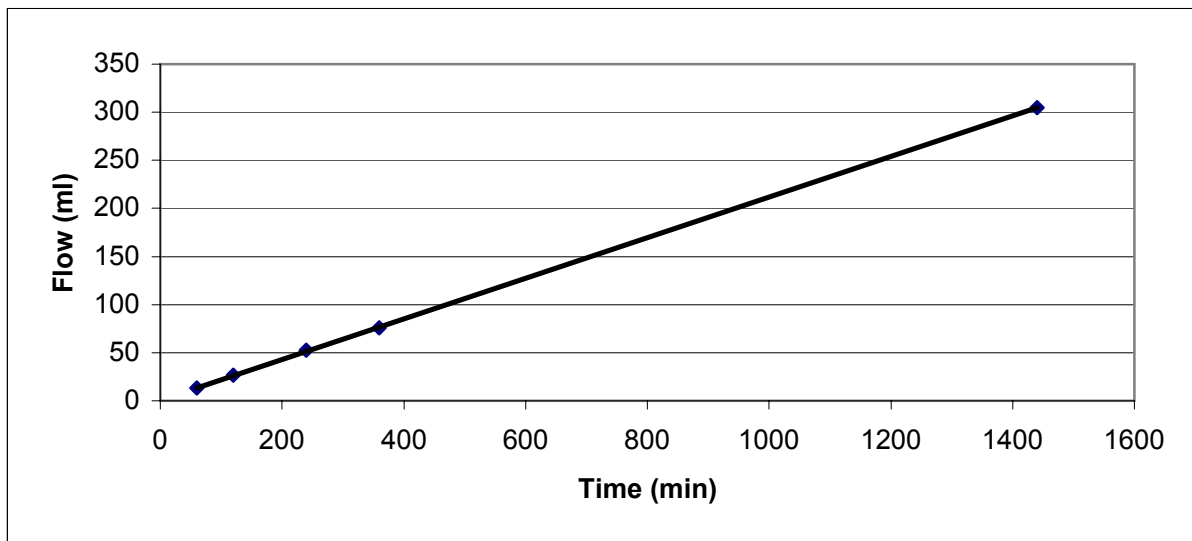
**Initial Sample Data:**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 11.9         | 81.5           | 7.140         | 9.887       | 40.03                   | 129.0             | 113.7             |

**Final Sample Data**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 14.9         | 100.0          | 7.025         | 9.753       | 38.76                   | 137.8             | 120.0             |

| Reading | Time (h:m) | Chamber | Upper | Lower | Flow  | $K_{20}$ (cm/s) |
|---------|------------|---------|-------|-------|-------|-----------------|
| 1       | 0:00       | 72.9    | 372.3 | 32.6  | 0.0   | --              |
| 2       | 1:00       | 74.5    | 358.3 | 45.6  | 13.5  | 2.68E-06        |
| 3       | 2:00       | 77.8    | 346.0 | 59.5  | 26.6  | 2.64E-06        |
| 4       | 4:00       | 79.4    | 319.8 | 84.8  | 52.3  | 2.60E-06        |
| 5       | 6:00       | 79.4    | 296.8 | 109.2 | 76.0  | 2.52E-06        |
| 6       | 24:00      | 81.0    | 67.2  | 337.4 | 304.9 | 2.52E-06        |





**Laboratory Test Summary**  
**JL03433**  
 1/7/2004

**Sample Data**

ASTM D 2216

| Sample Number | Sample (m) | Depth (ft) | Tare Number | Tare Weight | Wet Weight | Dry Weight | Sample Weight | Moisture Content |
|---------------|------------|------------|-------------|-------------|------------|------------|---------------|------------------|
| FBQ-167-ST2   | --         | --         | 114         | 9.97        | 851.33     | 757.50     | 747.53        | 12.6%            |

**Bulk Density**

ASTM D 2937

| Total Weight | Tube Weight | Sample Weight | Diameter (in) | Length (in) | Volume (cm <sup>3</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|-------------|---------------|---------------|-------------|---------------------------|-------------------|-------------------|
| 941.6        | 0.00        | 941.6         | 2.822         | 3.980       | 408.030                   | 144.1             | 128.0             |

**Specific Gravity (-10 Material)**

ASTM D 854

| Sample Weight (Mo) | Full Pycno (Mb) | Temp (°C) | Density Water d(T <sub>b</sub> ) | Correction K | Pynco/Water (M <sub>a</sub> at T <sub>b</sub> ) | Specific Gravity (T <sub>b</sub> ) | Specific Gravity (T <sub>20</sub> ) | Porosity (n) | V <sub>s</sub> | V <sub>w</sub> | V <sub>a</sub> |
|--------------------|-----------------|-----------|----------------------------------|--------------|---|------------------------------------|-------------------------------------|--------------|----------------|----------------|----------------|
| 40.33              | 188.94          | 20.7      | 0.99809                          | 0.9999       | 163.46  | 2.715                              | 2.715                               | 0.245        | 75.5%          | 25.7%          | -1.3%          |

Note: Sample over saturated.

**Particle Size Distribution**

ASTM D 422

| 3/8" | Percent Passing (by weight) |      |      |      | Sand       |          |          |          |          |          |           |
|------|-----------------------------|------|------|------|------------|----------|----------|----------|----------|----------|-----------|
|      | #4                          | #10  | #100 | #200 | Gravel (%) | Cor. (%) | Med. (%) | Fine (%) | Silt (%) | Clay (%) | Fines (%) |
| 84.5 | 78.7                        | 71.3 | 55.0 | 41.5 | 21.3       | 7.4      | 16.3     | 18.6     | 22.7     | 13.7     | 36.4      |

**Limits**

ASTM D 4318 Classification

| Atterberg Limits | USCS Classification | ASTM D 2487 |      |       |       |       |       |
|------------------|---------------------|-------------|------|-------|-------|-------|-------|
| LL               | PI                  | Cu          | Cc   | D10   | D30   | D50   | D60   |
| 21.1             | 4.4                 | 303         | 0.27 | 0.003 | 0.027 | 0.323 | 0.908 |

# Permeability Test Report

Project: Ravenna Arsenal (FBQ-167-ST2)

Client: SpecPro, Inc.

**Sample Data:**

| Sample Number | Sample Type | Depth (ft) |
|---------------|-------------|------------|
| FBQ-167-ST2   | ST          | --         |

$K_{20^{\circ}\text{C}} = 4.15\text{E-}07 \text{ cm/sec}$

**Test Conditions:**

| Permeant Liquid           | Back Pressure | Hydraulic Gradient | Consolidation Stress |           | Total Test Time (min) | Total Flow (cc) |
|---------------------------|---------------|--------------------|----------------------|-----------|-----------------------|-----------------|
|                           |               |                    | Max (psi)            | Min (psi) |                       |                 |
| De-aired/De-ionized water | 45 psi        | 5 psi              | 6                    | 2         | 420                   | 14.8            |

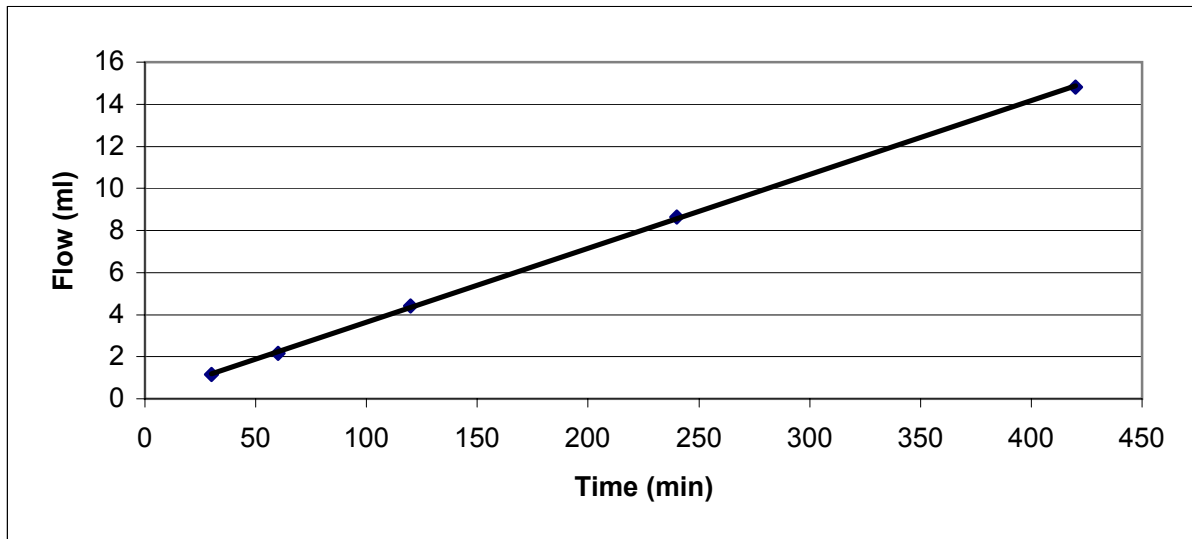
**Initial Sample Data:**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 11.9         | 105.1          | 7.169         | 10.109      | 40.36                   | 144.1             | 128.0             |

**Final Sample Data**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 12.5         | 100.0          | 7.194         | 10.099      | 40.65                   | 142.9             | 127.0             |

| Reading | Time (h:m) | Chamber | Upper | Lower | Flow | K <sub>20</sub> (cm/s) |
|---------|------------|---------|-------|-------|------|------------------------|
| 1       | 0:00       | 4.8     | 23.2  | 1.9   | 0.0  | --                     |
| 2       | 0:30       | 4.9     | 22.0  | 3.0   | 1.2  | 4.51E-07               |
| 3       | 1:00       | 4.9     | 21.0  | 4.0   | 2.2  | 4.22E-07               |
| 4       | 2:00       | 4.9     | 18.7  | 6.2   | 4.4  | 4.32E-07               |
| 5       | 4:00       | 4.9     | 14.5  | 10.5  | 8.7  | 4.24E-07               |
| 6       | 7:00       | 4.9     | 8.3   | 16.6  | 14.8 | 4.15E-07               |



J&L Laboratories, Inc.

1/7/2004

**Laboratory Test Summary**  
**JL03433**  
 1/7/2004

**Sample Data**

ASTM D 2216

| Sample Number | Sample (m) | Depth (ft) | Tare Number | Tare Weight | Wet Weight | Dry Weight | Sample Weight | pH   | Moisture Content |
|---------------|------------|------------|-------------|-------------|------------|------------|---------------|------|------------------|
| FBQ-167-ST1   | --         | --         | 112         | 9.50        | 654.41     | 554.51     | 545.01        | 5.99 | 18.3%            |

**Bulk Density**

ASTM D 2937

| Total Weight | Tube Weight | Sample Weight | Diameter (in) | Length (in) | Volume (cm <sup>3</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|-------------|---------------|---------------|-------------|---------------------------|-------------------|-------------------|
| 880.4        | 0.00        | 880.4         | 2.813         | 4.114       | 418.998                   | 131.2             | 110.8             |

**Specific Gravity (-10 Material)**

ASTM D 854

| Sample Weight (Mo) | Full Pycno (Mb) | Temp (°C) | Density Water d(T <sub>b</sub> ) | Correction K | Pynco/Water (M <sub>a</sub> at T <sub>b</sub> ) | Specific Gravity (T <sub>b</sub> ) | Specific Gravity (T <sub>20</sub> ) | Porosity (n) | V <sub>s</sub> | V <sub>w</sub> | V <sub>a</sub> |
|--------------------|-----------------|-----------|----------------------------------|--------------|---|------------------------------------|-------------------------------------|--------------|----------------|----------------|----------------|
| 39.70              | 187.41          | 20.8      | 0.99806                          | 0.9998       | 162.17  | 2.745                              | 2.745                               | 0.353        | 64.7%          | 32.5%          | 2.8%           |

**Particle Size Distribution**

ASTM D 422

| 3/8" | #4   | #10  | #40  | #100 | #200 | Sand       |          |          | Silt (%) | Clay (%) | Fines (%) |      |
|------|------|------|------|------|------|------------|----------|----------|----------|----------|-----------|------|
|      |      |      |      |      |      | Gravel (%) | Cor. (%) | Med. (%) |          |          |           |      |
| 98.6 | 97.1 | 94.1 | 84.0 | 68.3 | 64.8 | 2.9        | 3.0      | 10.1     | 19.2     | 22.6     | 42.2      | 64.8 |

**Limits**

ASTM D 4318 Classification

| Atterberg Limits | USCS Classification | ASTM D 2487 |    |      |       |       |       |       |
|------------------|---------------------|-------------|----|------|-------|-------|-------|-------|
| LL               | PI                  | Cu          | Cc | D10  | D30   | D50   | D60   |       |
| 35.6             | 18.7                | 16.9        | CL | 0.33 | 0.001 | 0.003 | 0.010 | 0.027 |

# Permeability Test Report

Project: Ravenna Arsenal (FBQ-167-ST1)

Client: SpecPro, Inc.

**Sample Data:**

| Sample Number | Sample Type | Depth (ft) |
|---------------|-------------|------------|
| FBQ-167-ST1   | ST          | --         |

$K_{20^{\circ}\text{C}} = 4.52\text{E-}06 \text{ cm/sec}$

**Test Conditions:**

| Permeant Liquid           | Back Pressure | Hydraulic Gradient | Consolidation Stress |           | Total Test Time (min) | Total Flow (cc) |
|---------------------------|---------------|--------------------|----------------------|-----------|-----------------------|-----------------|
|                           |               |                    | Max (psi)            | Min (psi) |                       |                 |
| De-aired/De-ionized water | 55 psi        | 5 psi              | 6                    | 2         | 480                   | 173.7           |

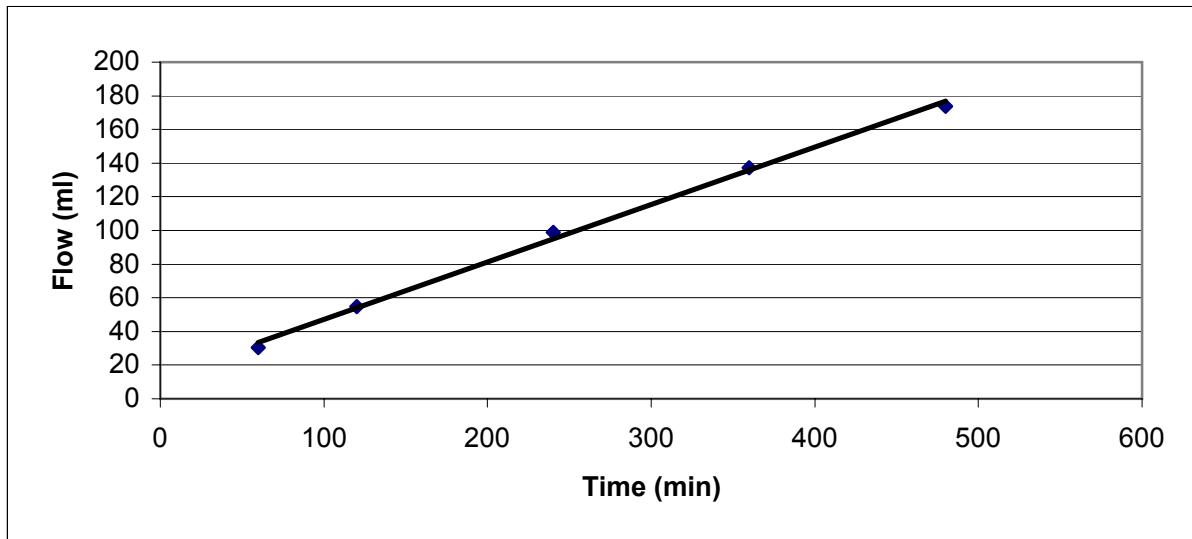
**Initial Sample Data:**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 16.9         | 92.2           | 7.145         | 10.449      | 40.10                   | 131.2             | 110.8             |

**Final Sample Data**

| Moisture (%) | Saturation (%) | Diameter (cm) | Length (cm) | Area (cm <sup>2</sup> ) | Wet Density (pcf) | Dry Density (pcf) |
|--------------|----------------|---------------|-------------|-------------------------|-------------------|-------------------|
| 18.9         | 100.0          | 7.120         | 10.498      | 39.81                   | 135.3             | 113.9             |

| Reading | Time (h:m) | Chamber | Upper | Lower | Flow  | K <sub>20</sub> (cm/s) |
|---------|------------|---------|-------|-------|-------|------------------------|
| 1       | 0:00       | 77.8    | 382.1 | 34.2  | 0.0   | --                     |
| 2       | 1:00       | 79.4    | 351.0 | 63.6  | 30.3  | 6.30E-06               |
| 3       | 2:00       | 81.0    | 326.4 | 88.0  | 54.8  | 5.70E-06               |
| 4       | 4:00       | 81.0    | 282.1 | 132.0 | 98.9  | 5.15E-06               |
| 5       | 6:00       | 82.6    | 242.7 | 169.5 | 137.3 | 4.77E-06               |
| 6       | 8:00       | 82.6    | 205.8 | 205.4 | 173.7 | 4.52E-06               |



J&L Laboratories, Inc.

1/7/2004