

**INFILTRATION AND RECHARGE NOTE:**  
 STORM DRAINAGE INFILTRATION/RECHARGE WILL BE INCORPORATED BY PROVIDING BOTTOMLESS CATCH BASINS, PERFORATED STORM SEWER AND BOTTOMLESS UNDERGROUND DETENTION. CALCULATIONS, DESIGN AND SPECIFICATIONS FROM THE MATERIAL SUPPLIER WILL BE PROVIDED DURING THE ENGINEERING SUBMITTAL

**UNDERGROUND STORAGE NOTE:**  
 UNDERGROUND STORAGE DESIGN & DETAILS WILL BE PROVIDED DURING THE ENGINEERING REVIEW PHASE. A MANUFACTURER/SUPPLIER WILL BE CHOSEN AND WILL PROVIDE SPECIFIC DESIGN DETAILS FOR CITY REVIEW

**LAND IMPROVEMENT PERMIT (LIP):**  
 THE APPLICANT SHALL SUBMIT A LAND IMPROVEMENT PERMIT APPLICATION WITH THE ENGINEER'S ESTIMATE, FEE AND CONSTRUCTION PLANS TO GET THE CONSTRUCTION PLAN REVIEW PROCESS STARTED

- LEGEND**
- △ CONTROL POINT
  - XXH FIRE HYDRANT
  - GATE VALVE
  - MANHOLE - STIM OR SAN AS INDICATED
  - PAVEMENT CATCH BASIN
  - REAR YARD CATCH BASIN
  - UTILITY POLE
  - GUY POLE
  - SIGN
  - MAIL BOX
  - STORM SEWER
  - SANITARY SEWER
  - WATERMAIN
  - 816.41 PROPOSED ELEVATION
  - 806 EXISTING ELEVATION

**WEIGHTED C FACTOR CALCULATION**  
 SITE AREA: 2.928 ACRES  
 AREA OF ROAD, WALK, BUILDING & DRIVEWAYS: 1.163 ACRES  
 GRASS AREA / OPEN SPACE: 1.765 ACRES  
 C PAVEMENT = 0.95  
 C AGRICULTURAL = 0.25  
 $[(1.163 \times 0.95) + (1.765 \times 0.25)] / 2.927 = 0.528$   
 USE C FACTOR 0.53

**SANITARY SEWER DESIGN:**  
 POPULATION: 12 UNITS x 2.5 PEOPLE/UNIT = 30 PEOPLE  
 AVERAGE FLOW:  $100 \times 30 / 24 / 3600 / 7.48 = 0.0046$  cfs  
 PEAK FLOW:  $4 \times 0.0046 = 0.0184$  cfs  
 8" SANITARY SEWER AT 0.50% = 0.85 cfs

**DETENTION CALCULATIONS**  
**REQUIRED STORAGE PER O.C.D.C. STANDARDS: (100 YEAR STORM)**  
 DEVELOPED AREA: 2.928 Ac. C = 0.53  
 EQUIVALENT AREA:  $(2.928 \text{ Ac.}) \times (0.53) = 1.552 \text{ Ac.}$   
 $Q_p = (2.928 \text{ Ac.}) \times (0.20 \text{ CFS/Ac.}) = 0.59 \text{ CFS}$   
 $Q_p = (0.59 \text{ CFS}) / (1.552 \text{ Ac.}) = 0.380$   
 $T = -25 + [10.3125 / (0.380)^{0.5}] \times 0.5 = 139.74 \text{ MIN}$   
 $V_s = 16,500(139.74 \text{ MIN}) - 40(0.380)(139.74 \text{ MIN}) = 11,972.01 \text{ CF}$   
 $V_t = (11,972.01 \text{ CF}) \times (1.552 \text{ Ac.}) = 18,581 \text{ CF}$

**ACTUAL POND VOLUME:**  
 $VOLUME = H/3(A_1 + A_2 + [A_1 \times A_2]^{0.5})$   
 A1 = AREA OF TOP SURFACE  
 A2 = AREA OF BOTTOM SURFACE  
 H = HEIGHT

| ELEVATION | AREA  | VOLUME    |
|-----------|-------|-----------|
| 743.80    | 6,635 | 5,747     |
| 742.80    | 4,903 | 4,128     |
| 741.80    | 3,398 | 2,291     |
| 741.00    | 2,363 | 1,025     |
| 740.30    | 722   | 72        |
| 740.00    | 0     | 13,263 CF |

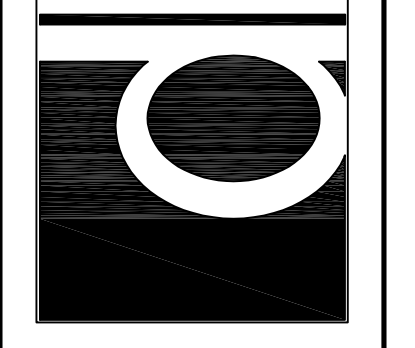
**DETENTION BASIN STORAGE**  
 STORAGE ELEV 743.80 - 740.00  
 STORAGE PROVIDED OPEN POND 13,263 CF  
 STORAGE PROVIDED UNDERGROUND 5,337 CF  
 TOTAL STORAGE PROVIDED 18,600 CF  
 STORAGE REQUIRED 18,581 CF

**NOTE:**  
 JOHN R ROAD IS UNDER THE JURISDICTION OF THE CITY OF ROCHESTER HILLS. A CITY RIGHT-OF-WAY PERMIT IS REQUIRED

**DRIVEWAY SLOPES:**  
 ALL DRIVEWAY SLOPES SHALL MEET THE FOLLOWING REQUIREMENTS:  
 APPROACH & DRIVEWAY: 2% MIN. - 10% MAX.  
 SIDEWALK CROSS-SLOPE: 1% MIN. - 2% MAX.

**\*RETAINING WALL:**  
 TOP OF RETAINING WALL: 748.00  
 BOTTOM OF RETAINING WALL: 745.30  
 RETAINING WALL HEIGHT MAXIMUM: 2.70'

**D'Anna Associates**  
 Architecture | Engineering  
 1055 SOUTH BLVD. E. SUITE 200  
 ROCHESTER HILLS, MI 48307  
 P 248-852-7702 F 248-852-7707  
 dannaassoc.com

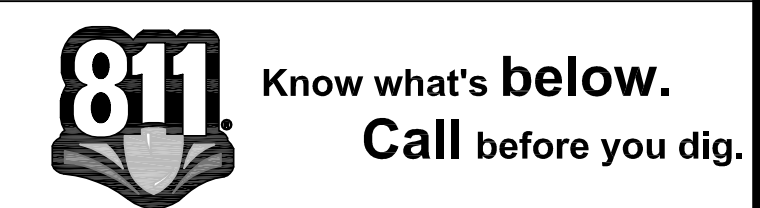


| DATE       | REV. DATE | DESCRIPTION |
|------------|-----------|-------------|
| 05/13/2015 | 7/20/15   | PER CITY    |
|            | 8/21/15   | PER CITY    |
|            |           | DATE        |
|            |           | DRAWN BY    |
|            |           | CHECKED BY  |
|            |           | S.D./J.L.L. |

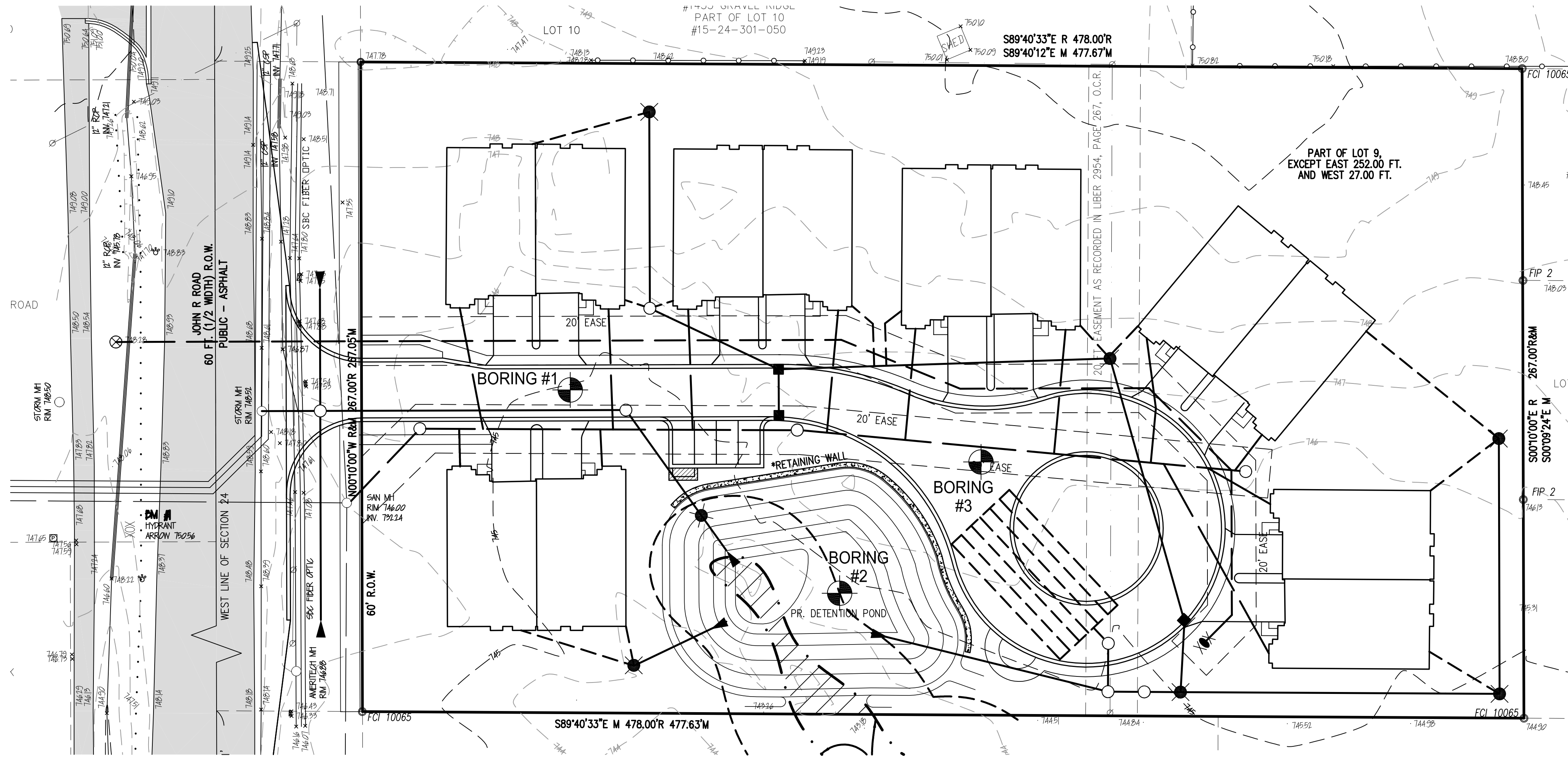
**"BRAMPTON PARC"**  
 PART OF THE SW 1/4 OF SECTION 24,  
 T. 3N., R. 11E., CITY OF ROCHESTER HILLS, OAKLAND COUNTY, MICHIGAN.  
**PRELIMINARY UTILITY LAYOUT AND GRADING PLAN**

SCALE: 1"=30'  
 CITY FILE # 15-001  
 DRAWING: PS-15-912  
**ENG-2**

**NOTE:**  
 NOT TO BE USED AS CONSTRUCTION DRAWINGS.







**TEST PIT OBSERVATION & SOIL INFILTRATION TESTING:**  
 PERFORMED BY TESTING ENGINEERS & CONSULTANTS, INC. ON  
 JULY 15, 2015 TEC REPORT #55804. REFER TO COMPLETE  
 REPORT FOR ADDITIONAL INFORMATION

| Test Pit I.D. | Soil Description   | Sand Layer Depth (A) | Test Depth (A) | Infiltration Rate Inches Per Hour |
|---------------|--|----------------------|----------------|-----------------------------------|
| TP-1          | Medium Compact Brown Fine Sand with Trace of Silt            | 1' to 5'             | 2.5'           | 6.2                               |
| TP-2          | Medium Compact Brown Fine Sand with Trace of Silt            | 0.8' to 6.5'         | 2.5'           | 26.6                              |
| TP-3          | Medium Compact Brown Fine Sand with Trace of Gravel and Silt | 1' to 7'             | 2.5'           | 40.5                              |

**SANITARY CAPACITY CALCULATION:**

CALCULATIONS BASED ON STUDY PROVIDED FOR "HARVARD PLACE" DEVELOPMENT

SANITARY CAPACITY CALCULATION  
 POPULATION BASED ON 2.5/UNIT

| SUB DISTRICT | MH                       | MH         | PIPE SIZE (IN) | A.B. SLOPE (%) | LENGTH (FT) | TOTAL REL'S | POP. EQUIV. | TOTAL POP EQUIV. | AVG. FLOW | PEAK FLOW | PIPE CAPACITY | EXTRA CAPACITY |
|--------------|--------------------------|------------|----------------|----------------|-------------|-------------|-------------|------------------|-----------|-----------|---------------|----------------|
| A            | 34 (AVON)                | 33         | 12             | 0.22%          | 350         | 424         | 1060        | 1060             | 0.16      | 0.62      | 1.66          | 1.06           |
| B            | 33                       | 32         | 12             | 0.22%          | 350         | 264         | 660         | 1720             | 0.27      | 0.97      | 1.88          | 0.71           |
| C            | 32                       | 31         | 12             | 0.22%          | 349         | 15          | 37.5        | 1757.5           | 0.27      | 0.98      | 1.68          | 0.69           |
| D            | 31                       | 30         | 12             | 0.32%          | 351         | 168         | 420         | 2177.5           | 0.34      | 1.20      | 2.02          | 0.82           |
| E            | 30                       | 29         | 12             | 0.92%          | 348         | 23          | 57.5        | 2235             | 0.35      | 1.23      | 3.43          | 2.20           |
| F            | 29                       | 28         | 12             | 0.25%          | 143         | 72          | 180         | 2415             | 0.37      | 1.32      | 1.79          | 0.47           |
|              | 28                       | 27         | 12             | 0.25%          | 216         | 0           | 0           | 2415             | 0.37      | 1.32      | 1.79          | 0.47           |
|              | 27                       | 26         | 15             | 0.20%          | 203         | 0           | 0           | 2415             | 0.37      | 1.32      | 2.90          | 1.58           |
| G            | 26                       | 25         | 15             | 0.20%          | 231         | 330         | 822.5       | 3337.5           | 0.50      | 1.74      | 2.90          | 1.19           |
| BRAMPTON     | 25                       | 24         | 15             | 0.27%          | 255         | 12          | 30          | 3267.5           | 0.51      | 1.72      | 3.37          | 1.65           |
|              | 24                       | 23         | 15             | 0.32%          | 253         | 0           | 0           | 3267.5           | 0.51      | 1.72      | 3.66          | 1.94           |
|              | 23                       | 22         | 15             | 0.38%          | 327         | 0           | 0           | 3267.5           | 0.51      | 1.72      | 3.99          | 2.27           |
| H            | 22                       | 21         | 15             | 0.36%          | 302         | 84          | 210         | 3477.5           | 0.54      | 1.82      | 3.89          | 2.07           |
| I            | 21                       | 20         | 15             | 0.60%          | 354         | 181         | 452.5       | 3930             | 0.61      | 2.03      | 6.01          | 3.98           |
|              | 20                       | 19         | 15             | 0.28%          | 258         | 0           | 0           | 3930             | 0.61      | 2.03      | 3.43          | 1.40           |
| J            | 19                       | 18         | 15             | 0.26%          | 350         | 79          | 197.5       | 4127.5           | 0.64      | 2.12      | 3.30          | 1.18           |
|              | 18                       | 17         | 15             | 0.32%          | 358         | 0           | 0           | 4127.5           | 0.64      | 2.12      | 3.86          | 1.54           |
|              | 17                       | 16         | 15             | 0.41%          | 251         | 0           | 0           | 4127.5           | 0.64      | 2.12      | 4.15          | 2.03           |
|              | 16                       | 15         | 15             | 0.39%          | 352         | 0           | 0           | 4127.5           | 0.64      | 2.12      | 4.04          | 1.92           |
| K            | 15                       | 14         | 15             | 0.40%          | 353         | 117         | 292.5       | 4420             | 0.68      | 2.25      | 4.10          | 1.85           |
|              | 14                       | 13         | 15             | 0.38%          | 350         | 0           | 0           | 4420             | 0.68      | 2.25      | 3.90          | 1.74           |
|              | 13                       | 12         | 15             | 0.35%          | 348         | 0           | 0           | 4420             | 0.68      | 2.25      | 3.83          | 1.58           |
|              | 12                       | 11         | 15             | 0.52%          | 350         | 0           | 0           | 4420             | 0.68      | 2.25      | 4.87          | 2.42           |
|              | 11                       | 10         | 15             | 0.19%          | 353         | 0           | 0           | 4420             | 0.68      | 2.25      | 0             | 0.50           |
| L            | 10                       | 9          | 15             | 0.17%          | 367         | 46          | 115         | 4535             | 0.70      | 2.30      | 2.97          | 0.37           |
|              | 9                        | 8          | 18             | 0.14%          | 355         | 0           | 0           | 4535             | 0.70      | 2.30      | 3.94          | 1.64           |
| M            | 8                        | 7          | 18             | 0.14%          | 350         | 27          | 67.5        | 4602.5           | 0.71      | 2.33      | 3.94          | 1.61           |
| N            | 7                        | 6          | 18             | 0.14%          | 350         | 18          | 45          | 4647.5           | 0.72      | 2.35      | 3.94          | 1.59           |
| O            | 6                        | 5          | 18             | 0.14%          | 345         | 68          | 170         | 4817.5           | 0.75      | 2.43      | 3.94          | 1.51           |
|              | 5                        | 4          | 18             | 0.14%          | 350         | 0           | 0           | 4817.5           | 0.75      | 2.43      | 3.94          | 1.51           |
|              | 4                        | 3          | 18             | 0.14%          | 350         | 0           | 0           | 4817.5           | 0.75      | 2.43      | 3.94          | 1.51           |
|              | 3                        | 2          | 18             | 0.14%          | 343         | 0           | 0           | 4817.5           | 0.75      | 2.43      | 3.94          | 1.51           |
|              | 2                        | 1          | 18             | 0.14%          | 330         | 0           | 0           | 4817.5           | 0.75      | 2.43      | 3.94          | 1.51           |
|              | 1                        | EX(AUBURN) | 18             | 0.76%          | 322         | 0           | 0           | 4817.5           | 0.75      | 2.43      | 9.18          | 6.75           |
| P            | EX(AUBURN) SEWER STATION | 18         | 0.76%          |                |             | 182         | 455         | 5272.5           | 0.82      | 2.63      | 9.18          | 6.55           |
|              |                          |            |                |                |             | 2109        | 5272.5      |                  |           |           |               |                |

Testing Engineers and Consultants, Inc.

PROJECT NAME: SANITARY TESTING  
 LOCATION: BRAMPTON PARC DEVELOPMENT  
 DATE: JULY 15, 2015

| TEST PIT I.D. | SOIL DESCRIPTION   | SAND LAYER DEPTH (A) | TEST DEPTH (A) | INFILTRATION RATE |
|---------------|--|----------------------|----------------|-------------------|
| TP-1          | Medium Compact Brown Fine Sand with Trace of Silt            | 1' to 5'             | 2.5'           | 6.2               |
| TP-2          | Medium Compact Brown Fine Sand with Trace of Silt            | 0.8' to 6.5'         | 2.5'           | 26.6              |
| TP-3          | Medium Compact Brown Fine Sand with Trace of Gravel and Silt | 1' to 7'             | 2.5'           | 40.5              |

Testing Engineers and Consultants, Inc.

PROJECT NAME: SANITARY TESTING  
 LOCATION: BRAMPTON PARC DEVELOPMENT  
 DATE: JULY 15, 2015

| TEST PIT I.D. | SOIL DESCRIPTION   | SAND LAYER DEPTH (A) | TEST DEPTH (A) | INFILTRATION RATE |
|---------------|--|----------------------|----------------|-------------------|
| TP-1          | Medium Compact Brown Fine Sand with Trace of Silt            | 1' to 5'             | 2.5'           | 6.2               |
| TP-2          | Medium Compact Brown Fine Sand with Trace of Silt            | 0.8' to 6.5'         | 2.5'           | 26.6              |
| TP-3          | Medium Compact Brown Fine Sand with Trace of Gravel and Silt | 1' to 7'             | 2.5'           | 40.5              |

Testing Engineers and Consultants, Inc.

PROJECT NAME: MECHANICAL ANALYSIS TEST REPORT  
 LOCATION: BRAMPTON PARC DEVELOPMENT  
 DATE: JULY 15, 2015

| TEST PIT I.D. | SOIL DESCRIPTION   | SAND LAYER DEPTH (A) | TEST DEPTH (A) | INFILTRATION RATE |
|---------------|--|----------------------|----------------|-------------------|
| TP-1          | Medium Compact Brown Fine Sand with Trace of Silt            | 1' to 5'             | 2.5'           | 6.2               |
| TP-2          | Medium Compact Brown Fine Sand with Trace of Silt            | 0.8' to 6.5'         | 2.5'           | 26.6              |
| TP-3          | Medium Compact Brown Fine Sand with Trace of Gravel and Silt | 1' to 7'             | 2.5'           | 40.5              |

Testing Engineers and Consultants, Inc.

PROJECT NAME: MECHANICAL ANALYSIS TEST REPORT  
 LOCATION: BRAMPTON PARC DEVELOPMENT  
 DATE: JULY 15, 2015

| TEST PIT I.D. | SOIL DESCRIPTION   | SAND LAYER DEPTH (A) | TEST DEPTH (A) | INFILTRATION RATE |
|---------------|--|----------------------|----------------|-------------------|
| TP-1          | Medium Compact Brown Fine Sand with Trace of Silt            | 1' to 5'             | 2.5'           | 6.2               |
| TP-2          | Medium Compact Brown Fine Sand with Trace of Silt            | 0.8' to 6.5'         | 2.5'           | 26.6              |
| TP-3          | Medium Compact Brown Fine Sand with Trace of Gravel and Silt | 1' to 7'             | 2.5'           | 40.5              |

Testing Engineers and Consultants, Inc.

PROJECT NAME: MECHANICAL ANALYSIS TEST REPORT  
 LOCATION: BRAMPTON PARC DEVELOPMENT  
 DATE: JULY 15, 2015

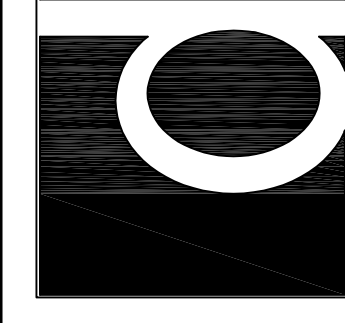
| TEST PIT I.D. | SOIL DESCRIPTION   | SAND LAYER DEPTH (A) | TEST DEPTH (A) | INFILTRATION RATE |
|---------------|--|----------------------|----------------|-------------------|
| TP-1          | Medium Compact Brown Fine Sand with Trace of Silt            | 1' to 5'             | 2.5'           | 6.2               |
| TP-2          | Medium Compact Brown Fine Sand with Trace of Silt            | 0.8' to 6.5'         | 2.5'           | 26.6              |
| TP-3          | Medium Compact Brown Fine Sand with Trace of Gravel and Silt | 1' to 7'             | 2.5'           | 40.5              |

Testing Engineers and Consultants, Inc.

PROJECT NAME: MECHANICAL ANALYSIS TEST REPORT  
 LOCATION: BRAMPTON PARC DEVELOPMENT  
 DATE: JULY 15, 2015

| TEST PIT I.D. | SOIL DESCRIPTION   | SAND LAYER DEPTH (A) | TEST DEPTH (A) | INFILTRATION RATE |
|---------------|--|----------------------|----------------|-------------------|
| TP-1          | Medium Compact Brown Fine Sand with Trace of Silt            | 1' to 5'             | 2.5'           | 6.2               |
| TP-2          | Medium Compact Brown Fine Sand with Trace of Silt            | 0.8' to 6.5'         | 2.5'           | 26.6              |
| TP-3          | Medium Compact Brown Fine Sand with Trace of Gravel and Silt | 1' to 7'             | 2.5'           | 40.5              |

**D'Anna Associates**  
 Architecture | Engineering  
 1055 SOUTH BLVD. E. SUITE 200  
 ROCHESTER HILLS, MI 48307  
 P 248-852-7702 F 248-852-7707  
 dannaassoc.com



| DATE       | REV. DATE | DESCRIPTION             |
|------------|-----------|-------------------------|
| 05/13/2015 | 7/20/15   | PER CITY                |
|            | 8/21/15   | PER CITY                |
|            |           | DRAWN BY: J.L.S.        |
|            |           | CHECKED BY: S.D./J.L.L. |

**"BRAMPTON PARC"**  
 PART OF THE SW 1/4 OF SECTION 24,  
 T. 3N., R. 11E., CITY OF ROCHESTER HILLS, OAKLAND COUNTY, MICHIGAN.

**SOIL BORING AND SANITARY CAPACITY DETAILS**

SCALE  
**SCALE 1" = 30'**  
 CITY FILE # **15-001**  
 DRAWING  
**PS-15-912**  
**ENG-3**

