# RMI ASSOCIATES LLC

## GEOTECHNICAL ENGINEERING REPORT
## ON INFILTRATION RATES FOR
## A PARKING AREA
## 19601 67TH AVE NE
## For
## MR. DAVID H. CLARK

Rd 1 Site Civil



824 Utsalady Road
Camano Island
Washington 98282

Vox: (360) 629-4711
Fax: (360) 629-9056

**RMI ASSOCIATES LLC**
*Geotechnical Consultants*
824 E. Utsalady Road
Camano Island, WA 98282
Vox: (360) 629-4711
Fax: (360) 629-9056

August 4, 2009

Mr. David H. Clark
Clark Electric, Inc.
731 250th Street NW
Stanwood, WA 98292

Geotechnical Report on
Infiltration Rate Determination
19601 67th Ave NE
Arlington, Washington
RMI File No. 44007B

Dear sir:

This report presents the results of our geotechnical engineering evaluation of the infiltration rates in the proposed infiltration trench in your lot at 19601 67th Ave NE, Arlington Washington as shown on the Vicinity Map (Figure 1).

## INTRODUCTION

You plan to infiltrate the runoff from your proposed parking lot at the storage facility north of your office. The City of Arlington has requested a geotechnical report with information on the seasonal high water table and soil types. The purpose of this study and report is to present our findings, opinions, and conclusions regarding existing geotechnical conditions and our recommendations for the design long-term infiltration rate for the proposed trench.

Our scope of services includes the following:

1. Review geologic maps of the area and information in our files.
2. Observe the digging of 3 test pits, logging of the soils and collection of samples from the 6-foot depth.

3. Arrange for gradation analyses to be done by a laboratory and use the 10% passing figures to calculate the long-term infiltration rates as recommended by the Department of Ecology.
4. Provide a geotechnical report discussing our findings, opinions and recommendations for the planned construction as applicable to this project.

## SITE CONDITIONS

### Surface

The site to be paved is rectangular shaped. It is bordered on the north by commercial property, on the east by railroad tracks, and on the west by 67th Avenue NE. The site is generally level and has been graded in the past. There is no significant vegetation on the site except a few scattered evergreens along the railroad track boundary. Access to the site is currently from the west.

### Geology

Most of the Puget Sound region was affected by past continental glaciations. The last period of glaciation, the Vashon Stade, ended approximately 10,000 to 11,000 years ago. Many of the geomorphic features seen today are a result of scouring and overriding by glacial ice. During the Vashon Stade, the Puget Sound region was overridden by over 3,000 feet of ice. Soil layers overridden by the ice sheet were compacted to a much greater extent than those that were not. A typical glacial sequence includes glacial recessional outwash, glacial till overlying advance outwash, underlain by transitional deposits and older non-glacial and glacial sediments. Locally glaciomarine drift is found in this assemblage.

We reviewed, the Surficial Geologic Map of the Port Townsend 30- by 60-minute Quadrangle, Puget Sound Region, Washington, by Fred Pessl, JR., D. P. Dethier, D. B. Booth, and J. P. Minard (1989) and the Geologic Map of Washington – Northwest Quadrant, by Joe D. Dragovich, Robert L. Logan, Henry W. Schasse, Timothy J. Walsh, William S. Lingley, Jr., David K. Norman, Wendy J. Gerstel, Thomas J. Lapen, J. Eric Schuster, and Karen D. Meters (WDNR, 2002) for the site geology. The site area is mapped as Vashon recessional marine sediments and Vashon recessional outwash, respectively on the two maps. The marine sediments (Qvrm) is defined as "a complex assemblage of fossil-bearing stony, silt, sand and clay with associated layers, lenses, and laminated sand, silt and clay." The recessional outwash (Qgos) is defined as "recessional and pro-glacial sand

with minor amounts of gravel and silt".

Our explorations encountered sand with varying amounts of silt and gravel consistent with both of the mapped units. Based on our past evaluations of similar sediments we interpret the soils to be recessional outwash. We found a thin layer of fill at the surface except in the first test pit where fill extended to the entire depth of 7 feet.

## Explorations

The subsurface conditions within the site were explored with three test pits on July 31, 2007. The test pits depths ranged from 6 to 7.5 feet below the existing surface. The pits were excavated with a backhoe provided by the owner. The approximate locations of the test pits are shown in Figure 2: Site Plan. A geotechnical engineer from RMI was present during the explorations, examined the soils and geologic conditions encountered, obtained samples of the different soil types, and maintained logs of the explorations. Samples were collected at 6 feet in Test Pits (TP) 2 and 3 for sieve analysis for infiltration rate determination.

The soils were visually classified in general accordance with the Unified Soil Classification System, presented in Figure 3. The test pit logs are attached to this report and are presented as Figure 4. We present a brief summary of the subsurface conditions in the following section. For a detailed description of the subsurface conditions, please review the test pit logs.

## Subsurface Conditions

Our explorations encountered approximately 0.2 to 0.5 of gravel surfacing or landscaping bricks in all the test pits. The soils encountered in Test Pit 1 down to the base of the excavation consisted of a silty fine sand over clay and were classified as fill.

In the other test pits we encountered a buff silty sand with varying amounts of gravel and silt below the surface fill down to the 2-foot depth. Beneath this unit we encountered a gray silty sand with varying amounts of gravel.

We interpret this soil to be recessional outwash. Samples were taken for sieve analysis at the 6-foot depth in both these test pits.

## Hydrologic Conditions and Infiltration Rates

Ground water seepage was not observed in any of the test pits during our site exploration. Soils at the base of the pit show no sign of oxidation associated with a rising and falling seasonal ground water. We expect, therefore, that there is not a seasonal high water table within the infiltration zone.

The recessional outwash sands should be suitable for infiltration. These soils are mapped as Everett gravelly, sandy loam (17) by the USDA – SCS in the Soil Survey of Snohomish County. This soil is listed in the Type A hydrologic soil group. Infiltration rates estimated from the textural triangle would be about 2.41 inches per hour based on our observations of the silt content. Based on the $D_{10}$ gradation, the long-term infiltration rates were equal to or greater than 9 inches per hour (see table below).

Table of Infiltration Rates

| Test Pit | $D_{10}$ Size | Corresponding Infiltration Rate |
|---|---|---|
| #2 | 0.647 | >9"/hr |
| #3 | 0.400 | 9"/hr |

We recommend that 9 in/hr be used for design.

## USE OF THIS REPORT

This report is the property of **RMI ASSOCIATES LLC** and has been prepared for Mr. David H. Clark of Clark Electric and his agents for use in planning and design of this project on this site only.

Within the limitations of scope, schedule and budget, our services have been performed in accordance with generally accepted geotechnical engineering practices in effect in this area at the time this report was prepared. No other warranty, expressed or implied, is made. Our observations, findings, and opinions are a means to identify and reduce the inherent risks to the owner.

Thank you for the opportunity to be of service. If you have any questions, or if we may be of further assistance, feel free to call.

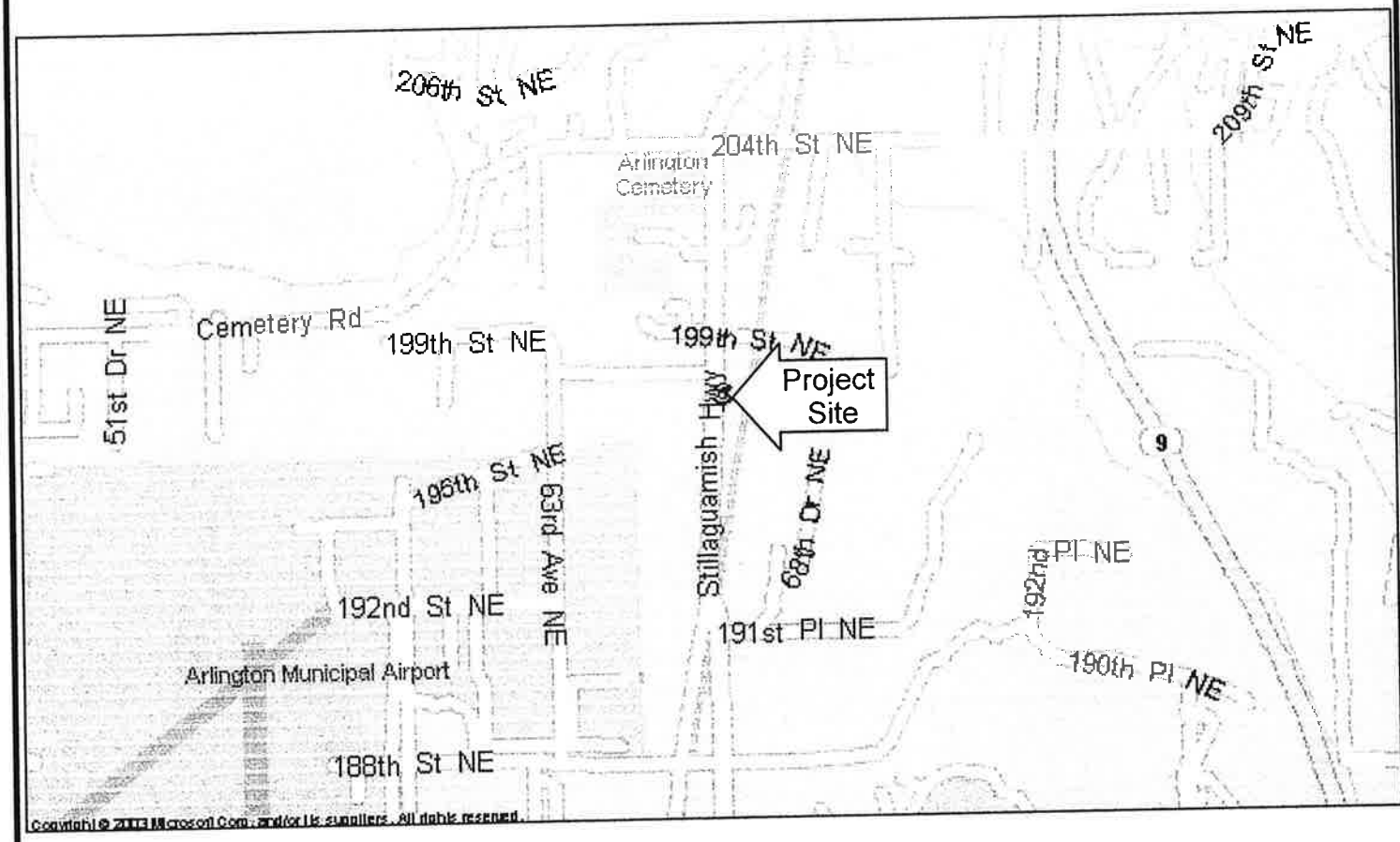
Sincerely,

**RMI ASSOCIATES LLC**


Ralph M. Isaacs, Ph. D., PE
Principal

Two Copies Submitted
Four Figures

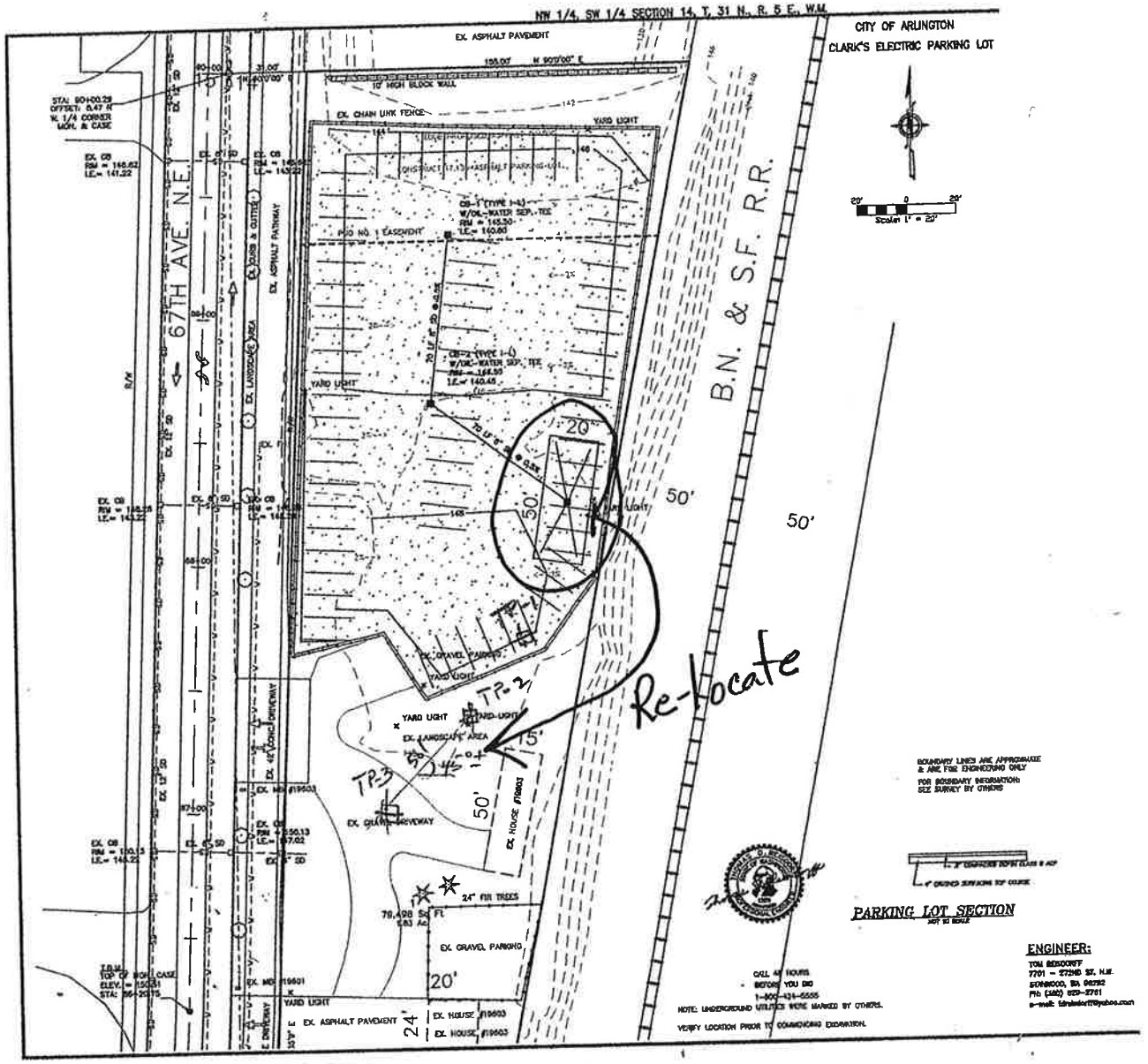
# Vicinity Map




Not to scale

| | | |
|---|---|---|
| **RMI ASSOCIATES LLC**<br>*Geotechnical Consultants*<br>**824 E. Utsalady Road**<br>**Camano Island, Washington 98282** | 19601 67th Ave NE | |
| | FILE NO.<br>44007B | FIGURE<br>1 |

# Site Plan




TP-1
Test Pit

| | | |
|---|---|---|
| **RMI ASSOCIATES LLC**<br>*Geotechnical Consultants*<br>**824 E. Utsalady Road**<br>**Camano Island, Washington 98282** | 19601 67th Ave NE | |
| | FILE NO.<br>44007B | FIGURE<br>2 |

# UNIFIED SOIL CLASSIFICATION SYSTEM

| MAJOR DIVISIONS | | | GROUP SYMBOL | GROUP NAME |
|---|---|---|---|---|
| COARSE - GRAINED SOILS<br>MORE THAN 50% RETAINED ON NO. 200 SIEVE | GRAVEL<br>MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE | CLEAN GRAVEL | GW | WELL-GRADED GRAVEL, FINE TO COARSE GRAVEL |
| | | | GP | POORLY-GRADED GRAVEL |
| | | GRAVEL WITH FINES | GM | SILTY GRAVEL |
| | | | GC | CLAYEY GRAVEL |
| | SAND<br>MORE THAN 50% OF COARSE FRACTION PASSES NO. 4 SIEVE | CLEAN SAND | SW | WELL-GRADED SAND, FINE TO COARSE SAND |
| | | | SP | POORLY-GRADED SAND |
| | | SAND WITH FINES | SM | SILTY SAND |
| | | | SC | CLAYEY SAND |
| FINE - GRAINED SOILS<br>MORE THAN 50% PASSES NO. 200 SIEVE | SILT AND CLAY<br>LIQUID LIMIT LESS THAN 50% | INORGANIC | ML | SILT |
| | | | CL | CLAY |
| | | ORGANIC | OL | ORGANIC SILT, ORGANIC CLAY |
| | SILT AND CLAY<br>LIQUID LIMIT 50% OR MORE | INORGANIC | MH | SILT OF HIGH PLASTICITY, ELASTIC SILT |
| | | | CH | CLAY OF HIGH PLASTICITY, FAT CLAY |
| | | ORGANIC | OH | ORGANIC CLAY, ORGANIC SILT |
| HIGHLY ORGANIC SOILS | | | PT | PEAT |

NOTES:

1) Field classification is based on visual examination of soil in general accordance with ASTM D 2488-93.
2) Soil classification using laboratory tests is based on ASTM D 2487-93.
3) Descriptions of soil density or consistency are based on interpretation of blowcount data, visual appearance of soils, and/or test data.

SOIL MOISTURE MODIFIERS

Dry- Absence of moisture, dusty, dry to the touch

Moist- Damp, but no visible water

Wet- Visible free water or saturated, usually soil is obtained from below water table

**RMI ASSOCIATES LLC**
*Geotechnical Consultants*
**824 E. Utsalady Road**
**Camano Island, Washington 98282**

UNIFIED SOIL CLASSIFICATION SYSTEM

| FILE NO. | FIGURE |
|---|---|
| 440078 | 3 |

# LOG OF EXPLORATION

| DEPTH | USC | SOIL DESCRIPTION |
|---|---|---|
| **TEST PIT ONE** | | |
| 0.0 – 0.5 | | **Gravel surfacing** |
| 0.5 – 3.0 | | Buff silty fine sand (Medium dense, dry)- **Fill** |
| 3.0 – 7.0 | | Gray clay (stiff, moist)- **Fill** |
| | | NO SAMPLE WAS COLLECTED<br>GROUND WATER SEEPAGE WAS NOT ENCOUNTERED<br>TEST PIT CAVING WAS NOT ENCOUNTERED<br>TEST PIT WAS COMPLETED AT 7.0 FEET ON 7/31/09 |
| **TEST PIT TWO** | | |
| 0.0 - 0.3 | | **Landscaping bricks** |
| 0.3 – 2.0 | SP | Buff silty sand with gravel (Medium dense, dry) |
| 2.0 – 7.5 | SP | Gray silty sand with gravel becoming coarser with depth (Medium dense, slightly moist) |
| | | SAMPLE WAS COLLECTED AT 6.0 FEET<br>GROUND WATER SEEPAGE WAS NOT ENCOUNTERED<br>TEST PIT CAVING WAS NOT ENCOUNTERED<br>TEST PIT WAS COMPLETED AT 7.5 FEET ON 7/31/09 |
| TEST PIT THREE | | |
| 0.0 – 0.2 | | **Gravel surfacing** |
| 0.2 – 2.0 | SP | Buff silty sand with gravel (Medium dense, dry) |
| 2.0 – 4.0 | SP | Gray silty sand with gravel (Medium dense, dry) |
| 4.0 – 6.0 | SP | Gray silty sand with trace gravel (Medium dense, dry) |
| | | SAMPLE WAS COLLECTED AT 6.0 FEET<br>GROUND WATER SEEPAGE WAS NOT ENCOUNTERED<br>TEST PIT CAVING WAS NOT ENCOUNTERED<br>TEST PIT WAS COMPLETED AT 6.0 FEET ON 7/31/09 |