

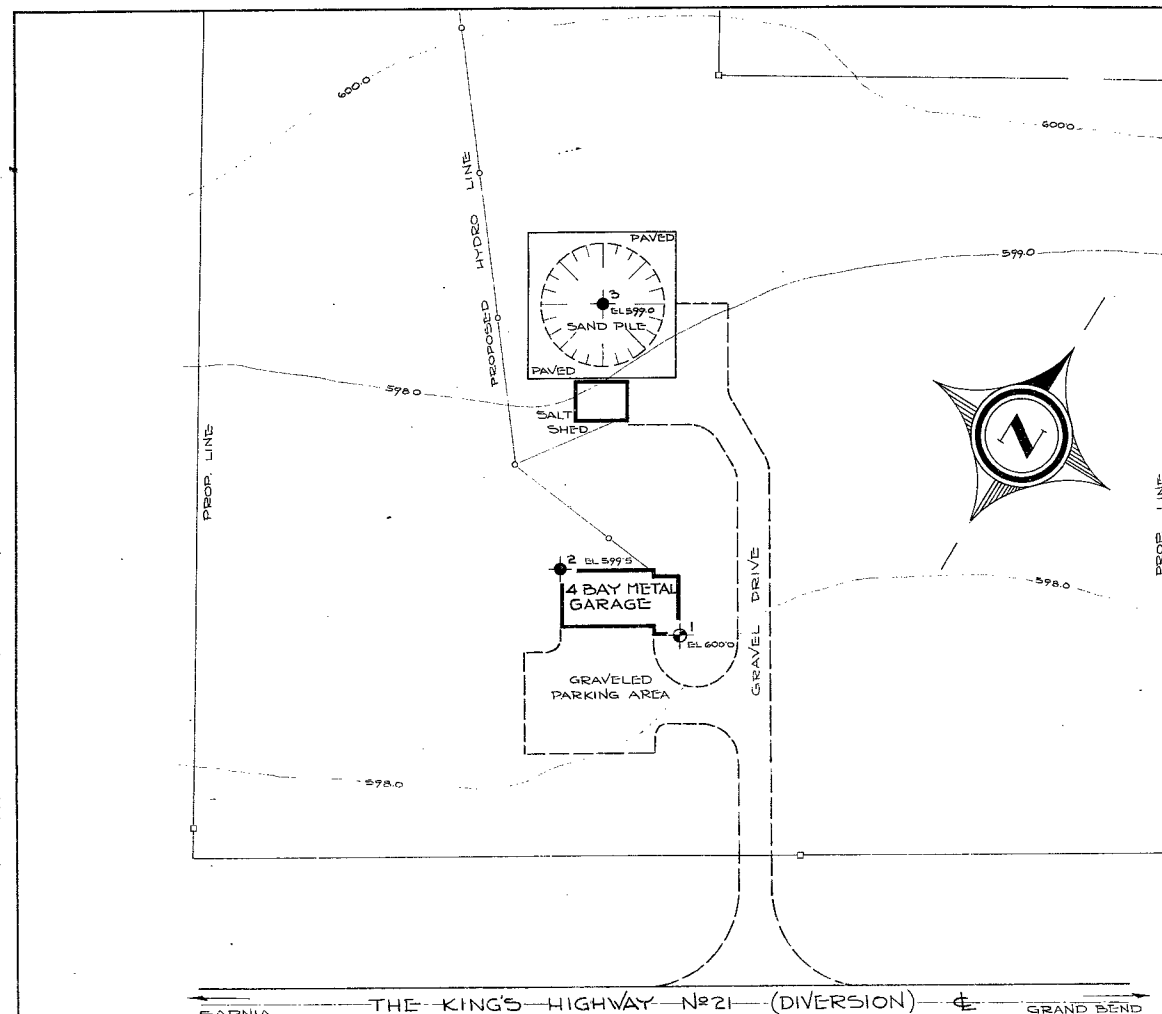
#63-F-43

W.P.# 341-65

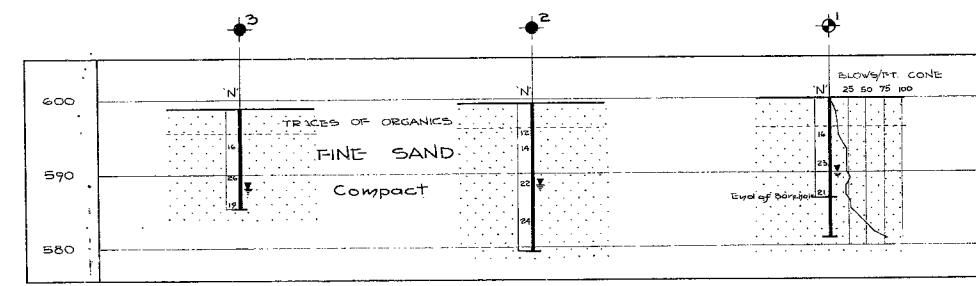
THEDFORD

PATROL YARD

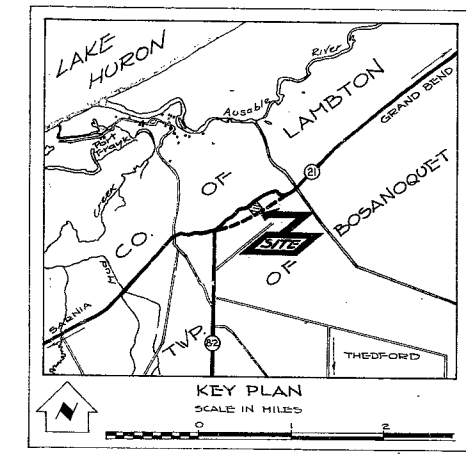
CHATHAM



PLAN  
SCALE IN FEET  
50 0 50 100



SUB-SOIL STRATIGRAPHY  
SCALE IN FEET  
10 0 10 20



LEGEND

- BORHOLE
- BORE & CONE PENETRATION HOLE
- ▽ WATER LEVELS AT TIME OF FIELD INVESTIGATION APR. 63

THE BORING WAS PERFORMED BY THE CHATHAM DISTRICT OFFICE OF THE DEPARTMENT OF HIGHWAYS - ONTARIO. THE RESULTS OF THE BORING ARE SET OUT IN THE REPORT OF THE BORING ENGINEER, MR. J. H. BROWN, DATED MAY 1, 1963.

It is the policy of the Department of Highways - Ontario to ensure that all work is done in accordance with the standards of the Department. The Department does not guarantee the accuracy of this report or the abridged version thereof.

|  |                |                 |
|--|----------------|-----------------|
| DEPARTMENT OF HIGHWAYS - ONTARIO<br>MATERIALS & RESEARCH SECTION |                |                 |
| THEDFORD PATROL YARD   |                |                 |
| ORIGINATED R. MAGI   | DISTRICT NO. 1 | DATE 6 MAY 63   |
| DRAWN D.G. HOSKOWATUK  | W.P. NO.       | JOB NO. 63 F 43 |
| CHECKED R. M. B.   | SCALE          | DRAWING NO.     |
| APPROVED <i>Afternoon</i>  | AS SHOWN       | 63-F-43A        |

Materials and Research Division

May 15, 1963

Mr. A. K. Watt,  
Ontario Water Resources Commission,  
67 College Street,  
Toronto, Ontario.

Re: Thedford Patrol Yard,  
Dist. #1 -- W.J. 63-F-43.

Dear Mr. Watt:

Attached, we are forwarding to you, a copy of  
the above-mentioned report for your use.

In accordance with the conclusions reached at  
the meeting on March 5, 1963, we would appreciate it if you  
would let us know of your opinion concerning the possible  
danger of well contamination by salt from the respective yard.

Yours very truly,

*A. G. Stermac*  
A. G. Stermac,  
PRINCIPAL FOUNDATION ENGR.  
For:  
A. Rutka,  
MATERIALS & RESEARCH ENGR.

AGS/MdeF  
Attach. (1)

cc: Foundations Office  
Gen. Files ✓

*af*

Mr. P. E. Cavell,  
Superintendent,  
Special Services Section.

Mr. A. G. Stemas,  
Principal Foundation Engr.,  
Foundation Section,  
Materials & Research Division.  
May 30, 1963

THEDFORD PATROL YARD -  
W.J. 63-F-43 -- Dist. No. 1

Attached, we are forwarding to you, copies  
of the letter by the Ontario Water Resources Commission  
concerning the above-mentioned site.

The letter is self-explanatory and does not  
require any comments. We believe this information will  
be useful with respect to your future work.

AGS/MacF  
Attach.

cc: Messrs. P. E. Cavell (4)  
H. D. McMillan  
E. J. Orr  
G. U. Howell

Foundations Office  
Gen. Filer

*A. G. Stemas*  
A. G. Stemas,  
PRINCIPAL FOUNDATION ENGINEER

*aly*

COMMISSIONERS:

A. M. SNIDER, CHAIRMAN  
W. D. CONKLIN, Q.C.  
J. H. H. ROOT, M.P.P.  
JAMES A. VANCE, LL.D.  
A. A. WISHART, Q.C.

ONTARIO WATER RESOURCES COMMISSION

801 BAY STREET  
TORONTO 5

D. S. CAVERLY  
GENERAL MANAGER  
W. S. MACDONNELL  
COMMISSION SECRETARY

MAY 24, 1963.

MR. A. RUTKA,  
DEPARTMENT OF HIGHWAYS,  
MATERIALS AND RESEARCH DIVISION,  
DOWNSVIEW, ONTARIO.

DEAR MR. RUTKA:

RE: THEDFORD PATROL YARD  
DISTRICT #1 - W.J.63-F43

IN RESPONSE TO THE REQUEST IN YOUR LETTER OF MAY 15TH, WE HAVE MADE AN EXAMINATION OF ALL GEOLOGIC AND HYDROLOGIC INFORMATION AVAILABLE FOR THE AREA IN THE VICINITY OF THE PROPOSED YARD AND ARE OF THE OPINION THAT CONTAMINATION OF WELLS COULD OCCUR IF PRECIPITATION FALLING ON THE SALT PILE IS ALLOWED TO INFILTRATE INTO THE GROUND.

OUR RECORDS INDICATE THAT THE SURFACE SAND MAY EXTEND TO A DEPTH OF 40 FEET AND TENDS TO BECOME COARSER WITH DEPTH. ALTHOUGH THE BORE HOLE OBSERVATIONS INDICATED THAT THE SAND IS COMPACT, IT IS PROBABLY STILL SUFFICIENTLY PERMEABLE TO ALLOW INFILTRATING WATER TO REACH THE 10-FOOT WATER TABLE QUITE READILY AND THUS EVENTUALLY CONTAMINATE SHALLOW WELLS. WE WOULD RECOMMEND THAT MAXIMUM PRECAUTIONS BE TAKEN TO PREVENT ANY PRECIPITATION WITH DISSOLVED SALT FROM ENTERING THE GROUND. SUCH WATER COULD LIKELY BE CHANNELLED-OFF TO THE CANAL TO THE EAST OF THE YARD.

YOURS VERY TRULY,



A. K. WATT,  
DIRECTOR,  
WATER RESOURCES DIVISION.

TJY/GP

Mr. F. E. Cavell,  
Superintendent,  
Special Services Section.

Mr. A. G. Stermac,  
Principal Foundation Engr.,  
Foundation Section,  
Materials & Research Division.

May 6, 1963

D.H.O. FOUNDATION INVESTIGATION REPORT --  
Proposed D.H.O. Patrol Yard at Hwy's 21 & 82,  
Twp. of Basenquet, Dist. of Chatham, Dist. No. 1  
W.J. 63-F-43 -- W.P. (N11)

It is proposed to erect a D.H.O. Patrol Garage 1/2 mile east of the intersection of Hwy's 21 and 82. A foundation investigation was requested by the Special Services Section in a memo dated April 8, 1963.

In order to determine the subsoil conditions at the site and decide on the type and elevation of the footings, an investigation, consisting of 3 sampled boreholes and one dynamic cone penetration test, was carried out. The locations and elevations of these boreholes are shown on Drawing 63-F-43A, which is attached to this report.

The subsoil conditions at the site are generally uniform and favourable. The site is covered by an extensive deposit of fine, brown sand. The depth of this deposit was explored to 14 ft. in boreholes #1 and #3, and to 20 ft. in borehole #2. The relative density of the deposit may be classified as compact with the 'N' values ranging between 12 and 24, and generally increasing with depth. There is no topsoil covering the site, but the sand is darker in colour and contains traces of organics (mainly roots), to an average depth of four feet.

cont'd. /2 ...

May 6, 1963

The water table, at the time of the investigation, was found to be 10' to 11' below the ground surface, from borehole observations.

It is recommended that the garage building be supported on continuous strip footings, placed as high as possible in the compact sand, as frost conditions will allow.

A safe bearing load of 1 T.S.F. may be used for design purposes.

No stability problems are anticipated at the proposed sand pile location.

Attention is drawn to the existence of some shallow wells to the north of the proposed garage area. The nearest well is about 400 ft. away, and 12 ft. deep. The intervening subsoil is highly permeable, fine sand.

For all service roads, parking lots and other areas to be paved or gravelled, a minimum of 18" of granular base consisting of 6" G.B.C. Class 'A' and 12" Sand Cushion, should be used.

A 1-1/2" thickness of HL-3 and 2" thickness of HL-6 is recommended for all paved areas.

The field work, undertaken during April 30 and May 1, 1963, together with the preparation of this report, was undertaken by Mr. R. Magi, Project Foundation Engineer. The investigation was carried out under the general supervision of Mr. M. Devata, who also reviewed this report.

cont'd. /3 ...

May 6, 1963

We believe the information contained in this report will suffice for your design work. However, should further information be required, please do not hesitate to contact our Office.

RM/MdeF

cc: Messrs. F. E. Cavell (S)  
H. D. McMillan  
E. J. Orr  
G. U. Howell  
A. Watt

Foundations Office  
Gen. Files

*K. Y. Lo*  
K. Y. Lo,  
SUPERVISING FOUNDATION ENGR.  
For:  
A. G. Stermac,  
PRINCIPAL FOUNDATION ENGR.



APPENDIX I.

# ABBREVIATIONS USED IN THIS REPORT

## PENETRATION RESISTANCE

STANDARD PENETRATION RESISTANCE 'N' - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A STANDARD SPLIT SPOON SAMPLER 12 INCHES INTO THE SUBSOIL, DRIVEN BY MEANS OF A 140 POUND HAMMER FALLING FREELY A DISTANCE OF 30 INCHES.

DYNAMIC PENETRATION RESISTANCE :- THE NUMBER OF BLOWS REQUIRED TO ADVANCE A 2 INCH, 60 DEGREE CONE, FITTED TO THE END OF DRILL RODS, 12 INCHES INTO THE SUBSOIL, THE DRIVING ENERGY BEING 350 FOOT POUNDS PER BLOW.

## DESCRIPTION OF SOIL

THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE DENSITY OR DENSENESS OF COHESIONLESS SOILS ARE DESCRIBED IN THE FOLLOWING TERMS :-

| <u>CONSISTENCY</u> | <u>'N' BLOWS / FT.</u> | <u>c LB. / SQ. FT.</u> | <u>DENSENESS</u> | <u>'N' BLOWS / FT.</u> |
|--------------------|------------------------|------------------------|------------------|------------------------|
| VERY SOFT          | 0 - 2                  | 0 - 250                | VERY LOOSE       | 0 - 4                  |
| SOFT               | 2 - 4                  | 250 - 500              | LOOSE            | 4 - 10                 |
| FIRM               | 4 - 8                  | 500 - 1000             | COMPACT          | 10 - 30                |
| STIFF              | 8 - 15                 | 1000 - 2000            | DENSE            | 30 - 50                |
| VERY STIFF         | 15 - 30                | 2000 - 4000            | VERY DENSE       | > 50                   |
| HARD               | > 30                   | > 4000                 |                  |                        |

## TYPE OF SAMPLE

|      |                       |                               |                   |
|------|-----------------------|-------------------------------|-------------------|
| S.S. | SPLIT SPOON           | T.W.                          | THINWALL OPEN     |
| W.S. | WASHED SAMPLE         | T.P.                          | THINWALL PISTON   |
| S.B. | SCRAPER BUCKET SAMPLE | O.S.                          | OESTERBERG SAMPLE |
| A.S. | AUGER SAMPLE          | F.S.                          | FOIL SAMPLE       |
| C.S. | CHUNK SAMPLE          | R.C.                          | ROCK CORE         |
| S.T. | SLOTTED TUBE SAMPLE   |                               |                   |
|      | P.H.                  | SAMPLE ADVANCED HYDRAULICALLY |                   |
|      | P.M.                  | SAMPLE ADVANCED MANUALLY      |                   |

## SOIL TESTS

|     |                                 |      |                 |
|-----|---------------------------------|------|-----------------|
| Qu  | UNCONFINED COMPRESSION          | L.V. | LABORATORY VANE |
| Q   | UNDRAINED TRIAXIAL              | F.V. | FIELD VANE      |
| Qcu | CONSOLIDATED UNDRAINED TRIAXIAL | C    | CONSOLIDATION   |
| Qd  | DRAINED TRIAXIAL                | S    | SENSITIVITY     |

## ABBREVIATIONS USED IN THIS REPORT

### SOIL PROPERTIES

|            |   |
|------------|---|
| $\gamma$   | UNIT WEIGHT OF SOIL (BULK DENSITY)                                    |
| $\gamma_s$ | UNIT WEIGHT OF SOLID PARTICLES  |
| $\gamma_w$ | UNIT WEIGHT OF WATER  |
| $\gamma_d$ | UNIT DRY WEIGHT OF SOIL (DRY DENSITY)                                 |
| $\gamma'$  | UNIT WEIGHT OF SUBMERGED SOIL   |
| G          | SPECIFIC GRAVITY OF SOLID PARTICLES $G = \frac{\gamma_s}{\gamma_w}$   |
| e          | VOID RATIO  |
| n          | POROSITY  |
| w          | WATER CONTENT   |
| $S_r$      | DEGREE OF SATURATION  |
| $w_L$      | LIQUID LIMIT  |
| $w_p$      | PLASTIC LIMIT   |
| $I_p$      | PLASTICITY INDEX  |
| s          | SHRINKAGE LIMIT   |
| $I_L$      | LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$                               |
| $I_C$      | CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$                             |
| $e_{max}$  | VOID RATIO IN LOOSEST STATE   |
| $e_{min}$  | VOID RATIO IN DENSEST STATE   |
| $I_D$      | DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$               |
|            | RELATIVE DENSITY $D_r$ IS ALSO USED                                   |
| h          | HYDRAULIC HEAD OR POTENTIAL   |
| q          | RATE OF DISCHARGE   |
| v          | VELOCITY OF FLOW  |
| i          | HYDRAULIC GRADIENT  |
| k          | COEFFICIENT OF PERMEABILITY   |
| j          | SEEPAGE FORCE PER UNIT VOLUME   |
| $m_v$      | COEFFICIENT OF VOLUME CHANGE = $\frac{-\Delta e}{(1+e)\Delta\sigma'}$ |
| $c_v$      | COEFFICIENT OF CONSOLIDATION  |
| $C_c$      | COMPRESSION INDEX = $\frac{\Delta e}{\Delta \log_{10} \sigma'}$       |
| $T_v$      | TIME FACTOR = $\frac{c_v t}{d^2}$ (d, DRAINAGE PATH)                  |
| U          | DEGREE OF CONSOLIDATION   |
| $\tau_f$   | SHEAR STRENGTH  |
| $c'$       | EFFECTIVE COHESION INTERCEPT  |
| $\phi'$    | EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION                   |
| $c_u$      | APPARENT COHESION   |
| $\phi_u$   | APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION                    |
| $\mu$      | COEFFICIENT OF FRICTION   |
| $S_t$      | SENSITIVITY   |

### GENERAL

|                           |                                   |
|---------------------------|-----------------------------------|
| $\pi$                     | = 3.1416                          |
| e                         | BASE OF NATURAL LOGARITHMS 2.7183 |
| $\log_e a$ OR $\ln a$     | NATURAL LOGARITHM OF a            |
| $\log_{10} a$ OR $\log a$ | LOGARITHM OF a TO BASE 10         |
| t                         | TIME                              |
| g                         | ACCELERATION DUE TO GRAVITY       |
| V                         | VOLUME                            |
| W                         | WEIGHT                            |
| M                         | MOMENT                            |
| F                         | FACTOR OF SAFETY                  |

### STRESS AND STRAIN

|            |  |
|------------|--|
| u          | PORE PRESSURE  |
| $\sigma$   | NORMAL STRESS  |
| $\sigma'$  | NORMAL EFFECTIVE STRESS ( $\bar{\sigma}$ IS ALSO USED) |
| $\tau$     | SHEAR STRESS   |
| $\epsilon$ | LINEAR STRAIN  |
| $\gamma$   | SHEAR STRAIN   |
| $\nu$      | POISSON'S RATIO ( $\mu$ IS ALSO USED)                  |
| E          | MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)        |
| G          | MODULUS OF SHEAR DEFORMATION                           |
| K          | MODULUS OF COMPRESSIBILITY                             |
| $\eta$     | COEFFICIENT OF VISCOSITY                               |

### EARTH PRESSURE

|          |   |
|----------|---|
| d        | DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE   |
| $\delta$ | ANGLE OF WALL FRICTION  |
| K        | DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS |
| $K_o$    | COEFFICIENT OF EARTH PRESSURE AT REST   |

### FOUNDATIONS

|       |  |
|-------|--|
| B     | BREADTH OF FOUNDATION  |
| L     | LENGTH OF FOUNDATION   |
| D     | DEPTH OF FOUNDATION BENEATH GROUND   |
| N     | DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY |
| $k_s$ | MODULUS OF SUBGRADE REACTION   |

### SLOPES

|         |  |
|---------|--|
| H       | VERTICAL HEIGHT OF SLOPE                 |
| D       | DEPTH BELOW TOE OF SLOPE TO HARD STRATUM |
| $\beta$ | ANGLE OF SLOPE TO HORIZONTAL             |

Mr. P. E. Cavell,  
Superintendent,  
Special Services Section.

Mr. A. G. Sternac,  
Principal Foundation Engr.,  
Foundation Section,  
Materials & Research Division.  
May 30, 1963

THEBYRD PATROL YARD -  
W.J. 63-F-43 -- Dist. No. 1

Attached, we are forwarding to you, copies  
of the letter by the Ontario Water Resources Commission  
concerning the above-mentioned site.

The letter is self-explanatory and does not  
require any comments. We believe this information will  
be useful with respect to your future work.

AGS/Wdef  
Attach.

cc: Messrs. P. E. Cavell (4)

H. D. McMillan

E. J. Orr

G. U. Howell ✓

*A. G. Sternac*  
A. G. Sternac,  
PRINCIPAL FOUNDATION ENGINEER

Foundations Office  
Gen. Files



COMMISSIONERS:

A. M. SNIDER, CHAIRMAN  
W. D. CONKLIN, Q.C.  
J. H. K. ROOT, M.P.P.  
JAMES A. VANCE, LL.D.  
A. A. WISHART, Q.C.

ONTARIO WATER RESOURCES COMMISSION

501 BAY STREET  
TORONTO 5

D. S. CAVERLY  
GENERAL MANAGER  
W. S. MACDONNELL  
COMMISSION SECRETARY

MAY 24, 1963.

MR. A. RUTKA,  
DEPARTMENT OF HIGHWAYS,  
MATERIALS AND RESEARCH DIVISION,  
DOWNSVIEW, ONTARIO.

DEAR MR. RUTKA:

RE: THEDFORD PATROL YARD  
DISTRICT #1 - W. J. 63-F43

IN RESPONSE TO THE REQUEST IN YOUR LETTER OF MAY 15TH, WE HAVE MADE AN EXAMINATION OF ALL GEOLOGIC AND HYDROLOGIC INFORMATION AVAILABLE FOR THE AREA IN THE VICINITY OF THE PROPOSED YARD AND ARE OF THE OPINION THAT CONTAMINATION OF WELLS COULD OCCUR IF PRECIPITATION FALLING ON THE SALT PILE IS ALLOWED TO INFILTRATE INTO THE GROUND.

OUR RECORDS INDICATE THAT THE SURFACE SAND MAY EXTEND TO A DEPTH OF 40 FEET AND TENDS TO BECOME COARSER WITH DEPTH. ALTHOUGH THE BORE HOLE OBSERVATIONS INDICATED THAT THE SAND IS COMPACT, IT IS PROBABLY STILL SUFFICIENTLY PERMEABLE TO ALLOW INFILTRATING WATER TO REACH THE 10-FOOT WATER TABLE QUITE READILY AND THUS EVENTUALLY CONTAMINATE SHALLOW WELLS. WE WOULD RECOMMEND THAT MAXIMUM PRECAUTIONS BE TAKEN TO PREVENT ANY PRECIPITATION WITH DISSOLVED SALT FROM ENTERING THE GROUND. SUCH WATER COULD LIKELY BE CHANNELLED-OFF TO THE CANAL TO THE EAST OF THE YARD.

YOURS VERY TRULY,

A. K. WATT,  
DIRECTOR,  
WATER RESOURCES DIVISION.

TJY/cp

Materials and Research Division

May 15, 1963

Mr. A. K. Watt,  
Ontario Water Resources Commission,  
67 College Street,  
Toronto, Ontario.

Re: Thedford Patrol Yard,  
Dist. #1 -- W.J. 63-F-43.

Dear Mr. Watt:

Attached, we are forwarding to you, a copy of  
the above-mentioned report for your use.

In accordance with the conclusions reached at  
the meeting on March 5, 1963, we would appreciate it if you  
would let us know of your opinion concerning the possible  
danger of well contamination by salt from the respective yard.

Yours very truly,

*A. G. Stermac*  
A. G. Stermac,  
PRINCIPAL FOUNDATION ENGR  
For:  
A. Rutka,  
MATERIALS & RESEARCH ENGR

AGS/MdeF  
Attach. (1)

cc: Foundations Office  
Gen. Files