

DATE November 10, 2011**PROJECT No.** 08-1122-0078**TO** Michel Kearney, Cheryl McWilliams, Kevin Hall
City of Ottawa**CC** Frank Cairo, Susan Murphy**FROM** Stephen Wilson, P.Geo.**EMAIL** srwilson@golder.com**SUMMARY OF THE HYDROGEOLOGICAL INVESTIGATION, PRODUCTION WELL PW09-1
WESTERN DEVELOPMENT LANDS, VILLAGE OF RICHMOND, OTTAWA, ONTARIO**

Mattamy Homes Limited (Mattamy) initiated a Water and Sewer Master Servicing Study for the Village of Richmond (Richmond) in 2008. This study, led by Stantec Consulting Ltd. (Stantec), included an investigation of the servicing options for the Village, which include the property controlled by Mattamy (site). The approximate site boundary is shown on Figure 1. The MSS identified communal wells as the preferred water servicing option for the site. In 2010, Mattamy released their option on part of the site, which was purchased by Richmond Village (North) Limited and Richmond Village (South) Limited (together referred to as RV). The Mattamy and RV properties are together referred to as the Western Development Lands.

There are two primary bedrock aquifer systems which can be used for water supply at the site. The upper aquifer is typically contained within the upper 35 metres of the Oxford Formation (limestone/dolostone). The majority of the private residential wells within Richmond are completed within this upper aquifer. The lower aquifer is contained within the upper portion of the Nepean Formation (sandstone) and lower portion of the March Formation (interbedded limestone and sandstone). This lower aquifer tends to be substantially more productive in comparison to the upper aquifer. Communal wells in the area (King's Park and Hyde Park in Richmond, and wells in Almonte, Munster, Kemptville and Merrickville) draw water from the lower aquifer. In some areas the two aquifers are separated by a bedrock aquitard consisting of limestone of the lower Oxford Formation and interbedded limestone and sandstone of the upper March Formations. The presence of this aquitard is often indicated by strong upward vertical gradients between the aquifers. The potentiometric surface of the lower aquifer is typically above ground surface, and wells therefore completed within this aquifer often flow.

Investigations that included well construction and aquifer testing were undertaken to assess the hydrogeological characteristics of the lower sandstone aquifer at the site. In November 2009, a 48-hour pumping test was conducted by Golder Associates Ltd. (Golder) using a pumping rate of 1,273 Litres per minute (L/min) on a well (PW08-1) completed in the lower sandstone aquifer. The transmissivity and storativity values generated by the analysis of drawdown data from the pumping test range from 328 metres squared per day (m^2/day) to $700 \text{ m}^2/\text{day}$ and from 9×10^{-4} to 1×10^{-2} , respectively. Based on the results of the pumping test, the sustainable yield of the well was estimated to be 2,600 L/min (Golder, 2011).

To allow for additional testing of the deep aquifer at the site, a second production well (PW09-1) was completed in the lower sandstone aquifer. The following provides a summary of the aquifer testing program completed using PW09-1.



Production Well Construction (PW09-1)

In December 2009, a 0.254-metre diameter production well (PW09-1) was drilled to a depth of 70 metres below ground surface (mbgs). PW09-1 is located near the eastern property boundary approximately 650 metres south of Perth Street (see location on Figure 1). The production well was completed with 45.72 metres of steel well casing which was grouted in place. The steel casing was installed through the upper portion of the Oxford Formation (i.e., through the upper aquifer), and groundwater flow to the pumping well is expected to occur primarily from the lower aquifer. A schematic of the well construction details for PW09-1 is provided in Attachment 1.

Aquifer Testing Methodology and Observations

A 72-hour pumping test was conducted at PW09-1 between September 27 and September 30, 2011. Recovery measurements were collected until October 3, 2011. The pumping test was started at a rate of 2,690 L/min. After the first day of pumping, the rate decreased slightly due to a loss of pump efficiency. The remainder of the test was completed at a rate that ranged from 2,690 L/min to 2,410 L/min.

During the pumping test, water level data was collected from the pumping well (PW09-1) and nine observation wells (PW09-2, PW08-1, MW08-1A, MW08-1B, MW08-1C, MW10-3A, OW-1, OW-2 and OW-3). The locations of the observation wells are shown on Figure 1, and the well completion details are provided on the logs in Attachment 1. The following table provides the radial distance from the pumping well, the open portion of the well, the formation the well is completed in, the static water level and the maximum drawdown measured during the pumping test for each location:

| Location | Radial Distance (m) | Open Portion of Well (mbgs) | Formation | Static Water Level (mags/mbgs) | Maximum Drawdown Measured During Pumping Test (m) |
|----------|---------------------|--------------------------------|--------------|--------------------------------|---|
| PW09-1 | 0 | open hole from 45.72 to 70.00 | Upper Nepean | 2.07 mags ¹ | 52.5 |
| PW09-2 | 5 | open hole from 45.72 to 70.00 | Upper Nepean | 2.07 mags | 4.79 |
| PW08-1 | 35 | open hole from 45.72 to 137.16 | Upper Nepean | 2.32 mags | 3.82 |
| MW10-3A | 79 | 4.4 to 6.0 | Upper Oxford | 0.99 mbgs | 0.7 |
| MW08-1A | 93 | 66.90 to 75.23 | Upper Nepean | 2.32 mags | 3.6 |
| MW08-1B | 93 | 48.51 to 53.46 | Lower Oxford | 2.36 mags | 3.4 |
| MW08-1C | 93 | 7.47 to 12.04 | Upper Oxford | 1.12 mags | 1.9 |
| OW-1 | 130 | open hole from 6.71 to 31.39 | Lower Oxford | 0.58 mags | 1.8 |
| OW-2 | 190 | open hole from 6.71 to 31.39 | Lower Oxford | 0.47 mbgs | 0 |
| OW-3 | 221 | open hole from 10.36 to 37.49 | Lower Oxford | 1.55 mags | 1.7 |

mags – metres above ground surface; mbgs – metres below ground surface

¹ Static water level could not be measured as well was flowing, static level assumed to equal static level in PW09-2

Water level measurements were collected in the observation wells using pressure transducers and data loggers, with periodic manual water level measurements collected for quality control. Due to the configuration of the pumping equipment that was used in PW09-1, a data logger could not be used appropriately, and only manual measurements were collected from the pumping well.

During the 72-hour pumping test the water level in OW-2 showed no significant change. Following the pumping test, OW-2 was sounded to confirm the well depth. At that time, the well was found to be blocked at a depth of approximately four metres. As such, OW-2 is not considered to be representative of aquifer conditions at the site, and will not be considered in the discussion provided below.

Aquifer Test Analysis

The drawdown and recovery data obtained during the 72-hour pumping test was analyzed using the Cooper and Jacob equation (Cooper and Jacob, 1946) and the Theis recovery equation (Theis, 1935), respectively, to estimate the local aquifer characteristics (transmissivity and storativity). The following table summarizes the results:

| Location | Transmissivity – Drawdown (m ² /day) | Transmissivity – Theis Recovery (m ² /day) | Storativity – Drawdown (dimensionless) |
|----------|---|---|--|
| PW09-1 | -- | 592 | -- |
| PW09-2 | 630 | 599 | 4.8 x 10 ⁻³ |
| PW08-1 | 672 | 644 | 5.9 x 10 ⁻⁴ |
| MW10-3A | -- | 527 | -- |
| MW08-1A | 663 | 638 | 1.4 x 10 ⁻⁴ |
| MW08-1B | 567 | 537 | 4.6 x 10 ⁻⁴ |
| MW08-1C | 637 | 453 | 1.0 x 10 ⁻² |
| OW-1 | 606 | 453 | 5.7 x 10 ⁻³ |
| OW-2 | -- | -- | -- |
| OW-3 | 755 | 570 | 1.4 x 10 ⁻³ |

Curve matching plots developed during the analysis of the drawdown and recovery data are provided in Attachment 2. Drawdown data collected in MW10-3A was sparse during the first 36 hours of the pumping test, and only recovery data could be analyzed. There is some question regarding the cause of the water level changes noted in this monitor, and it may reflect a precipitation event rather than response to pumping. The manual drawdown data from the pumping well PW09-1 could not be used with confidence and only recovery data was analyzed. The transmissivity of the lower sandstone aquifer is estimated to range from 500 m²/day to 800 m²/day. The pumping test results indicated that the sustainable yield for well PW09-1 is at least the minimum pumping rate of 2,410 L/min and is likely greater.

Preliminary Predictive Simulations

To estimate the potential drawdown associated with the long-term pumping related to water supply for the Western Development Lands, a simplified three-dimensional numerical groundwater model was constructed based on the results of the aquifer testing program. The code used was MODFLOW (McDonald & Harbaugh). Predictive simulations were completed using the assumed water taking rates required to supply the Western Development Lands. The assumptions are as follows:

- The RV lands will contain 1,000 units, including 650 singles and 350 town homes;
- The Mattamy lands will contain 1,000 singles; and,
- Average water demand is 835 L/day/unit for singles and 720 L/day/unit for town homes.

The number of planned units was provided by representatives of Mattamy and RV. The unit demand rates were taken from the Master Servicing Study (Stantec, 2011).

Using these assumptions, the average water demand for the Western Development Lands is 1,132 L/min.

The results of the numerical simulations suggest that pumping of PW09-1 (completed within the lower sandstone aquifer) at a rate equal to the assumed average daily pumping rate for the Mattamy/RV development (1,132 L/min), will result in a drawdown of approximately 1.0 metre at OW-1, and approximately 0.8 metres at OW-3 after 20 years of pumping. These two observation wells are completed in a similar manner and to a similar depth as typical private wells in Richmond. However, because they are flowing wells, they are considered representative of wells obtaining water from the upper limestone aquifer within an area of enhanced connection to the lower sandstone aquifer. OW-1 is located approximately 130 metres from the pumped well, and is closer than any existing private well. OW-3 is located approximately 220 metres from the pumped well, which is similar to the approximate radial distance of the nearest private well. A drawdown of less than one metre is considered insignificant and would not be noticed by local groundwater users.

If a maximum day demand of 2,320 L/day/unit for single family homes and 720 L/day/unit for town homes (Stantec, 2011) is assumed, a total demand of 2,833 L/min is predicted. This is slightly more than the pumping rate used during the 72 hour pumping test, and could be accommodated by one or both of the production wells without causing significant drawdown in the aquifer. Maximum day is typically not experienced for more than a few days at a time, but a numerical simulation was run using the maximum day rate for a period of 20 years. After this time, the drawdown at OW3 is predicted to be approximately two metres, which is considered minimal.

Groundwater Quality

The lower sandstone aquifer underlying the site is regionally extensive, and is utilized by the King's Park and Hyde Park communal wells in Richmond, as well as the communal wells systems in Almonte, Munster, Kemptville and Merrickville. In general, the groundwater quality in the lower aquifer is slightly better than in the upper aquifer. The groundwater in the lower aquifer is hard (typical for groundwater sources) and occasionally exceeds the non-health related aesthetic criteria for iron. The exceedances of the aesthetic criteria for iron in the lower aquifer are within the limit treatable using conventional water softening. Overall, wells completed in the lower aquifer are expected to produce groundwater that is safe and aesthetically suitable for human consumption.

The following description of the water quality and required treatment was provided by the City of Ottawa in the 2010 Annual Report for the King's Park communal well system:

The Kings Park water supply (serving a subdivision of Richmond) draws ground water from either one of two wells. The two wells are located at opposite ends of the Kings Park subdivision. The source water has consistently been found to be clear of bacteria and chemical contaminants, has a high hardness level and a noticeable concentration of naturally occurring iron and hydrogen sulfide.

The treatment process in Kings Park consists of the following steps:

- *Disinfection (free chlorine using sodium hypochlorite) which also oxidizes hydrogen sulphide; and,*
- *Chlorine contact time.*

This treatment process results in water that is clear and safe to drink. There is a slight noticeable taste of elemental sulphur in the finished water.

A similar treatment process and resulting acceptable water quality for drinking is reported by the Almonte, Munster, Kemptville and Merrickville communal well systems supplied by the lower sandstone aquifer. Based on the available water quality data from the existing communal well systems, high quality potable water is available from the lower sandstone aquifer underlying the site. To confirm that the water quality in the sandstone aquifer at the site is consistent with the water quality measured at the existing communal wells, water quality testing was completed at three intervals during the pumping test at PW09-1.

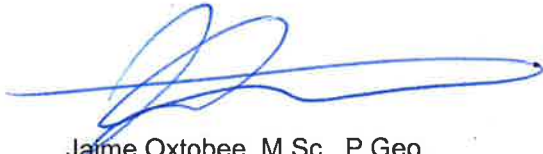
Following 20 hours of pumping and 44 hours of pumping at PW09-1, samples were collected for the "General Geochemistry of Groundwater package" which includes basic inorganic and metals parameters of interest in groundwater. Following 72 hours of pumping at PW09-1, samples were collected for a suite of volatile organic compounds (VOCs), as well as the "Subdivision Package" which includes a variety of organic, inorganic, metals and bacteriological parameters. All groundwater samples obtained from PW09-1 were collected using appropriate sampling and preservation techniques, placed in coolers with ice packs and delivered to Exova Laboratories Ltd. of Ottawa, Ontario.

The results of the water quality testing for PW09-1 are provided in Table 1. The water from PW09-1 is of excellent quality, meeting all of the health related Ontario Drinking Water Quality Standards and all of the established aesthetic objectives for the parameters tested. The hardness concentration of 286 to 305 milligrams per Litre (mg/L) at PW09-1 exceeds the operational guideline of 100 mg/L, but is considered typical for groundwater derived from a bedrock aquifer. The water quality measured at PW09-1 remained stable during the pumping test, and is consistent with the water quality observed at the existing communal wells completed in Richmond, and the water quality observed during the previous pumping test at PW08-1 (Golder, 2011). As a result, it is expected that communal wells completed at the site will provide high quality potable water.

Summary

This memorandum summarizes the aquifer testing and subsequent analysis completed at PW09-1 by Golder as part of the ongoing hydrogeological investigation for the Western Development Lands. A 72-hour pumping testing was completed on production well PW09-1. Based on the results of the pumping test, the sustainable yield at PW09-1 is at least 2,410 L/min. Analysis of the drawdown and recovery data gathered during the pumping test result in transmissivity estimates that ranged from 500 m²/day to 800 m²/day. Preliminary predictive numerical simulations were completed to estimate the potential impact of long-term pumping of the lower aquifer on private wells in Richmond. The preliminary modelling results, as well as the drawdown observed during the 72-hour pumping test, suggest that long-term pumping of the lower aquifer will not interfere with water supply from the upper aquifer.

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Attachments: Table 1 – PW09-1 Water Quality Results
Figure 1 – Site Plan
Attachment 1 – Water Well Records and Borehole Logs
Attachment 2 – Drawdown and Recovery Plots

References

- Cooper, H.H., and C.E., Jacob, 1946. *A Generalized Graphical Method for Evaluating Formation Constants and Summarizing Well Field History*, Am. Geophys. Union Trans., vol. 27, pp. 526-534.
- Golder Associates Ltd., 2011. Summary of Hydrogeological Investigation: Mattamy Richmond Lands, Ottawa, Ontario. March 25, 2011.
- McDonald, M.G., and Harbaugh, A.W. (1988). A modular three-dimensional finite-difference ground-water flow model. *Techniques of Water-Resources Investigations*, Book 6. U.S. Geological Survey.
- Stantec Consulting Ltd., 2011. Village of Richmond Water and Sewer Master Servicing Study. July 22, 2011
- Theis, C.V., 1935. The Relationship between the Lowering of the Piezometric Surface and the Rate and Duration of Discharge of a Well Using Groundwater Storage, Trans. Amer. Geophys. Union, Vol. 16, pp. 519-524.

TABLE 1
PW09-1 WATER QUALITY RESULTS
RICHMOND MATTAMY LANDS, OTTAWA, ONTARIO

| Location | | PW09-1 (21 Hours) | PW09-1 (21 Hours) | PW09-1 (21 Hours) |
|--|-----------|-------------------|-------------------|-------------------|
| Date Sampled | ODWSOG | 28-Sep-11 | 29-Sep-11 | 30-Sep-11 |
| Parameter | | | | |
| Bacteria | | | | |
| Escherichia Coli (units - CFU/100mL) | 0 (MAC) | -- | -- | 0 |
| Total Coliforms (units - CFU/100mL) | 0 (MAC) | -- | -- | 0 |
| Volatile Organic Compounds - VOCs | | | | |
| 1,1,1,2-tetrachloroethane | | -- | -- | <0.5 |
| 1,1,1-trichloroethane | | -- | -- | <0.4 |
| 1,1,2,2-tetrachloroethane | | -- | -- | <0.5 |
| 1,1,2-trichloroethane | | -- | -- | <0.4 |
| 1,1-dichloroethane | | -- | -- | <0.4 |
| 1,1-dichloroethylene | 14 (MAC) | -- | -- | <0.5 |
| 1,2-dibromoethane | | -- | -- | <0.2 |
| 1,2-dichlorobenzene | 200 (MAC) | -- | -- | <0.4 |
| 1,2-dichloroethane | 5 (MAC) | -- | -- | <0.2 |
| 1,2-dichloropropane | | -- | -- | <0.5 |
| 1,3,5-trimethylbenzene | | -- | -- | <0.3 |
| 1,3-dichlorobenzene | | -- | -- | <0.4 |
| 1,4-dichlorobenzene | 5 (MAC) | -- | -- | <0.4 |
| Benzene | 5 (MAC) | -- | -- | <0.5 |
| Bromodichloromethane | | -- | -- | <0.3 |
| Bromoform | | -- | -- | <0.4 |
| Bromomethane | | -- | -- | <0.5 |
| c-1,2-Dichloroethylene | | -- | -- | <0.4 |
| c-1,3-Dichloropropylene | | -- | -- | <0.2 |
| Carbon Tetrachloride | 5 (MAC) | -- | -- | <0.5 |
| Chloroethane | | -- | -- | <0.2 |
| Chloroform | | -- | -- | <0.5 |
| Chloromethane | | -- | -- | <0.2 |
| Dibromochloromethane | | -- | -- | <0.3 |
| Dichlorodifluoromethane | | -- | -- | <0.5 |
| Dichloromethane | 50 (MAC) | -- | -- | <4.0 |
| Ethylbenzene | 2.4 (AO) | -- | -- | <0.5 |
| m/p-xylene | | -- | -- | <0.5 |
| Monochlorobenzene | 80 (MAC) | -- | -- | <0.2 |
| General Chemistry | | | | |
| Alkalinity as CaCO3 | 500 (OG) | 259 | 258 | 258 |
| Calcium | | 75 | 81 | 79 |
| Chloride | 250 (AO) | 43 | 43 | 44 |
| Conductivity (Lab) (units uS/cm) | | 664 | 673 | 676 |
| Conductivity (Field) (units uS/cm) | | 627 | 593 | 647 |
| Colour (units - TCU) | 5.0 (AO) | -- | -- | <2 |
| Dissolved Organic Carbon | 5.0 (AO) | -- | -- | 1 |
| Fluoride | 1.5 (MAC) | 0.25 | 0.25 | 0.25 |
| Iron | 0.3 (AO) | 0.13 | 0.11 | 0.16 |
| Hydrogen Sulphide | 0.05 (AO) | -- | -- | <0.01 |
| Hardness as CaCO3 | 100 (OG) | 286 | 305 | 296 |
| Ion Balance | | -- | -- | 0.95 |
| Magnesium | | 24 | 25 | 24 |
| Manganese | 0.05 (AO) | <0.01 | <0.01 | <0.01 |
| Ammonia (N-NH3) | | -- | -- | 0.04 |
| Nitrite (N-NO2) | 1.0 (MAC) | -- | -- | <0.1 |
| Nitrate (N-NO3) | 10 (MAC) | <0.10 | <0.10 | <0.1 |
| pH (Lab) (pH units) | | 7.93 | 7.97 | 7.98 |
| pH (Field) (pH units) | | 6.32 | 6.41 | 6.47 |
| Phenols | | -- | -- | <0.001 |
| Potassium | | -- | -- | 3 |
| Sodium | 200* (AO) | 24 | 24 | 23 |
| Sulphate | 500 (AO) | 46 | 46 | 47 |
| Tannin & Lignin | | <0.1 | 0.2 | <0.1 |
| Temperature (Field) (°C) | | 11.6 | 10 | 10.8 |
| Total Kjeldahl Nitrogen | | -- | -- | <0.1 |
| Turbidity (units - NTU) | 5.0 (AO) | -- | -- | 1.6 |
| Total Dissolved Solids | 500 (AO) | -- | -- | 439 |

Notes:

all units are in mg/L unless otherwise noted

ODWSOG - Ontario Drinking Water Standards, Objectives and Guidelines

AO - aesthetic objective

OG - operational guideline

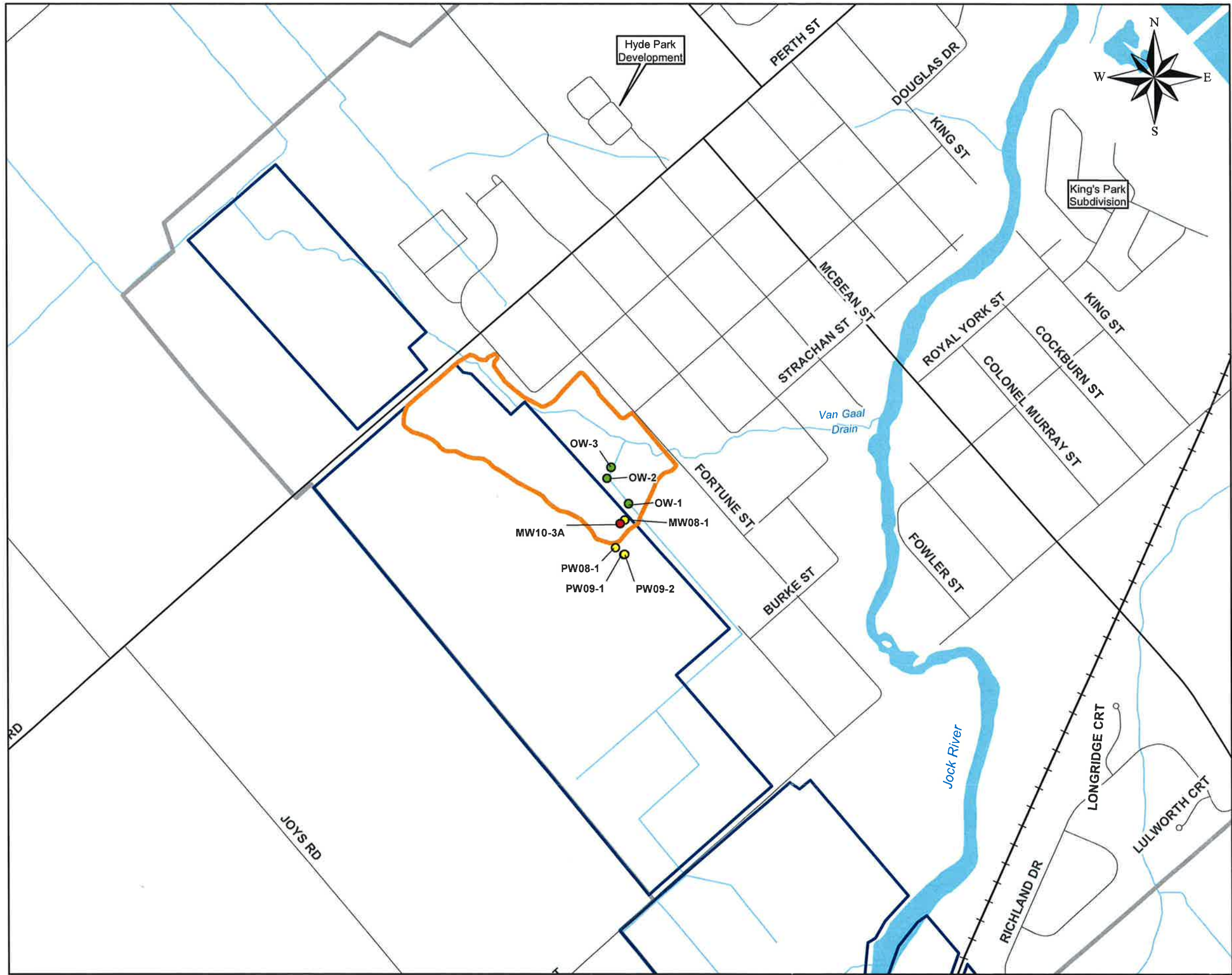
MAC - maximum acceptable concentration

Bold Values - indicate an exceedance of ODWSOG

a - the aesthetic objective for sodium in drinking water is 200 mg/L. The local Medical Officer of Health should be notified when sodium concentrations exceed 20 mg/L.

TCU - true colour units

NTU - nephelometric turbidity unit



LEGEND

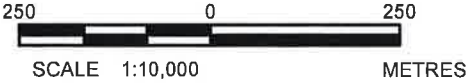
- Observation Well (Installed by Golder)
- Observation Well (Installed by Others)
- Test Well (Installed by Golder)
- Major Road
- Local Road
- Railway
- Richmond Village Boundary
- Watercourse
- Surface Water
- Site Boundary
- Flood Plain in Vicinity of Potential Well Drilling Area

NOTE

1. Locations for PW09-2 and MW10-3A were estimated using Google Earth
2. This figure is to be read in conjunction with the accompanying Golder Associates Ltd. report No. 08-1122-0078-2000

REFERENCE

Digital data provided by Ontario Ministry of Natural Resources, used under license
© Queen's Printer of Ontario, 2008.
Water wells provided by Ontario Ministry of Environment, 2006.
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 18




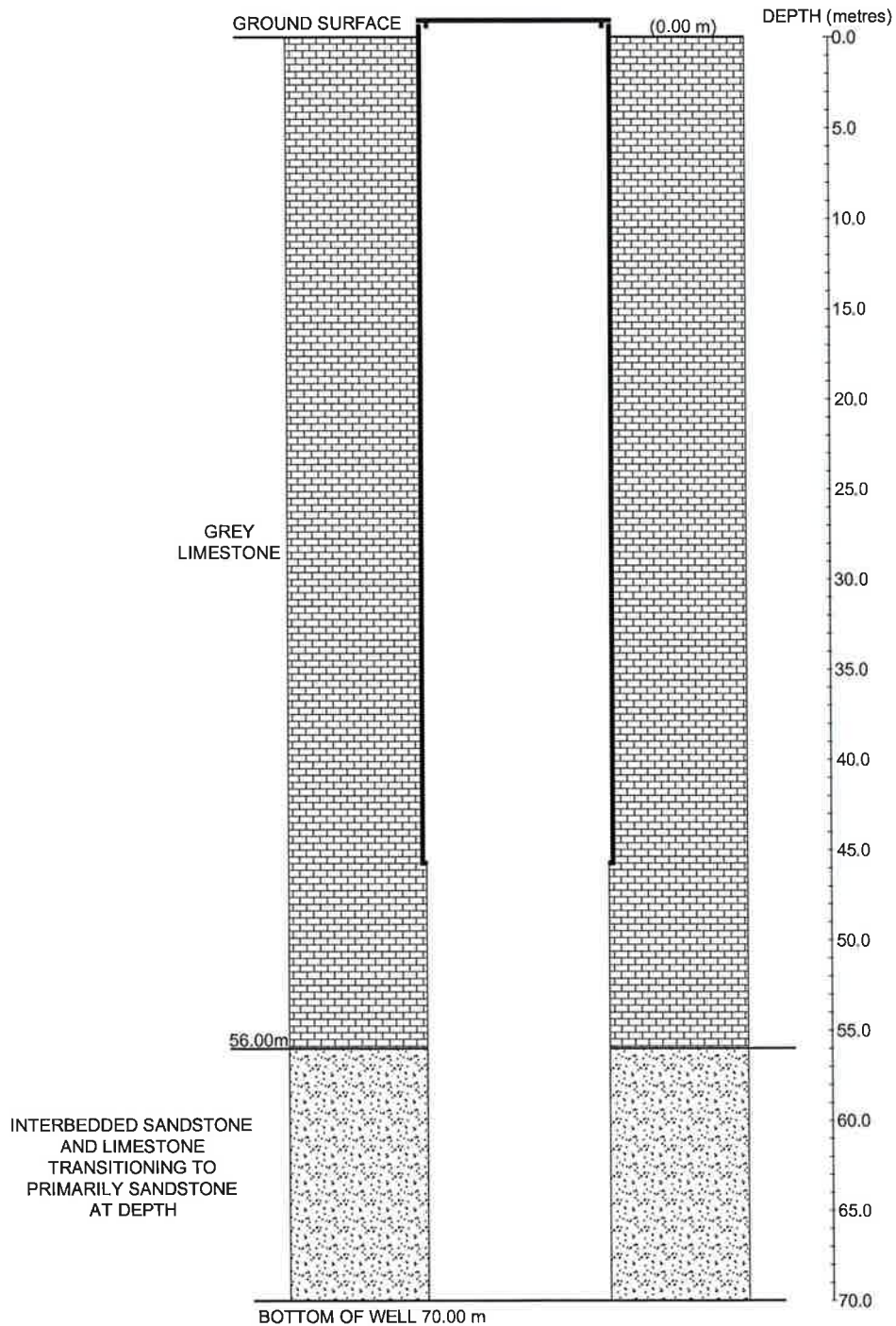
| | | | |
|---|--------------------------|---|--------|
| PROJECT | | MATTAMY RICHMOND LANDS HYDROGEOLOGICAL INVESTIGATION | |
| TITLE | | SITE PLAN | |
|  Golder Associates Ottawa, Ontario | PROJECT No. 08-1122-0078 | SCALE AS SHOWN | REV. 0 |
| | DESIGN MIB Nov 2011 | | |
| | GIS BT/AS Nov 2011 | | |
| | CHECK | | |
| | REVIEW | | |

FIGURE 1

ATTACHMENT 1

**Water Well Records/Borehole Logs
(PW09-1, PW09-2, PW08-1, MW08-1, MW10-3A, OW-1, OW-2 and OW-3)**

FILENAME: N:\Active\2008\1122 - Environmental\08-1122-0078 Mattamy Richmond\ACAD\Phase 8000\0811220078-8000-03.dwg



NOTE

1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT No. 08-1122-0078
2. WELL DIAMETER 0.254 m
3. OPEN HOLE FROM 45.72 m TO 70.00 m



| | |
|--------|-------------|
| SCALE | NTS |
| DATE | 4 Nov. 2011 |
| DESIGN | |
| CADD | PG |
| CHECK | |
| REVIEW | |

TITLE

PRODUCTION WELL CONSTRUCTION DETAILS FOR PW09-1

FILE No. 0811220078-8000-03.dwg

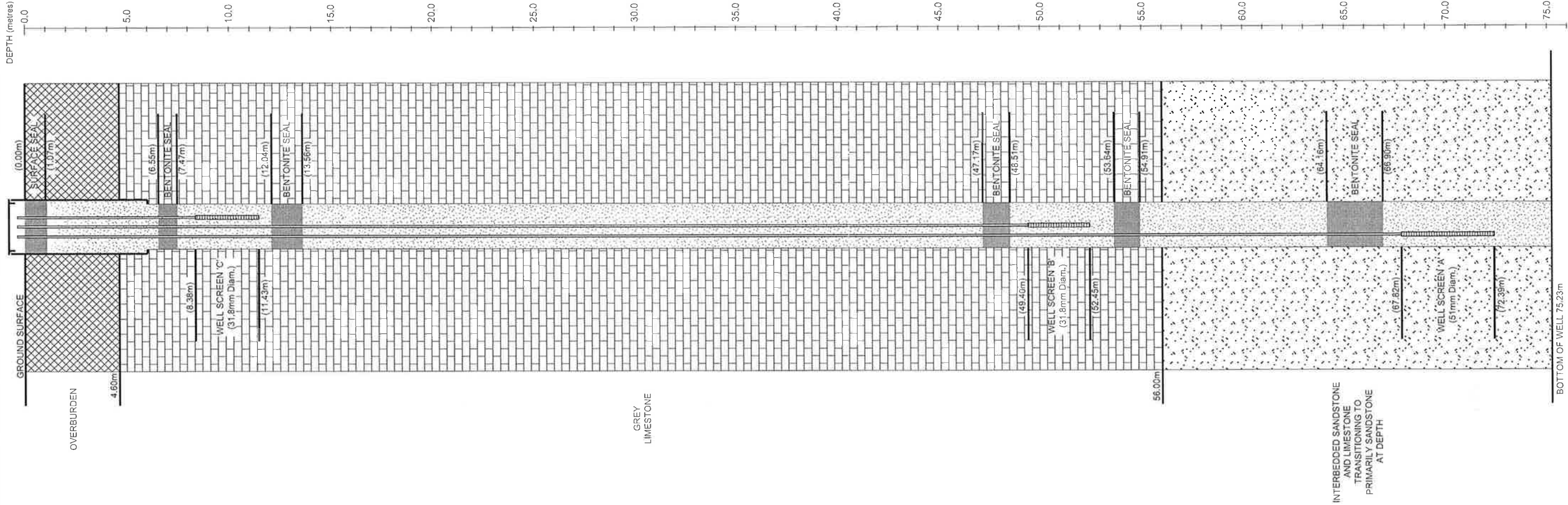
PROJECT No. 08-1122-0078

REV. 0

MATTAMY RICHMOND LANDS
HYDROLOGICAL INVESTIGATION

FIGURE

1



NOTE

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT No. 08-1122-078

| TITLE | | |
|---------|----------------------------|-----------|
| PROJECT | No.08-1122-0078 | |
| FILE | No. 0811220078-8000-02.dwg | |
| REV. 0 | SCALE | N.T.S. |
| DESIGN | MIB | Nov. 2011 |
| CADD | JM | Nov. 2011 |
| CHECK | | |
| REVIEW | | |

FIGURE 2

MATTAMY RICHMOND LANDS
HYDROGEOLOGICAL INVESTIGATION



Print Below
A 089810Measurements recorded in: ☐ Metric ☒ Imperial

Well Owner's Information

| | | | | |
|---|--------------------------------------|----------------|---|--------------------------------|
| First Name | Last Name / Organization | E-mail Address | <input type="checkbox"/> Well Constructed by Well Owner | |
| | Mattamy (Jack River) Limited. | | | |
| Mailing Address (Street Number/Name) | Municipality | Province | Postal Code | Telephone No. (inc. area code) |
| 123 Huntmar Drive | Ottawa | On | K2S1L1B9 | 61381253439 |
| Well Location | Township | Lot | Concession | |
| Address of Well Location (Street Number/Name) | Goulbourn | 22 | 3 | |
| County/District/Municipality | City/Town/Village | Province | Postal Code | |
| Goulbourn | Richmond | Ontario | | |
| UTM Coordinates Zone Easting Northing | Municipal Plan and Sublot Number | Other | | |
| NAD 83 | | | | |

Overburden and Bedrock Materials/Abandonment Sealing Record (Give instructions on the back of this form)

| General Colour | Most Common Material | Other Materials | General Description | Depth (m/ft) |
|----------------|----------------------|-----------------|---------------------|--------------|
| | | | | From To |
| Brown | Clay | | Packed | 0 14 |
| black | Shale | | | 14 180 |
| white | Sandstone | | | 180 195 |
| black | Shale | | | 195 255 |

| Annular Space | | | Results of Well Yield Testing | | | |
|---------------------|--|--|---|---|--------------|--------------------|
| Depth Set at (m/ft) | Type of Sealant Used (Material and Type) | Volume Placed (m ³ /ft ³) | After test of well yield, water was: | | Draw Down | |
| 0 150' | High Yearly Cement | 103 | <input type="checkbox"/> Clear and sand free | <input type="checkbox"/> Other, specify | Time (min) | Water Level (m/ft) |
| | | | If pumping discontinued, give reason: | | Static Level | Recovery |
| | | | | | Time (min) | Water Level (m/ft) |
| | | | Pump intake set at (m/ft) | | 1 | 1 |
| | | | Pumping rate (l/min / GPM) | | 2 | 2 |
| | | | Duration of pumping | | 3 | 3 |
| | | | hrs + min | | 4 | 4 |
| | | | Final water level end of pumping (m/ft) | | 5 | 5 |
| | | | If flowing give rate (l/min / GPM) | | 10 | 10 |
| | | | Recommended pump depth (m/ft) | | 15 | 15 |
| | | | Recommended pump rate (l/min / GPM) | | 20 | 20 |
| | | | Well production (l/min / GPM) | | 25 | 25 |
| | | | Disinfect? | | 30 | 30 |
| | | | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No | | 40 | 40 |
| | | | | | 50 | 50 |
| | | | | | 60 | 60 |

| Method of Construction | | | Well Use | |
|---|----------------------------------|---|---|-------------------------------------|
| <input type="checkbox"/> Cable Tool | <input type="checkbox"/> Diamond | <input type="checkbox"/> Public | <input type="checkbox"/> Commercial | <input type="checkbox"/> Not used |
| <input checked="" type="checkbox"/> Rotary (Conventional) | <input type="checkbox"/> Jetting | <input type="checkbox"/> Domestic | <input type="checkbox"/> Municipal | <input type="checkbox"/> Dewatering |
| <input type="checkbox"/> Rotary (Reverse) | <input type="checkbox"/> Driving | <input type="checkbox"/> Livestock | <input checked="" type="checkbox"/> Test Hole | <input type="checkbox"/> Monitoring |
| <input type="checkbox"/> Boring | <input type="checkbox"/> Digging | <input type="checkbox"/> Irrigation | <input type="checkbox"/> Cooling & Air Conditioning | |
| <input type="checkbox"/> Air percussion | | <input type="checkbox"/> Industrial | | |
| <input type="checkbox"/> Other, specify | | <input type="checkbox"/> Other, specify | | |

| Construction Record - Casing | | | Status of Well | |
|------------------------------|--|------------------------|----------------|--|
| Inside Diameter (cm/in) | Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel) | Wall Thickness (cm/in) | Depth (m/ft) | |
| | | | From To | |
| 10 1/8 | Steel | 1.88 | 0 150 | |

| Construction Record - Screen | | | Status of Well | |
|------------------------------|---------------------------------------|----------|----------------|--|
| Outside Diameter (cm/in) | Material (Plastic, Galvanized, Steel) | Slot No. | Depth (m/ft) | |
| | | | From To | |

| Water Details | | | Hole Diameter | |
|-----------------------------|--|--------------|---------------|------------------|
| Water found at Depth (m/ft) | Kind of Water: <input type="checkbox"/> Fresh <input checked="" type="checkbox"/> Untested | Depth (m/ft) | From To | Diameter (cm/in) |
| 73 | <input type="checkbox"/> Gas <input type="checkbox"/> Other, specify | 0 255 | | 10 1/8 |
| 190 | <input type="checkbox"/> Gas <input type="checkbox"/> Other, specify | | | |
| 210 | <input type="checkbox"/> Gas <input type="checkbox"/> Other, specify | | | |

| Well Contractor and Well Technician Information | | | Map of Well Location | |
|---|-------------------------------|--------------------------------|--|--|
| Business Name of Well Contractor | Well Contractor's Licence No. | | Please provide a map below following instructions on the back. | |
| J.R. Drilling Co. Ltd. | 31749 | | | |
| Business Address (Street Number/Name) | Municipality | | Franktown Rd | |
| 23 Witches rd. | Clarendon | | | |
| Province | Postal Code | Business E-mail Address | | |
| On | K0C 1A0 | jrdrilling2@hotmail.com | | |

| | | | |
|-------------------------------------|---|------------------------|--------------------------|
| Bus. Telephone No. (inc. area code) | Name of Well Technician (Last Name, First Name) | Date Package Delivered | Ministry Use Only |
| 6113186019 | Bill | Y Y Y Y M M D D | Audit No. 2103267 |
| Well Technician's Licence No. | Signature of Technician and/or Contractor | Date Work Completed | |
| 10150 | Bill | 20101010 | |

Well Owner's Information

First Name _____ Last Name / Organization Mattamy (Jack River) Limited. E-mail Address _____ ☐ Well Constructed by Well Owner

Mailing Address (Street Number/Name) 123 Hunter Drive Municipality Ottawa Province On. Postal Code K2G 1B9 Telephone No. (inc. area code) 613 825 3479

Well Location

Address of Well Location (Street Number/Name) _____ Township Goulbourn Lot 22 Concession 3

County/District/Municipality Goulbourn City/Town/Village Richmond Province Ontario Postal Code _____

JTM Coordinates Zone Easting NAD 83 75150 Northing 49645 11105

Municipal Plan and Sublot Number _____ Other _____

Overburden and Bedrock Materials/Abandonment Sealing Record (see instructions on the back of this form)

| General Colour | Most Common Material | Other Materials | General Description | Depth (m) |
|----------------|----------------------|-----------------|---------------------|-----------|
| | | | | From To |
| Brown | Clay | | Packed | 0 11' |
| black | Shale | | soft | 11 150' |
| black | Shale | | | 150 180' |
| white | Sandstone | | | 180 195' |
| black | Shale | | | 195 255' |
| black | granite | | | 255 395' |
| | | | | 395 450' |

Annular Space

Depth Set at (m/ft) From To _____

Type of Sealant Used (Material and Type) High Early Cement

Volume Placed (m³/ft³) 103

Method of Construction

☒ Cable Tool ☐ Diamond ☐ Public ☐ Commercial ☐ Not used

☒ Rotary (Conventional) ☐ Jetting ☐ Domestic ☐ Municipal ☐ Dewatering

☐ Rotary (Reverse) ☐ Driving ☐ Livestock ☒ Test Hole ☐ Monitoring

☐ Boring ☐ Digging ☐ Irrigation ☐ Cooling & Air Conditioning

☐ Air percussion ☐ Industrial ☐ Other, specify _____

Construction Record - Casing

Inside Diameter (mm/in) 2 1/8" Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel) Steel

Well Thickness (mm/in) 1.88" Depth (m/ft) From 0 To 150'

Status of Well

☐ Water Supply ☐ Replacement Well ☒ Test Hole

☐ Recharge Well ☐ Dewatering Well ☐ Observation and/or Monitoring Hole

☐ Alteration (Construction) ☐ Abandoned Insufficient Supply ☐ Abandoned Poor Water Quality ☐ Abandoned other, specify _____

☐ Other, specify _____

Construction Record - Screen

Outside Diameter (mm/in) _____ Material (Plastic, Galvanized, Steel) _____ Slot No. _____ Depth (m/ft) From _____ To _____

Water Details

Water found at Depth (m/ft) Kind of Water: Fresh ☒ Gas ☐ Other, specify _____

Water found at Depth (m/ft) Kind of Water: Fresh ☒ Gas ☐ Other, specify _____

Water found at Depth (m/ft) Kind of Water: Fresh ☒ Gas ☐ Other, specify _____

Hole Diameter

Depth (m/ft) From To Diameter (mm/in)

150 255 10 1/8"

255 450 6 1/8"

Results of Well Yield Testing

After test of well yield, water was: ☐ Clear and sand free ☐ Other, specify _____

If pumping discontinued, give reason: _____

Pump intake set at (m/ft) _____

Pumping rate (l/min / GPM) _____

Duration of pumping hrs + min _____

Final water level end of pumping (m/ft) 1

If flowing give rate (l/min / GPM) 100

Recommended pump depth (m/ft) _____

Recommended pump rate (l/min / GPM) _____

Well production (l/min / GPM) _____

Disinfectant? ☒ Yes ☐ No

| Time (min) | Draw Down | | Recovery | |
|------------|------------|--------------------|------------|--------------------|
| | Time (min) | Water Level (m/ft) | Time (min) | Water Level (m/ft) |
| 1 | | | 1 | |
| 2 | | | 2 | |
| 3 | | | 3 | |
| 4 | | | 4 | |
| 5 | | | 5 | |
| 10 | | | 10 | |
| 15 | | | 15 | |
| 20 | | | 20 | |
| 25 | | | 25 | |
| 30 | | | 30 | |
| 40 | | | 40 | |
| 50 | | | 50 | |
| 60 | | | 60 | |

Map of Well Location

Please provide a map below following instructions on the back.

PROJECT: 08-1122-0078

RECORD OF BOREHOLE: 10-3

SHEET 1 OF 2

LOCATION: See Site Plan

BORING DATE: Apr. 28-29, 2010

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE | | SAMPLES | | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m | | | | HYDRAULIC CONDUCTIVITY, k, cm/s | | | | ADDITIONAL LAB TESTING | PIEZOMETER OR STANDPIPE INSTALLATION | | | |
|-----------------------|--|---|-------------|-----------------------|--------|---|------------|----------------|--|------------------------------------|--|---------------------------------------|----|---------------------------|---|----|----|----|
| | | DESCRIPTION | STRATA PLOT | ELEV. DEPTH (m) | NUMBER | TYPE | BLOWS/0.3m | SHEAR STRENGTH | | | | WATER CONTENT PERCENT | | | | | | |
| | | | | | | | | Cu, kPa | nat V _u rem V _u | + Q - ● ⊕ U - ○ | 10 ⁻⁶ 10 ⁻⁴ 10 ⁻² 10 ⁻¹ | W _p ----- W _L | 20 | | | 40 | 60 | 80 |
| | | | | | | | | | | | | | | | | | | |
| 0 | Power Auger 200mm Diam. (Hollow Stem) | GROUND SURFACE | | 93.89 | | | | | | | | | | | | | | |
| | | TOPSOIL | | 93.89 | | | | | | | | | | | | | | |
| | | Very stiff to stiff grey brown SILTY CLAY, some sand (Weathered Crust) | | 93.89 | | | | | | | | | | | | | | |
| 1 | | | | | 1 | 50 DO | 9 | | | | | | | | | | | |
| 2 | | | | 2 | 50 DO | 3 | | | | | | | | | | | | |
| | Rotary Drill No Core | Compact to dense grey brown fine SANDY SILT | | 91.86 | | | | | | | | | | | | | | |
| | | | | 2.13 | | | | | | | | | | | | | | |
| 3 | | | | 3 | 50 DO | 28 | | | | | | | | | | | | |
| | | | | 4 | 50 DO | 47 | | | | | | | | | | | | |
| | | Dense grey brown SANDY SILT, some gravel (GLACIAL TILL) | | 90.49 | | | | | | | | | | | | | | |
| | | Very thinly to medium bedded light grey interbedded SANDSTONE and DOLOSTONE BEDROCK | | 3.51 | | | | | | | | | | | | | | |
| 4 | | | | 3.66 | | | | | | | | | | | | | | |
| | | | | C1 | NQ RC | DD | | | | | | | | | | | | |
| 5 | | | | C2 | NQ RC | DD | | | | | | | | | | | | |
| 6 | | End of Borehole | | 87.89 | | | | | | | | | | | | | | |
| | | | | 5.00 | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | |

Bentonite Seal

Silica Sand

32mm Diam. PVC #10 Slot Screen 'B'

Silica Sand

Bentonite Seal

32mm Diam. PVC #10 Slot Screen 'A'

W.L. in screen 'A' at Elev. 93.77m on Apr. 30, 2010

W.L. in screen 'B' at Elev. 93.17m on Apr. 30, 2010

DEPTH SCALE

1:50


 LOGGED: J.P.
 CHECKED: J.P.

MIS-BHS-001 0811220078-9500.GPJ CAL-MIS.GDT 6/3/10 J.M.

PROJECT: 08-1122-0078

RECORD OF DRILLHOLE: 10-3

SHEET 2 OF 2

LOCATION: See Site Plan

DRILLING DATE: Apr. 28-29, 2010

DATUM:

INCLINATION: -90°

AZIMUTH: ---

DRILL RIG: CME 55

DRILLING CONTRACTOR: Marathon Drilling

| DEPTH SCALE METRES | DRILLING RECORD | DESCRIPTION | SYMBOLIC LOG | ELEV. DEPTH (m) | RUN NO | PENETRATION RATE (mm/rev) | FLUSH | FRFX-FRACTURE F-FAULT | | | | | | | | | | SM-SMOOTH | | | FL-FLEXURED | | | BC-BROKEN CORE | | | DIAMETRAL POINT LOAD INDEX (MPa) | NOTES WATER LEVELS INSTRUMENTATION |
|-----------------------|-------------------------|---|--------------|-----------------------|--------|------------------------------|-------|---------------------------|--|--------------------|----------------|--|--|---------------------------------|--|---|---------------|-----------|--|---|-------------|----------------|---|----------------|--|--|--|--|
| | | | | | | | | CL-CLEAVAGE | | | J-JOINT | | | UE-UNEVEN | | | MB-MECH BREAK | | | | | | | | | | | |
| | | | | | | | | SH-SHEAR | | | P-POLISHED | | | ST-STEPPED | | | W-WAVY | | | | | | | | | | | |
| | | | | | | | | VN-VEIN | | | S-SLICKENSIDED | | | PL-PLANAR | | | C-CURVED | | | | | | | | | | | |
| | | | | RECOVERY | | R Q D % | | FRACT INDEX PER 0.3 | | DISCONTINUITY DATA | | HYDRAULIC CONDUCTIVITY K _f cm/sec | | TYPE AND SURFACE DESCRIPTION | | | | | | | | | | | | | | |
| | | | | TOTAL CORE % | | SOLID CORE % | | | | | | DP #11 CORE LOG | | | | | | | | | | | | | | | | |
| | | | | 100 % | | 100 % | | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | | | | | | |
| 4 | Rotary Drill NC Core | BEDROCK SURFACE | | 90.33 | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Very thinly to medium bedded light grey interbedded SANDSTONE and DOLOSTONE BEDROCK | | 3.68 | 1 | | | | | | | | | | | | | | | | | Bentonite Seal | | | | | | |
| 5 | | | | | | 2 | | | | | | | | | | | | | | | | | 32mm Diam PVC #10 Slot Screen 'A' | | | | | |
| 6 | | End of Borehole | | 87.69 | | | | | | | | | | | | | | | | | | | W.L. in screen 'A' at Elev. 93.77m on Apr. 30, 2010 | | | | | |
| 7 | | | | 6.00 | | | | | | | | | | | | | | | | | | | W.L. in screen 'B' at Elev. 93.17m on Apr. 30, 2010 | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

DEPTH SCALE

1 : 50



LOGGED: J.D.

CHECKED: *MR*

MIS-ROCK 001 0811220078-9500 (ROCK) GP1 GAL MISS GDT 6/3/10 JIM

Ministry
of the
Environment

The Ontario Water Resources Act

WATER WELL RECORD

3 FIRST NAME IN 454522 20040610
4 SURNAME (9) 20040610 20040610 20040610

| | | | |
|--------------------|-------------------|--------------------|----------------|
| FOURTH WA DISTRICT | TENANT'S ADDRESS | STREET NUMBER | CITY |
| <i>Carlisle</i> | <i>Fulton Ave</i> | <i>1</i> | <i>Con 3</i> |
| OWNER'S NAME | ADDRESS | LESSOR'S SIGNATURE | DATE |
| <i>Carlisle</i> | | | <i>4-17-82</i> |

LOG OF OVERBURDEN AND BEDROCK MATERIALS - SEE INSTRUCTIONS

[illegible][illegible][illegible]

LOCATION OF WELL

IN GRAPH SHOW HORIZONTAL DISTANCES OF WELL FROM ROAD AND
LOS LINE INDICATE NORTH BY ARROW

68470

| | | |
|------------------------------|--|---|
| FINAL STATUS OF WELL | <input type="checkbox"/> WATER SUPPLY <input type="checkbox"/> OBSERVATION WELL <input type="checkbox"/> TEST HOLE <input type="checkbox"/> RECHARGE WELL | <input type="checkbox"/> ABANDONED - INSUFFICIENT SUPPLY <input type="checkbox"/> ABANDONED - POOR SUPPLY <input type="checkbox"/> MINED OUT <input type="checkbox"/> DRY/WERMS |
| | <input type="checkbox"/> DOMESTIC <input type="checkbox"/> STOCK <input type="checkbox"/> IRRIGATION <input type="checkbox"/> INDUSTRIAL <input type="checkbox"/> OTHER | <input type="checkbox"/> COMMERCIAL <input type="checkbox"/> MUNICIPAL <input type="checkbox"/> PUBLIC SUPPLY <input type="checkbox"/> COOLING OR AIR CONDITIONING <input type="checkbox"/> HOT WATS |
| METHOD OF CONSTRUCTION | <input type="checkbox"/> CABLE TOOL <input type="checkbox"/> ROTARY (CONVENTIONAL) <input type="checkbox"/> ROTARY (HYDRAULIC) <input type="checkbox"/> ROTARY (JET) <input type="checkbox"/> AIR LIFT <input type="checkbox"/> OTHER | <input type="checkbox"/> DRILLING <input type="checkbox"/> DIAMOND <input type="checkbox"/> JETTING <input type="checkbox"/> DRIVING <input type="checkbox"/> DRIVING <input type="checkbox"/> OTHER |

| | | |
|--|---|---|
| CONTRACTOR | NAME OF MAJOR CONTRACTOR <i>W. H. Harris W. B. Dilling</i> | DEVELOPER <i>3666</i> |
| | ADDRESS <i>Box 326, Rockwell, O. A.</i> | NAME OF SUBMITTER <i>ROBERT H. BENTLEY</i> |
| SIGNATURE OF CONTRACTOR/CONFESSION <i>[Signature]</i> | | DATE <i>9-12</i> |

OFFICE USE ONLY

68470

Ministry
of the
Environment

The Ontario Water Resources Act

WATER WELL RECORD

2. CHECK ☒ CONTRACT FOR WHETHER APPLICABLE

| | | | | | | | |
|---------------------------------------|--|-------------------------------------|--|--|--|------------------|--|
| LICENSE OR DISTRICT <i>Carlton</i> | | TOWN OR TOWNSHIP <i>Portland</i> | | CON. POLICE BOARD DISTRICT NO. <i>Con 3</i> | | AGE <i>92</i> | |
| OWNER OR LESSEE <i>Arbuckle</i> | | ADDRESS <i>Portland</i> | | DATE LICENSED <i>4</i> <i>10</i> <i>72</i> | | | |

[illegible][illegible][illegible]

| | | |
|---------------------------------------|--|---|
| FINAL STATUS OF WELL | <input type="checkbox"/> WATER SUPPLY <input type="checkbox"/> DRAINAGE/SEWERAGE <input type="checkbox"/> TEST HOLE <input type="checkbox"/> RECHARGE WELL | <input type="checkbox"/> APPROXIMATE INSUFFICIENT SUPPLY <input type="checkbox"/> APPROXIMATE POOR QUALITY <input type="checkbox"/> UNDESIRABLE <input type="checkbox"/> OBSOLETE |
| | WATER USE | <input type="checkbox"/> DOMESTIC <input type="checkbox"/> STOCK <input type="checkbox"/> IRRIGATION <input type="checkbox"/> INDUSTRIAL <input type="checkbox"/> OTHER |
| METHOD OF CONSTRUCTION | <input type="checkbox"/> CABLE TOOL <input type="checkbox"/> AIRLIFT (CENTRIFUGAL) <input type="checkbox"/> AIRLIFT (WATERLIFT) <input type="checkbox"/> AUGER (AUX) <input type="checkbox"/> DIG PERCUSSION | <input type="checkbox"/> DRILLING <input type="checkbox"/> DIAMOND <input type="checkbox"/> JETTING <input type="checkbox"/> SHIELDING <input type="checkbox"/> DIGGING <input type="checkbox"/> OTHER |

[illegible]

LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND
SOS LINE. INDICATE NORTH BY ARROW

12

11

WELL

68470

UNCLASSIFIED

68470

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Environment

The Ontario Water Resources Act

WATER WELL RECORD

1. PRINT ONLY IN PLACES PROVIDED
 2. CHECK ☒ CORRECT BUT MAKE ANY OTHER CHANGES

| | | | |
|---------------------|------------------------------------|-------------------------------|------|
| COUNCIL OR DISTRICT | EDUCATION DISTRICT (SEE FORM 1000) | CON. GIVEN (CHECK ONE) YES NO | DATE |
| Carleton | Wheatburn (Richmond) | Con 4 | 122 |
| NUMBER OF STUDENTS | ADDRESS | DATE COMPLETED | |
| Orinuckle | Richmond (1st 1st 1st 1st) | 122 | |

[illegible]

| WATER RECORD | | CASING & OPEN HOLE RECORD | | | | SCREEN | |
|--------------------------|--|---------------------------|---|-------------------------------|-------------|--------------|--------------|
| WATER FOUND AS - FEET | AND IF WATER | DEPTH OF HOLE | WATER IN HOLE | WELL NUMBER AND DATE | WELL NO. | WELL DATE | WELL DATE |
| 117 | <input type="checkbox"/> FRESH <input type="checkbox"/> SALT <input type="checkbox"/> SALT | 65 | GREEN UNSATURATED COARSE OPEN HOLE GRAVEL | 188 | 34 | | |
| 70 | <input type="checkbox"/> FRESH <input type="checkbox"/> SALT <input type="checkbox"/> SALT | 6 | GREEN UNSATURATED COARSE OPEN HOLE GRAVEL | 34 | 133 | | |
| | <input type="checkbox"/> FRESH <input type="checkbox"/> SALT <input type="checkbox"/> SALT | | GREEN UNSATURATED COARSE OPEN HOLE GRAVEL | | | | |
| | <input type="checkbox"/> FRESH <input type="checkbox"/> SALT <input type="checkbox"/> SALT | | GREEN UNSATURATED COARSE OPEN HOLE GRAVEL | | | | |
| | <input type="checkbox"/> FRESH <input type="checkbox"/> SALT <input type="checkbox"/> SALT | | GREEN UNSATURATED COARSE OPEN HOLE GRAVEL | | | | |
| | <input type="checkbox"/> FRESH <input type="checkbox"/> SALT <input type="checkbox"/> SALT | | GREEN UNSATURATED COARSE OPEN HOLE GRAVEL | | | | |
| | <input type="checkbox"/> FRESH <input type="checkbox"/> SALT <input type="checkbox"/> SALT | | GREEN UNSATURATED COARSE OPEN HOLE GRAVEL | | | | |
| | <input type="checkbox"/> FRESH <input type="checkbox"/> SALT <input type="checkbox"/> SALT | | GREEN UNSATURATED COARSE OPEN HOLE GRAVEL | | | | |

PLUGGING & SEALING RECORD

| WELL NO. | DATE | WELL NO. | DATE |
|----------|------|----------|------|
| 34 | 54 | 133 | 54 |

[illegible]

LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND
LOE LINE INDICATE NORTH BY ARROW

68488

| | | |
|------------------------------|--|--|
| FINAL STATUS OF WELL | <input type="checkbox"/> WATER SUPPLY <input type="checkbox"/> OBSERVATION WELL <input checked="" type="checkbox"/> DRY HOLE <input type="checkbox"/> RECHARGE WELL | <input type="checkbox"/> ABANDONED INSUFFICIENT SUPPLY <input type="checkbox"/> ABANDONED POOR QUALITY <input type="checkbox"/> UNDESIRABLE <input type="checkbox"/> DETERIORATING |
| WATER USE | <input checked="" type="checkbox"/> DOMESTIC <input type="checkbox"/> STOCK <input type="checkbox"/> IRRIGATION <input type="checkbox"/> INDUSTRIAL <input type="checkbox"/> OTHER | <input checked="" type="checkbox"/> COMMERCIAL <input checked="" type="checkbox"/> MUNICIPAL <input type="checkbox"/> PUBLIC SUPPLY <input type="checkbox"/> SURFING OR AIR CONDITIONING <input type="checkbox"/> NOT USED |
| METHOD OF CONSTRUCTION | <input type="checkbox"/> EARLY TOOL <input type="checkbox"/> ROTARY (CONVENTIONAL) <input type="checkbox"/> ROTARY REVERSE <input type="checkbox"/> ROTARY JARS <input checked="" type="checkbox"/> AIR PERCUSSION | <input type="checkbox"/> AERIAL <input type="checkbox"/> DRILLING <input type="checkbox"/> SPLITTING <input type="checkbox"/> DRIVING <input type="checkbox"/> CRACKING <input type="checkbox"/> OTHER |

| | | |
|------------|--|--|
| CONTRACTOR | NAME OF SELLER/CONTRACTOR <i>Ed. Mains Will Dilling</i> | SELLER/CONTRACTOR LICENSE NUMBER <i>3642</i> |
| | ADDRESS <i>Box 376 Richmond Va</i> | SELLER/CONTRACTOR LICENSE NUMBER |
| | NAME OF SELLER/CONTRACTOR <i>[Signature]</i> | SELLER/CONTRACTOR LICENSE NUMBER |
| | SIGNATURE OF SELLER/CONTRACTOR <i>[Signature]</i> | TELEPHONE NO. <i>21-9-14</i> |

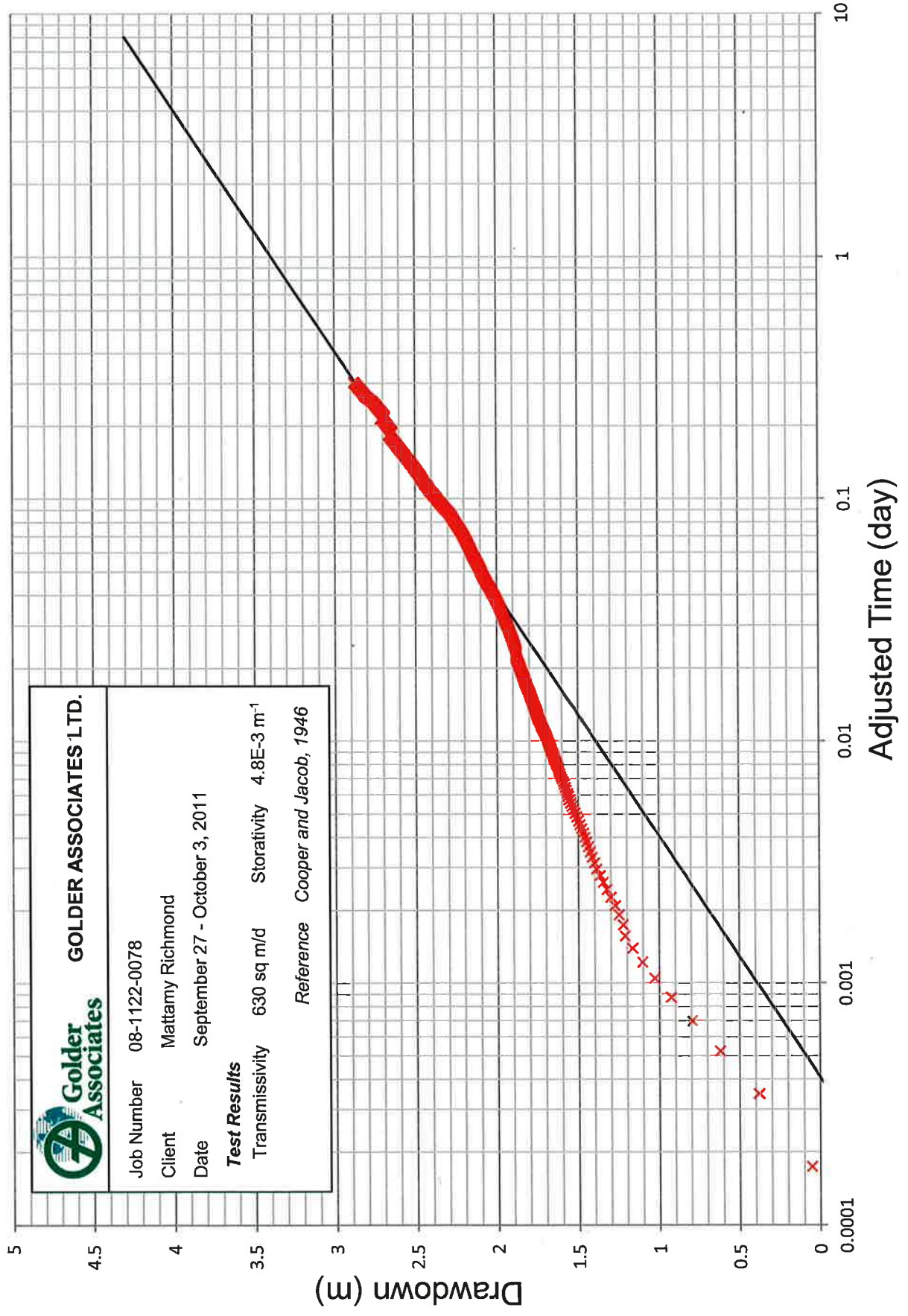
DUPLICATE COPY

$$+ (1.61 \pm 0.42) \times 10^{-4} \Delta A_4 (1^\circ) - (1)_{\text{c}} \quad (2)$$

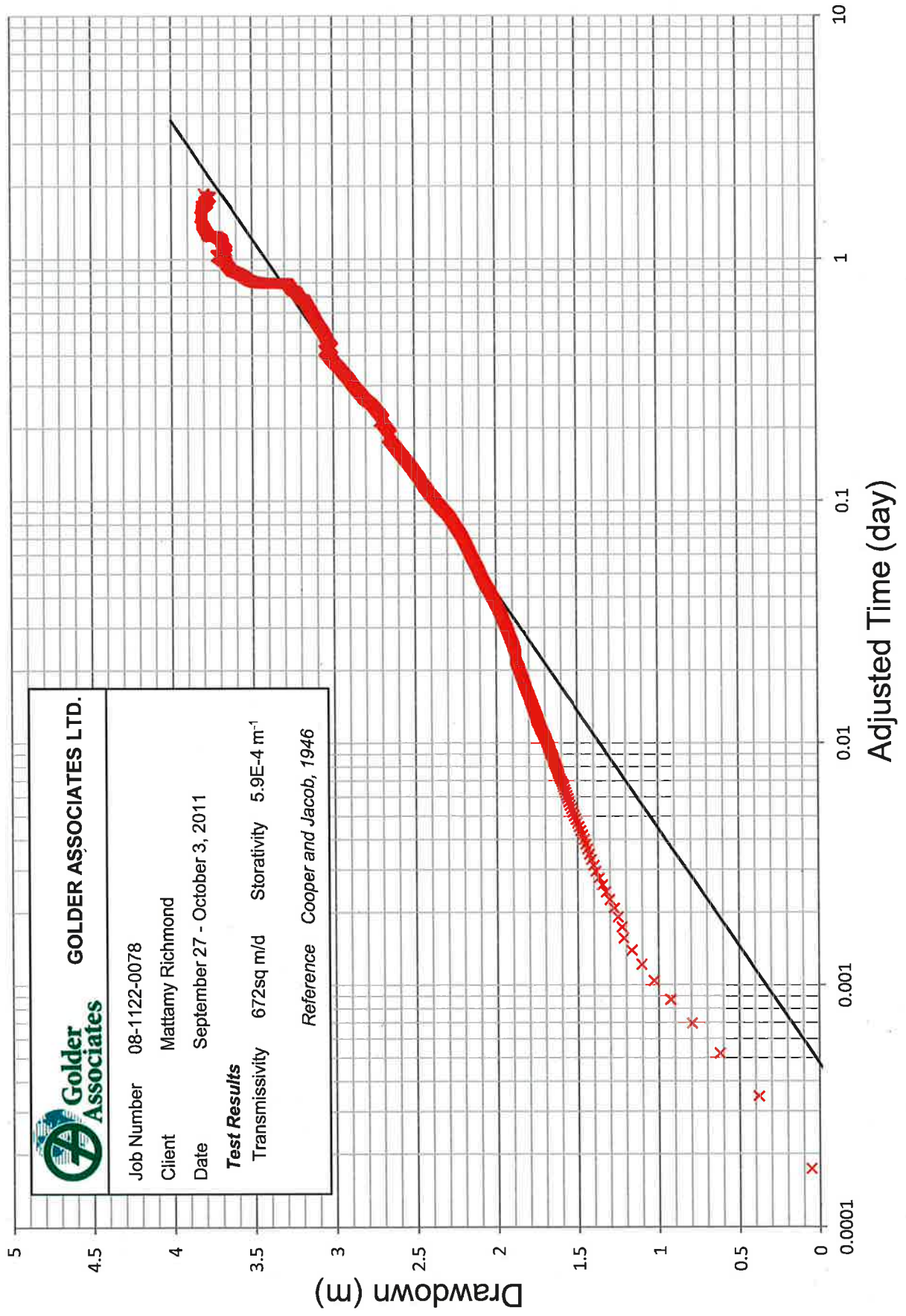
ATTACHMENT 2

Drawdown and Recovery Plots

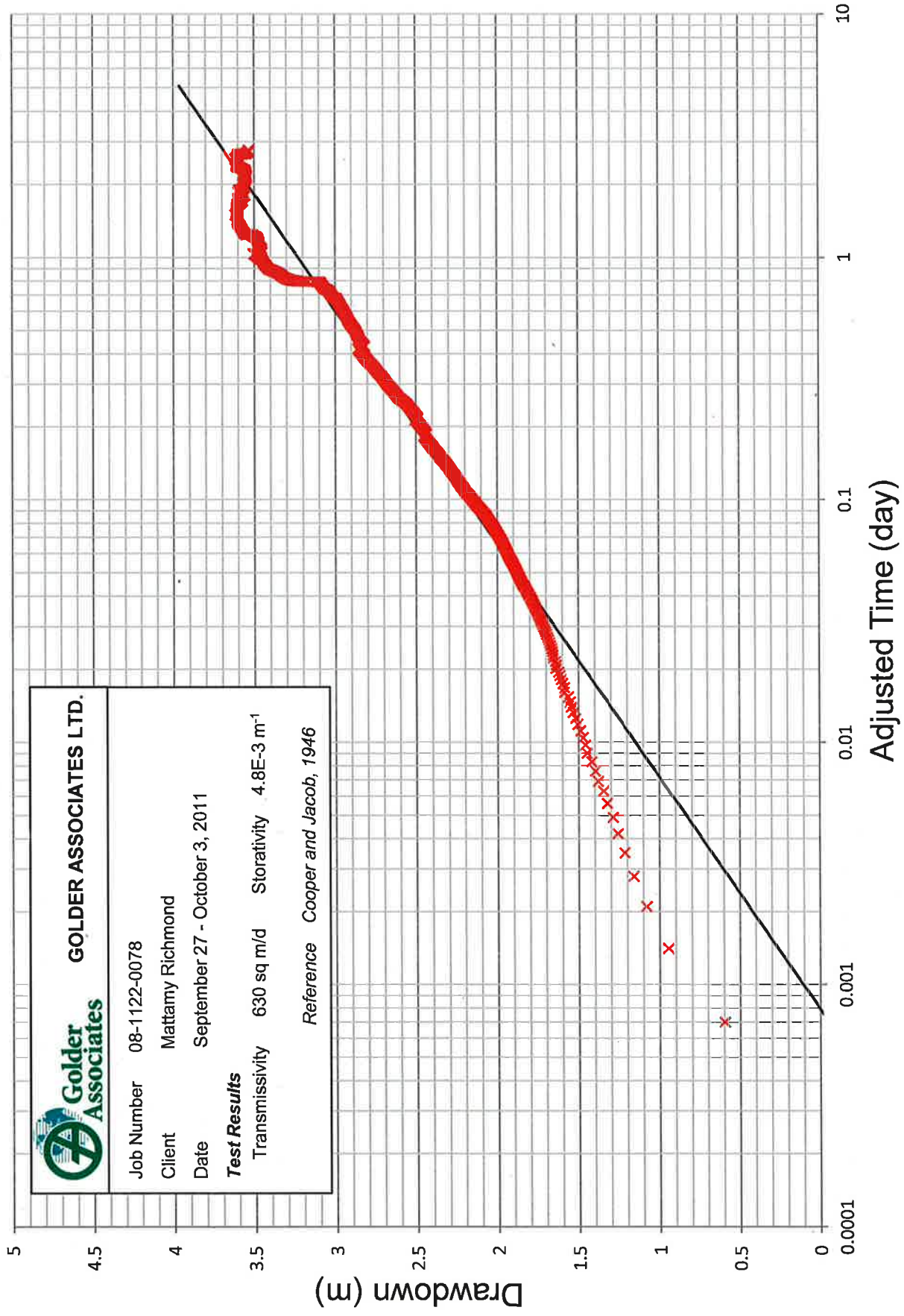
PW09-2



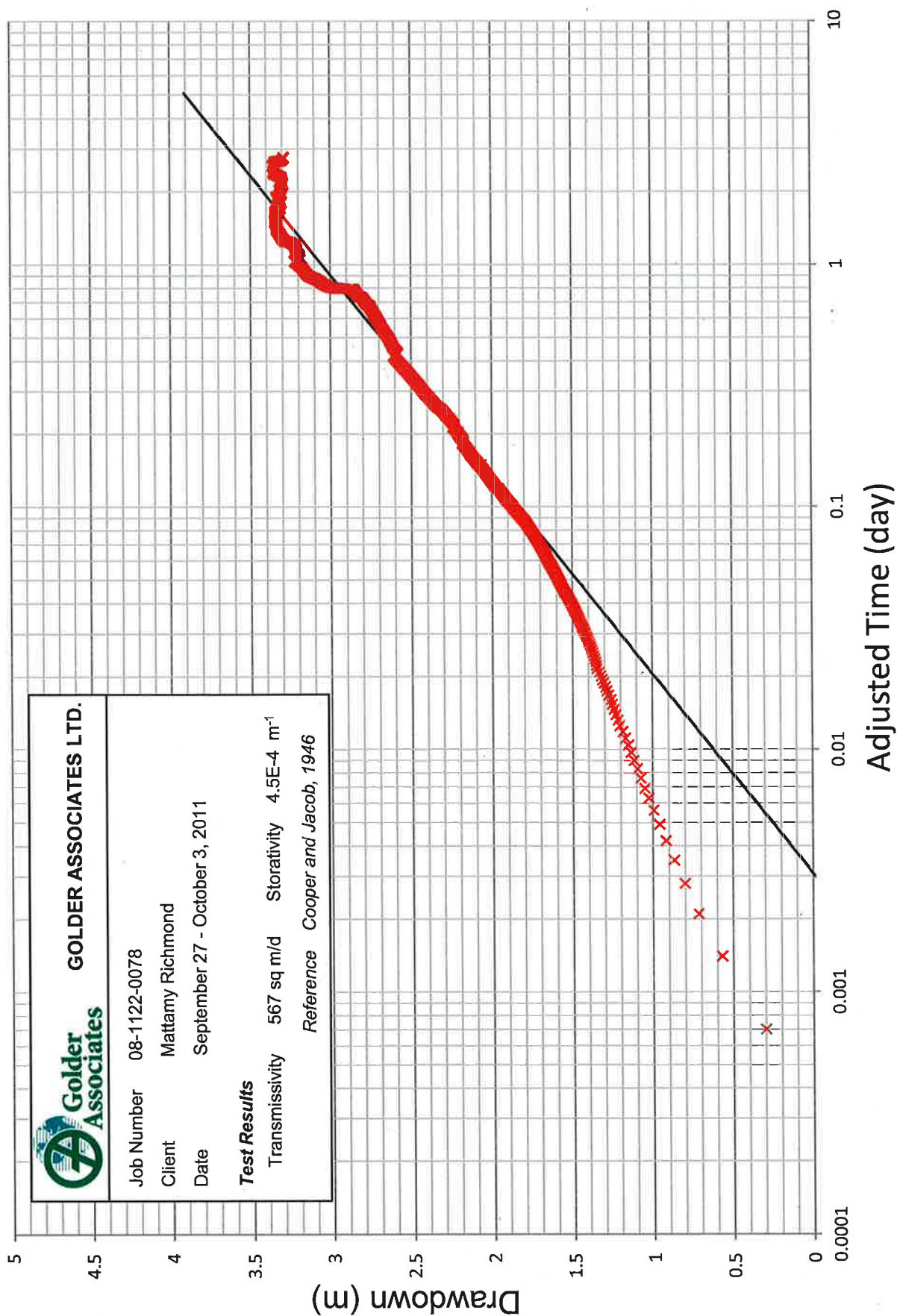
PW08-1



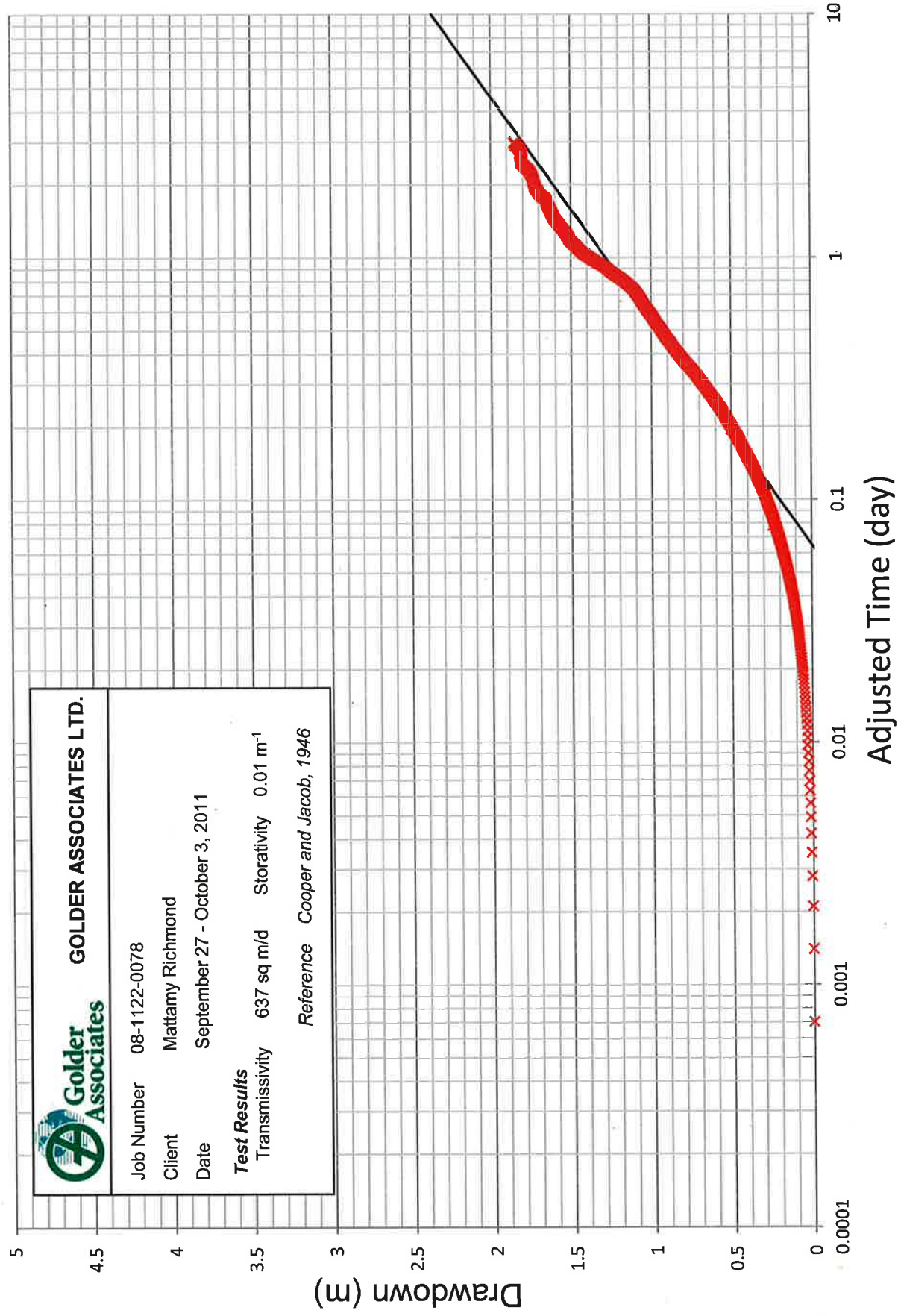
MW08-1A



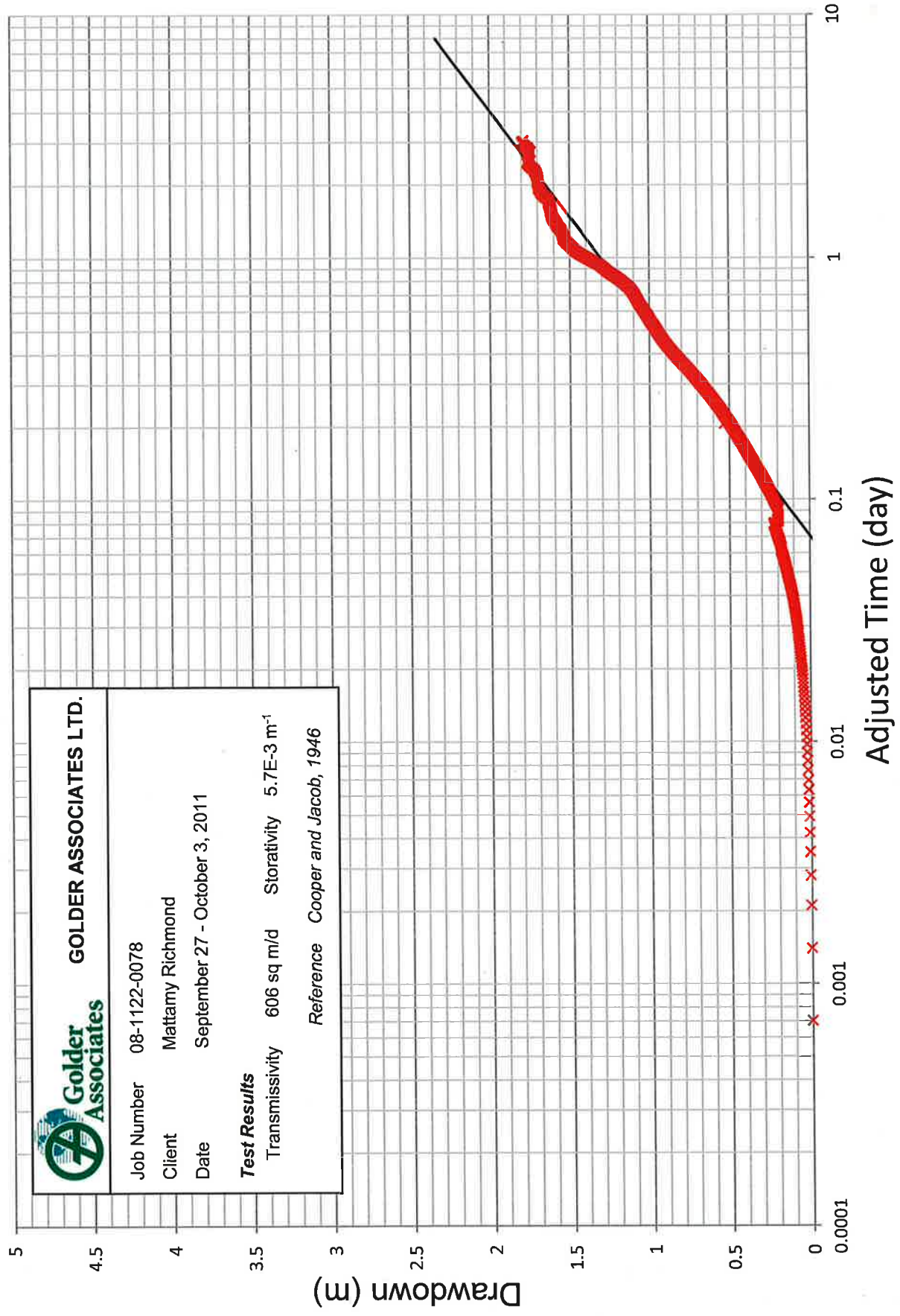
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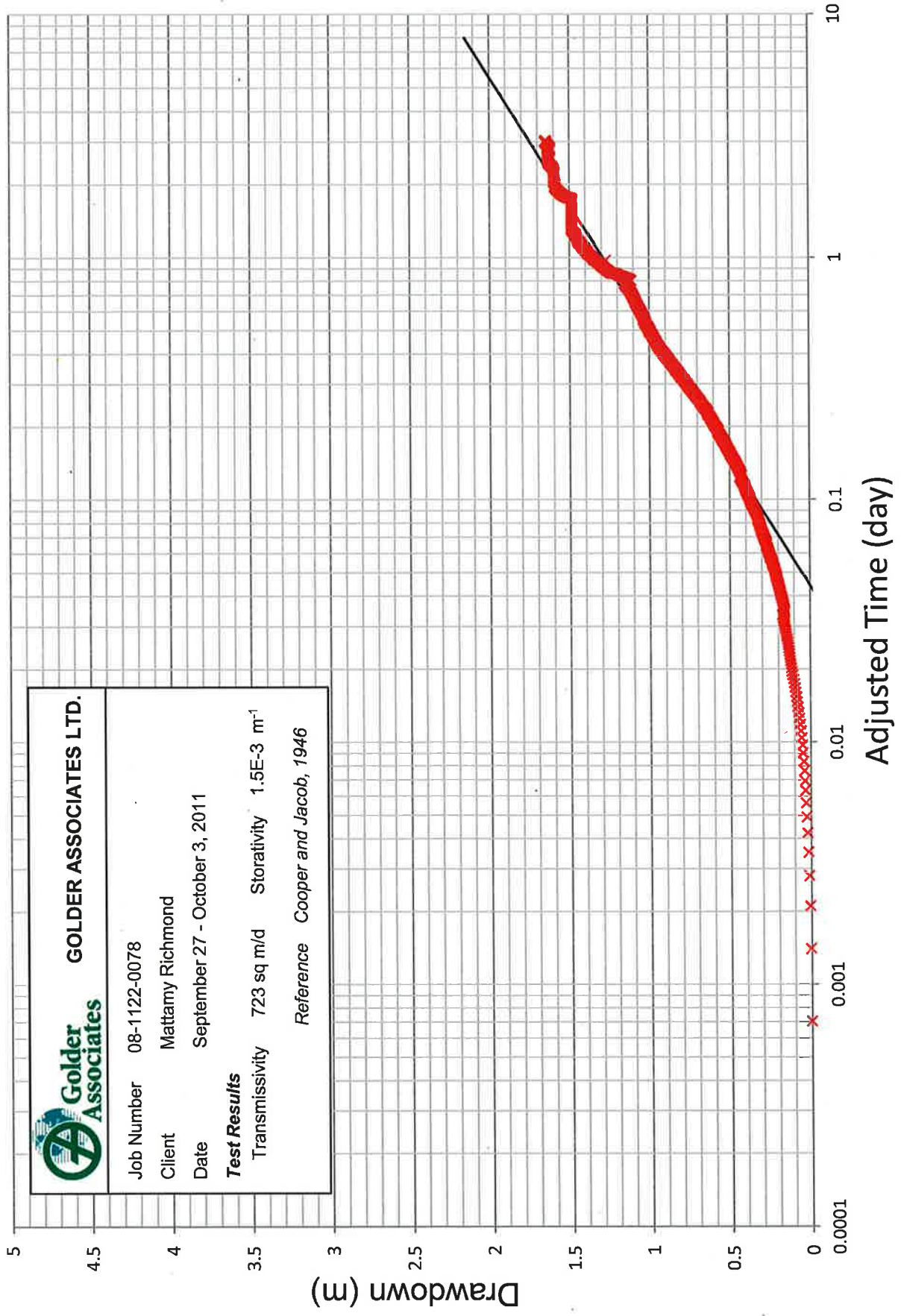
MW08-1C



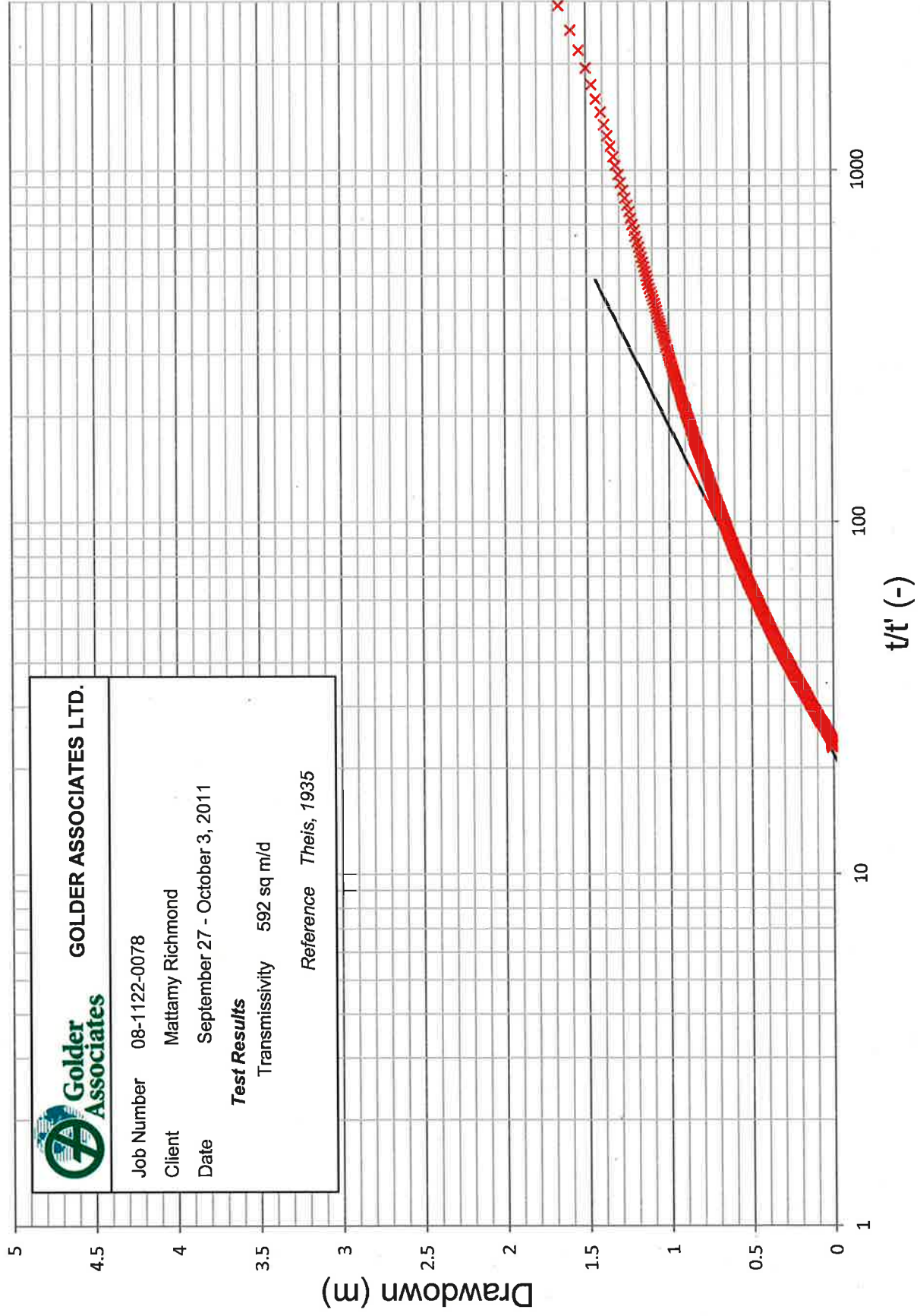
OW-1



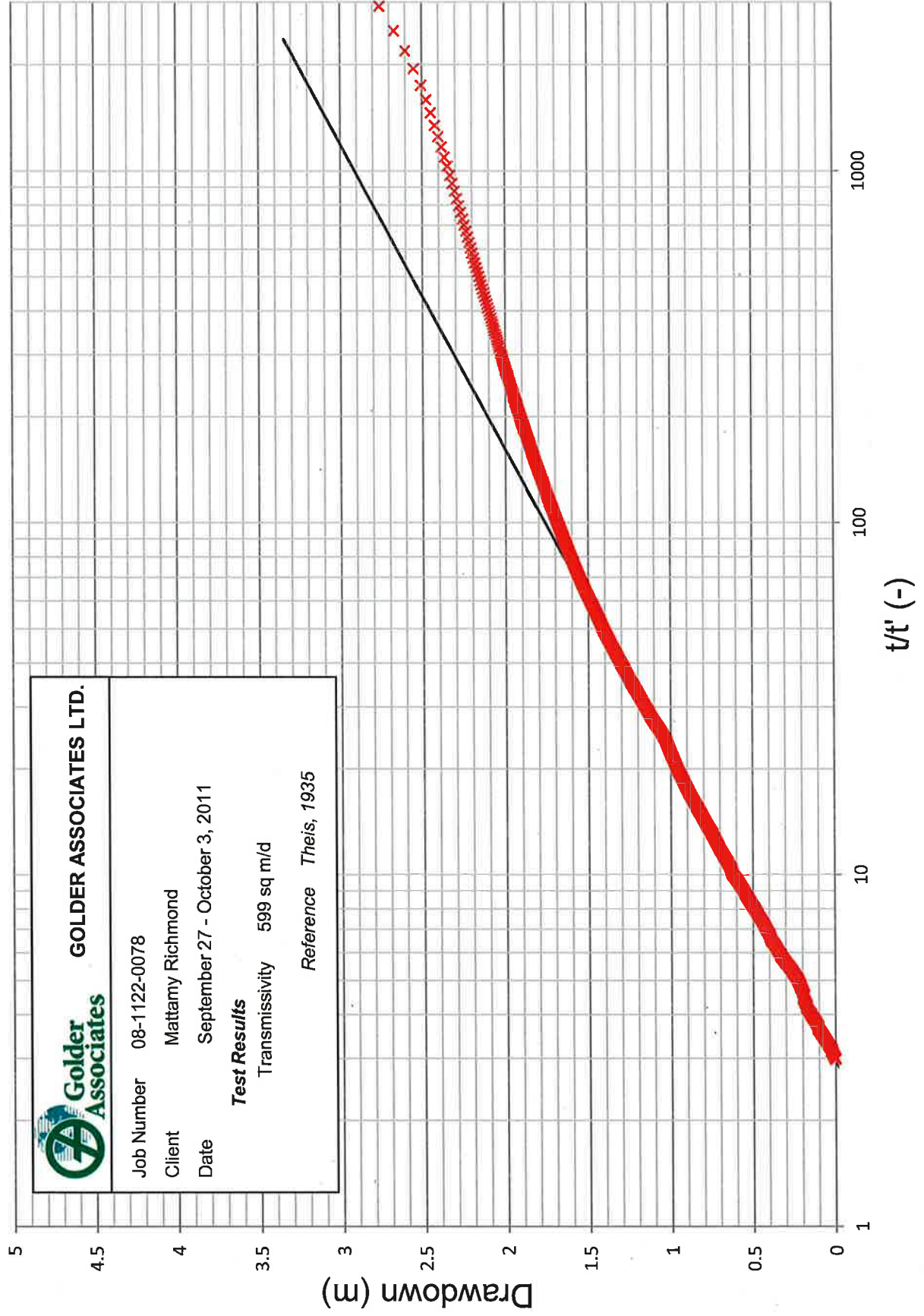
OW-3



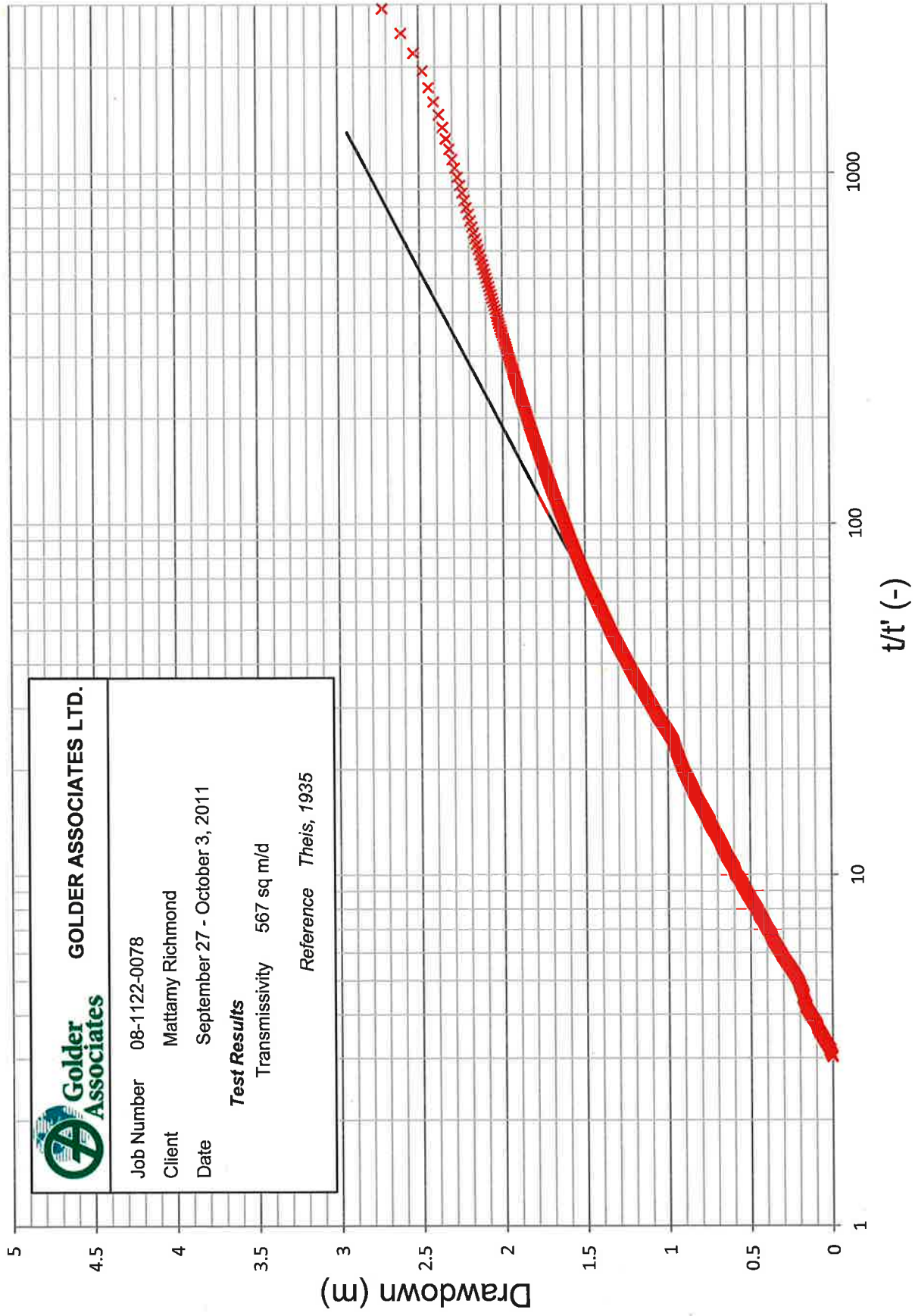
PW09-1



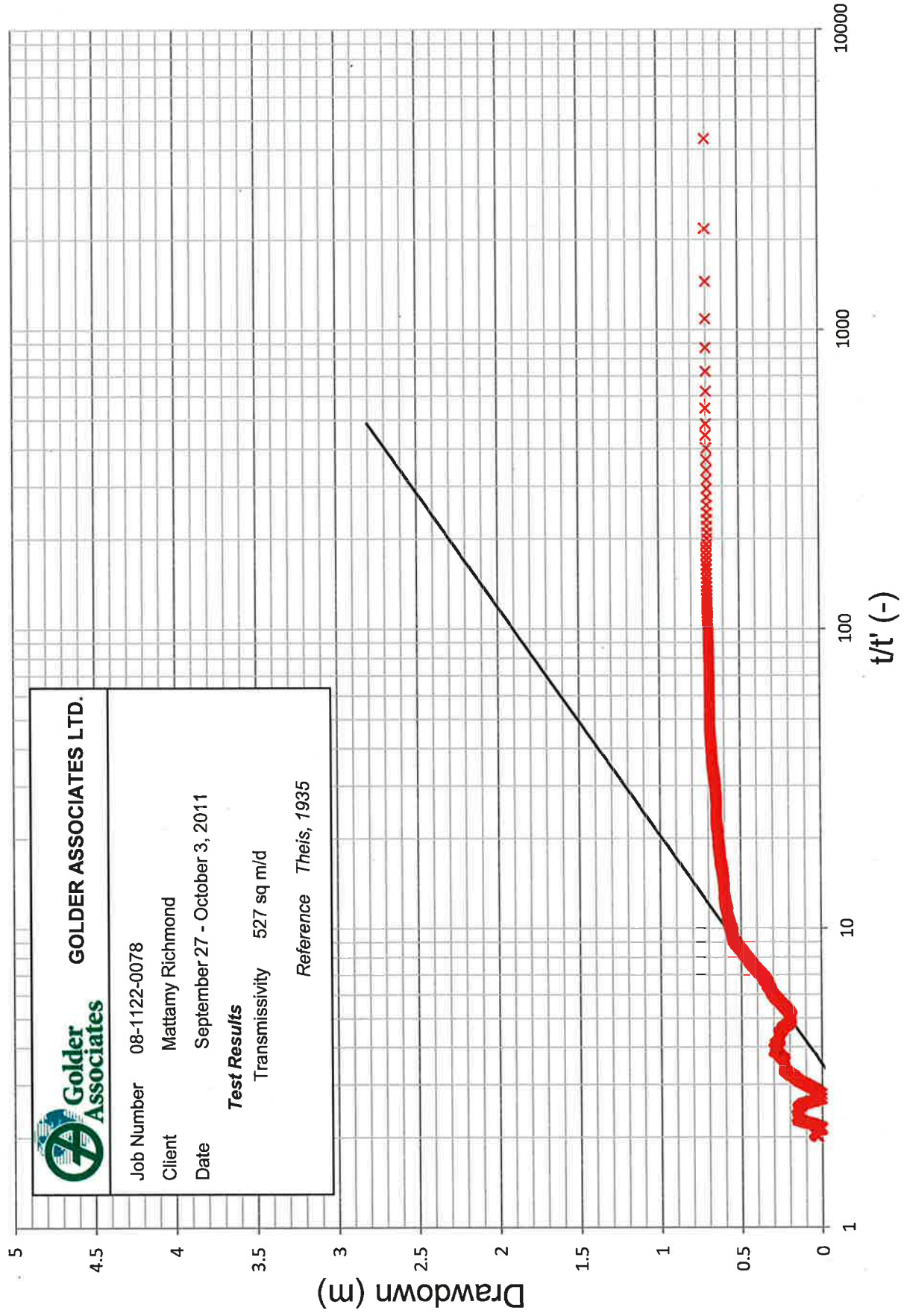
PW09-2



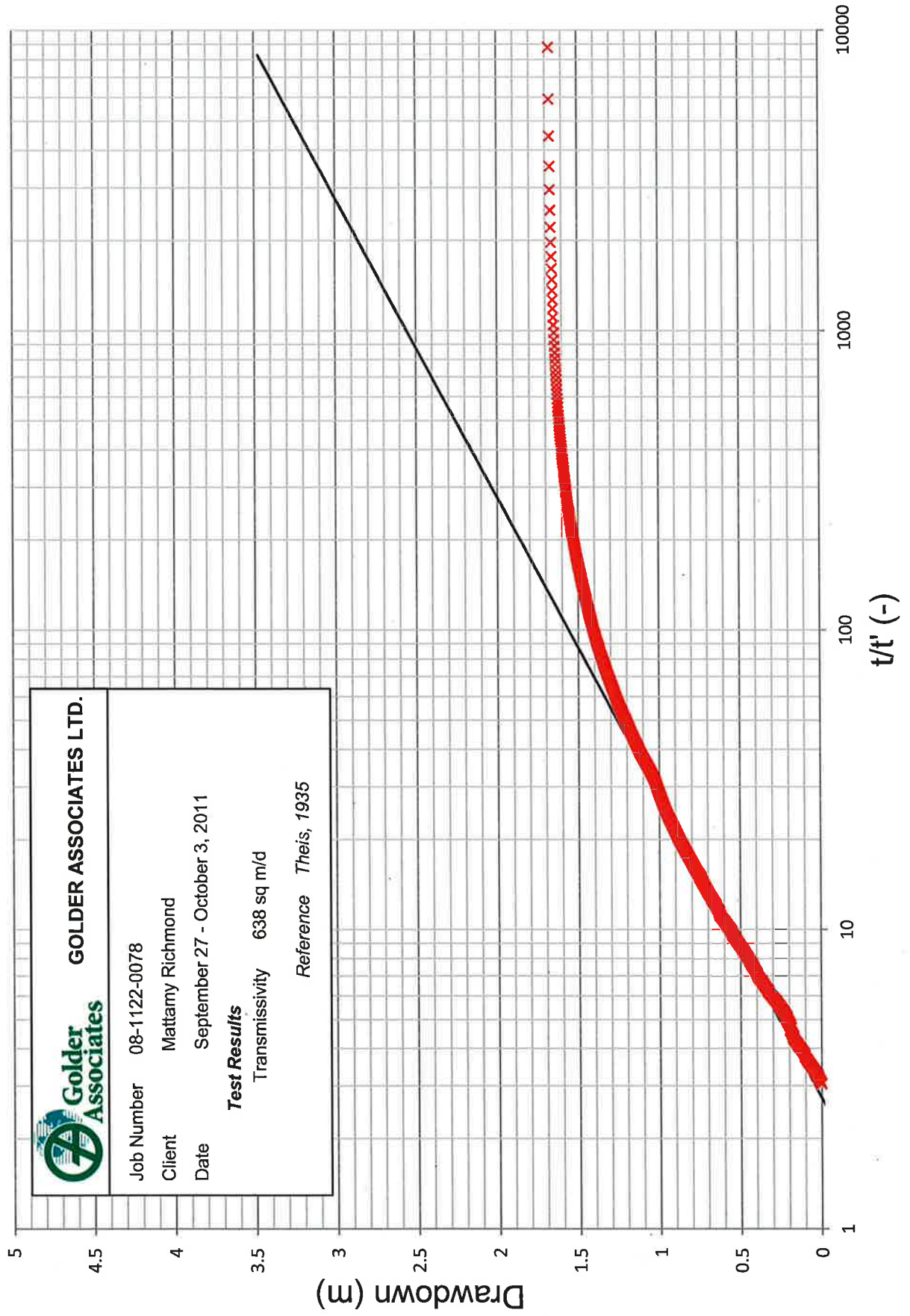
PW08-1



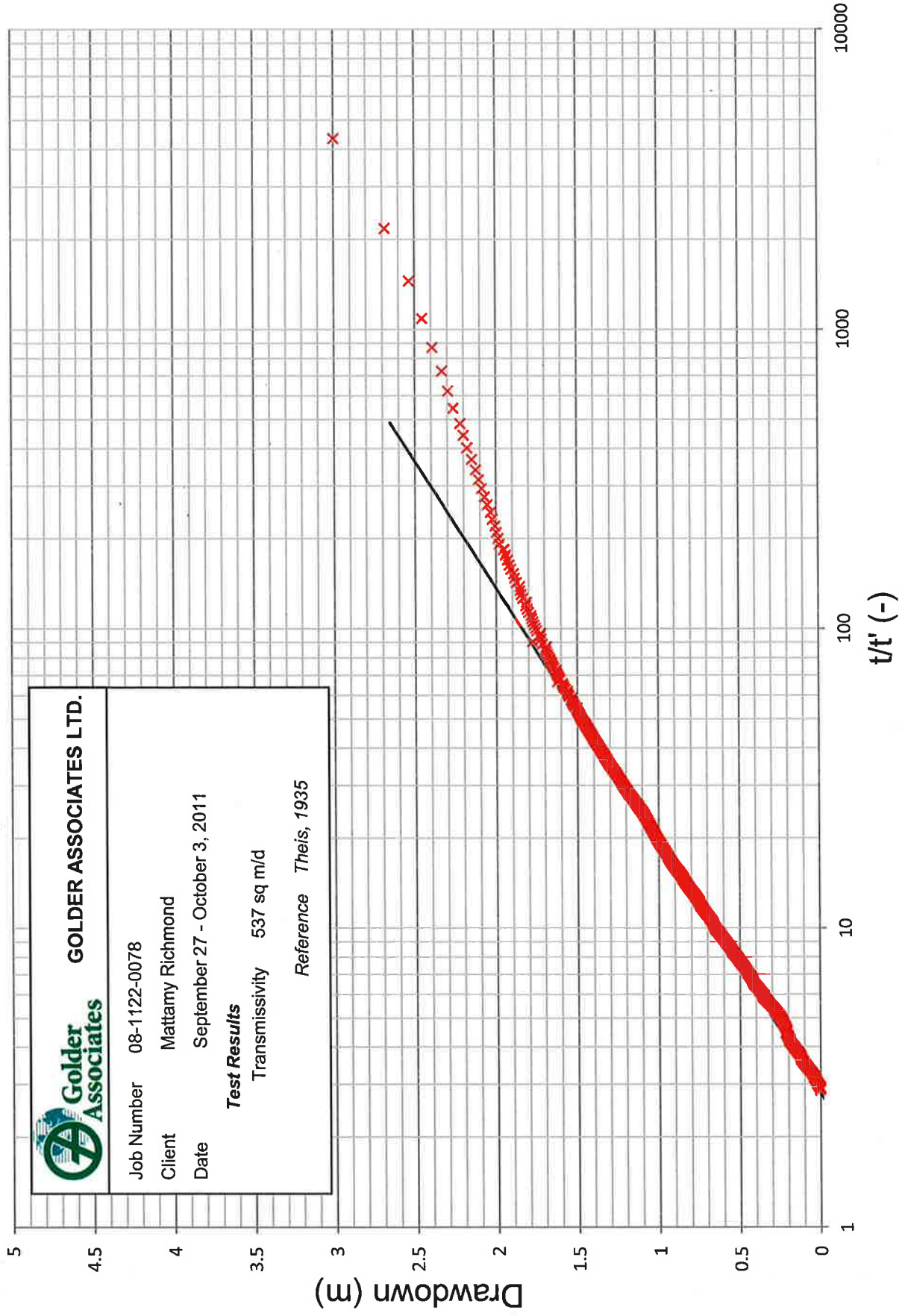
MW10-3A



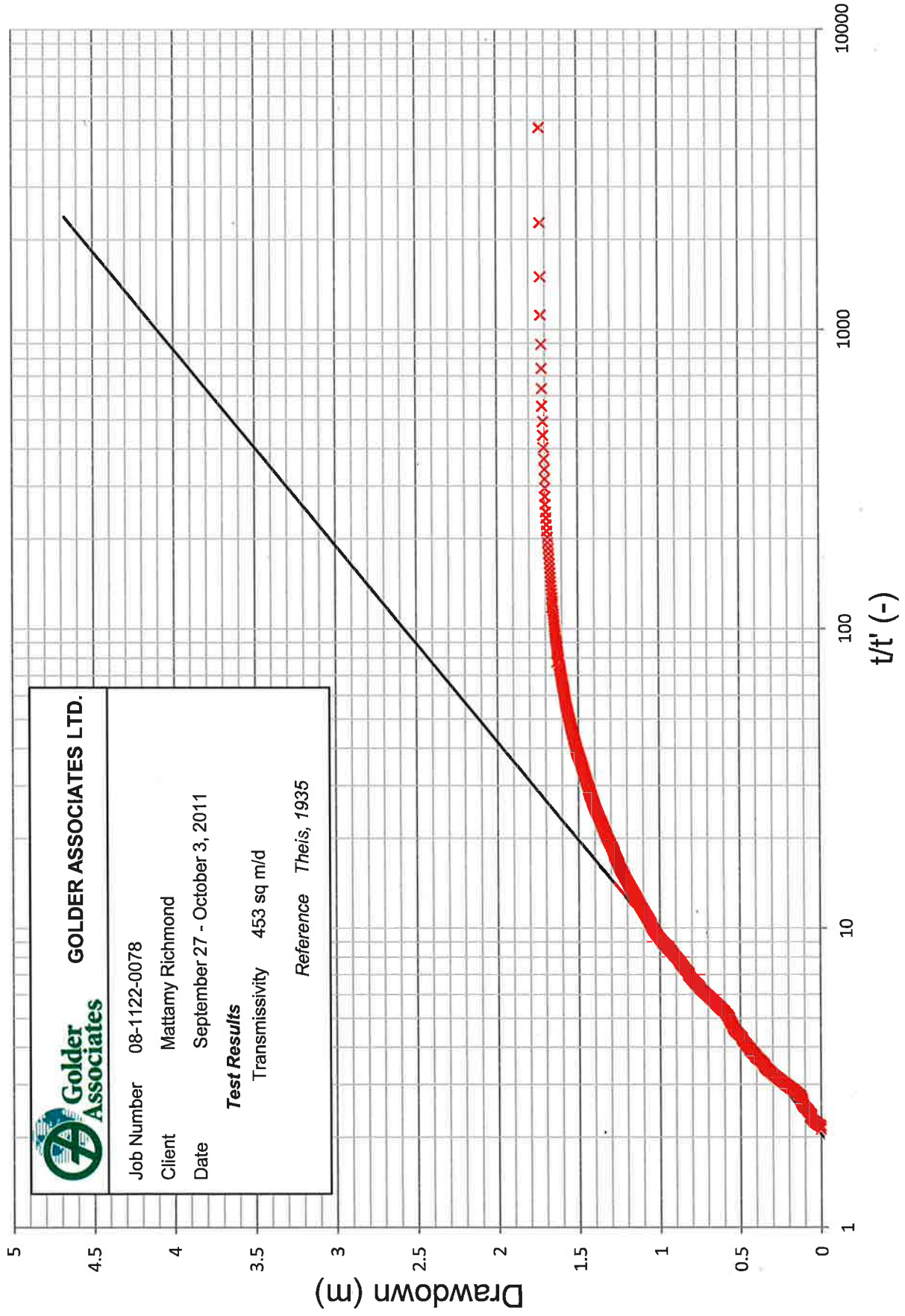
MW08-1A



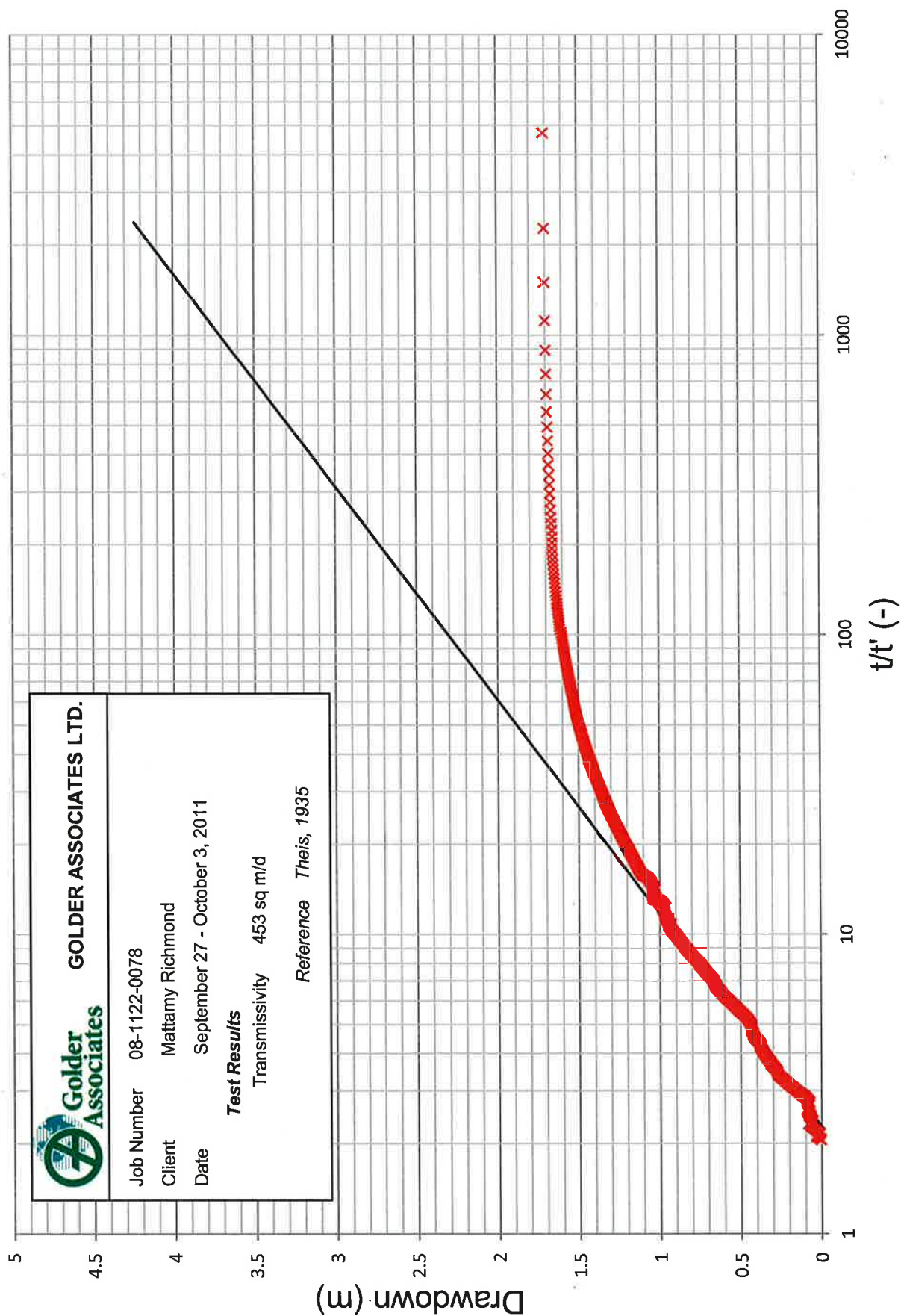
MW08-1B



MW08-1C



OW-1



OW-3

